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Communities of Practice for Student Assessment in a South Korean Middle School

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ABSTRACT

This study examined the interactions of teachers with different professional development (PD) backgrounds in communities of practice (CoPs) formed for student assessment in a South Korean middle school. We analyzed the teachers' collaborative and reflective processes regarding the development, implementation, and feedback processes for student assessment in two CoPs that each consisted of two middle school science teachers. Two different types of CoP were identified: a routine practice CoP and a challenge practice CoP. The routine practice CoP displayed weak interaction between teachers and poor PD, while the challenge practice CoP displayed stronger interaction between teachers and better PD. These two types of CoP were determined by the mutual respect between the teachers. The results of this study can contribute to the development of teacher PD based on its implications for forming teacher CoPs that induce the active participation of members and the formation of mutually respectful relationships among them.

Keywords: assessment strategies, communities of practice, professional development, reflection, science education

INTRODUCTION

Teachers must consider many factors to ensure the success of their students, such as the effect of student thinking and experience on achievement (NCTM, 1995). It is true that the teacher's role is important in facilitating student learning (National Research Council, 2012; Department for Education, 2013), and the effect of professional development (PD) and professional knowledge on teaching has received considerable attention from researchers (Cochran-Smith & Lytle, 1993; Gess-Newsome, Carlson, Gardner, & Taylor 2011; Hashweh, 2005; Lewis, 2011; Magnusson et al., 1999; Park et al., 2007; van Driel, 2010). It has also been the subject of case studies (Friedrichsen et al., 2009; Munby & Russell, 1994; Park & Chin, 2011) as well as ways of documenting professional development (Loughran, Mulhall & Berry, 2004; Nilsson & Vikström, 2015; Veal, 2002).

Teachers' professional knowledge is more influenced by collaborative interactions with colleagues than by independent practice in the classroom (Akerson et al., 2009; Flint, Zisook, & Fisher, 2011; Fultak & Heredia, 2014; Gao & Wang, 2014; Jones et al., 2013; Lewis et al., 2015; So, 2013; Rytivaara & Kershner, 2012; van Driel, 2010).

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Contribution of this paper to the literature

- The teachers modified scoring rubrics to increase correct answer rates. This was because the consideration of colleagues' needs took precedence over the students' needs. The teachers had conflicts with one another but were able to resolve the issues that came up in the CoP. However, conflicts were only resolved when there was mutual trust and respect between the teachers.
- Two types of practice in teacher CoPs were found in the process of developing, implementing, and giving feedback in student assessment: challenge and routine.
- Teacher identification with CoPs and learning partnerships were observed only in the challenge CoP.

Therefore, it is essential to study teacher communities of practice (CoPs) in order to understand their influence on teachers' PD.

Teacher CoPs (Cochran-Smith & Lytle, 1999; Correa, Martínez-Arbelaiz, & Aberasturi-Apraiz, 2015; Wenger, 1998) have been called by different names, such as professional learning communities (Dooner, Mandzuk, & Clifton, 2008; Jones et al., 2013) and teacher learning communities (Gao & Wang, 2014; van Es, 2012). The common assumption is that teachers develop their professional knowledge through sharing lesson plans, instructional strategies, and discussion in the CoP (Garet et al., 2001; Gao & Wang, 2014; van Driel, 2010). Through participation in CoPs, teachers become both the researchers of teaching and learning and the subjects of developing professional knowledge gained through practice (Lytle & Cochran-Smith, 1992).

The purpose of this study was to investigate teacher PD through CoPs that focused on assessment practices, an area that currently lacks research that connects this practice to professional knowledge. In particular, we explored the factors that influence PD in the educational context of South Korea. This study is a natural approach to examining CoPs (Wang et al., 2002) that had already been established in one middle school in South Korea.

LITERATURE REVIEW

Communities of Practice

The concept of the CoP was developed to account for the social nature of human learning (Wenger, 2000). A CoP provides opportunities for members to develop professional knowledge. Members of a CoP can progress from novices to experts through their involvement in the community (Correa, Martínez-Arbelaiz, & Aberasturi-Apraiz, 2015). They work collectively on key tasks, and their proficiency levels increase over time. The members rely on support and feedback from the community and share ideas through discussion and dialogue (Correa et al., 2015). The community can be seen as a simple social system; this complex social system can be interpreted as the interaction of simpler social systems. This is similar to understanding a mixture of complex properties as the interaction of simple elements and compounds.

The CoP should be understood as a conceptual framework for learning at the social level and can be found in the relationship between people and society. In this relationship, the individual and society act as constitutive factors. In order for meaningful learning to occur in a social context, the interaction of two factors, participation and reification, are essential (Wenger, 2000). Wenger (1998) argued that all communities are diverse because they all have their own unique practices; however, all communities have common attributes. Wenger (1998) stated that the common attributes of the CoP are mutual engagement, joint enterprise, and shared repertoire (Akerson et al., 2009; Fultak & Heredia, 2014; Jones et al., 2015). According to Wenger (1998), mutual engagement refers to participation based on cooperative relationships among various members, while joint enterprise refers to shared responsibility with other members, and shared repertoire refers to the artifacts and discourse produced by the members through community activities.

Over the past 30 years, many international studies have focused on the importance of teacher learning communities (Akerson et al., 2009; Daniel et al., 2013; Dobie & Anderson, 2015; Gao & Wang, 2014; Johnston & Settlage, 2008; So, 2013). In a school setting, CoPs are naturally and intentionally organized among teachers. They

focus of collaborative planning of lessons and study units, assessment, improving teaching practices, as well as coaching and mentoring, processes which are inherently collaborative. van Driel and Beijaard (2003) reported on experience-based interaction, which can be described as the sharing of ideas related to teaching practices. Teachers discuss ideas with their colleagues and listen and respond to each other. Importantly, in this environment, teachers can be inspired by and learn from colleagues when interactively sharing ideas.

In CoPs, teachers develop mutual trust, which is the basis for explorative and reflective thinking on relevant issues. It also builds a foundation for establishing common values and setting goals, promotes collective responsibility for student learning, increases reflective professional inquiry, promotes collaboration, and incorporates collaborative learning as well as personal learning (Jones et al., 2013; Nickerson & Moriarty, 2005; Stoll et al., 2006). Therefore, CoPs not only strengthen the professional community but are important for effective PD (Thomas et al., 1998; van Es, 2012; Vescio, Ross, & Adams, 2008). Specifically, CoPs can work more efficiently when the following elements are satisfied: (1) there are shared norms and values, (2) there is a focus on student learning, (3) there is reflective dialogue among teachers, (4) there is a sharing of practice through public discussions on instructional cases and problems among colleagues, and (5) there is collaboration regarding curriculum and instruction (Schweingruber, Duschl, & Shouse, 2007; Stoll et al., 2006).

Teachers' professional development can be promoted through CoPs as well as through individual practice, since teachers in CoPs can become autonomous experts, rather than simply passive knowledge deliverers (Sato, Akita, & Iwakawa, 1993). Cochran-Smith and Lytle (1999) suggested three types of knowledge related to practice: *knowledge-of-practice,* which is constructed within teacher CoPs; *knowledge-for-practice*, which is produced by researchers; and *knowledge-in-practice*, which is developed through competent and experienced teachers' practice. The knowledge relating to teacher CoPs represents knowledge-of-practice, which teachers construct through practice. That is, teachers can be active constructors of knowledge, rather than simply passively receiving it from an outside source (Lytle & Cochran-Smith, 1992).

All professional development programs have value when teachers are provided with new opportunities (Garet et al., 2001). Therefore, studies of teacher PD that focus on teacher learning communities require a higher level of participation than merely joining in CoP activities (Grossman et al., 2001; Jones et al., 2013). However, when teachers collaborate with their colleagues to achieve common goals, occasionally the relationship between them can become tense because of conflicting individual beliefs on teaching practice (Dooner, Mandzuk, & Clifton, 2008; Glackin, 2016; So, 2013).

Teledahl (2015) reported that teachers can arrive at different evaluations of the same students' work because they have different content knowledge. In Teledahl's study, when assessing students' work, teachers looked for content knowledge gaps in their understanding of science concepts. However, different evaluations of the same students' work came from interactions between factors such as the teachers' beliefs and previous experience (Gao & Wang, 2014). Therefore, professional discussion on the different ways in which teachers assess student work is key to confirming the quality of assessment (Clarke, 1996), since different grading evaluations stem from differences in interpretation, not from a difference in standards (Morgan & Watson, 2002). Therefore, teachers' professional knowledge of assessment might be influenced by CoPs, as they can reveal these differences of interpretation and encourage cooperation and reflection on assessment practices.

Grossman et al. (2001) reported that the expression of opposing opinions within CoPs could strengthen the community. In their study, teachers initially ignored conflicting opinions, but gradually began to acknowledge diverse opinions, and eventually considered all the various discussion points offered in the group. This reflects how critical discussion can be key to developing teacher CoPs (van Es, 2012). Dobie and Anderson (2015) found that expressing an opposing opinion could improve the quality of collaboration and decision-making within a community. Thus, by contributing to critical discussions with colleagues, teachers can potentially modify their beliefs and improve their professional practices (Achinstein, 2002; Grossman et al., 2001; Mitchell, 2015).

Mertler (2009) indicated that previous studies relating to assessment knowledge and practice had focused on identifying what teachers do not know, on what teachers do know, and on which methods individual teachers use to assess student work. After marking, the teachers discussed their methods with the researcher and other

participants in a workshop and determined best practice methods. Specifically, when students answer open-response questions, in contrast to multiple-choice questions, teachers can improve their knowledge of their students' understanding through the assessment process (Mertler, 2009). Teachers can construct new knowledge through this experience, which in turn affects their practice (So, 2013). Such reflective thinking comprises a "purposeful, deliberate act of inquiry into one's thoughts and actions" (Loughran, 1996) and therefore improves teaching practice.

Teachers should continue to improve their practice by regularly using the reflection process: *reflection-in-action* is the process of reflection during practice, *reflection-on-action* is the process of reflection after practice, and *reflection-for-action* is the process of reflection on practice whereby teachers reflect on their past actions and plan for future actions accordingly (Schön, 1983). Reflection serves as a starting point for teachers to examine and evaluate their professional knowledge and beliefs (So, 2013). For this reason, teachers' reflective practices are essential for professional growth and learning (Schön, 1983). If we promote autonomous reflective thinking during teaching practice, teacher PD can be accelerated.

Individual teacher growth is less effective with independent reflective practices in terms of practical knowledge for effective teaching (Schön, 1983). However, this could be improved with colleague interaction (van Driel, 2010), because teachers within a community can exchange individual reflections based on their own experiences (Pintrich, Marx, & Boyle, 1993; So, 2013; Tillema, 1997). Therefore, teachers should be given the opportunity to reflect on different perspectives within CoPs that they may not have been exposed to otherwise (Mitchell, 2015).

This study differs from existing research in that the teachers' communities were already in place prior to the study and were voluntarily established among the teachers themselves. In the case of voluntary CoPs, it is likely that conflict will not become serious because it is not necessary to reach consensus. However, as in the case of student assessment, if the teachers need to agree on student scoring standards, the communities will likely encounter conflicts among the teachers. Research on how teachers collaborate to overcome conflict and develop their professional knowledge is crucial. In the study of Jones et al. (2013), the greatest change observed in teachers' professional knowledge in the CoP was regarding science assessment strategies. Therefore, in the present study, the distinct feature of teacher's PD in CoPs for student assessment was observed.

PURPOSE OF THE PRESENT STUDY

The purpose of the present study is to explore the interactions of teachers in CoPs and identify the factors that develop or inhibit the development of teachers' professional knowledge. In the present study, the interactions among teachers were divided into three types: the process of developing assessment items, the process of implementing assessment, and the process of feedback. The research questions of this study are as follows:

1) What are the characteristics of the teacher interaction in the two teacher communities at the stage of developing the assessment items?

2) What are the characteristics of the teacher interactions in the two teacher communities at the stage of implementing the assessment?

3) What are the characteristics of the teacher interaction in the two teacher communities at the feedback stage after assessment?

In this study, we investigated the obstacles and support for teacher's PD within the CoPs. In particular, we wanted to explore the teachers' complex social relationships (Erickson, 1986; Lave & Wenger, 1991; Lewis et al., 2015). Since all teachers' PD experiences are unique (Lewis et al., 2015), it will be difficult to draw general conclusions from this study. However, it is useful to have an understanding of how a teacher's PD is actively applied, implemented, or rejected in a CoP.

Table 1. The Three Dimensions and Properties of a CoP

Dimensions of CoP	Properties of CoP
Mutual engagement	• Members of other backgrounds (involvement of different subject teachers, full-time and part-time teachers) participate in the development of common assessment items and assessment criteria, and common evaluation activities. • At least one year of continuous involvement is maintained for evaluation activities with complex relationships with guidance students, parents, school administrators, local education offices, and the Department of Education.
Joint enterprise	• Members have a collective responsibility for assessing students. • Evaluation activities are conducted through continuous negotiation among the teachers in the community.
Shared repertoire	• Curriculum resources and policies related to assessment are developed by the members. • Data and events related to the evaluation and the evaluation criteria can be modified by the members.

METHOD

Research Design

For the purposes of the present study, we analyzed the classroom activities of each teacher and their collaboration and reflection processes for student assessment within their CoP. Similar methods of research design to several existing studies (Cochran-Smith & Lytle, 1993; Hashweh, 2005; Magnusson et al., 1999; Friedrichsen et al., 2009; Park & Chin, 2011; Veal, 2004; Gess-Newsome et al., 2011; Lewis, 2011; Park et al., 2007; van Driel, 2010) were used in this study.

Based on Wilson (2013), who identified five main characteristics of an effective PD program, we focused on the following five aspects in the present study: (1) the specific content of the assessment item, (2) the active participation of teachers in the CoP, (3) the collective participation of teachers in the assessment process, (4) the procedures through which student achievement of Ministry of Education learning targets could be measured, and (5) the use of a one-semester or longer observation.

The observation of interactions in the teacher CoPs was divided into three stages. The first stage consisted of the development of the assessment items and rubrics. The second stage consisted of the elaboration of the assessment tools developed–this was where assessment practice, reflection, and cooperation occurred most actively. The final stage consisted of the return of teachers to their classrooms provide feedback of the assessment results to the students. This last stage allowed us to identify the individual teacher's perceptions of the interactions that had occurred within the CoP.

Since the community designed in this study had three dimensions, it was considered to possess the characteristics of a CoP as proposed by Wenger (1998). The concrete contents are shown in **Table 1**.

Context and Participants

Public schools in South Korea face intense pressure to improve student achievement, so there is a significant demand for effective teacher PD. All schools in South Korea are required to follow the standard national curriculum that is revised periodically. Although various textbooks are developed and used, all textbooks are part of the national curriculum to ensure consistency in the contents at each grade level.

Most middle schools in South Korea conduct regular assessments twice a semester. These assessments comprise the students' summative evaluations and are used as base data for entrance to high school. Because of their importance, most students and parents are very sensitive to test scores. The fairness of the assessment criteria

Table 2. Participant Characteristics

Community	**Community 1 (Grade 7)**		**Community 2 (Grade 9)**	
Characteristics	**Teacher A**	**Teacher B**	**Teacher C**	**Teacher D**
Gender	male	female	male	female
Age	late 30s	early 40s	early 50s	early 40s
Major	physics	physics	physics	earth science
Years of experience	7 years	9 years	25 years	14 years

and the clarity of the scoring results are of great concern to teachers. Teachers put forth a lot of effort to avoid receiving complaints from students and parents about overly subjective test results. When there is a significant difference in class average according to the teacher, they receive negative feedback from administrators, parents, and students. That is why the teachers collaborate with their colleagues in a CoP to develop assessment items and determine scoring. This collaboration among teachers in CoPs is thus important in establishing teachers' identities. In most schools, a teacher does not develop student assessment items independently, but all teachers of the same grade work together. The Ministry of Education in South Korea implemented a policy to increase the number of open-ended assessment items to measure the in-depth knowledge of students. During the process of scoring students' answers to open-ended test items, active cooperation occurs among teachers in a CoP to ensure that the wide variety of student responses that can occur are graded consistently. Therefore, this study collected data on teacher interactions in CoPs regarding the development and scoring of open-ended assessment items.

The school selected as the site of this research consists of 28 classes from seventh to ninth grade. The school is located in the outskirts of Seoul, South Korea. According to the results of the National Achievement Test conducted at the time of the study, 52% of all students at the school were within the average range and 11.6% were within the low academic achievement range. This means that the level of student achievement at the school is close to the national average.

There was a total of six science teachers at the school; four of them participated in this study. Teachers A and B, who teach seventh grade science, comprised Community 1, while teachers C and D, who teach ninth grade science, comprised Community 2. Teacher B also taught some subjects in 9th grade, but she acted as an advisor to Community 2 rather than a participant because she had to participate in Community 1. The characteristics of the teachers who participated in this study are displayed in **Table 2**.

Data Sources

In this study, we obtained various data through continuous participant observation and analysis (Spradley, 1980) to investigate the social communication processes within the teacher CoPs. After obtaining permission from all participants, we installed recording devices on the discussion tables to record discussion in the CoPs, which took as long as one week per exam.

We obtained meaningful data from the focal situations (Merriam, 1988) before consensus was reached in the CoPs. In such cases, the teachers had difficulty communicating, and engaged in active discussion to come to a consensus regarding the evaluation of open-ended test questions. After reaching an agreement on the scoring criteria, the teachers individually scored the students' tests. After grading the tests, the CoPs met again to restart discussions regarding student test responses where necessary, until consensus was reached again. Then, rubrics were revised and the scoring of exams was corrected as needed.

We obtained data from the midterm and final exams during the first semester and from the teachers' CoP activities related to these assessments. We also obtained data from the observation of the CoP teachers' classroom activities, as well as individual interviews to aid in the interpretation of the data.

In total, we recorded 170-185 minutes of discussion from each CoP. Community 1's discussions consisted of a lot of debate due to the teachers' different beliefs and knowledge backgrounds. Community 2 worked more

often than Community 1 at the request of Teacher D, who wanted to reach consensus on student scoring criteria. However, the lack of conflict may be attributable to Teacher C's desire to avoid confrontation with Teacher D. Video data from 10-15 lessons per teacher were collected because teachers' responses in the CoP were related to their teaching strategies and their personal understanding of students in their classes. For this, the first author of this study installed video cameras in the back of the classrooms, and she remained in the classrooms during the recorded lessons to take field notes.

To acquire additional information from the participants, three formal interviews were conducted with each of the four teachers and informal interviews were conducted before and after teaching and during the grading of the students' exams. The first interview was conducted at the beginning of this study to assess the teachers' professional knowledge of developing assessment items. The second interview was conducted in the middle of this study to identify the characteristics of interactions among teachers in the CoP during the implementation of the assessment. The third interview was conducted after scoring the students' exams to study the teachers' relationship within the CoPs. We observed the classes taught by each of the four CoP teachers, and these data were used as supplementary materials for interpreting the teacher's activities and behavior in the CoP.

Five or six open-ended questions were produced for each exam by the teachers, and the CoP actively worked to agree on the scoring criteria to fairly evaluate the students' responses to them. Although open-ended questions are difficult to score compared to multiple-choice questions, they were introduced into the Korean national curriculum to measure students' higher-order thinking skills. However, in most cases, the average score for the open-ended questions requiring higher-order thinking skills was higher than the average score for the multiple-choice questions requiring simple knowledge recall. This means that the scoring criteria of the open-ended questions agreed to by the teachers failed to adequately measure the students' higher-order thinking skills. We analyzed and diagnosed the causes for this phenomenon based on the teachers' interactions in the CoP.

Data Analysis

The data were collected from the discourse within the CoPs, participant interviews, observation notes from the CoPs, assessment item data, and the scoring criteria generated within the CoPs. We compared the data using a triangulation method to gain a better understanding of the teachers' activities in the CoP.

In general, the cooperation and reflection of the teachers in the CoPs differed in each of the three stages: the development stage of the assessment items (Process D), the implementation stage of the assessment (Process I), and the feedback stage after the assessment of the students' exams (Process F). Therefore, we analyzed the data separately for each of the three stages.

Teachers' interactions within the CoPs were coded into six types: reflection, conflict within collaboration, conflict resolution, continued conflict, identification, and learning partnership. We attempted to identify data by the codes individually, and reach a consensus on the patterns involved in the interaction. We explored the factors that could explain the teacher's activities within the CoP through their arguments in the scoring process, as well as through additional data obtained through individual interviews. In similar cases, we coded data by applying common patterns. In particular, when it was difficult to identify the factors in a teacher's decision-making process, the data was reanalyzed and recoded until a more general meaning was found to understand individual cases. Using constant comparative analysis (Miles & Huberman, 1994), we identified the characteristics of the teachers' assessment practices and arrived at a concerted conclusion.

The coding was focused on finding factors that influenced the teachers' interactions in the assessment process. In other words, we tried to find the areas where PD influenced the CoP by analyzing the relationships of the coding data related to the interactions between the teachers. **Table 3** shows the meaning of each code and examples.

Table 3. Coding Categories and Examples

Category	Description Example
Collaboration	Teachers make a shared repertoire in a CoP.
	Teachers conduct activities that determine the scope of the assessment, design test items, and cross-examine them with a colleague in the CoP.
Reflection	Teachers reflect on the assessment items they made in the CoP
	Teachers reflect on their own activities when they realize a scoring criterion was wrong.
Conflict	Conflict can occur due to differences in teachers' beliefs and knowledge in a CoP.
	Conflicts can arise when the teachers have different understandings of the curriculum, such as the importance of the calculation process or writing units, as well as differences in opinions regarding the weighting questions or the scoring criteria.
Resolution	Teachers suggest a solution to their colleagues to solve conflicts or problems encountered in the CoP.
	Teacher B changed her opinion on the scoring criteria by considering her colleague's point of view.
Continuing conflict	Teachers' suggestions do not contribute to the resolution of the problem encountered in the CoP.
	Even though they agreed in the CoP, they continued to complain about the outcome of the agreement.
Identification	Recognizing problems that occur in the CoP as their own problems.
	When the correct answer rate was low on the items made by Teacher A, Teacher B felt responsible because she did not cross check the questions.
Learning partnership	Teachers' professional knowledge is developed by forming partnerships with colleagues in the CoP.
	Teacher A helped Teacher B with the answer to a question that she could not solve.

RESULTS

Interaction in the CoPs in the Stage of Developing Assessment Items (Process D)

Reflection. In the process of developing open-ended assessment questions, the factor that the teachers considered most was the ease of scoring. Open-ended questions should evaluate students' thinking in greater depth than multiple-choice questions, so assessing different student responses was burdensome for the teachers. However, in order for teachers to develop their PD and assessment knowledge, they must establish valid evaluation criteria and evaluate students' work accordingly. However, most teachers in the study displayed resistance to PD by making the open-ended questions easy for scoring, which could not contribute to their professional growth. The following discussion was recorded in Community 1, which consisted of Teachers A and B, while cross-examining the open-ended test items.

Teacher B: Most of the items are difficult.

Teacher A: I am also reviewing the difficult items.

Teacher B: Did you not review the open-ended items?

Teacher A: Not yet. I made it long and difficult because the score of the item is 10 points. It will be difficult because the students have to write long answers. I divided the items into several sub-scores to make it easier for us to score. It's easy to score.

(Community 1 on September 19, 2011)

The following discussion was recorded in Community 2:

Teacher C: I can finish scoring it tomorrow morning.

Teacher D: It is not hard to score the open-ended items.

Researcher: Good!

Teacher C: But when we make the open-ended items this way, the administrator notices.

Researcher: I think Teacher D changed her usual style of open-ended item form.

Teacher C: It is a simple change.

Researcher: Was scoring the last open-ended item too difficult?

Teacher C: My head was hurting. After scoring the answers of one class, my head was hurting too much.

Researcher: Last time, you talked to teacher D a lot in the community.

Teacher D: It's because the item was too open. The open-ended item was too difficult to score. It was too open at that time.

(Community 2 on September 28, 2011)

The intention of the open-ended assessment was to invite diverse responses from the students. However, the teachers had a difficult time scoring unexpected answers. They resolved this problem by changing the item type to restrict the potential for diverse responses. This was successful in terms of improving the ease of scoring from the teachers' viewpoint, and strengthened the consensus to enable simpler scoring for the next assessment. The teachers' experience of past exams seemed to be a hindrance of teacher PD.

The teachers were aware that their practice was inadequate to measure student achievement on open-ended questions made in accordance with the Ministry of Education's guidelines. Thus, Teacher C mentioned that it was a good idea to obtain the administration's approval of the open-ended questions they had made. However, they had already learned about the effort required to score complex responses. It is difficult to expect a certain outcome in a situation where the teachers have different professional backgrounds or the administrative policies and guidelines are unclear or restrictive.

In contrast to the intention to make scoring easier, Teacher A realized during the interview with the researcher that it was difficult to make scoring criteria in Process D. This was due to Teacher A's lack of professional knowledge of assessment, and he did not consider the students' diverse responses or the curriculum targets when he created the open-ended questions. The following statement by Teacher A was recorded in an interview with the researcher:

Teacher A: Actually, I made this item because I did not want to make a 10-point item carefully. If I suggested 2 or 3 keywords to the students for an answer to a 10-point item, it was a problem because the score for one keyword was too high. So I wrote the item so that students would write a long answer, but that made it difficult to score. It would have been nice if I had created sub-items for the 10-point item. Now it's too difficult to make scoring criteria. I am not sure how could I change the scoring criteria since the combination of words is too complex.

(Interview with Teacher A on September 28, 2011)

Considering the convenience of scoring rather than the curriculum or the students' understanding indicates a low level of professional knowledge. He did not realize that the intention of open-ended evaluation is to access the students' higher-order thinking, even though he made the open-ended items in accordance with the Ministry of Education policy. Therefore, although Teacher A produced a certain percentage of open-ended questions in accordance with the policy, he thought that the assessment items were troublesome and required too much effort to score. The following conversation between Teacher A and B was recorded during a CoP meeting:

Teacher A: If the students' answers are not what we wanted, we should decide that they are definitely wrong.

Teacher B: You should have put the word "concentration" as one of the keywords, but it was not suggested in the question.

Teacher A: (Loudly) I should have put the word "concentration" at the right time when I realized the problem, but I neglected to fix the item because I had to change the space for the answer again. So I just left it.

Teacher B: Why would you need to change the space for the answer to add the keyword "concentration?"

Teacher A: You have to increase your scoring chart to five if you add keywords. Because Teacher B did not say anything, I did not fix it because I was irritated.

Teacher B: I did not review the scoring criteria.

Teacher A: When I first thought of "concentration," I should have fixed the item by putting it in.

(Community 1 on September 28, 2011)

In general, during Process D, the teachers' interactions within the CoP were superficial. Although the teacher who created the item found the error on his own, he decided to ignore the problem when his fellow teacher did not recognize it. The teacher's attitude related to writing the test items and scoring them would eventually lead to a waste of time by lowering the criteria of the open-ended items for measuring the students' higher-order thinking. Generally, during Process D, the teachers' interactions within the CoPs were mainly influenced by past experience, and focused on the ease of scoring the test items. Therefore, the depth of their reflection was superficial.

Conflicts within collaboration. In Process D, although the two CoPs displayed similar patterns of reflective thinking, they showed different patterns of cooperation. In Community 1, deep interactions were often observed in Process D, and conflicts appeared on the surface of interaction. Within the community, interaction was initiated by Teacher B, who recognized the problems in the test items. The following conversation was recorded during a CoP meeting:

Teacher B: Item 5. Are the students doing well? Should we put in the item statement that 1kg of gravity is 9.8? Because some of the students may calculate it with different values, such as 10 instead of 9.8.

Teacher A: Do not put 9.8. The contents are in the textbook. For the students, I will emphasize it in class next time. When we teach it, we should not say that we can consider 1 kilogram of gravity as 10N.

Teacher B: Right? I still have time to teach it. And these two items are similar to the questions that you wrote last year.

Teacher A: I remember.

Teacher B: Do students remember last year's items and raise objections?

Teacher A: This item is completely different than last year's items. You are too timid.

Teacher B: I agree. You know how to solve this item?

Teacher A: You will know when you read the items. In fact, it might be difficult for some students.

Teacher B: So I put the word "buoyancy" in the scoring criteria for those students who cannot do the calculations. But you omitted the word in the criteria.

Teacher A: The item seemed too complicated so I changed it. The rest is the same.

Teacher B: The students will find it hard to figure out.

(Community 1 on September 19, 2011)

In Community 1, the teachers' conflicts are related by Teacher A, who considered the importance of the curriculum in the assessment items, and Teacher B, who took account of the students' abilities. Teacher A had greater professional understanding of curriculum planning and Teacher B had a greater professional awareness of the students.

Teacher A and Teacher B conflicted in Community 1, but the conflict was solved by providing a teaching strategy suggested by Teacher A. Therefore, the students' ability level required to answer the items correctly remained high.

However, in Community 2, the same level of cooperation between the two teachers was not often observed. In Community 2, Teacher D recognized most of the problems, as Teacher B did in Community 1. On this matter, Teacher D stated the following in an interview:

Teacher D: Oh! The students have difficulty with the law of conservation of mass and the law of constant composition ratio. I taught it well, but did the students understand it? This is a calculation problem, why can't the students solve the calculation problem? I am afraid that the students who learned from me will not be able to solve the problems written by Teacher C.

(Interview with Teacher D on September 19, 2011)

In a similar situation to Community 1, Teacher A rejected Teacher B's proposal and suggested a consensus on improving the students' understanding through instructional strategies during class. In the process, the conflicts between the teachers were revealed, and as a result, the difficulty level of the item was retained. However, in Community 2, Teacher C did not respond to Teacher D's proposal; thus, conflicts were not exposed on the surface. As a result, Teacher D made the items developed by Teacher C easier for her students to answer. Teacher D expressed the cause of his behavior to the researcher as follows:

Researcher: Are there any items that were revised while reviewing the items together?

Teacher D: Teacher C did not discuss many of the items I had made. And if I saw items written by Teacher C that I did not teach to my students, I removed them. Teacher C did not get involved if I deleted or modified any items at will. In fact, teachers often teach what they do not know, and if that is the case, then we have to mark all kinds of students' answers as correct. So I examined the items very well. Because I was worried about the items written by Teacher C that I had not taught, I edited them.

(Interview with Teacher D on September 19, 2011)

The poor communication between the two teachers in Community 2 seemed to be because of a lack of respect between them. Teacher D did not trust the items that Teacher C had written, and judged Teacher C's professional knowledge related to the contents to be low. She expressed this by saying, "Teachers often teach what they do not know." Teacher C was aware of Teacher D's attitude, and did not interfere with her in order to avoid conflict. Therefore, in Community 2, it was hard to observe any conflictual interactions between the two teachers. On the surface, they appeared to work well together and cooperate with each other.

Interaction in the CoPs in the Stage of Implementing Assessment (Process I)

Conflict resolution within collaboration. Sometimes, the conflicts between Teacher A and Teacher B in Community 1 revealed during Process D were serious and they did not reach consensus easily. However, during Process I, when problems occurred from the conflicts, the two teachers worked together to resolve them. The following conversation was recorded in Community 1:

Teacher B: Because the word "concentration" is really important for the answer to this item, an answer without this word is wrong.

Teacher A: But this student has written everything that the question demanded. By the way, if you look at this answer, the student should have received a score higher than 8 out of 10 points. Teacher B: There are no really important words that must appear in this answer because we did not suggest any words in the question. So we should score the answer...

Teacher A: So according to the scoring rubric, the score of this answer is 8 points.

Teacher B: I'll score it as 8 points. I cannot find a better solution.

(Community 2 on September 28, 2011)

The characteristics of these collaborations included agreeing with assessment criteria that were lower than the scoring criteria established in Process D. This means that more students are getting higher marks, which is how Teacher A persuaded Teacher B to agree. In this context, it was more important for the teachers to consider their colleague than the impact of the evaluation on students. For example:

Teacher B: I marked this as a wrong answer.

Teacher A: Really? I thought it was a calculation process when students wrote this. So let's mark this answer as correct. Many of our students scored low on it.

(Community 1 on October 4, 2011)

Teacher A claimed higher assessment criteria in Process D, but changed his attitude in Process I because the rate of correct answers was lower than expected. In process I, Teacher A showed a similar attitude as Teacher B by insisting on lowering the scoring criteria for students. To gain a greater understanding of the teachers' feelings regarding consensus in Community 1, the researcher conducted interviews. As a result, it was confirmed that the health of the partnership was maintained by considering the position of the colleague after encountering conflict. Teacher A revealed the following opinion during an interview:

Researcher: Since the scoring criteria have changed, should you mark the students' answers again?

Teacher A: I was scoring certain answers as correct, but Teacher B was scoring them as wrong. So I talked with her to consider the situation differently. But Teacher B would not change her mind and said that I was wrong. But I did not agree with her. So I was angry and shouted, "So I am wrong."

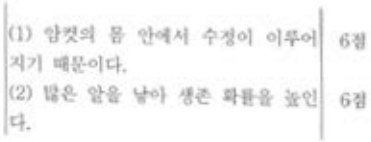
Researcher: You expressed your opinion very strongly.

Teacher A: I did not express myself in a pleasant way. So Teacher B said she was sorry and agreed that the answer was correct. I felt so disgusted because I was too assertive. Finally, we considered each other's positions.

(Interview with Teacher A on October 4, 2011)

In Process I, Teacher A tried to reach consensus in the discussion with Teacher B by being overly assertive and making an effort to share his knowledge with Teacher B. Teacher A shared his reasons for this behavior in an interview with the researcher:

Initial scoring rubric made in Process D



Modified scoring rubric made in Process I

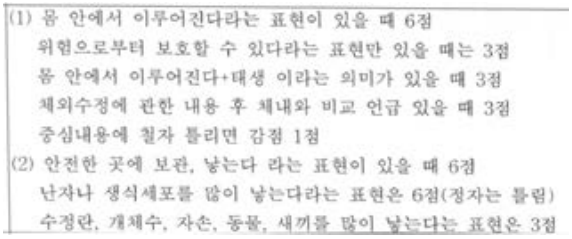


Figure 1. An example of initial and modified scoring rubrics in Community 2

Researcher: In general, answers with the wrong calculation processes are marked wrong, as Teacher B stated. Why did you insist on marking it correct?

Teacher A: Students may make the wrong calculations. This particular item does not require the students' calculation ability. As a matter of fact, I have participated in grading online assessments of academic achievement during summer vacation. At that time, the scoring criteria did not merely consist of calculating ability, but more importantly of judging whether the students knew what they really needed to do in this problem. I wanted to explain that to Teacher B.

(Interview with Teacher A on September 29, 2011)

The result of Community 2's agreement was similar to that of Community 1 by lowering the scoring criteria. In Process D, the criterion of the correct answer was very high and there was no consideration of partial scores, but the rubric of scoring which the teachers agreed to in Community 2 in Process I lowered the standard for a perfect score and increased partial scores. This also means that cooperation between teachers occurred so that more students received better grades.

Figure 1 shows an example of the scoring rubrics made in Process D and Process I in Community 2. In Process I, the expected responses were very simple and the scoring criteria were high. However, after the assessment of Process I, students were given partial scores for their responses and various answers were marked as correct.

Reflection and cooperation for raising students' correct answer rates to solve problems due to the lack of teachers' professional knowledge about students were frequently observed. When multidimensional problems that stemmed from a lack professional knowledge, such as an understanding of the students or teaching and assessment strategies, were revealed in the CoP, teachers tried lowering the scoring criteria to solve the problems. This can be interpreted as a decision made out of the consideration for colleague teachers in order to avoid revealing their lack of professional knowledge.

Lasting conflict within collaboration. In Community 2, Teacher D did not respect Teacher C, as it was revealed during Process D. Teacher D responded aggressively to Teacher C's suggestion of lowering the scoring criterion by saying, "Did you ever it teach in reverse?," which caused difficulties in their working partnership and impeded interaction. The following conversation was recording in Community 2:

Teacher D: Then just give a full score to answers with circles on top of the stationary front. The upper side should be round and the bottom side should be spiky because this is the condition of Korea.

Teacher C: These students drew it the opposite way.

Examples of students' answers

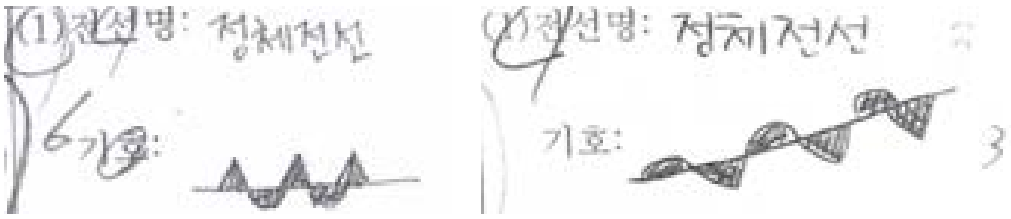


Figure 2. Two student answers that created conflict between Teacher C and Teacher D

Teacher D: Really. Korea has a warm front on the bottom side and a cold front on the top. Did you ever teach it in reverse? (Laughing)

Teacher C: I did not teach it like that. It's in the book. I simply taught that the round shape is the warm front, and the sharper one is the cold front.

Teacher D: Then, what should we do with the student answers? There are all types of answers, such as uncolored ones or ones with deviant crease lines, or backwards ones. Should we mark them all as correct answers?

Teacher C: Score all the answers as correct answers. I do not like it, either. But let's do it.

Teacher D: OK.

(Community 2 on September 29, 2011)

Figure 2 shows a comparison of student responses that conflicted with the scoring criteria of Community 2. The one on the left is an answer that Teacher D had judged to be correct, and the one on the right is an answer that Teacher C insisted on giving full marks to.

However, consensus was reached after the conflict because power was conceded to Teacher C, even though Teacher D did not internalize the consensus. The reason for this is that Teacher D doubted the professional content knowledge of Teacher C on this test item. The question was related to earth science, which Teacher D had majored in, but Teacher C had majored in physics. Another reason why Teacher D did not agree internally was that she expected student complaints due to the way Teacher C had taught the concept in class. Teacher D stated the following in an interview:

Teacher D: I agreed with Teacher C that answers showing opposite directions were correct, but I taught the concept using a map of Korea in my class and explained that the direction was important using the analogy of "What happens when North Koreans and South Koreans fight with each other? Of course, South Korea wins." This analogy teaches the students that the cold front of the upper direction means north and the warm front of the lower direction means south. So if they draw the figure using the opposite directions (on a map of Korea), it's wrong.

(Interview with Teacher D on October 7, 2011)

Teacher C was also aware of Teacher D's criticism, and the difference in their majors made the situation of determining the scoring criteria more sensitive. Teacher C stated the following:

Teacher C: I taught my students without thinking about it at all. Teacher D majored in earth science, so I know that she is more knowledgeable then me on the subject. In this respect, there are differences between major and non-major teachers. I've taught students using this method so far, but I have never thought about the direction. I did not see this information in the teacher's guidebook.

(Interview with Teacher C on October 5, 2011)

Initially, we judged that Teacher D had a better understanding of content related to the assessment items, but after the interview with Teacher C, we ascertained that he had a more complex understanding of curriculum planning. The claim of Teacher D that the right picture in **Figure 2** was correct is in the precondition of Korea map. But as explained in Teacher C's comment, there was no Korean map included in the instructions for that test item.

However, because his major was not earth science, Teacher C did not interact with Teacher D in a positive discussion. Teacher C suggested that he had taught the concept differently in his classes and so the scoring criteria might need to be changed. The power in Community 2 shifted to Teacher C, but he did not know how to effectively resolve conflict in the community. He suggested a superficial level of consensus because he was not trained to deal with complicated human relations issues.

In sum, consideration for colleague teachers was the reason for consensus in Community 2, which Teacher C suggested to Teacher D. If only the answer on the left in **Figure 2** was marked as correct as insisted by Teacher D, which would have placed Teacher C in a difficult position because of the opposition he would have received from his students. Thus, the most important factor in the interactions of Process I was the consideration of colleague teachers rather than the actual learning of the students.

Interaction in the CoPs in the Stage of Feedback (Process F)

Identification. Different types of interactions were observed between the two CoPs in Process F. The most obvious difference was the identification of problems. Although there were conflicts between the teachers in Process D and Process I, after coming to an agreement, the identification of a problem in scoring criteria that was their own responsibility was often observed in Process F for Community 1. Teacher A commented as follows:

> Teacher A: The students did not get so many wrong answers on past exams, but I left a mark in my teacher life. I just noticed that the scoring rubric is wrong, too. I did not think that the problem was the scoring rubric at first. But when I saw the students' answers, I noticed my mistake. It's a mess, so many students came and asked "Teacher, is this the answer or not?" I hated scoring it. I could not score it any more.
>
> (Interview with Teacher A on September 29, 2011)

Teacher A insisted on keeping the level of difficulty high during Process D. However, after encountering the low rate of correct answers, Teacher A reflected on his professional knowledge related to assessment, as follows:

> Teacher A: It's all my fault.
>
> Researcher: Why do you think it is your responsibility?
>
> Teacher A: Because I made the items difficult, and I did not think it was difficult when Teacher B insisted on it. But the kids felt that it was hard. I was wrong when I made the assessment items, or I was wrong when I taught the students. The problem is one of those.
>
> (Interview with Teacher A on December 15, 2011)

The willingness to accept responsibility for one's mistakes is also an aspect of professional growth. Teacher B, who agreed with Teacher A's concerns, accepted joint responsibility for the situation. She felt guilty for not having prevented this problem in the CoP. This can be seen as evidence of teacher identification with the CoP. On this matter, Teacher B stated the following:

> Teacher B: Too many students got this question wrong. I should have examined it properly when you gave it to me, but I did not know there was a problem.
>
> Researcher: You talked a lot with Teacher A when you edited the assessment items?
>
> Teacher B: I have to examine the items with the scoring rubrics together. But I did not because I was short on time. So both Teacher A and I made a mistake.

(Interview with Teacher B on September 29, 2011)

Although Teacher A made the initial decision about the item, Teacher B also took responsibility for the mistake. Therefor we decided that Teacher B identified the decision in the community. In Community 1, the identification within reflection was continuously observed during Process F. During Process F in Community 1, the teachers recognized the differences in students' understanding between teaching and assessment phases. Through the scoring process, the teachers were able to improve their understanding of student learning and received an important opportunity to reflect on their teaching goals and strategies. The teachers had related the error to their lack of professional knowledge. However, this kind of experience, if coupled with effective reflection, can have a positive impact on teacher PD.

On the other hand, Teacher D, who was dissatisfied with the consensus in Community 2, had often been seen expressing her frustration to the students in her class. This reaction means that identification with the community was not formed. The following conversation was recorded during a class observation:

Teacher D: This problem is easy. The stationary front stays in one place because the forces of the two fronts are similar. The correct answer is that there is a warming front in the south, and a cold front in the north. But there are many students who drew it differently.

Student 1: That's what I drew.

Teacher D: That's why I scored it as the correct answer.

Students: Wow!

Teacher D: I marked the figures without coloring as correct.

Student 2: Oh, no!

Teacher D: I was upset when I marked these answers as correct. Can you imagine who insisted on these scoring criteria?

Students: Teacher C?

Teacher D: Anyway, you understand the meaning.

Student 2: Oh, no. Really!

Student 3: You should score that answer as wrong.

Teacher D: That's why I'm so upset. There will be about 10 students per class who achieved a full score with wrong answers.

Students: It was too easy.

(Teacher D's classroom observation on October 4, 2011)

In this situation, Teacher D thought that her judgement was correct regarding the items related to earth science because her major was earth science. However, she did not draw a map of Korea or suggest preconditions related to Korea's situation when she developed the item. Therefore, it is wrong to assert that only specific directions are correct. However, she did not realize that the way she wrote the question could cause problems, and the CoP activities failed to assist Teacher D's PD. However, it was found through the interview with Teacher D that the problem was not related to her identification with the community.

Researcher: How did the students respond to modifying the scoring criteria?

Teacher D: When I told them that Teacher C made me score the wrong answers as correct, the students liked it very much.

Researcher: So what are you going to do next?

Figure 3. An example of notes taken in Community 1

Teacher D: If I form a community with other teachers, the scoring criteria will be changed. If they are in agreement, answers with wrong spellings or units will be treated wrong.

(Interview with Teacher D on June 30, 2011)

In Community 2, where there was only superficial agreement and no internal consensus, the root cause was the lack of mutual respect between the teachers.

Learning Partnership. Teacher A and Teacher B, who were both physics majors, showed the process of teacher PD through positive interactions and learning partnership in the CoP. They stimulated their PD through active participation in the community and discussions within the zone of proximal development (ZPD). These interactions were particularly evident in Process F. The following conversation was recorded in Community 1:

Teacher B: I had a question while scoring the answers. "F" means force. Is this symbol used only on Earth? Or can we use the symbol for force on the moon?

Teacher A: Normally "f" is only used on Earth because the meaning of "f" is 9.8.

Teacher B: Does "f" simply mean gravity acceleration? The value of gravity acceleration varies from Earth to the moon, but the moon also has gravity.

Teacher A: I think that "f" is only used on Earth. I have never seen "f" used elsewhere.

Teacher B: "Kilogram" is a unit of mass. I thought that wherever gravity acts on the mass, it represents gravity acceleration.

Teacher A: I never thought of that. Now that I think about it, I am not sure whether "f" is only used on Earth. But the item asked to compare the force of Earth and the moon. If you marked "f" for both situations, we would not be able to distinguish them. So, you should mark it as wrong.

(Community 1 on September 28, 2011)

An example of notes taken from a discussion in Community 1, shown in **Figure 3**, provides evidence of the learning partnership that existed within that CoP.

An important goal of assessment is feedback on student achievement. It also includes motivating further learning by providing a sense of satisfaction or accomplishment. Teacher C had a better understanding of the function of evaluations than Teacher D, and the bad scores did not help the students improve their learning. It is not ideal to diminish students' motivation to learn through bad scores. Teacher C had a better understanding of students because of his many years of teaching experience. His understanding of the students influenced his

opinions of the scoring criteria. However, Teacher D did not clearly understand the intentions of Teacher C for lowering the scoring criteria. Teacher C explained his opinion on the matter in an interview with the researcher:

> Teacher C: Since the students' thoughts are so diverse, there are too many unintended answers. However, when I read the students' answers as a whole, even though they did not match my expectations, I saw that meaningful learning had taken place, only that there were many misrepresented expressions. For example, in science, units are important. Of course, I think spelling is not important because it is a foreign language. It's a matter of pronunciation. But very few students have unit concepts. If you do not write a unit, you can only give a half score according to the scoring rubric that the teachers agreed to use. Then the students will be disappointed. The role of the assessment is to convey a message of caution to the students, but this does not work. So even if the unit is wrong, I will give those a full score. Half of the reason is to make scoring easier for me and the other half is to satisfy students with the scores.
>
> (Interview with Teacher C on June 30, 2011)

Teacher C developed his professional knowledge of students through the assessment process. However, Teacher D showed a negative attitude toward Teacher C because she thought Teacher D had less professional knowledge. She explained her attitude as follows:

> Teacher D: I do not agree with Teacher C. I think that students should not misspell their answers. But Teacher C treats those answers as correct. Teacher C made the scoring rubric easy after he made the test items difficult. He wanted to treat everything as correct answers if he found anything correct in them. But I cannot stand it. So I kept on arguing, but in the end, I agreed with Teacher C. That's the only way to raise the rate of correct answers. If the rate of students' correct answers is too low, it is the teachers' problem because it shows that their professional knowledge is poor.
>
> (Interview with Teacher D on June 30, 2011)

Mutual trust and respect are important factors in learning partnerships. If there is no mutual trust and respect among member teachers of a CoP, the teachers' PD cannot progress.

DISCUSSION

In this study, we investigated teacher CoPs in the process of developing assessment items, scoring, and providing feedback to students on the results. Throughout the study, we explored the PD of teachers within the community, and the factors to promote the efficient operation of a teachers' CoP. In this study, we found reflection, cooperation, conflict, identification, and partnership. The partnership in a CoP may be collaborative and harmonious, or it may be antagonistic and conflictual (Wenger, 2000). However, these complex and dynamic interactions did not guarantee the development of teachers' professional knowledge within the CoP. As a result of these interactions, we identified two different types of community implementation: challenge and routine.

At all stages of the assessment activity, the teachers considered their colleagues to ensure that low professional knowledge was not exposed. This appeared to be cooperation on the surface, but it did not aid in the growth of teacher PD. Cooperation for teachers' PD in a CoP involved solving the conflicts that arose within the community. Conflict resolution occurred when colleagues perceived each other as learning partners. This study revealed the importance of this partnership for teachers' PD in a CoP by presenting a case of a harmonious partnership and a conflictual one.

The difference between the two CoPs was clearly revealed from the identification of the members with the community. In Community 1, the teachers recognized the problems that arose in the assessment process as their own responsibility. This is a very important point. When a teacher assumes the responsibility for a problem because of his or her own lack of professional knowledge, this leads to PD. On the other hand, the teachers in Community 2 blamed their colleague for the problem in the community, and no real reflection or PD occurred as a result.

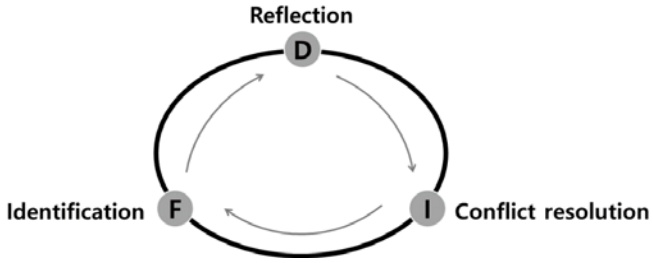


Figure 4. Challenge practice

Type I: Challenge Practice

Learning within a teachers' CoP should be challenging to incur professional growth. In addition, the learning must be cyclical. Challenge practice was observed in Community 1, consisting of Teacher A and Teacher B. Positive interactions between the teachers were continually observed in Processes D, I, and F for student assessment. Moreover, growth of the teachers' PD was easily observed. We called this type of practice challenge practice. In challenge practice, teachers engaged in activities of the community and developed their professional knowledge. The process is illustrated in **Figure 4**.

During this process, cooperation between the teachers was not always easy. For example, subsequent exams were planned based on the teachers' experience planning previous assessments. This caused a great debate and the teachers were only able to reach a consensus after lengthy discussion.

According to Kunzman (2003), conflicts can arise in teacher CoPs due to differences in teaching experience. Middle school teachers tend to think negatively about their students (Lewis et al., 2015). Teacher B in Community 1 and the teachers of Community 2 tended to have lower expectations for the students' abilities, while Teacher A had higher expectations for student achievement. It became clear that the debate occurred due to the teachers' different understandings of the students. This cycle has continued, and through these challenges and failures, the teachers were able to develop their professional knowledge.

Initially, the practice of the two teachers in Community 1 seemed unstable. They made many assessment decisions based on past experiences. However, their professional knowledge levels were not high. Through the conflict between the teachers in Community 1 and their reflection on their practice, they assessed their own beliefs (Lyon, 2011) and began to see their activities from a different point of view (Mitchell, 2015). This means that they were not passive participants, and that they acted as researchers by actively participating in a CoP (Erickson et al., 2005; Flint et al., 2011; Mitchell, 2015). Teachers' PD can be improved through peer interaction (van Driel, 2010). This is because teachers can exchange personal reflection with their colleagues based on their own experiences (Pintrich, Marx, & Boyle, 1993; So, 2013; Tillema, 1997).

We have confirmed the implementation of the challenge practice in Community 1 as a result of various types of interactions in Process D, Process I, and Process F. These reflections could help teachers to judge their level of professional knowledge and help them to understand how their knowledge affects their teaching and assessment practices. As a result, they were able to develop their professional knowledge within the practice community (So, 2013). They also accepted the results of the assessment as their own responsibility and identified with the community. Identification with a community can make a member vulnerable to its power dynamics. (Wenger, 2000). Reflection and identification are also inseparable (Wenger, 1998).

In order to be able to perform challenging practice, it is important to establish mutual trust and respect within the teacher community and to respect each other's professional knowledge. Mutual trust and respect provide the solid ground from which unanticipated problems related to student assessment, which may stem from a lack of professional knowledge, can be effectively resolved.

Type II: Routine Practice

Routine practice was observed between Teacher C and Teacher D in Community 2. Because they avoided confrontation through superficial interactions, they did not have the chance to develop their professional knowledge. Teachers can acquire new knowledge in a CoP, but the teachers in Community 2 failed to do so because of their misunderstanding of the students and their previous experience. In addition, they did not try to understand the reason for the failure through self-reflection. They chose to externalize the cause by blaming, for example, the other teacher's lack of professional knowledge (Grossman et al., 2001; Weiner, 2010).

In this community, the performance of the two teachers appeared to be stable. They achieved the expected results with minimal effort and thus reinforced their daily practice with this repetition. For example, if conflicts occurred, the teachers did not discuss it deeply and quickly resolved the conflicts by lowering the agreed-upon scoring criteria.

Wenger (2000) insisted that "conflict is a core part of practice" and Dooner et al. (2008) suggested that conflict can facilitate problem solving and understanding of alternative perspectives. Some conflict is healthy, stimulating problem solving and helping to understand alternative perspectives within the teacher communities. However, if these conflicts move to personal attacks and suspicion, and distrust penetrates the collaborative process, the community collapses and leaves members desiring to leave the community (Dooner et al., 2008; Jones et al., 2013). As such, Wenger (1998) also warned that conflicts can be potentially harmful to the teacher community.

In Community 2, we observed that Teacher C avoided conflict and failed to establish meaningful cooperation due to a lack of respect for his colleague. According to Kunzman (2003), there are five main topics in experienced teachers' learning, one of which is the importance of collegiality and collaboration. However, when there is a lack of respect among colleagues, it may not be possible for teachers to develop professional knowledge through collaboration or conflict in teachers' communities.

Some teachers have reported that they avoid interactions with colleagues with problematic dialogue skills in teacher communities (Jones et al., 2013). Teachers do not wish to participate in communities that involve aggressive or uncooperative teachers. If these problematic interactions are not resolved, the teachers' community will not have a positive impact on teacher PD. It is a challenging task for researchers to solve this problem because critical dialogue has a powerful function that interferes with the teacher's discourse (Carver & Katz, 2004; Clandinin, Downey, & Huber, 2009; Pomson, 2005). Thus, critical dialogue was called "unnatural work" by Ball and Forzani (2009). The teachers of Community 2 thus faced a problematic situation.

It is the mutual trust and respect between teachers that should be constructed first in order for conflict in a community to lead to positive development of teachers' professional knowledge. Because conflicts in a community are solved by considering other members' positions or opinions, when there is a lack of trust and respect among the teachers, conflicts can be perceived as personal attacks. In that case, conflict resolution through discussion may not contribute to educational growth or the development of teachers' professional knowledge. In such cases, community discussion may not be productive. In Community 2, few productive interactions were observed.

In South Korea, middle school science teachers have to teach physics, chemistry, biology, and earth science, but teachers major in only one of these subjects. A lack of knowledge in a non-major field can lead to teacher conflict over assessment; thus, conflict, such as that which occurred in Community 2, is common. For that reason, we called this type of practice routine practice. In routine practice, non-major teachers superficially participate in the interactions of their community, while mainly the subject-major teachers make the teaching materials, assessment items, and share them with the other teachers. The process of routine practice is illustrated in **Figure 5**.

Weak interactions between teachers were continuously observed in Process D, Process I, and Process F, and facilitation processes for teacher professional development were not easily observed.

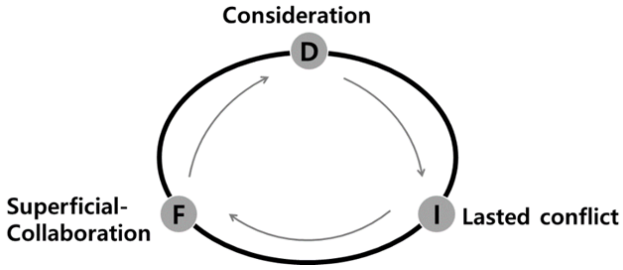


Figure 5. Routine practice

CONCLUSIONS AND IMPLICATIONS

Teachers should have the capacity for collective growth as well as individual growth. A teacher's community plays a very important role in raising these competencies. Teachers need opportunities to engage in genuine activities and rigorous and controversial discussions within the community. It is especially important to consider the factors that influence teacher PD in order for dynamic community activities to take into account various aspects of the teacher's personal perception, social interaction, and learning environment. We searched for complex and dynamic variables in this study to explore how teachers develop professional knowledge from their relationships in the community.

Assessment affects all levels of the education system and is an important catalyst for reform of the science curriculum and teaching strategies. This study examined teacher's interactions within CoPs for student assessment, and investigated which factors positively influenced teacher PD. Teacher responses to interactions within communities vary. Particularly, conflicts can be resolved or perpetuated depending on whether they are using challenge practice or routine practice. The most crucial factors found to influence this were mutual trust and respect between the teachers.

In most cases, it was more important to consider other teachers' points of view than the students' learning while resolving conflict in the community. This teacher-centered thinking implies a low level of professional knowledge. The professional knowledge of these teachers was reinforced by their past experiences. The easiest path for the teacher was adopted first rather than a harder path requiring more professional knowledge (Lewis et al., 2015). Reflection from past experiences changed teachers' behavior toward producing items that asked a single and simple answer of the students.

Many studies (Akerson et al., 2009; Daniel, Auhl, & Hastings, 2013; Jones et al., 2013; Thomas & Pedersen, 2003; Vescio, Ross, & Adams 2008; Wenger, 1998) have suggested that reflection may have a positive effect on teachers' professional development. However, this finding confirms that teachers' reflective thinking from past negative experiences may interfere with teacher PD.

However, the community resorted to challenge practice only when there was mutual trust and respect between the teachers, in which the teachers' professional knowledge was developed. In the absence of mutual trust and respect between teachers, the community resorted to routine practice, and their professional knowledge was not developed. In particular, teachers were trying to avoid negative reactions from other teachers in the community.

Although the professional development of teachers is an objective of the community, professional knowledge will not develop if teachers simply cooperate with each other to avoid conflict. The community should provide opportunities for teachers to examine their practice from an unconventional perspective in order to improve their professional knowledge. This experience can be either positive and negative depending on the nature of the teachers' cooperation.

Obstacles that interfere with teachers' PD are other teachers and the students. In both CoPs, the reason why the teachers chose not to admit to their own mistakes was their concerns for parents and students. This phenomenon arises from collective responsibility for student learning. Teachers in CoPs must collaborate in

curriculum and classroom planning as well as in assessment implementation. If they work on challenge practices while discussing their opinions to develop their PD, they will have more productive outcomes. If the process of resolving conflicts among teachers within CoPs is consistent across all areas of curriculum, teaching, and assessment, the teachers' PD will make student learning and assessment more effective.

Mutual trust and respect in CoPs are very important factors in resolving conflicts, and it is very important to experience learning partnership in and identification with the community. If the teachers' PD or past experiences in the CoP are similar, conflicts rarely occur. Since Korean science teachers are aware of the Korea national curriculum and the national standards of assessment, there are few differences in their PD and assessment experience. In particular, teachers have a common belief in knowledge assessment. It is therefore difficult to observe conflict situations that arise from different beliefs and PD.

We were fortunate to observe serious conflict between the teachers in this study. Through our observations, we found that it is important to strengthen the community by establishing a collaborative environment in which teachers can resolve conflicts openly and effectively with mutual trust and respect. Teachers' PD can occur more effectively through the resolution of conflicts with colleagues than by teaching students in isolation. However, this study has limitations. Here we focused on the potential conflicts between teachers in the CoPs that emerged from unintended consequences. After the school year, we expected that the teachers would continue their practice in the new communities. However, the teachers of Community 1 did not continue the challenge practice they had achieved before.

This means that the one-semester duration of the study was not long enough to acquire the competencies that would affect the professional development of other teachers. Therefore, it is necessary to have enough time to establish the challenge practice in the community for the teachers' PD. For this, school administers should provide encouragement for this kind of practice, considering the school's situation. In particular, the professional development of individual teachers within the community is possible through mutual respect and trust of colleague teachers, but in a complex school reality, substantial support is needed to realize these conditions.

Hord (1997) noted that "individual and community improvement is enabled by the mutual respect and trustworthiness of staff members." In particular, younger teachers are more likely to think that their professional knowledge related to content is superior to older teachers. Therefore, in order for beginning teachers to develop professional knowledge through interaction in the teachers' community, they need to learn the importance of mutual respect and effective conflict resolution.

Recently, the numbers of CoPs for teacher PD has increased in South Korean schools. Therefore, this study offers important implications for teachers' PD through community conflict resolution. Younger teachers, in particular, need to learn productive ways to resolve conflicts with experienced older teachers. However, at the same time, experienced teachers should also recognize the value of interaction with younger teachers. Some experienced teachers reported disappointing and unacceptable sharing experiences (Jones et al., 2013). To solve this problem, school-based support for establishing effective teacher CoPs is needed.

Finally, a limitation of this study was a lack in the diversity of members in the CoPs. In South Korea, members of student assessment CoPs are largely constricted to teachers of the same grade level and subject. Therefore, the results of this study may not be generalizable to other countries.

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Financial Education on Bank Lending and Economic Volatility in Taiwan

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ABSTRACT
Education regarding money and banking always tells us that banking is a critical point for macroeconomics. However, there is not enough evidence to further prove the relationship between banking and volatility. In our view, an integration of small and medium-sized enterprises (SMEs) with serious financing constraints, small open economy and bank-based financial system can provide the best opportunity to explore bank-volatility nexus. Fortunately, Taiwan is the most notable case to offer the key to an understanding of banking and volatility for our students of finance. There is sufficient evidence based on panel data analysis with spatial dependency to support the significance of regional bank lending (credit supply) rather than the stock market (credit demand) in explaining volatility. It is clear that the role of bank system in volatility in Taiwan deserves explicit emphasis.

Keywords: volatility, SMEs, credit view, bank lending

INTRODUCTION

The financial-growth nexus stems from the traditional economic wisdom that the financial system can help to overcome market frictions and to improve the allocation and flow of capital more efficiently as a lubricant for promoting economic growth (King and Levine, 1993; Jayaratne and Strahan, 1996; Beck and Levine, 2004). However, there is no conclusive proof that bank system can significantly affect economic fluctuation or risk. To convince our students of accepting this viewpoint, we find that Taiwan itself is an excellent case to emphasize the importance of banking in economic volatility on the grounds that Taiwan is an integration of SME-based, bank-based and small open economy and these characteristics all points to critical role of banking in national development.

In particular, Taiwan's successful experience as an SME-based economy has been regarded as a unique role model for the developing world (Hu and Schive, 1998). Wu and Huang (2002) have further described these unique characteristics in several ways: (1) Taiwan's SMEs are more concentrated in the manufacturing sector, which faces more global than domestic competition; (2) Taiwan's FDI flows come primarily through SMEs, which are different from those in other countries where large multinational corporations are mainly involved, and (3)

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Contribution of this paper to the literature

- Facing a variety of arguments for economic volatility, searching a sound and reasonable model is indispensable to teaching and learning the role of bank lending in economic volatility and this paper integrates all possibilities to evaluate the effects of bank lending on local economic volatilities.
- This paper shows all theories and channels to let students better understand the relationship among volatility, economic factors and bank lending. At the same time, Taiwan is a notable example to all of my students.
- We teach our students to survey articles, to read textbooks, to set up a model, to calculate volatility, to collect different types of data, and to apply panel data methodology. Finally, we can determine the sources of economic volatility; at the same time, propose some policy implications.

Taiwan's SMEs have the greatest impact on employment and job opportunities.[1] These findings all point out that the development of SMEs is the most important reason behind Taiwan's economic miracle.[2] However, it is generally believed that SMEs have two distinctive characteristics: a lack of access to capital markets and opaque information as a result of local banks being the single most important source of external credit for small firms (Meyer, 1998). The role of banks is to facilitate information exchange between lenders and borrowers (Fishman, 2009). In other words, the financial and operating conditions of SMEs suffer from finance gaps (Avery et al., 1998; Berger and Udell, 1998) and the relationship between SME financing and banks is therefore noteworthy (Grunert and Norden, 2012; Berger and Udell, 2006).

Financial system in Taiwan, which is dominated by government-controlled banks, leads to banks function as central institutions not only for allocating capital but also for managing development policies (Zhang, 2009). In fact, Taiwan is still a notable of bank-based system with more than 50% of the amount of corporate financing capital from banking industry now. For the above reasons, the influence of the banking lending is much more conspicuous in Taiwan than in other nations. In addition, Taiwan is a small open economy with a high ratio of economic output from exports and hence the advance in international competitiveness comes from the infusion of massive public resources in some specific regions and industry segments, namely, a "growth pole" strategy, which may result in serious regional divergence. This policy makes it more vulnerable to economic risks (Chiang, 2009).

Finally, while most studies in the past have focused their attention on volatility at the macroeconomic level, we choose to analyze panel data for 23 regions over the 1998-2008 period to identify the critical factors which influence regional volatility. More specifically, monetary policy transmission causes a complicated interworking between monetary-policy tools and credit view. Thus, another contribution of this paper is to disentangle pure credit view from these possible correlations in order to delicately evaluate the effects of real credit view and monetary policy, respectively on local volatility. The empirical result that regional bank lending channel significantly affects regional volatility is fully consistent with our expectations.

The remainder of the paper is organized as follows. Section 2 reviews past studies on the bank lending and all other possible sources of volatility. Section 3 discusses the model and describes the data. Section 4 outlines the econometric method and discusses the empirical findings. Finally, Section 5 provides the conclusions and policy implications.

[1] SMEs, which are defined as enterprises with less than 200 employees, account for nearly 70% of total employment in Taiwan (MOEA, 2008).

[2] Abe and Kawakami (1997) and Kato and Wan (2001) both compared Korea (conglomerate business groups) with Taiwan (SMEs).

REVIEW OF LITERATURE

Banking Credit, Monetary Policy, and Economic Growth

One of the new growth theories suggests that financial deepening can promote economic growth (Bencivenga et al., 1991; Levine et al., 2000).[3] The bank lending of the "credit view" emphasizes that financial intermediation, such as banks possesses specialized techniques and information advantage to allow them to evaluate borrowers, especially bank-dependent borrowers and thus their credit performance affects real economic activity (Blinder and Stiglitz, 1983; Fama, 1985; Bernanke and Blinder, 1988). Wu (1999) and Ramirez (2004) proved that the influence of monetary policy using credit view on a small open economy will be apparently straightened up. This view regarding bank lending is referred to as "narrow" credit view. On the other hand, Onliner and Rudebusch (1996), Bernanke et al. (1996) and Bernanke and Kuttner (2005) argued that the increases in asset markets, such as stock market can spur credit demand from firms and households and then leads to higher investment and aggregate output. To distinguish from narrow credit view, this contention regarding asset markets is referred to as the "broad" credit channel. It is interesting to note that narrow credit channel from bank lending focuses on credit supply, while broad credit channel mainly from stock prices stresses on credit demand from firms and households.

More specifically, in accordance with credit market imperfection and localized information, there is good evidence provided by Bernanke and Lown (1991) to show that the growth rate of bank loans is positively correlated with changes in state employment. Samolyk (1994) provided the credit view from the regional perspective to stress the role of local banks in funding information-less borrowers, particularly small local firms that do not have direct access to the capital market. Carlstrom and Samolyk (1995) also proved that asymmetric information exists due to the localized advantages of local banks. Similar studies tended to discuss the direct relationship between local bank lending and regional economic performance (Jeong et al. 2006; Elyasiani et al., 2007). In fact, many studies suggested that regional analysis is possessed of several advantages over cross-country analysis. Institutional, cultural and other qualitative variables can, for example, be controlled, and local information regarding local borrowers is more available to local banks (Carbó et al., 2007; Fernández de Guevara and Maudos, 2009).

Economic Volatility and Other Factors

There has been renewed interest in identifying which variables can account for this reduction in overall economic volatility. First, Stock and Watson (2002) found that an effective monetary policy can significantly account for the reduction in volatility and Clarida *et al.* (2000) also agreed that a comprehensive monetary policy, such as an interest rate policy, can help reduce economic volatility. In fact, money aggregates have recently been ignored in the implementation of monetary policy, while the target interest rate has become more and more popular because it is relatively definitive; at the same time, it can avoid a tragedy of inflation (Romer, 2000; Ireland, 2004). However, Poilly (2010) argued that money aggregates and the interest rate as the two tools of monetary policy should be evaluated and determined simultaneously. In addition, FDI, international trade and the oil price should be critical for economic volatility. de Mello (1999) and Lensink and Morrissey (2006), for example, have both suggested that the volatility of FDI inflows reflects the stability (or volatility) of the host country. Moreover, some studies have asserted that employment volatility can be regarded as labor market flexibility (Roders and Nataraj, 1999). Finally, oil price shocks can affect the economy (Hamilton, 1983; Ahmed et al., 2004) and Hooker (1996) further suggested that oil-price volatility is a better index for understanding its impact on economic volatility.

As far as regional volatility is concerned, Conroy (1974) first applied portfolio theory to investigate the relationship between industrial diversification and local economic volatility. The volatility-growth relationship (Malizia and Ke, 1993; Trendle, 2006) found that industrial diversification at the state or metropolitan level can reduce regional volatility. In addition, Baldwin and Brown (2004) proposed two different relationships between

[3] Although it is believed that financial development and economic growth are positively related, the causality between financial development and economic growth has been the subject of controversy (Ang and McKibbin, 2007; Bangake and Eggoh, 2011).

Table 1. The channels of monetary transmission

Monetary policy	Mediator	Real variables	Demand or supply side	Channels
interest rate	real term	investment	aggregate demand	interest rate
money aggregate	bank lending	investment	credit supply	narrow credit
interest rate money aggregate	stock prices	investment	credit demand	broad credit 1 (firms)
interest rate money aggregate	stock prices	consumption	credit demand	broad credit 2 (households)

Note: While the interest rate channel is based on money view, the other remaining channels can be classified as the narrow and broad credit views

exports and regional volatility: exports reduce volatility due to geographic diversification of international markets, whereas exports may promote regional specialization and thereby increase risk and volatility. Besides, Clark and Summer (1981) and Rios-Rull (1996) found that the young experience much more employment volatility than prime-aged individuals. Jaimovich and Siu (2009) also pointed out, the baby boom can account for the moderation of volatility in the U.S. In addition, Carlino and DeFina (1998, 1999) found little evidence in the credit channel effect of monetary policy transmission. Finally, Bhattacharya (2003) highlighted the significantly positive role of the oil price shocks in employment fluctuations in energy-rich states.

It is clear that past studies on the sources of volatility have lacked a linkage with the credit view, especially in relation to local bank lending. Furthermore, Taiwan combining SME-led economy, a pole policy with a bank-based system offers a key understanding of the bank-volatility nexus. The purpose of this paper is to explore the magnitude of regional volatility in Taiwan to be reflected in the status of the banking.

METHODOLOGY AND DATA

Monetary Policy Transmission Mechanism

As long as monetary policy transmission mechanism is very complicated, past studies mostly applied vector autoregression (VAR) or structural VAR models to pursue the possible effects of monetary policy on macroeconomics. We summarize them following by Mishkin (2007) as shown in **Table 1**.[4]

First, traditional economic theory emphasizes that monetary policy from money view and interest rate channel is to reduce interest rate to stimulate economic growth. Secondly, the credit view can be further classified into two categories: narrow credit view and broad credit view. The former indicates that bank lending as credit supply is critical to surviving SMEs and economic development. The latter suggests that an active monetary policy can become an impetus of a bullish stock market and then the increases in stock prices can improve net worth in firms and households and so leads to higher credit demand.

Economic Model

First, due to the limited availability of regional data and highlighting the importance of SMEs, regional output is replaced by regional employment. In order to account for the link between regional employment volatility (Vol_emp) and two kinds of factors, namely, national factors (NF) and regional factors (RF), this study proposes the following model in (1):

$$Vol\_emp_{it} = f(RF_{it}, NF_t) \quad (1)$$

[4] In fact, even Mishkin (2007) mentioned that, for other types of balance sheet channels such as cash flow and unanticipated price level channels, these two effects are ultimately reflected in stock prices. In addition, other asset price channels such as Tobin's q theory and wealth effects also correspond to stock prices. Therefore, quoting "stock prices" in support of the broad credit channels should be appropriate for our analytical simplicity.

$$RF_{it} = RF(Vol\_lending_{it}, DIV_{it}, POPR_{it}, DEP_{it}) \quad (2)$$

$$NF_t = NF(Vol\_rr, Vol\_M, Vol\_stock, \exp ortg, Vol\_FDI, Vol\_Oil) \quad (3)$$

The subscript represents region i at time t. It is important to note that many variables are transformed into volatility measures so as to explain employment volatility more directly, except for local demographics or explicit arguments to announce the relationship between some factor and volatility. Compared with Owyang et al. (2008) and Carlino et al. (2011), this study considers regional and national factors in (2) and (3) to explain sources of regional volatility with the role of credit views.

We first want to discuss about monetary policy, credit views and economic volatility. Traditionally speaking, the interest-rate volatility (Vol_r) can affect macroeconomic performance through the interest rate channel. Another monetary tool, money-aggregates volatility with Vol_M, can investigate the degree of its effect on economic stability. In addition, monetary policy through affecting the desire for bank lending (narrow credit) and stock-market performance (broad credit) can also affect real economic activity. Two volatilities, namely, $Vol\_lending_{it}$ and Vol_stock_t, show the effects of the two kinds of pure credit views on economic volatility. The former denotes the degree of volatility in local bank lending itself to quote the regional credit view that greater volatility in local bank lending makes firms' operations more difficult and the situation is further reflected in increased employment volatility. The latter from stock-market performance itself which affects aggregate lending activity, regardless of whether from firms or households, should be positively related to real economic fluctuations.

For reasons already stated, regional volatility in (1) may come from regional factors (RF) in (2) and national factors (NF) in (3) followed by Carlino et al. (2013). The former includes local bank lending, industrial diversification, and the demographic distribution (age population and the dependency ratio), while the latter refers to monetary policy (the interest rate and money aggregates), exports, FDI inflows and the oil price. As a beginning, we provide three indices to control the status of regional economics and it is unnecessary for these variables to be transformed into volatility measures since the industrial structure and demographics are used to control regional economy. DIV_{it} is the index of industrial diversity at the regional level and it is expected that a higher degree of industrial diversity calculated by the Herfindahl index, can reduce employment volatility, according to portfolio theory. A higher (lower) DIV implies advanced industrial specialization (diversity) in a given region, and so it should reflect a positive relationship between DIV and volatility. $POPR_{it}$ and DEP_{it} represent percentages of the young in population and the dependency ratio, respectively. A higher $POPR_{it}$, the ratio of the young in the population leads to greater volatility while a higher DEP_{it} pushes workers to remain in their jobs in order to maintain their family's living standards, thus leading to lower employment volatility.

It follows from what has been said that the employment volatility model with the expected impacts of different explanatory variables can be summarized as follows:

$$Vol\_emp_{it} = \underset{(+)\ (+)\ (+)\ (-)\ (+)\ (+)\ (+)\ (+)\ (+)\ (+)}{f(Vol\_lending_{it}, DIV_{it}, POPR_{it}, DEP_{it}, Vol\_rr_t, Vol\_M_t, Vol\_stock_t, exp\ ortg_t, Vol\_FDI_t, Vol\_Oil_t)} \quad (4)$$

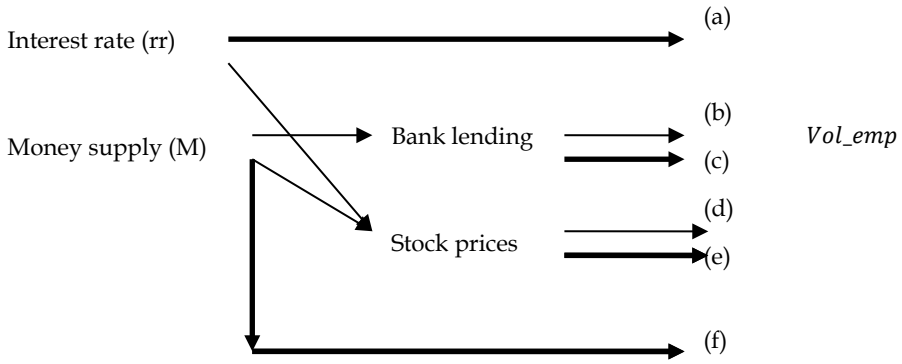
Measuring Volatility

Defining and estimating the volatility is a critical step and this study follows Morgan *et al.* (2004):

$$g_{it} = c_i + c_t + v_{it} \quad (5)$$

$$g_t = c_t + v_t \quad (6)$$

Where g_{it} and g_t stand for growth rate of a specific variable in region i at time t and its national growth rate at time t, respectively. Thus, c_i and c_t are represented by regional and time fixed effects, respectively. From (5) and (6), we can run regional or national growth of this variable against one or two fixed effects to obtain regional or national residuals as regional or national volatility.



Note: bold and thin lines represent direct and indirect effects on employment volatility, respectively.
Figure 1. Route map of monetary policy transmissions

On the grounds that monetary policy can affect real economic volatility through different credit channels, how to distinguish monetary policy from different credit views becomes a difficult but essential question. Illustration from **Figure 1** may be informative. First, flows a and d show direct and indirect effects of interest rate channel. Similarly, flows b and d represent two kinds of indirect effects from money supply and flow f indicates direct effects of money supply on employment volatility. What is more, flow c is the impact of bank lending itself on employment volatility, while flow e points to its own effect of stock price. If we can compute their own effects from bank lending (credit supply) and stock price (credit demand), we can obtain the full impacts of monetary policy from interest rate and money supply no matter from direct or indirect effects.

To reach this goal, in the first step, by regressing stock-price growth (SG) on time fixed effects, interest-rate growth (r_g) and money-aggregate growth (M_g) as (7), we can obtain the stock-price-specific volatility, which is the deviation from average national growth (c_t) plus two tools of monetary policy, namely, the average growth rates of both the interest rate and money aggregates. In other words, we utilize the regression process to remove the direct effect of monetary policy on stock market and the residual is the volatility of the stock price itself (Vol_stock). Analogously, we can run a regression of bank-lending growth (BLG) against two fixed effects at regions and time (c_i and c_t) associating with money supply growth in (8) to obtain the residuals as the volatility of region-specific bank lending.

$$SG_t = c_t + \alpha_1 r\_g_t + \alpha_2 M\_g_t + \varepsilon_t \tag{7}$$

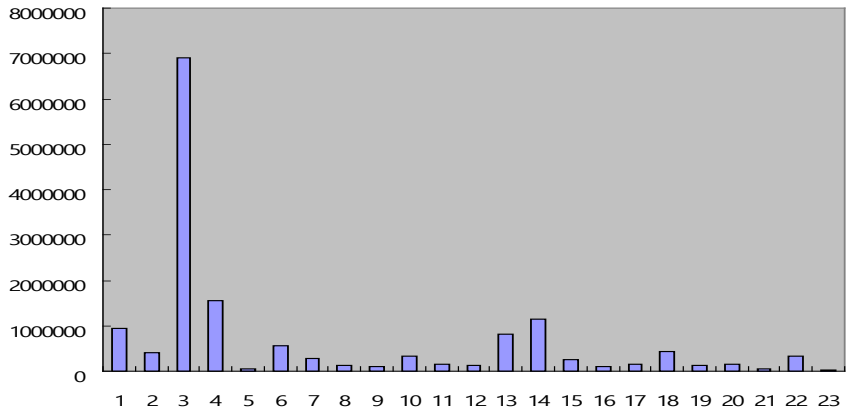
$$BLG_{it} = c_t + c_i + \beta_1 M\_g_t + \mu_{it} \tag{8}$$

Since Vol_stock_t and $Vol\_lending_{it}$ are two residuals, which are statistically independent of volatilities from interest rate and money supply, four individual effects on employment volatility can be estimated by a regression model in (4).

Data Description

Regional differences occur due to the pole policy that Taiwan's public investment and industrial base are highly concentrated in the Northern region. In this environment, it is necessary that the development of region-specific labor markets on an individual regional basis. In general, the counties or cities having geographic contiguity and sharing similarities in resources are aggregated into four regions: the Northern region (the cities of Taipei, Keelung, and Hsinchu and the counties of Taipei, Taoyuan, Hsinchu, and Illan), the Central region (Taichung city and the counties of Miaoli, Taichung, Changhua, Nantou, and Yunlin), the Southern region (the cities of Kaohsiung, Tainan, and Chiayi and the counties of Chiayi, Tainan, Kaohsiung, Pingtung, and Penghu), and the Eastern region (the counties of Hualien and Taitung), as shown in **Figure 2**.

Figure 2. Map of Taiwan's counties and cities



Unit: millions (NT)

Figure 3. The distribution of regional bank loans

Figure 3 depicts by the distribution of average amounts of regional bank lending in 23 regions during 1998-2008. It is clear that bank lending is excessively unevenly concentrated in Taipei city and other metropolitan areas. This pattern preliminarily proves the validity of the regional credit view from bank lending.

The descriptive statistics for related variables from various sources of data are summarized in Table 2. As far as monetary policy is concerned, the interest rate is the interbank loan rate in real terms to show that the interest rate channel of monetary policy and money aggregates is represented by broad money, M2. The sample period is restricted by the fact that the statistics for local banking are available only since 1997. Moreover, the industrial

Table 2. Descriptive statistics and data sources for the 1997-2008 period

Variable	Mean	Max	Min	Data sources
Vol_emp_{it}	3.61	15.07	0.01	*Manpower Survey*
$Vol\_lending_{it}$	3.62	15.74	0.04	*County Financial Statistics*
DIV_{it}	9.93	20.52	6.09	*Manpower Survey*
$POPR_{it}$	24.21	27.41	19.74	*Statistical Yearbook of Interior*
DEP_{it}	42.59	50.50	31.90	*Urban and Regional Development*
Vol_rr_t	6.62	18.73	0.35	*Statistical Abstract of National Income*
Vol_M_t	1.22	2.68	0.004	*Statistical Abstract of National Income*
Vol_stock_t	22.02	43.59	2.93	*Statistical Abstract of National Income*
$Exportg_t$	8.01	18.64	-10.04	*Statistical Abstract of National Income*
Vol_FDI_t	49.87	198.48	6.39	*Handy Guide for Foreigners*
Vol_Oil_t	21.78	53.46	2.22	*Handy Guide for Energy Statistics*

Table 3. Estimation Results

	OLS	Fixed Effects with Spatial Errors
Intercept	0.035 (0.799)	0.130 (3.083)***
$Vol\_lending_{it}$	0.032 (1.122)	0.026 (1.690)*
DIV_{it}	0.089 (1.355)	-0.035 (-0.364)
$POPR_{it}$	-0.207 (-1.240)	-0.057 (-0.474)
DEP_{it}	0.001 (1.581)	-0.002 (-2.053)**
Vol_rr_t	-0.001 (-1.640)	-0.001 (-0.430)
Vol_M_t	0.023 (0.006)	0.432 (2.133)**
Vol_stock_t	-0.007 (-0.435)	0.004 (0.700)
$Exportg_t$	-0.046 (-1.915)*	-0.042 (-4.515)***
Vol_FDI_t	0.010 (2.517)**	0.005 (2.820)***
Vol_Oil_t	0.013 (0.569)	0.065 (4.825)***
R^2	0.109	0.402
Diagnostic tests	F=2.949***	F=4.613***
	D-W=1.714	D-W=2.230
Specification tests	Test of fixed effects: F=3.183***	
	Test of local factors effects: F=2.850**	
	Test of national factors effects: F=14.470***	

Note: Numbers in parentheses are t statistics; *, **, and *** denote significance at the 10%, 5% and 1% levels, respectively

classification has increased to 37 sectors and the index of industrial diversity in this study is more robust than the index in Chiang (2009).

ESTIMATION RESULTS

Our data is consisted of 23 regions covering for 1998-2008 period, so this is a standard panel-data format. **Table 3** shows the results of comparing the pooled OLS method with the fixed effects model adjusted for spatial dependency. It is easily found that the latter econometric model is the most efficient and robust estimation based on R^2 as well as two diagnostic tests, namely, the Wald test and the Durbin-Watson (D-W) test, which indicate that the selected variables are adequate and that no autocorrelation exists. Finally, the fixed effects test fully proves the existence of regional heterogeneity.

As far as the local factors are concerned, a joint test is conducted to check whether the effects of local factors are important. Although it is found that effects of local factors are statistically significant in explaining regional volatility, their effects are less pronounced than those of national factors. In addition, the industrial diversity index

(DIV) and the ratio of young population (POPR) both have insignificant effects on regional volatility. On the other hand, the estimated coefficient of the dependency ratio (DEP), which is statistically significant and negative, is consistent with our expectation that a higher dependency ratio forces workers to keep their jobs and, therefore, leads to lower employment volatility.

Most important of all is the finding that the coefficient of "pure" local bank lending volatility is significantly positive, and this not only fully shows that local financial conditions play a critical role in local employment fluctuations, but it also supports the regional credit view. We believe this is a reasonable outcome given that SMEs, which play a much more important role in Taiwan than in other Asian countries, rely more on the local banking system for economic stability.

To sum up, based on the significant results from the regional credit view and money aggregates, we can conclude that the authorities should once again consider the importance of money in the case of Taiwan and the credit environment is very critical to regional employment volatility. However, in this era of globalization, the Taiwan's government always focuses on the internationalization of the stock market. What seems to be lacking is a decision to accelerate and improve the function of bank lending in relation to SMEs. In particular for an SME-based economy with a bank-based financial system, the critical position of local bank lending can really affect the survival of SMEs and subsequently the magnitude of employment volatility from our study. We propose that Taiwan's authorities should change its mind from stock globalization to financial reforms. In other words, an efficient allocation of capital based on the ability of SMEs to compete through local bank lending is especially worth noting in the case of Taiwan on the grounds that SMEs absorb the majority of employment. Regional specialization for a small economy with pole policy tends to lay emphasis on the importance of regional analysis. Moreover, the issues regarding reducing the dependency ratio at the regional level and the volatilities caused by FDI inflows and the oil price are also vital for reducing employment volatility. After all, we believe that the above arguments can provide our students more sensible for the role of banking system in Taiwan.

CONCLUSION

This study identifies and estimates the differential impacts of national factors and region-specific variables on employment volatility in local counties and cities in Taiwan. We try to provide our students with a good illustration of relationship between banking and employment volatility in financial education. In the case of Taiwan that involves the integration of SMEs, export-orientation, and a bank-based characteristic of the economy, empirical results completely support our view point. We believe that this result can impress students who are learning a course of "Money and Banking" with the importance of banking industry. Finally, from the standpoint of national policy, bank lending attitude toward SMEs rather than the stock market can improve volatility through SMEs with the absorption of massive job opportunities. Thus, we strongly recommend that the authorities engage in banking-sector reform to straighten out the performance of local bank lending in relation to SMEs, namely, relationship lending (Berger and Udell, 1995; Petersen and Rajan, 1995).

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Research on the Development and Change of Chinese Sports Science Based on Bibliometric Analysis

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ABSTRACT
Information has become a kind of resource wealth in the development of contemporary society, it is the spread of the channel, and exchange method may also be with the development of society and constantly changes. In recent years, the concept of healthy China has attracted wide attention. This paper USES a series of research methods, according to research shows that in modern times I for sports academic research am on the rise, sports study power is widely dispersed throughout the province. But all obvious gap, unbalanced development. Since modern times, China has involved the development of sports academic major sports, but there is still a problem, the major sports projects and project research among their strength is different, therefore there is a lot of strong project; At the same time, there are also some weak project, even the outline. This article also in the pro-cess of development and transformation of sports academic problems put forward some Suggestions and solutions, In the study of health education to become a global concern, it provides some meaningful exploration.

Keywords: literature metrology, scientific research, sports literature, sports health education

INTRODUCTION

Life lies in movement, and exercise is good for health. With the continuous development of social economic and political progress, the improvement of living standard, the thought idea also follow change, becoming more and more people pay attention to the quality of life of life, I improve the self-health consciousness, more and more people pay more attention to physical exercise (Zhang & Peng, 2017). Health is the connotation of modern civilization, and now we are in their own action to create a happy life and good future, health is the premise, health is the guarantee, is the important part of health. In the modern civilized way of life, health, much attention has been paid to be referred to an unprecedented height, the understanding of health also has taken place in the larger change, its concept, nature, content, form be injected fresh blood, reflects its advancing with The Times, reflected the people understanding of the essence of life (Zheng, 2015). The first thought of health has been translated into behaviour, and physical exercise can make the body's metabolism strong and enhance the function of organs and systems so as to achieve the goal of enhancing the constitution and extending the life (Li & Mei, 2017).

Twenty-first centuries are an era that science and technology are rapidly developing, information has already become a kind of resource wealth in contemporary social development, its transmission channel, exchanging methods will also constantly change followed by social development. But thesis as academic information communication basic ways, it will never be obsolete in the rapidly development of science today

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Contribution of this paper to the literature

- The academic thesis of sports has also played a great role in the development of sports.
- As a record of people's practice in sports, many social science and natural science workers have made great contributions to the research of sports.
- To strengthen cooperation between the sport scholar's consciousness, as far as possible to realize the interdisciplinary exchanges and cooperation, strengthen the research of non-sports discipline knowledge, to further improve the quality of sports scientific research achievements.

(Chien, 2017). Therefore, sports circles thesis also performs extreme big effects in sports development, it not only is description and record in sorts science research result, and meanwhile it also makes huge contributions to human academic communication, scientific results popularization, therefore, he plays extreme important roles in recent years' sports academic development valuable collections and propelling to sports development. Thesis not only states recognition and opinions on scientific knowledge, but also acquires other scholars and experts' recognition (Dai, 2012); let more people to learn and accept, so as to keep extension of science.1-5 Thesis has gradually become new opinions and new methods places of origin, domestic and overseas many experts keen on academic researches Sports as one part of social culture, it plays important roles in people's daily life, it not only can build one's body, but also can enrich people's amateur life, and nowadays, sports are more developing towards professionalization, each item professional sports competitive games are developing (Jiang & Ding, 2007). Sports literatures as records that people go in for sports practices, lots of social science and natural science workers have made huge contributions to sports academic researches, they collect numerous useful facts, theories, data, methods, definitions and also records on sports performance, all of these are crystallization of sports scientific research discussion and recognition, and meanwhile it also records numerous successful or failure experiences (Lv, 2011). These literatures record specific times (Liu & Zhang, 2008). 6-9 in specific regions and certain social conditions, people recognition on sports such discipline and sports technical level forecast future sports science and technology development orientations and trends (Xu et al., 2017). In current science and technology developed era, sports circles also penetrate into science technology, it no more is a comprehensive discipline, but gradually fuses social science, natural science and other correlation disciplines, and forms into a comprehensive discipline, therefore, sports involved field becomes wider and wider, research on problems also move towards more professionalization. In sports discipline constantly development, literatures that record sports scientific research achievements are also getting more and more various (Li et al., 2017).

MODEL ESTABLISHMENTS

The new world health organization's new concept of health is that health, not just disease, should include mental health as well as social interaction. That is to say, health is mentally, physically and socially maintained. The organic combination of these three aspects can constitute the quality of human life. In people's life in this 3d cube, physical, psychological and social attributes of the three area is larger, the greater the volume of a cube is life, in the natural and the social position of the higher, the contact area and the social is, the greater the show and the higher the quality of life of the individual. Conversely, if the area of these three properties is too small, the smaller the contact surface of the individual and society, the worse the quality of life. The experience of many healthy people tells us that the higher the quality of life, the more likely it is to live a long and healthy life. On the contrary, if the individual is depressed and self-closed, the disease can easily lead to disease and shorten life span. It also shows that a person can improve the quality of life and ensure their healthy and happy life only by starting with biology, physiology and society.

Pre-Modeling Preparation

In universities, spare time is more, life is also colorful, and they have more time to participate in sports activities. Then, university sports become important stage that cultivates students' lifelong sports awareness so that have higher requirements on sports teachers, it not only can fulfil teaching tasks, but also possess certain scientific

Table 1. Different types of hierarchical universities released scientific research these statistics

	Regular college course			Junior college				
	George mason University	Ordinary workers stadium	Total	George mason University	Ordinary workers stadium	Total	Total	Percentage
Core journals	181	32	213	2	9	11	224	30.81%
Journal of Universities	296	171	467	6	30	36	503	69.19%
Total	477	203	680	8	39	47	727	
Percentage	65.61%	27.92%	93.54%	1.10%	5.36%	6.46%		

Table 2. Sports scientific research papers contents distribution

Type	Number of frequency	Percentage
Social sciences	115	23%
Psychology of physical education	120	24%
Human movement science	40	8%
Physical education	10	2%
Exercise training	100	20%
Else	115	23%
Total	500	100%

research ability (Peng, 2010). They release lots of theses every year, become main forces in sports academic circles development, their theses releasing dominants, proportions also get larger, and it contains huge scientific research advantages as **Table 1**.

From above analysis, it is clear that regular college course published pieces are obviously higher than junior college published amount, in regular college course, George Mason University is obviously higher than ordinary worker's stadium, while junior college is just opposite to it.

Theoretical Basis of the Paper

The paper according to research purposes, by CNKI Chinese periodicals database, VIP database, it consults sports theses or sports scientific research aspect relative literatures since recent years. According to consulted relative literatures, analyze predecessors' sports theses research status and its development. 10-12 As **Table 2** shows:

People's Republic of China national standard GB7713-87 defines thesis as: thesis is a place that records such professional and scientific research breakthrough and recognized by relative academic circles. Sometimes it can be used to summarize such new principles that have already been applied in practice, and has new breakthrough in practice process, generally the type of these are used to discuss and exchange and learn in academic circles.

According to their written usage demands, academic type theses can also be divided into two types, communicative thesis and assessment thesis, from which communicative thesis is used to issue in academic journals, let people to learn and exchange, sometimes it also will be read out in academic conferences. Here we talked communicative thesis is scientific research paper that referred in our article. According to our consulted relative literatures, Qiu Jun-Ping went deeper research and learning in bibliometric aspect, the method mainly took bibliometric features and literature system as research objects, adopted all kinds of methods to make analytic statistics of literature contents, include quantity relations and their changing rules so on, and then explored one science technology. By far most of scholars mainly base on formers definitions. Here concepts regarding bibliometric are from Qiu Jun-Ping conception definition.

Table 3. Nationwide universities published sports scientific research papers quantity statistics

Name of periodical	Occupied article Number (n)	Name of periodical	Occupied Article number (n)
Sports science	22	Journal of North University of China	50
Journal of Beijing University of physical education	49	Journal of Shanxi Datong University	54
Chengdu Sport University	36	Journal of Taiyuan University of Technology	16
Journal of Tianjin University of Sport	11	Journal of Shanxi University of finance and economics	47
Sports and science	10	Journal of Shanxi Agricultural University	42
Sports culture guide	9	Journal of Hebei University of Sport	11
Journal of Shanghai University of Sport	3	Journal of Inner Mongolia Normal University	4
China sports science	37	Journal of Changchun University of Technology	1
Journal of Shandong University of Sport	4	Journal of Chongqing Jiaotong University	1
Journal of Xian University of Sport	7	Journal of Taiyuan University of Science and Technology	10
Journal of Wuhan University of Sport	7	Liaoning sports science and technology	4

(Data source: Zhao Yuan-Yuan, Wang Yun-Han and others data collection statistics in "Regarding national universities sports scientific research papers research")

Model Establishment

Chinese sports academic development process has gone through a relative longer process; scholars have made lots of relative literature on its researches. Now we have enormous literature system, accompanying with bibliometric. Bibliometric emergence and development have made huge contributions to Chinese academic aspect researches, which is very universally used in present international academic circles researches. It is used to analyze and estimate one discipline growth and relative literatures contents, quantity, composition and mutual effects relationships, and then estimate the discipline emergence, development, differentiation and mutual penetration. Scientific staff just targeted at acquired these information, and then analyze acquired its demands contents, grasp scientific and technological development latest dynamics and orientations and then define scientific research topics, test whether research topics are correct and novelty or not; and also should measure one research result used research methods efficiency and so on. Bibliometrics earliest application and sports scientific research aspect is performing its evaluation value, evaluating periodical academic values or research objects. With constant development of Chinese sports, researches on sports academic aspect are also increasingly deepening, literatures research methods are gradually and frequently used in evaluating sports circles academic activities, and constantly propelling to Chinese sports academic aspect research.

In China, Xu Hong-Feng and others earliest adopted citation analysis method, for published six main sports universities journals theses that were directly under national sports commission during 1989-1994, they carried out citation statistical analysis from citation language structure, type structure, citation time and others, and made horizontal and vertical comparative research on them with domestic and overseas relative periodicals. Subsequently, regarding citation analysis theses successively emerged in every periodical, such as Liu Xue-Song "Twelve sports core journals references literatures statistics and analysis in 2004", Yuan Yu "Journal of Wuhan sports institute", Zhang Xue-Yan "Chinese universities sports scientific research status depth and thinking" papers and also citation features academic impacts analysis and so on, these articles, except for researching and analyzing citation type structure, citation time, language structure aspects, they also analyzed from citation sources, quantity,

Table 4. Physical policies paper yearly distribution

Code Number	Year	Theses quantity	Proportion
1	2002	1	0.01
2	2003	5	0.06
3	2004	5	0.06
4	2005	12	0.14
5	2006	7	0.08
6	2007	11	0.13
7	2008	15	0.18
8	2009	14	0.16
9	2010	15	0.18
Total	——	85	1

even citation published time, and also citation's self-citation and non-self-citation as well as others multiple aspects and multiple perspectives, therefore, citation analysis by far has gradually matured in China.

With group researches constantly deepening, we find most of sports researchers carry out researches and analysis from group of authors genders, job titles, age, subsidiary organs, and group of authors coauthor situation, coauthor unit type and other aspects, Guo Li-Ping published theses in 2005 were relative representative, it adopted documents literature, logical analysis and mathematical statistics, and combined with Price Law and Lotka's Law, analyzed 13 types of domestics public periodicals published totally 619 pieces of volleyball scientific research papers authors during 1994 to 2003, they carried out systematic and scientific analysis of authors' job titles, genders, age, located units, cooperation ratio and their adopted cooperation ways. And overseas sports aspect academic research was relative little, Xu Hong-Feng analyzed China representative academic journal "Sports science" 1982-1995 recorded 1257 pieces of theses authors, coauthor and types in 1997, and then exchanged and cooperated with American "Sports movement research quarterly" and other works. For periodicals papers analysis theses, they were relative little; research in the aspect was still weak. In collected all information, only found one piece of periodicals papers' analysis. With China constantly emphasis on sports academic development, application of bibliometric in China also gets more and more frequently, for academic activities evaluation, it needs to apply the method, which makes huge contributions.

Zhou Hong-Ping consulted Chinese school physical education mainly research fields' physical education teaching, physical education faculty, physical education course, physical education evaluation, school extracurricular physical education and Chinese and foreign school physical education comparative research and others seven aspects since 1994, investigation result showed that most were physical education teaching papers published papers, physical education course research structure, type, evaluation corresponded to their teaching objectives; physical education faculty team construction papers development orientations had gradually converted into strong ability, broad knowledge, high quality; and physical education evaluation papers were also gradually becoming humanized, integrated; Extra-curricular physical education research lacked of linking with society, physical education textbook development was backward: Chinese and foreign school physical education comparative research turned to be weaker. Concrete situation is as **Table 4** shows.

Fujian Normal University's Li Mi in her master thesis, she made statistical analysis of Chinese 21 kinds of sports academic periodicals published 2196 pieces of social sports research papers bibliometric features since 1996, analyzed these papers' paper quantity year, group of authors, subject distribution and other aspects, according to research, it showed, current society researches on physical education were mainly description and application-based, for research methods, they mainly adopted literature method, interview method, questionnaire survey and others multiple methods, citation types were relative comprehensive, but also had certain problems, as citation updating speed was slow, citation language distribution was relative irrational. Yang Hui-Yun researched on China 1996-2005 ten years' physical education type core journals regarding competitive sports gymnastics relevant 392pieces of papers, made detailed statistical analysis of articles' published papers status, authors situation, and

Table 5. Shanxi province Universities physical education teachers published scientific research papers fund program papers type overview

Year	National paper (paper)	Provincial paper (paper)	Field paper (paper)
2005	4	8	0
2006	5	4	2
2007	11	7	5
2008	13	11	5
2009	13	12	6

(Data sources: Newspaper of Shanxi province sports news, no.18, 2009)

Table 6. Institution of higher learning physical education scientific research authors group's job titles structure

Code Number	Level	Quantity	Percentage
1	Senior professional	8	10%
2	Vice professional	20	25%
3	Middle rank	34	42%
4	Primary	18	23%
5	Total	80	100%

citation relevant status, analyzed and got competitive gymnastics main features and their rules in past ten years, and pointed out literatures, periodicals and authors that had great impacts in such aspect. Zhang Hua made analytic statistics of year 1992-2006 Chinese 17 kinds of physical education type academic periodicals published 1544 pieces of football movement scientific research papers bibliometric features, they respectively adopted experts interview, data sorting method, contents analysis method, literatures and logical reasoning as well as other research ways. And meanwhile he also pointed out presently scientific research papers in football circles mainly concentrated on competition analysis, targeted at football training and football development influential social factors as well as other aspects researches, but lacked of researching on football system and other talents selection contents and other aspects. Hao Yong-Chao applied bibliometric method to carry out researching and analysis of domestics public published thirteen kinds of Chinese physical education types regarding Wushu 693 pieces of papers during 2001-2005 from article's published papers status, works status, research methods, citation status and research contents and else, it got the five years Wushu academic papers development main rules and features as **Table 5**.

Based on above, in current physical education academic constantly development, national each province more focuses on physical education academic researches. Presently, in current universities physical education scientific research papers status analysis, they mostly research on them only from one perspective, so it shows relative single, documents literature and questionnaire survey methods are more used. Bibliometric application in physical education discipline by far is still not matured, so researchers mostly adopt single indicator research and analysis method, while little adopts multiple-indicator combinative analysis method, most researches are core journals rather than single one province school physical education academic papers. In order to propel to Chinese overall physical education circles academic levels promotion and comprehensive development, we should carry out physical education papers multiple-indicator bibliometric analysis and research on every province universities so as to promote balanced development, as **Table 6**.

Research Result and Analysis

Chinese physical education academic development and changes have gone through a series of development and changes, our experts and scholars have made all aspects of investigation and researches, and published relative papers. Current social sciences mainly adopt literature method and investigation method, and sports psychology mainly adopts investigation method and mathematical statistics. By researching and analyzing domestics sports papers literatures, we can get that: sports scholars published papers designing aspects are relative comprehensive, but quoted foreign literatures are little, and quoted language only limits in English, which is to be broken through. In addition, it is citation affiliated disciplines is not reasonable, involved humanity and social

science aspects are more. Currently relative influential sports academic periodicals are "Journal of Beijing University of Physical education", "Sports sciences", "China sports science and technology" and so on.

For China future sports academic development orientations, we make following suggestions:

China should increase investment on sports science researches, and more focus on sports academic type development, and should encourage and support some junior colleges to publish more sports scientific research papers, for such people with outstanding contributions, it should increase reward system on sports scientific achievements, and then let them to positive go in for scientific research activities, and propel to national sports to positive and sound develop.

Optimize national sports department books and periodicals information and experiment instruments, and then provide good conditions for broad sports scholars scientific researching, and then whole national sports scientific levels can be promoted.

It should enlarge requirements of sports periodicals scientific research papers normalization extent, such as: Author personal information, applied research methods and citation standard and others, all should try to be unified as requests.

It should strengthen sport circles scholars' cooperative consciousness, help and support them to try to implement cross-discipline exchanging and cooperation, intensify researches on non-sports disciplines knowledge so as to further promote scientific research results quality to provide strength for China sports sustainable development.

It should promote reference and utilization abilities on foreign excellent and latest information and knowledge, bring foreign new achievements and new opinions into China sports scientific research and practical application.

CONCLUSION

Sports science technical work as an important part of China socialism sports, is an indispensable part in China development and progress, and plays important roles in Chinese social development and people's living standards improvement. Since Deng Xiao-Ping proposed "Science and technology are the primary productive forces", sports circles scientific research consciousness is constantly increasing, sports management levels are also constantly promoting, science research techniques works play irreplaceable roles in sport development. And sports scientific papers as scientific research results and academic research one carrier, it not only reflects a national scientific research ability and academic level, but also propels to a nation comprehensive strength promotion.

We after analyzing the effect of physical exercise on health, it is not hard to see, not only can exercise a strong body, enhance physical fitness, also has a perfect body, the development, the science of uniting the life, healthy heart, healthy personality and improve the ability of social adaptation, and other functions, its important value lies in improving the human way of life, vitality, psychological character and realize the modernization of the people, to embody the essence of man power, not only from the body, also from the spiritual, social adaptation to the person's sound and healthy state.

Presently Chinese sports academic development is in the rising stage, China should highly focus on it, strengthen investment on sports academic research to provide good environment and conditions for sports scientific researchers better researching, and fully drive their positivity and promote their comprehensive and scientific development. And meanwhile, it also should solve current existing problems, solve academic type researches' narrow coverage range, lacking of fusion with relative disciplines, small visions and other problems, positive learn overseas advanced techniques and experiences to pave the way for sports academic development.

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Factors and Levels Associated with Lecturers' Motivation and Job Satisfaction in a Chinese University

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ABSTRACT
Motivation and job satisfaction of employees have been an important research area in recent years. Based on a case study on two-new-established colleges in one university located in China Beijing town, this study aimed to correlate and investigate the levels and factors affecting lecturers' motivation and job satisfactions in this university. The descriptive survey and co-relational methods were used. Seventy lecturers with 51.4 % male and 48.6 % female participated in the study. Data were analyzed by frequencies, percentages, means and Pearson' Linear Correlation Coefficient. Means were interpreted as poor, fair, satisfactory and very satisfactory. The motivational level of lecturers was satisfactory (average mean = 2.707, Std=.8014) mostly affected by Incentives &promotions and salary. The level of job satisfaction was interpreted as satisfactory (average mean of 2.660, Std=.7804) mostly affected by financial reward. The correlation reported a significant relationship between lecturers' motivation and job satisfaction (r = 0.615 with the sig-value of.000 lesser than .001). The continuity of lecturers' motivation was recommended by taking into consideration all analyzed factors.

Keywords: human development, job satisfaction, lecturers' motivation, working conditions

INTRODUCTION

Generally, organization or any social entity exists because it is sustained by its human resources (Munyengabe et al., 2016). Organizations are basically composed by three crucial key components; these include physical to mean equipment, financial to mean money and human capital. Motivation and job satisfaction in different contexts were studied and defined by different authors. According to Vroom (1964), motivation is defined as a process governing choices made by persons among alternative forms of voluntary activity while the job satisfaction is looked as the totality of one's perceptions and attitudes to one's job (Graham, 1982). Motivation and job satisfaction of employee are very crucial for the successfulness of any working organization.

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Contribution of this paper to the literature

- Lecturers' motivation and job satisfaction in university are significantly correlated.
- The level of lecturers' motivation in a Chinese university where the study was conducted was mostly affected by incentives &promotions while the job satisfaction was mostly affected by the financial rewards.
- The motivation and job satisfaction of university' lecturers play a vital role in facilitating the overall achievements of the university.

Successful organizations always try to maintain their employees motivated and satisfied at their jobs (Griffin, 2006). In any education system, teachers are considered to be the pillars of society because they shoulder the responsibility of educating and training students until they become important elements to develop their countries (Li & Bray, 2007). Findings in previous researches have revealed that employees who are satisfied with their job are more likely to be creative, innovative and initiate the breakthroughs that can increase their job performance (Usop et al, 2013). According to Garcia et al., (2005) in their research they realized that organizations cannot achieve competitive levels of quality, either at a product level or a customer service level, if their employees do not feel satisfied or do not identify with the company. On the hand of Oshagbemi (1999) it is shown that an understanding of the factors affecting job satisfaction is relevant for improving the wellbeing of a huge number of people. It is very important to note also that in education system, it is indispensable to keep and try to maintain the teaching staff motivated and satisfied at their job (Munyengabe et al., 2016). In China for example; the research done by Lu (2004), on motivation and engagement of teachers in Chinese higher education institutions indicated that 80% of the teachers were dissatisfied with their jobs and 50% said that they would not be lecturers again if they had a choice. In Lu (2004), it is shown that 30% of the lecturers were trying to change their profession by engaging in further graduate education. In that research, lecturers reported that increased pressure for academic performance, a lack of challenge, no sense of self-growth, no sense of self-efficacy, and limited work autonomy were having a negative impact on their teaching (Lu, 2004). The study concluded that there was a serious crisis in motivation among English language lecturers in China (Lu, 2004). There are many attributes expected to attain in qualified teacher dependently on the level of motivation and job satisfaction. According to Shu (2005), these attributes include good teaching skills, good skills for classroom management, communication, research competence, rich knowledge, suitable personality and professional dedication are attributes expected from teachers. With different expectations to be attained from universities' teachers in the development of the country it is very crucial to motivate lecturers for being interested and satisfied to their lecturing job (Munyengabe et al., 2016). The present study was carried out to investigate to the current levels of the lecturers' motivations and job satisfaction and find out factors associated with in two schools newly established in a Chinese university. The study also hypothesized seven null hypotheses to find out the relationship ship between: (1) Factors of lecturers' motivation, (2) level of lecturers' motivation all correlated with job satisfaction.

LITERATURE REVIEW

Motivation

The concept of motivation originated from the Latin "movere" (to move) and can be defined as the processes that account for an individual's intensity, direction, and persistence of effort (Baron, 1991). Motivation may be also explained as the process that initiates, guides, and maintains goal-oriented behaviors in all activities. Guay et al., (2010) showed how motivation refers to the reasons underlying behavior. Broussard and garrison (2004) defined motivation as the attribute that moves someone to do or not do something. According to Vroom (1964), motivation is defined as a process governing choices made by persons among alternative forms of voluntary activity. According to Elliot and Covington (2001), motivation is defined as one's direction to behavior, or what causes a person to want to repeat a behavior and vice versa. On the other hand, motivation was looked as a pervasive and important determinant of behavior for students, teachers, and administrators at all educational levels (Pintrich and Schunk, 1996). According to Griffin (2013), motivation involves a series of modifying and directing human behaviors into desired patterns of work. Still, some authors also argue that individuals may vary in the

extent to which they are more oriented to higher order needs or intrinsic motivators. According to Amabile (1993), unmotivated employees are likely to expend little effort in their jobs, avoid the workplace as much as possible, exit the organization if given the opportunity, and produce low quality work. From above view and the general view of the study motivation in this study is defined as the efforts that encourage people in their activities to work in the mood of achieving the personal target and organizational targets.

Job Satisfaction

Job satisfaction explains the totality of one's perceptions and attitudes to one's job (Graham, 1982). Sempane et al (2002) maintain that satisfaction concerns the individuals' own evaluation towards their tasks against those issues that are important to them. People's emotions are also involved in such assessments; therefore, employees' levels of satisfaction at job impact significantly on their personal, social and work lives, and hence also impact their behavior at work. These views are shared by Beck (1983) and Buitendach (2005) who agree that satisfaction at work is an attitudinal and emotional response that orients on how individuals think about their overall working activities, as well numerous facets of the work. Considering the education context, Ololube (2006) maintains that satisfaction at work relates to the capability of the teaching job to reach on teachers' desire and increase their performance in teaching. Besides all different explanations of the term, the meaning of job satisfaction in this study relates on extent by which people within a working area are contented because of needs' fulfillment from their job.

Motivation and Job Satisfaction within Organizations

The existence of schools or organizations is for the human beings who direct their existence. It is important to remember, however, that individuals are only assets in so far as they choose to invest knowledge and skills which benefit their organizations (Seniwoliba, 2013). Because of the existence of different human beings in any organizational structure, it is very important to set strategies for maintaining them motivated and satisfied in the organization. Motivation and job satisfaction of employees have been found to be the important research orientation for being successful in organizational plans and targets (Broussard & Garrison, 2004). Motivation and Job satisfaction of teachers have been an important research area in the past several decades, as dissatisfaction on the job might cause teachers resignation climax (Liu, 2007). It is individuals' motivation for drawing people to become teachers, sustaining their commitment to teach, and promoting their professional knowledge (Day et al, 2005). According to Griffin (2013), motivation involves a series of modifying and directing human behaviors into desired patterns of work. Miech and Elder (1996), in their research found and suggested a relationship between teachers' entry motivations and their continued commitment to teaching: those who enter teaching because of strong altruistic motives are more likely to be frustrated by a lack of evaluation of their work and guidance with respect to goals, and are thus more likely to leave teaching. It is commonly suggested that intrinsically motivated teachers are likely to be more committed to teach than extrinsically motivated teachers. On the other hand, job satisfaction has been a subject to scientific researches with "Hawthorne" studies in 20th centuries. According to Locke (1976), job satisfaction is described as a pleasurable or positive emotional state as a result of evaluation of the job or job experience. Churchil et al (1974) described the term of "job satisfaction" for salesmen as a state relating with being satisfied with the emotional devotion, conferment (rewarding), all characteristic features constituting the job environment and the job itself. According to LaBelle (2005), employees have a different perception of rewards, some of them prefer to having intrinsic rewards and others prefer extrinsic rewards. According to the Fredrick Herzberg two-factor theory, couple of factors have been proved to affect towards employees' satisfaction, and increase efficiency in their work (Munyengabe et al., 2016). He found that, some of these factors increase the internal happiness (intrinsic motivation), the others increase the external happiness (extrinsic motivation). If some factors are missing, the possibility of employee's dissatisfaction will arise. In order to prevent this result, organizations should have a deeper understanding of the motivation aspect to reach a perfect level of employees' satisfaction (Saleem et al., 2010). To improve employee satisfaction has become one of the main corporation objectives in recent years (Garcia et al., 2005). It is realized that organizations cannot achieve competitive levels of quality, either at a product level or a customer service level, if their employees do not feel satisfied or do not identify with the company (Garcia et al., 2005). The topic of job satisfaction is a crucial one because of its relevance to the

physical and mental well-being of employees, and its implications for job related behaviors such as productivity, absenteeism or turnover. Work is an important aspect of people's lives and most employees spend a large part of their working life at work. An understanding of the factors affecting job satisfaction is relevant to improve the well-being of a huge number of people (Oshagbemi, 1999). Improving job satisfaction has become an important subject in both the professional world and the academic world (Garcia et al., 2005). Therefore, job satisfaction is perhaps one of the single most frequently researched variables in the field of organizational behavior or psychology.

Conceptual Framework

The development of human resources in motivation was a very interesting topic from which the organizations could discover factors associated with their employees' motivation and job satisfaction (Munyengabe et al., 2017). The organizations got much interested on the result. It is very important for organizations to explore and research in all different corners regarding factors that may cause the decrement of their employees' levels of motivation and job satisfaction. In the study of Osakwe (2014), factors such as good salary, conditions of service, prompt and regular promotion, recognition and feedback, increased job security/enrichment, professional development programs, empowerment and authority, good working environment, challenging and varied work, participation in decision making, and research grants were found to be significant to affect the level of motivation and job satisfaction in the academic staff. Findings from that study justify the importance of motivational factors to the job satisfaction of academic staff. Factors such as personal/social, classroom environment, socio economic status, student's behavior, examination stress, rewards/incentives, self-confidence/personality of teacher were studied in the study of Alam (2011) and concluded that teachers were not satisfied with their socio-economic status, choice of profession, student's behavior and examination stress. The work of Munyengabe et al, (2016), pointed out some major factors affecting motivation and job satisfaction of lecturers within a university. Hill and Power (2013) have previously pointed out similar major factors that affect motivation and job satisfaction. Because the current study adopted the existing research questionnaire adopted in the previous researches, the study assessed six factors of lecturers' motivation; these are: cheer love of career, salary, incentives &promotions, social, code of conduct and Classroom environment for independent variable (Lecturers' Motivation) and factors such as financial rewards, opportunity for advancement, relation with supervisors, workload and stress level; respect co-workers and working conditions were factors analyzed in the dependent variable that is lecturers job satisfaction (Hill and Power, 2013; Munyengabe et.al, 2016). The study hypothesized 7 null hypotheses to evaluate link between motivation and job satisfaction for lecturers in two schools newly established in a Chinese university located in Beijing. Firstly, the link between cheer love of the career with job satisfaction was determined by the null hypothesis of no significant relationship between cheer love of career with job satisfaction. Secondarily, the link between salary with job satisfaction was determined by the null hypothesis of no significant relationship between salary with job satisfaction. Thirdly, the link between incentives & promotions with job satisfaction was determined by the null hypothesis of no significant relationship between incentives and promotions with job satisfaction. Fourthly, the link between social factors with job satisfaction was determined by the null hypothesis of no significant relationship between social factors with job satisfaction. Fifthly, the link between code of conduct with job satisfaction was determined by the null hypothesis of no significant relationship between code of conduct with job satisfaction. Sixthly, the link between classroom environment with job satisfaction was determined by the null hypothesis of no significant relationship between classroom environment with job satisfaction. Lastly, the link between the level of motivation with job satisfaction by the null hypothesis of no significant relationship between the level of motivation with job satisfaction among lecturers of two schools newly established in a Chinese university.

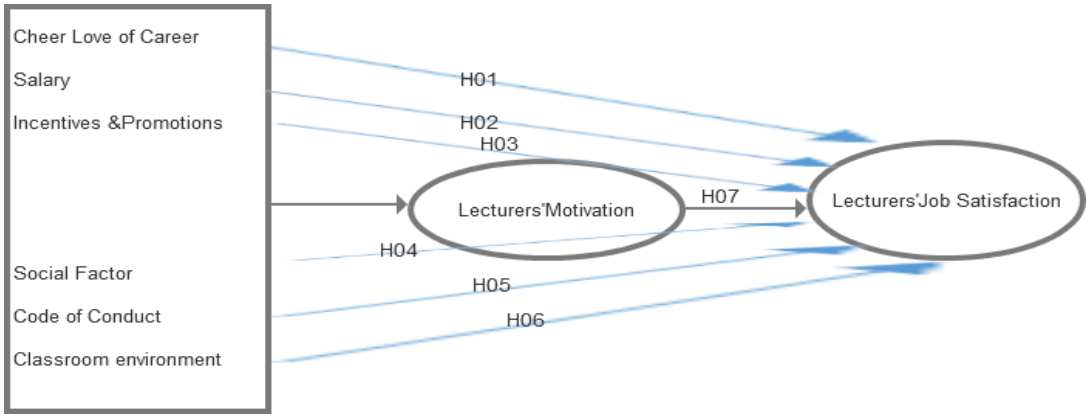


Figure 1. Proposed Conceptual Frame work

MATERIALS AND METHODS

Design, Population, Research Instrument and its Validity

The design of the study was mainly a descriptive survey type. It had adopted the descriptive co- relational design since it explored the relationship between the independent variable and the dependent variable. Seventy lecturers from two colleges of one university of Beijing town, China (with both male & female) accepted to participate in the study.

The population of the study was 101 university' lecturers from two colleges newly established in one university located in Beijing town, China. The universal sampling was used to select the respondents because the target was to let all lecturers in two considered colleges to participate into the study. At the time of the study, one hundred lecturers were available and all of them were given the research questionnaires by the researcher and his assistant. Only seventy-five research questionnaires were returned in which five of them were not filled correctly. The researcher considered seventy-research questionnaires that were correctly filled by respondents.

Data were collected by existing structured questionnaires composed by three parts adopted in recent researches of Munyengabe et al (2016). The first part of the research questionnaire was composed by five items to determine the profile of respondents. Lecturers motivational' level and job satisfaction were respectively determined in the second and third parts. The factors composing the dependent variable were cheer love of career composed by seven items, salary composed by ten items, incentives and incentives composed by five items, social factor composed by six items, code of conduct composed by six items and classroom environment composed by six items. The independent variable was composed by six factors including: Financial rewards, relation with supervisors, opportunity for advancement, workload and stress level, respect co-workers and working conditions. Except the financial rewards factor that was composed by ten items each of other remaining factors was composed by six items. Levels of factors, both independent dependent variable were measured by different rating items such as strong agree (SA), agree (A), disagree (DA) and strong disagree (SD). To ensure the validity of questionnaire, it gained the different suggestions, correction and adjustments from experts and supervisors. To determine if the questionnaire was valid, a minimum Content Validity Index (CVI) of 0.7 was used considered to that, one suggested by Amin (2005) as shown in **Table 1**.

Table 1. Content Validity Index

Questionnaires	Number irrelevant questions	Number relevant questions	CVI
1. Questions to Determine the levels of factors affecting lecturers' motivations and the level lecturers' motivation	1	39	0.975
2. Questions to Determine the levels of factors affecting job satisfaction and the level of job satisfaction among lecturers	2	38	0.95

CVI=R/N: Where R refers to the number of questions declared valid and N is the total of all questions. Based on 0.975 calculated content validity index of independent variable and 0.950 of dependent variable both were combined and yielded an overall CVI of 0.9625; from that it was declared excellent and recommended to be used for data collection compared to 0.7 suggested by Amin (2005) also cited in Munyengabe et al. (2016).

Data Gathering Procedures

Researchers visited different lecturers to request them to fill the part of his research in the questionnaires. Interested respondents were explained and then briefed by introductory letter to motivate them and show how to fill the questionnaire. Besides all those measures, the researcher also decided again to indicate and include guidelines in the questionnaire. During data collection' phase, respondents were asked to give responses to all the items in questionnaire. After that, the filled questionnaires were collected by the researcher, organized and encoded into computer using the statistical package for social sciences (SPSS) 19th version.

Data Analysis

Data on the first part of questionnaire concerning the profile of respondents were analyzed using frequencies and percentage distributions. We used means to determine the levels of lecturers' motivation and job satisfaction. Means were used in identification of ranks of factors affecting both independent and dependent variables. The Likert' scale of four levels were used to measure and interpret the obtained means. The following numerical values and response modes were used to interpret the means.

Mean range	Description	Interpretation
3.26-4.00	Strong agree	Very satisfactory
2.51-3.25	Agree	Satisfactory
1.76-2.50	Disagree	Fair
1.00-1.75	Strong disagree	Poor

A Pearson Linear Correlation Co-efficient (PLCC) was used to determine the significance of relationships between: (1) levels of six factors affecting motivation, (2) level of lecturer's motivation all correlated with job satisfaction.

Ethical Considerations

The full confidentiality and secrecy were guaranteed to the respondents by the following activities: a) respondents' names could not figurate in the study, b) coding of all questionnaires c) respondents signed the informed consent and d) findings were presented in generalized manner.

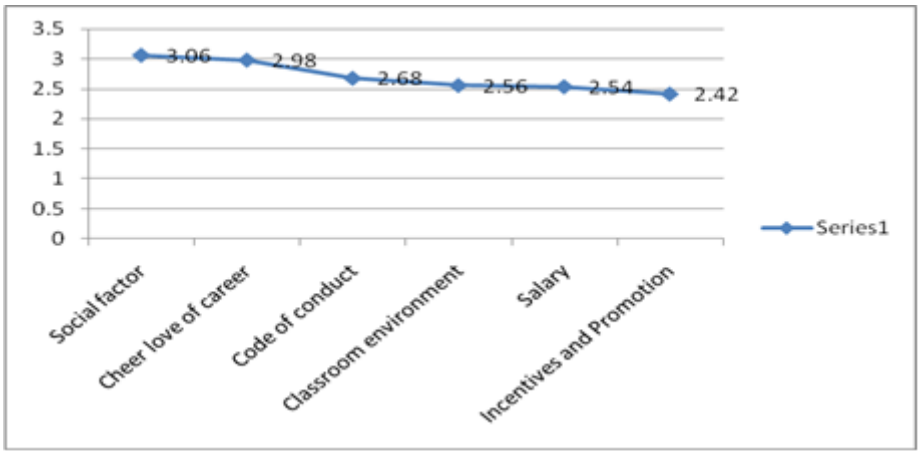
Results and Discussions

All findings presented in this part, were generated from respondents' demography of the following characteristics: the percentage of male lecturers was 51.4 while that of female was 48.6. Regarding the age of respondents: 7.1% were lecturers aged between 21-30 years old, the second range of 31-40 years old was 32.9%, the range of 41-50 was represented by 37.1% and the last category of lecturers 'age felt in the range of 51-60 with 22.9%. No lecturer was found to be in the range of 61years old and above. Regarding the experience 20% were ranged in

1-5 years, 20% in range of 6-10 years, 28.6% in range of 11-15 years, 11.4% in the range of 16-20 years and the last range of 21 years and above was made by 20% of all participants. The data analyzed showed that the qualifications of respondents were composed by masters' (11.4%), doctorates (40%), associate professors (35.7%) and full professors 12.9%. Regarding the nationality, all lecturers who participated in the research were Chinese lecturers.

Level of Lecturers' Motivation

Results associated with Level of Lecturers' Motivation are presented in **Figure 2** and **Table 2** of all items. The level of lecturers' motivation was satisfactory with a grand mean of 2.707 (Std=.8014). The factors affecting the level of motivation were arranged as follows: Social Factor (mean: 3.061, Std=0.7236), cheer love of career (mean: 2.971, Std=.7640), Code of Conduct (mean: 2.680, Std=.8369), Classroom environment (mean: 2.568, Std=.8446), Salary (mean: 2.545, Std=.8757) and incentives &promotions with average mean of 2.420 (Std= .7640)



Source: Primary Data collected in 2016

Figure 2. Ranking of factors affecting lecturers' motivation in a Chinese university

From **Figure 2** of results on the level of motivation among lecturers in a Chinese university one may conclude that social factor highlights a very big influence in increasing the level of motivation compared to other factors while incentives and promotions was noted to be the factor that tend to reduce the level of motivation. The tendency of factors in reducing the level of motivation among lecturers in a Chinese university where the study was conducted is arranged as follows: Incentives &promotions > Salary > Classroom environment > Code of Conduct > Cheer love of career > social factor.

Social Factors

Findings presented in **Table 2** revealed the social factor to be the first with the highest mean of 3.060 (Std=0.7236) and interpreted the satisfactory on the 4th level of Likert' scale. The motivation among lecturers in a Chinese university is highly associated with their communities. The satisfactory level of lecturers' motivation may be concluded from cultural context of Chinese society where teachers are paid respect and valued as important personal in their society. From that, one may deduct that the society in which the lecturers live has an important role in their everyday activities that tends to increase the level of motivation. From this it also found the recognition of one's activities by the society is the key element to maintain the level of motivation among employees. Similar to the findings of other previous studies such as that of Munyengabe et al (2016), Alam (2011) the social factor was proven to be a very influential factor in increasing the level of motivation.

Table 2. Level of Lecturers' motivation in a Chinese university

Items & Rank	N	Sum	Mean	Std. Deviation
1.Cheer love of career				
I have set my own objectives to enjoy the lecturing job	70	227.00	3.242	.69022
No other factors that pushed me to select the lecturing job	70	224.00	3.200	.73426
I choose the teaching career because I like it.	70	224.00	3.200	.69366
When I teach, I feel being motivated of that	70	211.00	3.014	.73214
I am not interested to get other job because I like to be a lecturer	70	198.00	2.828	.74155
I can't change this career because it is my preference from the beginning	70	193.00	2.757	.84159
My lecturing job doesn't depend on the salary even if my salary may be reduced I can't change my job	70	186.00	2.657	.91502
Mean average			**2.985**	
2.Salary				
I receive my salary on time	70	221.00	3.157	.75442
With my salary I hope to improve and succeed my plans	70	203.00	2.900	.95021
Nobody in superiors has right to decide on my salary or obliges me to give its part to	70	202.00	2.885	.90958
My salary doesn't affect negatively my teaching activities	70	186.00	2.657	.88278
My superiors do all necessities to increase my salary	70	168.00	2.400	.84098
I appreciate the way my teaching activities are considered in terms of payment.	70	163.00	2.328	.86345
My salary is sufficient to equip me and my relatives in all necessities.	70	163.00	2.328	.91242
My salary is good compared to the work I do	70	162.00	2.314	.90958
My salary motivates me to work hard.	70	158.00	2.257	.87949
I have a reasonable salary	70	156.00	2.228	.85417
Mean average			**2.545**	
3. Promotions and incentives				
Promotion is based on lecturers' performance.	70	184.00	**2.6286**	.55653
The way promotions are given motivates me to work hard so that I can be promoted.	70	180.00	**2.5714**	.65132
Incentives given are relevant compared to the work I do.	70	165.00	**2.3571**	.56831
I do really appreciate the way lecturers are promoted.	70	159.00	**2.2714**	.62983
There is a good established way to motivates lecturers by giving incentives.	70	159.00	**2.2714**	.66314
Mean average			**2.420**	
4. Social factor				
Students 'effort in learning and ambitions motivate me to help them.	70	231.00	3.3000	.70915
I am motivated by respect students pay to me.	70	225.00	3.2143	.81459
I am interested to help students because they are interested themselves to learn.	70	224.00	3.2000	.69366
The students discipline motivates me to do my job.	70	214.00	3.0571	.79647
I am motivated by the way the society considers my everyday effort in lecturing.	70	199.00	2.8429	.73496
I am considered important person in attaining the country vision.	70	193.00	2.757	.64686
Average mean			**3.060**	
5.Code of conduct (punishment avoidance)				
I do perform well my work to avoid punishment.	70	239.00	3.414	.78929
The way the code of conduct is set doesn't interrupt me	70	190.00	2.714	.80114
Lecturers are same towards the code of conduct.	70	182.00	2.600	.87477
Lecturers' opinions are considered when they are suggested in decision making.	70	176.00	2.514	.82958
Lecturers are well treated at work and their challenges are solved.	70	172.00	2.457	.77433
There is no injustice in handling issues related to job performance.	70	167.00	2.385	.95239
Mean Average			**2.680**	
6. Classroom' environment				
I am self-confident in classroom management	70	212.00	3.0286	.79803
The number of students doesn't affect me in my teaching activities.	70	187.00	2.6714	.94365
The class size and disposal don't affect me while teaching.	70	186.00	2.6571	.94617
The university disposes all required teaching material.	70	175.00	2.5000	.75661
Students 'performance motivates my lecturing activities.	70	166.00	2.3714	.80165
I am not stressed by examination processes.	70	153.00	2.1857	.82168
Mean average			**2.56**	
Grand Mean			**2.707**	
Interpretation			**Satisfactory**	

Source: Data collected in 2016

Cheer Love of the Career (Internal Motivation)

Findings of this factor are presented in **Figure 2**. This factor was ranked as the second by having the average mean of 2.971 (Std=.7640), at Likert' Scale of four levels and interpreted as satisfactory. From the analysis, all means associated with the items were interpreted as satisfactory to show the motivation level among lecturers in a Chinese university, and it is highly associated with internal motivation. The findings of the study were in the agreement with findings of Munyengabe et al (2016) who indicated that the cheer love of career among university' lecturers play a vital role in increasing their commitment and the will of remaining at their lecturing job. The findings also were not different from other researchers such Broussard and Garrison (2004), who argue that teachers who feel deprived of internal motivation factor are less motivated to do their best in the classroom.

Code of Conduct (Punishment Avoidance)

The factor "code of conduct" also referred as punishment avoidance was analyzed to discover if their achievements at work were relying on punishment avoidance. It is a common sense that some employees heavily achieve to prevent any consequence if the results are different from the overall target of the organization (McGregor, 1960). Findings revealed the code of conduct to have a mean of 2.680 (Std=.8369) and interpreted as satisfactory on the 4th level of Likert' scale. It is found that even though lecturers are internally motivated at their lecturing job, the code of conduct plays an important role to redress those with low level of motivation to achieve in their everyday lecturing job.

Classroom Environment

A good classroom environment makes teachers and students feeling good and comfortable during their teaching/learning processes. The good classroom environment is not only helpful at the secondary or primary schools levels, it is also an indispensable factor at the university level, and the good environment provides the motivation of lecturers in their everyday teaching activities (Munyengabe et al (2016). Findings regarding the classroom environment factor showed the average mean of 2.560 (Std=.8446), from that it was ranked as third in affecting negatively the level of motivation among lecturers. The findings of the study were in agreement with the previous studies where it was found that a positive environment is one in which teachers and students feel a sense of belonging, trust others, and feel encouraged to tackle challenges, take risks, and ask and respond to questions (Sheffler, 2009).

Salary

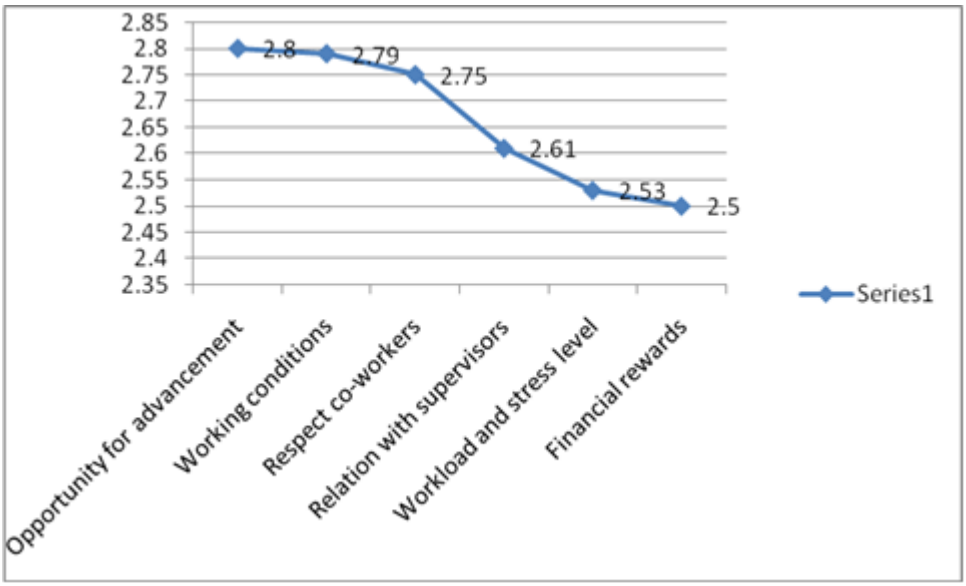
The impact of salary was found to be the second with low level (mean: 2.545, Std=.8757) compared to other factors affecting the overall level of motivation among lectures in a Chinese university. According to Deci et al (1989), the motivation is classified as internal and external. Findings regarding salary as one external factor of overall motivation revealed to be the second factor in lowering the level of motivation and interpreted as satisfactory with low value of mean at the 4th level of Likert' scale. Similar to studies of Munyengabe et al (2016) and Alam (2011), the findings on this study regarding the salary were in agreement with other related studies where it was shown that employees tend to be motivated by their incomes from the job. From the findings on this factor, lecturers valued the equity theory as suggested by Johnson (1986).

Promotions and Incentives

Promotions and incentives are stimulus to greater actions; they are also given in addition to what employees were suggested to get. Findings regarding promotion and incentives revealed this factor to be interpreted as fair and ranked as the last with a lowest average mean of 2.420 (Std= .7640) as presented in **Figure 2** and **Table 2**. It is found that the level of motivation among lecturers in a Chinese university tends to decrease when there is a decrement of promotions and incentives. Similar to other related studies salary is not the only external factor to increase the level of motivation, to mean that employees are also likely to be motivated by other additional form of rewarding like getting promotions and other types of incentives (Munyengabe et al, 2016; Alam, 2011)

Level of Job Satisfaction among Lecturers

Findings presented in **Figure 3** and **Table 3** revealed the level of job satisfaction within a Chinese university to be interpreted as satisfactory with an average mean of 2.660 (SD=.7804). Six analyzed factors starting from the highest mean were ranged as follows: opportunity for advancement (mean:2.800, SD=.7670); working conditions (mean: 2.790, SD=.7368) ; respect co-workers (mean: 2.750, SD=.7383); relation with supervisors (mean:2.610, SD=.7955); workload and stress level (mean :2.530, SD=.7964) ;financial reward (mean:2.500, SD=.8489). From this observation, it was found that the level of job satisfaction is highly affected negatively by the financial rewards. One might observe from the findings that the level of job satisfaction was highly associated with the earnings obtained from their job.



Source: Primary Data collected in 2016

Figure 3. Ranking of factors affecting the level of job satisfaction in a Chinese university

Opportunity for Advancement

Advancement in the career is one of the factors that increases employees' job satisfaction level in organizations (Hill & Power, 2013). Findings revealed that lecturers in a Chinese university ranked this factor the first with an average mean of 2.800 (SD=.7670) and interpreted as satisfactory on the fourth level of Likert' scale. It has been noted that when workers are helped to advance in the career; there will be the reduction of challenges related to the job performance and their satisfaction level will be increased (Munyengabe et al, 2016).

Working Conditions

The analysis of this factor showed to be ranked as the second with average mean of 2.790, (SD=.7368) interpreted as satisfactory on the fourth level of Likert' scale. From above findings, it is observed that people tend to be satisfied when the working conditions are good, safe and equipped by all necessities. The impact of this factor on the job satisfaction was also studied by Bakotić and Fiskovića (2013), they found that workers who work in normal working conditions usually show the high level of being satisfied at their work while those working in not favored conditions were presented with the low level of satisfaction at their work. The same as Poggi (2010) and Munyengabe et al. (2016) for their findings they reached to illustrate that working conditions play a vital role in increasing or reducing the level of employees' satisfaction at their work.

Table 3. Level of job satisfaction among lecturers in Chinese university

Items and Rank	N	Sum	Mean	Std. Deviation
1. Financial reward				
I am satisfied with my salary because it will help me to improve and reach my plans.	70	214.00	3.0571	.81447
I am satisfied with the way my salary is respected; nobody in superiors has right to decide on my salary or obliges me to give its part to other social activities.	70	208.00	2.9714	.81599
I am satisfied with the payment time.	70	202.00	2.8857	.77165
My salary satisfies me because it doesn't affect negatively my teaching activities.	70	183.00	2.6143	.92145
I am satisfied because my superiors do all necessities to increase my salary.	70	163.00	2.3286	.86345
I am satisfied because my salary is enough compared to the work I do.	70	161.00	2.3000	.87394
I am satisfied with the way my teaching activities are considered in terms of payment.	70	158.00	2.2571	.89581
My salary satisfies me because is reasonable.	70	155.00	2.2143	.84943
I am satisfied with my salary because is sufficient to equip me and my relatives in all necessities.	70	155.00	2.2143	.84943
I am satisfied with my salary.	70	152.00	2.1714	.83356
Mean Average			**2.50**	
2. Relation with supervisors				
I am satisfied with the ways my supervisors pay respect to me	70	190.00	2.7143	.80114
I am satisfied with the way my supervisors give feedback	70	184.00	2.6286	.78337
I am satisfied because my supervisors don't harm me at work always support me.	70	183.00	2.6143	.82168
I am my satisfied because my opinions at work are considered	70	182.00	2.6000	.76896
I am satisfied because my supervisors gave me clear responsibilities	70	180.00	2.5714	.75319
I am satisfied at work because my supervisors are able to manage employees equally.	70	179.00	2.5571	.84503
Mean average			**2.61**	
3. Respect co-workers				
I am satisfied with Lecturers' respect towards their colleagues.	70	203.00	2.9000	.64043
I am satisfied with the respect existing among lecturers	70	200.00	2.8571	.70784
I am satisfied with the way lecturers help each other.	70	192.00	2.7429	.75538
I am satisfied because there is a good communication between lecturers.	70	192.00	2.7429	.71598
I am satisfied with the way there is a team work in the working area.	70	187.00	2.6714	.79348
I am satisfied with the job because my colleagues don't fell jealous of me	70	185.00	2.6429	.81713
Mean average			**2.759**	
4. Opportunity for advancement				
I am satisfied with my work because through it I hope that my profession will be highly developed.	70	200.00	2.8571	.74767
I am satisfied with my work because I always advance in the career.	70	199.00	2.8429	.77339
I am satisfied with the chance given to all lecturers.	70	198.00	2.8286	.77966
I am satisfied because my universities give us the study leave in need.	70	197.00	2.8143	.74781
I am satisfied with the way the university favors lecturers to increase their skills.	70	193.00	2.7571	.73101
I am satisfied with the way the university has set regular training to lecturers.	70	189.00	2.7000	.82269
Mean average			**2.8**	
5. Workload and stress level				
I am satisfied with my working hours because they do not stress me	70	189.00	2.7000	.72930
I am satisfied because other university' activities do not affect my teaching activities	70	184.00	2.6286	.83703
I am satisfied with my work because there is a clear policy towards the work.	70	183.00	2.6143	.78561
I am satisfied at my work because exams do not stress me.	70	176.00	2.5143	.75648
I am satisfied at work because none blames me because of learners 'low results	70	168.00	2.4000	.78758
I am satisfied at my work because there is no stress.	70	163.00	2.3286	.88008
Mean average			**2.530**	
6. Working conditions				
I am satisfied at work because of job security.	70	209.00	2.9857	.71207
I am satisfied at job because the university always makes the working conditions affordable.	70	206.00	2.9429	.65686
I am satisfied because classrooms are equipped by all necessities to favor teaching activities.	70	200.00	2.8571	.70784
The way teaching materials are provided satisfies me a lot.	70	191.00	2.7286	.77873
I am satisfied with my work because the teaching environment doesn't affect me.	70	186.00	2.6571	.79647
I am satisfied with my work because the job location doesn't affect me.	70	182.00	2.6000	.76896
Mean average			**2.790**	
Grand Mean			**2.660**	
Interpretation			**Satisfactory**	

Source: Data collected in 2016

Respect Co-Workers

Findings presented in **Figure 3** reveals this factor to be important among lecturers in a Chinese university where the study was conducted. Lecturers ranked the respect co-workers at the third place with an average mean of mean 2.750 (SD=.7383). From that, one may analyze that a working organization where each employee is paying respect to other employees, there will be the tendency of the increment of level of job satisfaction. The study agreed with the findings of May *et al* (2004), who stated that employee relationships with co-workers and supervisors have an inconsiderable effect on the psychological state of employees in the working area. People at working place need to talk about their experiences and discuss ideas altogether by sharing the happiness and sorrows (Munyengabe et al., 2016).

Relation with Supervisors

The ranks of items used to analyze the level of relation with supervisors on job satisfaction are listed in **Figure 3** and **Table 3**. The level of relation with supervisors was interpreted as satisfactory on the fourth level of Likert' scale with an average mean of 2.610 (SD=.7955). Findings from lecturers showed that the factor is highly linked with job satisfaction. Employees are happy and interested to work in the place where there is a good relationship with their employers (Munyengabe et al, 2016). Similar to May *et al* (2004) in their study showed that workers in the organization relay on the good relationship existing between them and employers. In the recent study of Munyengabe et al (2017), it was stated that lecturers at university valued highly the respect between the leaders and lecturers as an influential item to construct the good relationship between lecturers and their leaders. From above results, it is seen that if the good relationship is maintained at the workplace the level of job satisfaction will be increased.

Workload and Stress Level

Findings regarding this factor are presented in **Figure 3** and **Table 3**. The level of workload and stress level was shown by the mean of 2.530 (SD=.7964) interpreted as satisfactory on the fourth level of Likert' scale. It was ranked as the fourth factor in increasing the overall level of job satisfaction. From the findings, it was observed that workload and stress level had a negative impact to the overall level of job satisfaction. The findings of this study did not contrast with other existing studies such that of Munyengabe et al (2016) who indicated that the increment in reducing the workload and stress level impact will go in hand with the increment with the job satisfaction

Financial Reward

The negative impact of financial reward on job satisfaction in a Chinese university was ranked the first and interpreted as fair on the fourth level of Likert' scale with an average mean of 2.500 (SD=.8489). Respondents were given the chance to rank different suggested items related with their financial rewards. From above presented data one may observe that the higher financial reward is the higher will be the level of satisfaction at work. Similarly, to the recent studies of Mustapha (2013) and Munyengabe et al. (2016), it is agreed that a good financial reward influences positively on the level of job satisfaction among university' lecturers. According to Sarwar and Abugre (2013), in their study, it was shown that a positive financial reward plays a vital role in increasing the level job satisfaction among workers within a working organization.

Hypotheses Testing

Findings regarded to the tested null hypotheses are presented in **Table 4**. The results are interpreted as follows: The null hypothesis of no significant relationship between the level of cheer love of the career and job satisfaction was rejected because of r-value of 0.317 and sig -value of .000 lesser than 0.001. From this, the study confirmed the significance relationship between cheer love of career and job satisfaction. The null hypothesis of no significant relationship between the level of salary and job satisfaction was rejected because of r-value of 0.688 and sig -value of .000 lesser than 0.001. The findings of this study confirmed a significance relationship between salary and job satisfaction.

Table 4. Correlations between factors and level of lecturers' motivation correlated with job satisfaction

		Cheer Love of career	Salary	Incentives & Promotions	Social Factor	Code of Conduct	Classroom environment	Level of Motivation	Level of Job Satisfaction
Cheer Love of career	Pearson Correlation	1	.422**	.092	.360**	.458**	.561**	.652**	.317**
	Sig. (2-tailed)		.000	.450	.002	.000	.000	.000	.000
	N	70	70	70	70	70	70	70	70
Salary	Pearson Correlation	.422**	1	.613**	.027	.513**	.437**	.752**	.688**
	Sig. (2-tailed)	.000		.000	.824	.000	.000	.000	.000
	N	70	70	70	70	70	70	70	70
Incentives &Promotions	Pearson Correlation	.092	.613**	1	.154	.624**	.480**	.697**	.559**
	Sig. (2-tailed)	.450	.000		.203	.000	.000	.000	.000
	N	70	70	70	70	70	70	70	70
Social Factor	Pearson Correlation	.360**	.027	.154	1	.495**	.208	.488**	.054
	Sig. (2-tailed)	.002	.824	.203		.000	.084	.000	.659
	N	70	70	70	70	70	70	70	70
Code of Conduct	Pearson Correlation	.458**	.513**	.624**	.495**	1	.544**	.830**	.636**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000
	N	70	70	70	70	70	70	70	70
Classroom environment	Pearson Correlation	.561**	.437**	.480**	.208	.544**	1	.730**	.357**
	Sig. (2-tailed)	.000	.000	.000	.084	.000		.000	.002
	N	70	70	70	70	70	70	70	70
Level of Motivation	Pearson Correlation	.652**	.752**	.697**	.488**	.830**	.730**	1	.615**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000
	N	70	70	70	70	70	70	70	70

**. Correlation is significant at the 0.001 level (2-tailed)

The null hypothesis of no significant relationship between the level of incentives &promotions and job satisfaction was rejected because of r-value of 0.559 and sig -value of .000 lesser than 0.001 and this confirmed the significance relationship between incentives & promotions and job satisfaction. Contrarily to other tested factors, the null hypothesis of no significant relationship between the level of social factors and job satisfaction was not rejected because of r-value of **0.054** and sig -value of **.659** greater than 0.001. From this, one may deduct that the influence of social factor on job satisfaction might be attached to the social context in which the study is carried out. The null hypothesis of no significant relationship between the level of code of conduct and job satisfaction was rejected because of r-value of **0.636** and sig -value of .000 lesser than 0.001. From that, the significance relationship between code of conduct and job satisfaction was confirmed by the current study. The null hypothesis of no significant relationship between the level of classroom environment and job satisfaction was rejected because of r-value of 0.**357** and sig -value of .000 lesser than 0.001. From that, the significance relationship between classroom environments with job satisfaction was confirmed. The null hypothesis of no significant relationship between the level of lecturers' motivation and job satisfaction was rejected because of r-value of 0.**615** and sig -value of .000 lesser than 0.001. Similarly, to the other related studies such those of Alam (2011); Munyengabe et al (2016) and Sheffler (2009), the findings of this study, greatly supported the existing established relationship between motivation and job satisfaction of employees in any organization setting. For example, the recent study of Munyengabe et al. (2016), has proven a great relationship between job satisfaction with factors as cheer love, salary, incentives & promotions, social, code of conduct, learning environment and overall motivation.

CONCLUSIONS

Based on the findings, the conclusion for this research should be as this: there is a significant relationship between lecturers 'motivation' level and jobs satisfaction level in a Chinese university located in Beijing. Starting on the first factor affecting negatively the lecturers 'motivation, the arrangement of factors should be as followed: Promotions and incentives; Salary; Classroom environment; Code of conduct; Cheer love of career (internal motivation) and Social factors. For job satisfaction level, starting at the first negative influence of factors, the ranking was shown as the followings: financial rewards; workload and stress level; working conditions; relation with supervisors; respect co-workers; working conditions and opportunity for advancement. From above, the general conclusion was drawn that an upgraded factor of motivation will have a positive impact on job satisfaction.

RECOMMENDATIONS

The study recommended setting a good plan to adjust all issues related on salaries, incentives and promotions regularly. The regular trainings and more opportunities for career advancement should be created to increase the level motivation and job satisfaction for the lecturing staff. The efficient communication and feedback should be maintained among staff that works on administration, teaching and service supporting area in the university. Finally, regular researches should be done in different corners regarding the motivation and job satisfaction among lecturers in other colleges of the similar university.

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The Relationship between Language Learning Strategies and Achievement Goal Orientations from Taiwanese Engineering Students in EFL Learning

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ABSTRACT

This study investigated the relationships between language learning strategies (LLSs) and achievement goal orientations (AGOs) in Taiwanese engineering students taking an EFL (English as a Foreign Language) class. Fifty freshmen from college of technology in university in central Taiwan participated in this study. All of the participants had studied English as a foreign language for more than six years. This study found that, among six categories of language learning strategies, students preferred using social strategies, such as asking for help from others while learning English. Students also frequently employed compensation strategies when presented with unfamiliar English words. Cognitive and affective strategies were the least used. In terms of achievement goal orientations, students employed the mastery-approach and the performance-approach more frequently than mastery-avoidance and performance-avoidance. Finally, a significant correlation was identified between language learning strategies and achievement goal orientations.

Keywords: language learning strategies, achievement goal orientations, EFL

INTRODUCTION

Language Learning Strategies (LLSs) play indispensable roles in the field of language learning. Strategic competence is an essential component of communicative competence, and refers to the ability to use strategies which allow the speaker to compensate for language knowledge limitations. Oxford (1990) described strategies as tools that involve active and self-directed development towards communicative competence. In an EFL classroom, LLSs are important for two reasons. First, by examining the LLSs used by EFL learners, learning processes that involve different strategy systems can be elucidated. Second, LLSs can be taught to less successful EFL learners in order to help them achieve better learning results (Chamot, 2005).

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Contribution of this paper to the literature

- This study aims to elucidate what language learning strategies are employed by engineering students in EFL learning.
- This study aims to elucidate which achievement goal orientations are used by engineering students in EFL learning.
- This study aims to characterize the relationship between LLSs use and AGOs among engineering students in EFL learning.

Different learners employ different LLSs. Researchers have therefore tended to focus on the relationship between LLSs and "individual differences". Benson and Gao (2008) classified individual differences into two categories: first, supposedly innate attributes such as age, gender, aptitude and learning style; second, supposedly acquired attributes such as motivation and attitudes. Achievement goal orientation (AGO) which is described as an individual's disposition or response to tasks is considered to be one of the variables affecting LLSs. In addition, both LLSs and AGOs in EFL learning are closely related to the contents of texts that play an important role in achieving effective learning. Short (2017) discussed the way to integrate content and language learning effectively for English language learners. Prediger and Zindel (2017) presented a design for fostering the conceptual understanding of language learners by the principles of relating registers and systematic variation of texts.

LLSs research has previously been conducted in Taiwanese EFL classrooms, primarily to investigate relationships between LLSs and grade level (Liu, 2005; Ong, 2005; Chuang, 2007), language proficiency (Chen, 2001), learning motivation (Liao, 2000; Peng, 2001), learning attitudes (Yang, 1992), and learning styles (Ko, 2001). However, few studies have focused on undergraduate students in investigating the relationship between LLSs and AGOs. Therefore, the current study sought to fill this research gap by examining the relationship between LLSs and AGOs in undergraduate EFL learners. The research questions were as follows:

Q1: What kinds of language learning strategies do engineering students use for EFL?

Q2: What are the achievement goal orientations of engineering students toward EFL?

Q3: What relationships exist between language learning strategies and achievement goal orientations?

LITERATURE REVIEW

Classification of Language Learning Strategies (LLSs)

LLSs have been one of the most popular research topics in the field of EFL (Griffiths & Oxford, 2014; Jeon & Yamashita, 2014). Rubin (1987) defined LLSs as strategies employed by a learner to regulate their learning. O'Malley & Chamot (1990) emphasized the use of thoughts or behaviors to achieve comprehension, learning, and retention of new information. Different LLS classifications have been proposed. Metacognitive strategies have been described as strategies by which the individual "learns about learning" through conscious effort. Cognitive strategies include steps that learners take to make material more manageable or easier to master. Social/affective strategies involve interactions with other individuals as well as the affective side of language learning. The aforementioned can be further broken down into direct and indirect strategies. Direct strategies directly involve targeted language and comprise memory strategies, cognitive strategies, and compensation strategies. Indirect strategies support language learning indirectly and include metacognitive strategies, affective strategies, and social strategies.

Research on LLSs in Taiwan

In Taiwan, high-proficiency learners have tended to report significantly more frequent use of LLSs than medium and low proficiency learners (Chen, 2001). Motivation has been identified as one of the factors that underlies individual differences, and Liao (2000) and Peng (2001) investigated the relationship between motivation and LLSs. Attitude (Yang, 1992) and learning style (Ko, 2001) have also been correlated with LLSs use.

Achievement Goal Orientations (AGOs) Theory

AGO is described as individual's disposition when responding to tasks and explains how individuals orient themselves when pursuing goals (Vandewalle, 1997; Musa et al., 2016; Allahdadi et al., 2016). Ames's (1992) study provided a dichotomous framework of AGOs in which goals were classified as being oriented towards mastery (mastery goals) or oriented towards performance (performance goals). Elliot (1999) considered the dichotomous framework insufficient to account for all types of goal orientation and therefore proposed the trichotomous framework. This framework retained the original concept of mastery goals, but sub-divided performance goals into two categories: performance-approach goals and performance-avoidance goals. Performance-approach goals are indicative of an individual's desire to outperform others and demonstrate his or her superiority. In contrast, performance-avoidance goals focus on the avoidance of demonstrating incompetence and gaining unfavorable judgments (Vandewalle, 1997).

Elliot and McGregor (2001) stated that neither the dichotomous framework nor the trichotomous framework took mastery avoidance goals into consideration; therefore, they proposed the 2×2 achievement goal framework, which constructed goal orientation in two dimensions by considering the definition of competence (performance versus mastery) and the valence of competence (approach and avoidance).

Research on AGOs in Taiwan

Research pertaining to AGOs theory has gradually increased in Taiwan, and researchers (He, 2004; Lin, 2011; Chen, 2012) have generally been interested in the relationship between AGOs and three variables. The first variable is self-efficacy, which represents the student's belief that he or she can successfully perform a task; self-efficacy influences the AGOs students adopt. The choice of whether to adopt mastery-approach or mastery-avoidance goals has been attributed to the self-efficacy of participants. The second variable is learning goal orientations, and students that adopted these demonstrated better academic achievement (Lin & Hsieh, 2001). The third variable is self-regulated learning (Li, 2012; Wu, 2016). In investigating self-regulated learning, Lin (2011) concluded that, under the cues of approach-performance classroom goals, cognitive processing strategies tended to become less effective for the mastery goal group, whereas cognitive processing strategies improved for the approach-performance goal group.

The Relationship between LLSs and AGOs

Although researchers have classified AGOs differently, most research that has focused on the relationship between LLSs and AGOs has tended to employ the dichotomous framework, which divides AGOs into mastery goals and performance goals. A study by Ames & Archer (1988) found that a student's AGO was related to different patterns of LLS use, wherein students who adopted mastery goals were more likely to report the use effective learning strategies. Tickle (2001) further concluded that students motivated by mastery goals were more likely to employ deep learning strategies. Other researchers (Fenollar et al., 2007; Liem et al., 2008) reported that mastery goals were usually related to greater use of deep-processing learning strategies, such as elaboration or organization strategies. A study by Dupeyrat and Mariné's (2005) also showed that mastery goal orientation was positively correlated with deep-processing strategies, while performance goals were positively correlated with both shallow and deep strategies.

Findings pertaining to the relationship between performance goals and LLSs have been inconsistent; some studies have reported that performance goals were related to both shallow and deep learning strategies while others revealed a close correlation between performance goals and shallow-processing strategies, such as rote learning or memorization (Nolen, 1988; Miller et al., 1996). According to Harackiewicz et al. (2002) and Pintrich et al. (2003), performance-approach goals may benefit students' cognitive learning. Indeed, performance-approach goals have been correlated with the use of cognitive strategies, while performance-avoidance goals have been correlated to surface processing activities, such as rehearsal (Pintrich, 2000).

METHODOLOGY

Participants

The present study employed a cluster sampling design, and participants included fifty freshmen enrolled in a college of technology at a university in central Taiwan. All participants were male students who were attending the same class and were aged 19 or 20 years old. All participants had studied English as foreign language for more than six years.

The college of technology was chosen because all of the freshmen in this college had attended a vocational high school, which typically require fewer English credits than normal senior high schools. Unlike students from other high schools, vocational high school students choose whether to study English as a primary subject. Therefore, to investigate language learning strategies and achievement goal orientations in the context of English learning, freshmen enrolled in the college of Technology were selected as study participants.

Instrumentation

Since the objective of the present study is to elucidate the correlation between the language learning strategies and achievement goal orientations adopted by undergraduate students, a quantitative research method was employed. Participants were given two questionnaires: the Strategy Inventory for Language Learning (SILL) and the Achievement Goal Orientation Scale (AGOS).

The Strategy Inventory for Language Learning (SILL)

The Strategy Inventory for Language Learning (Oxford, 1989) is the language learning strategy questionnaire which is most commonly employed world-wide. The SILL includes six categories of language learning strategies: memory strategies (items 1-9), cognitive strategies (items 10-23), compensation strategies (items 24-29), metacognitive strategies (items 30-38), affective strategies (items 39-44), and social strategies (items 45-50).

Participants were asked to rate each strategy statement on a five-point Likert scale. The choices were as follows: 1) Never or almost never true of me, 2) Generally not true of me, 3) Somewhat true of me, 4) Generally true of me, and 5) Always or almost always true of me. To obtain an overall SILL score, a point value was assigned to each response, and the points were totaled. A higher score indicated that the participant tends to use multiple strategies when learning English. The reliability and validity of Oxford's Strategy Inventory for Language Learning were .96 and .95, respectively. To account for the different English abilities of participants, this study adopted the Chinese version of the SILL, which was translated by Yang (1992). Yang reported a Cronbach alpha coefficient of .94 based on a sample of 590 Taiwanese university students, confirming that the Chinese version of the scale also has high reliability.

Achievement Goal Orientation Scale (AGOS)

This study employed a version of the achievement goal orientation scale that is suitable for Taiwanese students. Specifically, this scale was developed by Liu (2005), who adapted the original achievement goal orientation scale proposed by Pintrinch (2000) and Hsieh (2003). The AGOS consists of four types of goals: mastery-approach goals (items 1-8), performance-approach goals (items 9-16), mastery-avoidance goals (items 17-23) and performance-avoidance goals (items 24-30).

The AGOS uses a five-point Likert scale. Participants were asked to choose an answer from among the following: 1) Never or almost never true of me, 2) Generally not true of me, 3) Somewhat true of me, 4) Generally true of me, and 5) Always or almost always true of me. Since the scale by Liu (2005) was developed to investigate participant goal orientation while learning psychology, this study further modified the scale to measure participant goal orientation while learning English. The Cronbach's Alpha of the modified version of the scale was .944.

Table 1. The highest and lowest mean scores in each of the six SILL categories

Categories	Highest mean item (M)	Lowest mean item (M)
Memory	Item 1: I think of relationships between what I already know and new things I learn in English. (3.45)	Item 6: I use flashcards to remember new English words. (2.76)
Cognitive	Item 10: I say or write new English words several times. (3.57)	Item 17: I write notes, messages, letters, or reports in English" got the lowest mean score. (2.64)
Compensation	Item 24: To understand unfamiliar English words, I make guesses. (3.40)	Item 26: I make up new words if I do not know the right ones in English. (2.86)
Metacognitive	Item 33: I pay attention when someone is speaking English. (3.24)	Item 34: I plan my schedule so I will have enough time to study English. (2.69)
Affective	Item 40: I encourage myself to speak English even when I am afraid of making a mistake. (3.29)	Item 43: I write down my feelings in a language learning diary. (2.69)
Social	Item 45: If I do not understand something in English, I ask the other person to slow down or say it again. (3.57)	Item 47: I practice English with other students. (2.81)

Data Collection

This study selected a class of freshmen enrolled in a college of technology at a university in central Taiwan. On the day of questionnaire administration, the researcher briefly explained the purpose of the questionnaires and provided participants with instructions pertaining to how the questionnaires should be answered. Every participant was given two questionnaires: SILL and AGOS, which took about 50 minutes to complete. After participants completed the questionnaires, answer sheets were collected.

Data Analysis

SPSS software was used to analyze the collected data. Means (M) were calculated for each category of the SILL and AGOS questionnaires. The Pearson product-moment correlation was employed to investigate the relationship between learning strategy and goal orientation.

RESULTS

The present study examined the LLSs and AGOs of undergraduate students and the relationship between them. The results of the study are divided into two sections. Section one reported the descriptive statistics from questionnaire items. Section two reported the correlations between the LLS and AGO.

Descriptive Statistics of SILL

Items that received the highest and lowest mean scores in each category of the SILL are shown in **Table 1**. In the memory strategies category, item 1 received the highest mean score (M=3.45), and item 6 received the lowest mean score (M=2.76). In the cognitive strategies category, item 10 received the highest mean score (M=3.57), and item 17 received the lowest mean score (M=2.64). In the compensation strategies category, item 24 received the highest mean score (M=3.40), and item 26 received the lowest mean score (M=2.86). In the metacognitive strategies category, item 33 received the highest mean score (M=3.24), and item 34 received the lowest mean score (M=2.69). In the affective strategies category, item 40 was the most frequently used (M=3.29), and item 43 was the least frequently used (M=2.69). In the social strategies category, item 45 received the highest mean score (M=3.57), and item 47 received the lowest mean score (M=2.81).

Table 2. The six items with the highest mean SILL scores

Highest item	Learning strategies	M	Category	n
10	I say or write new English words several times.	3.57	Cognitive	
45	If I do not understand something in English, I ask the other person to slow down or say it again.	3.57	Social	
1	I think of relationships between what I already know and new things I learn in English.	3.45	Memory	
24	To understand unfamiliar English words, I make guesses	3.4	Compensation	
29	If I can' t think of an English word, I use a word or phrase that means the same thing.	3.38	Compensation	
46	I ask English speakers to correct me when I talk	3.36	Social	
Total			Compensation	2
			Social	2
			Memory	1
			Cognitive	1

Table 3. The six items with the lowest mean SILL scores

Lowest item	Learning strategies	M	Category	n
17	I write notes, messages, letters, or reports in English.	2.64	Cognitive	
18	I first skim an English passage (read over the passage quickly) then go back and read carefully.	2.69	Cognitive	
34	I plan my schedule so I will have enough time to study English.	2.69	Metacognitive	
43	I write down my feelings in a language learning diary.	2.69	Affective	
16	I read for pleasure in English	2.74	Cognitive	
6	I use flashcards to remember new English words	2.76	Memory	
Total			Cognitive	3
			Metacognitive	1
			Memory	1
			Affective	1

In order to better elucidate participants' language learning strategies, the six items with the highest overall mean and the six items with the lowest overall mean were investigated further. The six items with the highest mean scores are listed in **Table 2**. As shown in **Table 2**, the items with the highest overall means were item 10 (in the cognitive strategies category), item 45 (in the social strategies category), item 1 (in the memory strategies category), items 24 and 29 (in the compensation strategy category), and item 46 (in social strategies category).

The six items with the lowest overall mean scores are listed in **Table 3**. Three of these items (16, 17, and 18) belonged to the cognitive strategies category. The other three items belonged to the metacognitive strategy category, the memory strategy category, and the affective strategy category, respectively.

Table 4 shows that, of the six categories of learning strategies, the EFL learners in this study most preferred social (M=3.19), compensation (M=3.14) and memory (M=3.07) strategies, while cognitive (M=2.99), affective (M=3.02), and metacognitive (M=3.03) strategies were the least preferred.

Table 4. Mean scores of the six learning strategy categories

Direct strategies	M	Indirect strategies	M
Memory	3.07	Metacognitive	3.03
Cognitive	2.99	Affective	3.02
Compensation	3.14	Social	3.19

Table 5. Items that received the highest and lowest mean scores in each AGOs category

Categories	Highest mean item (M)	Lowest mean item (M)
Mastery-approach	Item 7: The reason I learn English is to improve my English proficiency rather than show off my ability. (3.62)	Item 5: I want the teacher to teach something challenging so that I can learn more knowledge" got the lowest mean score. (3.14)
Performance-approach	Item 9: When I get better score on English than others, I think I am successful. (3.62)	Item 15: It doesn't matter whether I acquire knowledge or not because what's more important is to get good grades. (2.90)
Mastery-avoidance	Item 21: When learning English, I am confused and wonder if I learn English in wrong ways. (3.43)	Item 18: I am worried about making no progress in English, so I supervise myself with high standard. (2.88)
Performance-avoidance	Item 26: My main goal in English class is to avoid bad performance. (3.21)	Item 28: It is important to not be considered silly in English class. (2.69)

Descriptive Statistics of AGOS

Table 5 shows that, of mastery-approach goals, item 7 received the highest mean score (M=3.62), and item 5 received the lowest mean score (M=3.14). Of performance-approach goals, item 9 received the highest mean score (M=3.62), and item 15 received the lowest mean score (M=2.90). Nonetheless, the lowest mean score received by a performance-approach goals item was far below the lowest mean score received by a mastery-approach goals item.

Regarding mastery-avoidance goals, the highest and lowest mean scores were received by item 21 (M=3.43) and item 18 (M=2.88), respectively. In general, the mean scores of performance-avoidance goals were not high. Specifically, in this category, the highest mean score was achieved by item 26 (M=3.21), and the lowest mean score was received by item 28 (M=2.69).

As shown in **Table 6**, three out of six items that received the highest overall mean scores on the AGOS questionnaire belonged to the mastery-approach goals category; another two belonged to the performance-approach goals category; and the final item belonged to the category of mastery-avoidance.

Table 6. The six items with the highest mean AGOs scores

Highest item	Achievement goal orientation	M	Category	n
7	The reason I learn English is to improve my English proficiency rather than show off my ability.	3.62	Mastery-approach	
9	When I get better score on English than others, I think I am successful.	3.62	Performance-approach	
10	When my performance on English is better than others, it sufficiently proves my English ability.	3.55	Performance-approach	
3	I hope that I can comprehend and much more familiar with what I learn in English.	3.45	Mastery-approach	
8	It is important that I can comprehend what is taught in English class and have sense of achievement in learning English.	3.45	Mastery-approach	
21	When learning English, I am confused and wonder if I learn English in wrong ways.	3.43	Mastery-avoidance	
Total			Mastery-approach	3
			Performance-approach	2
			Mastery-avoidance	1

Table 7. The six items with the lowest mean AGOs scores

Lowest item	Achievement goal orientation	Mean	Category	n
28	It is important to not be considered silly in English class.	2.69	Performance-avoidance	
18	I am worried about making no progress in English, so I supervise myself with high standard.	2.88	Mastery-avoidance	
29	The reason I study English is to avoid getting the worst score in English class.	2.88	Performance-avoidance	
15	It doesn't matter whether I acquire knowledge or not because what's more important is to get good grades.	2.9	Performance-approach	
14	In English class, I am encouraged because I want to be better than others.	2.93	Performance-approach	
25	I am afraid of asking my teacher silly questions because I don't want to be considered silly.	2.93	Performance-avoidance	
Total			Performance-avoidance	3
			Performance-approach	2
			Mastery-avoidance	1

Table 7 reveals that most of the items with the lowest mean scores were related to performance goals. Specifically, three of these items belonged to the performance-avoidance category and two of these items belonged to the performance-approach category. Only one item was related to mastery-avoidance.

Table 8. Mean scores of AGOs categories

Mastery Goals	M	Performance Goals	M
Mastery-approach	3.38	Performance-approach	3.22
Mastery-avoidance	3.11	Performance-avoidance	2.98

Table 9. Correlations between LLSs and AGOs categories

LLSs	AGOs			
	Mastery-approach	Performance-approach	Mastery-avoidance	Performance-avoidance
Memory strategies	.418**	.589**	.652**	.230
Cognitive strategies	.418**	.589**	.652**	.230
Compensation strategies	.539**	.566**	.627**	.400**
Metacognitive strategies	.697**	.631**	.684**	.480**
Affective strategies	.543**	.457**	.571**	.379*
Social strategies	.651**	.707**	.751**	.408**

*p<.05, **p<.01

Table 8 reveals that students were most likely to adopt a mastery-approach (M=3.38), followed by performance-approach (M=3.22) and mastery-avoidance (M=3.11). Performance-avoidance (M=2.98) was the least preferred approach to goal orientation.

Correlation between LLSs and AGOs

As indicated in Table 9, both memory strategies and cognitive strategies had highly significant correlations with mastery-approach goals, performance-approach goals, and mastery-avoidance goals; but no significant correlation existed between these strategies and performance-avoidance goals.

Compensation strategies, metacognitive strategies, and social strategies were all correlated with four AGO items, and these correlations were highly significant. Affective strategies showed highly significant correlations with mastery-approach goals, performance-approach goals, and mastery-avoidance goals.

DISCUSSION

In this section, the results are discussed in the context of the following research questions: Q1) What kinds of language learning strategies do engineering students use for EFL? Q2) What are the achievement goal orientations of engineering students toward EFL? Q3) What relationships exist between language learning strategies and achievement goal orientations?

Q1: LLSs of EFL Learners

Results from the SILL indicate that, among the six learning strategy categories, EFL learners most preferred social, compensation, and memory strategies, while cognitive, affective, and metacognitive strategies were the least preferred. These results are similar to those obtained by Chen (2001) and Chen (2012), who found that technology college students with both high and low English proficiency used compensatory learning strategies most frequently. Furthermore, Ong (2005) found that sophomores also use compensatory strategies most frequently, while cognitive strategies were used least frequently. However, research by Lin (2011) that investigated the LLSs of college English majors suggested that students employed cognitive strategies the most and affective strategies the least. Ong (2005) found that students enrolled in different majors/schools showed significantly different use of English learning strategies. Therefore, the inconsistent results between Lin's research and the present study may be due to the different academic disciplines of participants. Lin's research focused on English majors, while the present research focused on engineering majors.

In addition, although one of the highest scoring learning strategies fell under the cognitive strategies category, cognitive strategies ranked as the least preferred strategies overall. Indeed, half of the least preferred items belonged to the cognitive strategies category, implying that English learners are less likely to employ cognitive strategies. Conversely, the results suggest that EFL learners prefer using social strategies. For example they might "ask others to slow down or say it again when they don't understand," or "ask English speakers to correct their speech." This finding is in line with a study by Wharton (2000). Specifically, Wharton (2000) examined the language learning strategy use of university students in Singapore and reported that social learning strategies received a high mean and rank. Regarding compensation strategies, this study found that EFL learners tended to guess and seek for similar meaning when they encounter unfamiliar English words. This finding is supported by Wu's (2016) research, which reported that "guessing the approximate meaning" was ranked first among all LLSs that had been considered.

Q2: AGOs of EFL Learners

Results pertaining to AGOs indicate that EFL students tended to prefer the mastery-approach and performance-approach orientations more than the than mastery-avoidance and performance-avoidance orientations. The main reasons that students wished to learn English were to improve their English proficiency and to demonstrate their English ability. Students also noted that they believed a sense of achievement was important and that they considered themselves to be successful learners. Most previous AGOs studies in Taiwan have focused on elementary and junior high school students. Results of those earlier works support the current study; specifically, they suggested that mastery-approach orientations were most common, followed by performance-approach orientations, mastery-avoidance orientations, and performance-avoidance orientations (Hsieh, 2003). In other words, when the mean scores of goal categories were ranked, students were more inclined towards mastery goals than performance goals. However, five of the six items with the lowest overall mean scores were related to performance goals, implying that students are more likely to pursue mastery-oriented goals than performance-oriented goals.

Q3: Relationships between LLSs and AGOs

In general, this study found a highly significant correlation between LLSs and AGOs. The six learning strategy categories showed especially strong correlations with the mastery-approach orientation, the performance-approach orientation, and the mastery-avoidance orientation. The correlation between LLSs and performance-avoidance was less significant, implying that students' desire to avoid demonstrating incompetence and receiving unfavorable judgments did not impact their learning strategy use to the same degree.

Study Limitations

The participants of the study were EFL freshmen that were majoring in engineering. Therefore, the results of this study do not necessarily reflect the relationships between LLSs and AGOs for all undergraduate EFL learners. In addition, this study did not account for different levels of English proficiency. Future studies that include English proficiency as a variable may be able to provide a more comprehensive elucidation of LLSs, AGOs, and the correlations that exist between them.

Pedagogical Implications

The results of this study can help teachers better understand their students' LLSs and AGOs. By understanding LLSs that are commonly employed by students, teachers can tailor their classes to better meet student strengths and learning needs. By understanding common AGOs, teachers can design curriculum goals which cater to students' goal orientations. The significant correlations that we identified between certain LLSs and AGOs can also help teachers better design their teaching to correspond to curriculum goals.

CONCLUSION

This study investigated the relationship between learning strategies and achievement goal orientations in 50 Taiwanese engineering students involved in EFL learning. All participants had studied English as foreign language for more than six years. Of the six LLSs categories considered, students reported using social strategies most frequently. In terms of AGOs, students were more likely to be mastery-approach and performance-approach oriented than mastery-avoidance and performance-avoidance oriented. Finally, this study founds a significant correlation between the LLSs and AGOs employed by students.

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Understanding Factors that Affecting Continuance Usage Intention of Game-Based Learning in the Context of Collaborative Learning

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ABSTRACT
Due to the rapid progress of information technology and the Internet generation of students now on campus, game-based learning (GBL) has become an important issue with regard to education. In addition, in an increasingly competitive work environment, students need to cultivate not only their own abilities, but also the ability to collaborate with colleagues after graduation. However, such collaboration needs to be directed by appropriate guidance in order to demonstrate the expected results, and the rules of the related game guide can be applied to achieve this. Therefore, it is of interest to analyse students' learning processes in a digital game with a collaborative learning environment. In this study, we designed a digital history game providing collaboration opportunities for learners to solve problems. The partial least squares (PLS) approach was applied to analyse the effects of this collaboration on the attitude towards and willingness to use game learning, in order to validate our research model.

Keywords: game-based learning, collaborative learning, expectation confirmation model, technology acceptance model, social influence, continuance usage intention

INTRODUCTION

Rapid advances in computer technology have pushed educators and learners to pay increasing attention to the use of digital games, and many such games have been designed in several subject domains to supplement learning, such as mathematics, science and social studies (Dorji, Panjaburee & Srisawasdi, 2015). The increasing adoption of digital games has raised the question of how to take advantage of their potential for educational purposes (Plass, Homer & Kinzer, 2015). Watson, Mong and Harris (2010) examined educational computer games, and found that the use of game-based learning resulted in a shift from a traditional teacher-centered environment to a student-centered one, in which the learners were much more active and engaged. This may be because digital games allow learners to access educational contents in a more enjoyable and interactive way, attracting their curiosity and directing their learning paths (Papastergiou, 2009).

Game-based learning (GBL) is as a system in which learners are immersed in a set of interactive components and challenging activities based on a series of clear goals, agreed rules and constraints, and such issues are often discussed in the context of educational technology (Salen & Zimmerman, 2004). Applying games to

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Contribution of this paper to the literature

- This study found that satisfaction was the strongest predictor of learners' continued GBL usage intention, followed by social influence, usefulness and attitude to collaborative GBL; that is, users' continued GBL usage intention after the initial acceptance was determined by their satisfaction.
- This study confirmed that learner's confirmation and perceived usefulness were key determinants of their level of satisfaction, confirmation also had a significant impact on perceived usefulness, and confirmation had the dominant effect on satisfaction with collaborative GBL.
- This study confirmed a strong relationship between attitude and intention to use GBL, between usefulness and attitude, and between perceived ease of use and perceived usefulness, thus supporting the application of the TAM.

learning situation not only increases the enjoyment of students, but also enhances their learning motivation through the challenge and excitement of games. Indeed, several studies have shown that educational games can enhance students' learning motivation and learning performance. Regarding learning motivation, Chen (2017) suggested that students with high self-efficacy would have more elaborative problem-solving abilities, and that GBL could enhance students' learning motivation with a short time. Regarding learning performance, Kebritchi, Hirumi and Bai (2010) conducted a study to investigate the effects of GBL on students' mathematics performance. The results indicated that students with GBL saw greater gains in their mathematics skills than those with traditional instruction.

Due to these positive effects, digital games also provide opportunities for social engagement and contexts where peer and social interactions occur to enhance learning outcomes (Squire, 2006). Working collaboratively also provides opportunities for the development of group members' cognitive structures more creative positive attitudes toward the task and stronger task motivation compared to when working alone (O'Donnell & Kelly, 1994). Ke and Grabowski (2007) compared collaborative game play to competitive game play for learning mathematics, and the results showed that collaborative mechanics had more positive affective outcomes than competitive game play outcomes. Sung and Hwang (2013) compared collaborative and individual GBL, and found that learners' achievements in collaborative games were significantly better than in individual games. Although previous studies have investigated the positive influence of collaborative games, to the best of our knowledge there is little research on the factors affecting collaborative GBL. Therefore, the technology acceptance model (TAM) was applied in this study as a theoretical framework to examine the effects of collaboration in GBL

Educational digital games, which typically require the use of logic, memory, problem-solving, and critical thinking skills, generate higher levels of student interest in the focal subject matters (Annetta, 2008). They can also provide a rich context allowing learners to reinforce and consolidate their knowledge through practice (Chen & Law, 2016), in ways that might force the students to process various type of information simultaneously (Kalyuga & Plass, 2009), although the use of too many (often unnecessary) learning elements would distract learners' attention and increase their cognitive load (Bartsch & Cobern, 2003). Moreover, not all learners have enough capabilities to overcome such problems when they arise, and thus increasing their initial acceptance of digital games is an important first step toward implementing GBL. In addition, successful educational applications of such games depend on their continued use, and the expectation confirmation model (ECM) (Bhattacherjee, 2001) was thus also incorporated in this study to investigate the factors affecting learners' intention to continue using GBL.

This study's structure is as follows. First, the next section reviews the relevant literature focusing on the applications of GBL and the theoretical framework of combining the ECM and TAM models, along with the research hypotheses. This study then describes the procedure used and explains the results. Finally, this study presents and discusses an interpretation of the results, the limitations of this work and the implications for future research.

LITERATURE REVIEW

In this paper, we synthesize the expectation–confirmation model, the technology acceptance model, and social influence to hypothesize a theoretical model to explain users' intention to continue using GBL. We combine these theoretical perspectives for the following three reasons. First, although previous research has found ECM to be an essential model for continued information technology (IT) adoption (Bhattacherjee, 2001), it employs only three variables to explain behavioral intention: satisfaction, confirmation, and post-adoption expectations. However, user's continued intention to use GBL is also affected by ease of use, perceived usefulness, and user attitude, which are the focuses of TAM (Davis, 1989). Finally, social influence is based on the idea of peer-driven participation, and thus we should take into account the social relationships related to game-based learning. Since each theory has distinct perspectives, we suggest that combining them can provide a more comprehensive understanding of continued usage in this context than each theory considered alone.

Expectation Confirmation Model (ECM)

The expectation confirmation model (ECM) was developed by Bhattacherjee (2001) based on expectation confirmation theory (Oliver, 1980), and includes three dimensions of user intention to continue using certain technologies: perceived usefulness, confirmation of expectations and satisfaction. The ECM posits that an individual's intention to continue using information technology is dependent on three variables: the user's level of satisfaction with the IT; the extent of that the user's expectations are confirmed; and post-adoption expectations, in the form of perceived usefulness. The ECM is one of the most widely applied models in a variety of domains on continued information system (IS) usage (Kang, Hong, & Lee, 2009).

The ECM posits that users' perceived usefulness of IT has a positive effect on their intentions to continue IT usage. The confirmation of expectations suggests that users obtained the expected benefits through their usage of the focal IT, and this has a positive effect on their satisfaction. In addition, users' satisfaction is determined by the confirmation of expectations and the perceived usefulness of the IT (post-adoption expectations). Perceived usefulness of IT can be adjusted by confirmation experience, particularly when the users' initial perceived usefulness is unclear due to the uncertainty over what to expect from using the IT (Bhattacherjee, 2001). The ECM has been widely applied to examine user attitudes toward information systems, such as e-learning (Lee, 2010), electronic textbooks (Stone & Baker-Eveleth, 2013), and web 2.0 usage (Chen, Yen & Hwang, 2012). Because GBL is a pedagogical application of IT, we thus posit that the following hypotheses:

H1. Confirmation of expectations is positively related to learners' satisfaction with GBL.

H2. Confirmation of expectations is positively related to the perceived usefulness of GBL.

H3. Perceived usefulness of GBL is positively related to learners' satisfaction with GBL.

H4. Perceived usefulness of GBL is positively related to learners' continued GBL usage intention.

H5. Satisfaction with GBL is positively related to learner' continued GBL usage intention.

Technology Acceptance Model (TAM)

The technology acceptance model (TAM) (Davis, 1989) is the most frequently cited and influential model for explaining technology acceptance and adoption. Davis (1989) first introduced the TAM as a theoretical extension of the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975), and found that it could better explain user acceptance of a new technology. TAM proposes that two particular beliefs, perceived usefulness and perceived ease of use, are the primary drivers of technology acceptance. Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of physical and mental effort", while perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his/her job performance" (Davis, 1989).

Perceived ease of use theorized as a direct determinant of user attitude. In addition, researchers have found support for the indirect impact of perceived usefulness on user attitude through perceived ease of use. Both perceived ease of use and perceived usefulness thus influence an individual's attitude toward using a system. Pivec and Kearney (2007) pointed out that the integration of games with multimedia can provide greater motivation for learners, which makes learning more efficient. Learning with the integration of digital games allows learners to learn in a lively and vivid environment, and this is especially true if the system is easy to use (Chang et al., 2017). When learners think that a digital game is easy to use, they will be more willing to use it, which will make them have a positive attitude towards GBL. Many empirical studies have supported these arguments (Pando-Garcia et al., 2016; Hwang et al., 2016), and thus we posit the following hypotheses:

H6. Perceived usefulness is positively related to learners' attitude toward GBL.

H7. Perceived ease of use is positively related to learners' perceived usefulness with regard to GBL

H8. Perceived ease of use is positively related to learners' attitude toward GBL.

The purpose of this study is to examine the kind of situated social interactions occurring between students in the context of game play, focusing on how they encourage engagement and learning. In the context of GBL, collaboration allows learners to carry out deliberate practice of elaborating learning materials and constructing formal semantic knowledge (Sánchez & Olivares, 2011). In addition, such collaboration facilitates the development of a new theoretical understanding of GBL that shows how complex forms of social interaction can occur, as well as fostering diverse opportunities for engagement and interaction between these constructs (Vasalou et al., 2017). Therefore, collaboration should enhance the learners' learning attitudes to the game as well as increased continued usage intention with regard to GBL. We thus posit the following:

H9. Attitude is positively related to learners' continued GBL usage intention.

Social Influence

There are some discrepancies that naturally occur in collaborative learning, as in some groups the interactions among members contain high levels of reasoning and collective thinking, resulting in learning gains for all students, while in other groups although the quality of group members' interactions and learning is disappointing (Barron, 2003). A possible explanation is that these results might due to factors such as group effectiveness and social skills. It is also likely due to the complex interactions among features of the task, students, and groups (Kirschner et al., 2009).

Several researchers have examined how social influence can generate favorable learning results for group members (Lin & Huang, 2015). Social influence profoundly affects user behavior (Ajzen, 1991; Lee, 2006), and thus users' decision to adopt a specific IT may often be influenced by the suggestions of group members. Ito et al. (2008) indicated that learners are greatly influenced by social interactions in multimedia learning environments. When learners perceive that their important referents think they should use GBL, they are likely to incorporate this idea into their own beliefs, simply because their friends are users of GBL, and have recommended it to them. We thus propose the following hypothesis:

H10. Social influence is positively related to learners' continued GBL usage intention.

RESEARCH MODEL AND HYPOTHESES

The research framework is constructed according to the relevant literature, as shown in **Figure 1**. Based on the theoretical background and 10 postulated hypotheses, the variables examined in this work include confirmation, satisfaction, usefulness, ease of use, attitude, social influence, and continued intention to use the GBL.

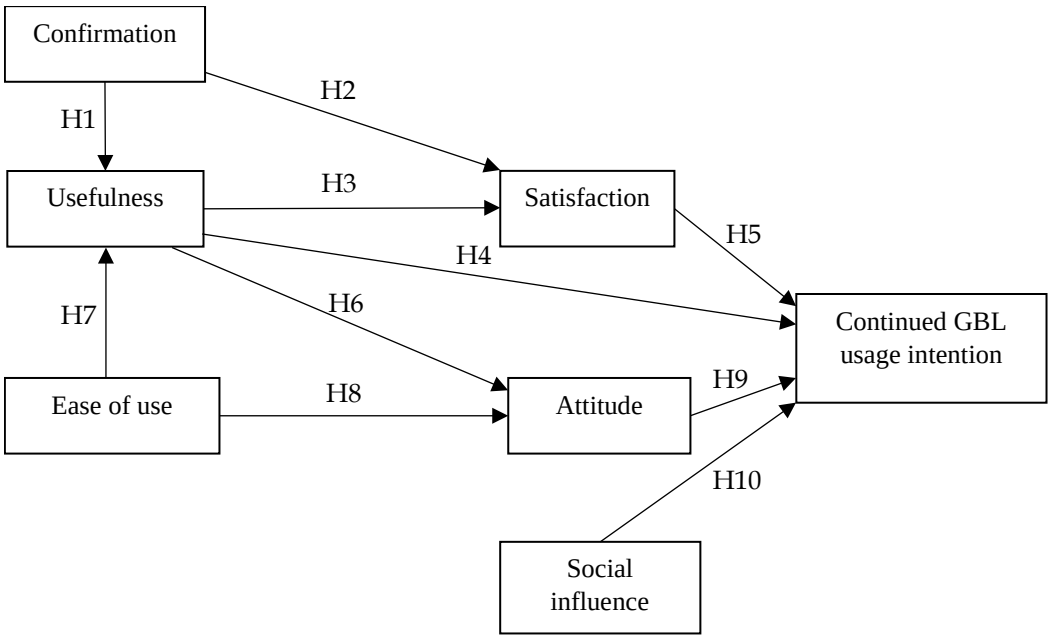

Figure 1. Research model

Experiential Educational Game for History Course

The learning content was adapted from an elementary history course and related to 16th century An-Ping (an area of Tainan, Taiwan). The digital game was developed based on Gerrig's (1993) two principles of cognitive processing in a narrative learning environment. First, learners are transported to a specific place and time in a manner that is so compelling it seems to be presenting the real scenes. Second, learners actively draw inferences and experience emotions based on their interactions with digital games. When embedding learning contents into digital games, an appropriate design of the gaming contexts, including the storyline and learning tasks, is important (Hwang, Chiu, & Chen, 2015). A good game design would not only enhance the playing experience, but could also increase the depth and scope of understanding in the learning context.

In this study, learners are connected with the daily life of An-Ping in the 16th century, and the digital game provides virtual scenes with scenarios and contexts, allowing the students to have the feeling of virtually being there. **Figure 2** shows the collaborative GBL environment used in this study. There are several tasks that the students must collaborate to achieve, and tasks that are used to attract students' attention and guide them through the process of problem solving. For example, the first mission was to search with the aid of various clues for Chi-Kan Tower, which was once the center of power in An-Ping. Once the students had obtained all the related data, they were allowed to proceed to the next level of the game. Using digital games can bring to life historical scenes and, more importantly for elementary school students, providing the opportunity to play a historical character is transformative and interesting.

Figure 2. Digital game setting

Participants

The participants in the experiment were four classes of fifth graders at an elementary school in southern Taiwan. A total 153 students participated in this study, 54.3% were boys (n = 83) and 45.7% were girls (n = 70). The students were taught by two instructors who had taught history for more than 10 years. The role of the instructor was to provide learning guidance. Monitor the students' learning progress, and solve any learning problems that arose. The students learned with the digital game collaboratively, by playing the role-playing game in a group of four or five to complete the learning tasks embedded in it.

Procedure

The study was conducted in four consecutive weeks of an elementary history course in southern Taiwan. The students used a desktop in a computer lab to play the game and participate in the learning. All participants first listened to a 10-minute training session to familiarize themselves with the game environment. Before entering the main page of the game, a short video was played to enhance the students' motivation. The students had to accomplish the learning tasks to successfully complete the game. The students started at the first level, where they interacted with characters provided by the game and could discuss things with team members to collaboratively complete the learning tasks. After the learning activities, the students completed a questionnaire to assess their learning experience with GBL.

Measurement

The questionnaire was divided into three sections. The first comprised questions about the demographic details of the respondents. The second part of the instrument was a nine-item questionnaire that examined three factors, confirmation, satisfaction, and continued intention, as revised from Bhattacherjee (2001). The final part of instrument was a nine-item questionnaire examining three factors: ease of use, usefulness, and attitude, as revised from Davis (1989). The social influence questionnaire was revised from Taylor and Todd (1995). All items, except

Table 1. The convergent validity and reliability of the measures in the measurement model

Construct	Convergence validity	Reliability	
	AVE	Composite reliability	Cronbach's α
Confirmation	0.83	0.92	0.91
Satisfaction	0.82	0.91	0.88
Usefulness	0.88	0.93	0.92
Ease of use	0.81	0.86	0.85
Attitude	0.78	0.88	0.87
Social influence	0.77	0.91	0.82
Continued GBL usage intention	0.82	0.92	0.85

Table 2. The discriminant validity of the measurement model

	Discriminant validity						
	Latent variable correlations						
Construct	1	2	3	4	5	6	7
1. Confirmation	0.89						
2. Satisfaction	0.82	0.91					
3. Usefulness	0.73	0.72	0.88				
4. Ease of use	0.78	0.74	0.81	0.85			
5. Attitude	0.81	0.78	0.73	0.82	0.83		
6. Social influence	0.77	0.71	0.69	0.81	0.82	0.88	
7. Continued GBL usage intention	0.73	0.66	0.65	0.82	0.77	0.87	0.91

for those in the first section, were answered based on a 5-point Likert scale, ranging from 1-strongly disagree to 5-strongly agree.

DATA ANALYSIS AND RESULTS

The partial least squares (PLS) approach was used to analyze the questionnaire data, as it is more suitable than using structural equation modeling (Chin & Newsted, 1999). The SmartPLS 2.0 software package was used to assess the measurements and structural model. In analysing the collected data, we followed the two-step procedure suggested by Anderson and Gerbing (1988). First, we examined the measurement model to assess convergent and discriminant validity. Convergent validity (see **Table 1**) was measured with two metrics: average variance extracted (AVE) and composite reliability (CR). All of the convergent validity metrics clearly exceeded a minimum standard of 0.5. The reliability of the measurements was examined through the use of composite reliability and Cronbach's alpha. In general, the minimum acceptable value of composite reliability is 0.7, and the minimum acceptable value of Cronbach's alpha is 0.6 (Hair et al., 2006).

The discriminant validity was assessed by using the square root of the average variance extracted and latent variable correlations (see **Table 2**). The square root of the average variance extracted of each construct should exceed the correlation shared among constructs, as this implies that constructs have good discriminant validity. In summary, the results of the tests of the measurement model, including of its convergent and discriminant validity measures, were satisfactory.

Structural Model

We then examined the structural model to verify the hypotheses based on the path coefficients and R2 values (Chin & Newsted, 1999). The R2 values were used to assess the ability of the model to explain the variance in the dependent variables. The path coefficients were used to assess the statistical significance of the hypotheses. **Figure 3** shows the results of the structural model, and it can be seen that the model explains 55% of the variation in usefulness, 67% of that in satisfaction, 62% of that in attitude, and 70% of that in continued use intention.

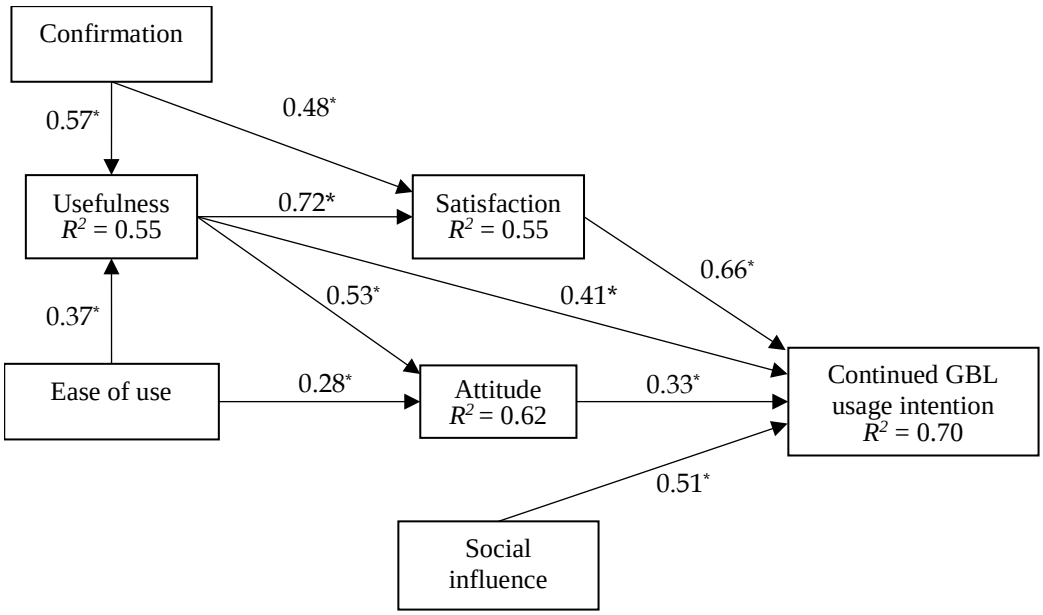

Figure 3. The results of structural model

The direct effects between the variables in the path model are shown in **Figure 3**. With regard to hypotheses H2 and H3, related to the effects of confirmation and usefulness on satisfaction, both hypotheses were supported. The path coefficient between confirmation and satisfaction was 0.48*, and 0.72* between usefulness and satisfaction. Regarding hypotheses H1 and H7, related to the effects of confirmation and ease of use on usefulness, both hypotheses were supported. The path coefficient between confirmation and usefulness was 0.57*, and 0.37* between ease of use and usefulness. With respect to hypotheses H6 and H8, pertaining to the effects of usefulness and ease of use on attitude, both hypotheses were supported. The path coefficient between usefulness and attitude was 0.55*, and 0.28* between ease of use and attitude. Finally, the hypotheses (H4, H5, H9, and H10) related to the effects of satisfaction, usefulness, attitude and social influence on continued GBL usage intention were all supported. The effects of satisfaction on continued GBL usage intention was higher than that of the other variables. However, social influence did play a significant part in affecting continued GBL usage intention.

DISCUSSION

In this study, we applied the concept of the ECM, TAM, and social influence to examine continued GBL usage intention in a collaborative learning environment. First, the results of the study showed that satisfaction is the strongest predictor of learners' continued GBL usage intention, followed by social influence, usefulness and attitude. The satisfaction-intention connection has previously been validated in an e-learning context (Lee, 2010). Oghuma et al. (2016) examined the factors that impact users' continued intention to use mobile instant messaging, and the results showed that users' satisfaction affects continued intention to use this technology. Therefore, satisfaction may be the primary factor to explain the acceptance-continued link; that is, users' continued GBL usage intention after the initial acceptance is determined by their satisfaction.

Secondly, this study confirmed that confirmation of the learners' expectations and perceived usefulness were key determinants of their levels of satisfaction, and this confirmation also had a significant impact on perceived usefulness, as well as the dominant effect on satisfaction. The results of this study thus strongly supported the ECM (Bhattacherjee, 2001). It is also in line with Stone and Baker-Eveleth's (2013) study on the adoption of electronic textbooks, which showed that confirmation of expectations influences perceived usefulness and satisfaction, consequently influences electronic textbook continued intention. In the digital game environment,

Riemer and Schrader (2015) suggested that such games are more likely to foster learning or to support positive attitudes toward perceived usefulness, resulting in more generally positive attitudes and further usage intention.

Third, the results of this study confirm strong relationships between attitude and intention to use GBL, between usefulness and attitude, and between perceived ease of use and perceived usefulness, thus supporting the application of the TAM (Davis, 1989) in the context of GBL. These findings are similar to those of other studies examining the acceptance of educational games (Bourgonjon et al., 2010), as well as supporting Garcia et al.'s (2016) research on a web-based business game-training program, which found that perceived usefulness has a very strong effect on intention to use such games.

In this study, we also examined social influence in a GBL environment, and found it was a strong predictor of continued usage intention. Asking students to collaboratively tackle a digital game challenges them to establish common frames of reference, work to resolve discrepancies in understanding, and so come to a shared understanding of the situation. Collaborative digital games often lead to positive learning outcomes and a higher level of abstract thinking through bridging multiple different perspectives (Echeverrîa et al., 2012). Collaboration in games can increase students' discussions and reflections on their arguments, which can foster knowledge co-construction and provide opportunities to cultivate a positive attitude and so enhance learning.

IMPLICATIONS

For academic researchers, this study proposed a theoretical framework to understand the factors affecting the continued GBL usage intention in a collaborative learning environment. Our research contributes a new theoretical understanding of the factors affecting the continued GBL usage intention in a collaborative learning environment. This study demonstrated the importance of two important variables with regard to fostering continued GBL usage intention, social influence and satisfaction, which together explained much of the variance in this intention. Collaboration in the digital game provided students with opportunities to achieve common goals and establish a sense of community through social interactions, and this increased their motivation for learning. In general, collaboration itself can be used as potential strategies for developing more effective educational digital games.

LIMITATIONS AND FUTURE RESEARCH

We incorporated the ECM, TAM, and social influence when examining the GBL environment in the context of collaborative learning, and the findings suggest that these factors have a significant impact on continued usage intention. The proposed model was verified and found to be valid in terms of explaining and predicting continued GBL usage intention in the context of a collaborative digital game. However, several limitations of this work should be addressed in future research. First, it should be noted that a bias exists because the sample was self-selected. Second, the other difficulty is the limited generalizability of this work. Since satisfaction, attitude, and social influence are additional antecedents of continued usage intention, it is impossible to generalize the findings to other collaborative digital games. Finally, the results of this study suggest that the researchers should investigate how emotional constructs, such as intrinsic motivation and flow, influence continued usage intention, and so provide a broader framework for the analysis of GBL.

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A Semantic Network Analysis on the Recognition of STEAM by Middle School Students in South Korea

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ABSTRACT

The purpose of this study is to investigate how much Korean students recognize STEAM (Science, Technology, Engineering, the Arts, and Mathematics) and to find out what keywords they associate with it and what the relationships among keywords mean. This study has surveyed 1,009 middle school students by using the purposive sampling method. In order to achieve the goal of this study, we have developed a questionnaire in consultation with survey research experts. The questionnaire asks each student to write down three words that come to his or her mind in each area of study: S/T/E/A/M. The survey was conducted during the period between July and September, 2016, and the results were collected directly from the target groups. For data analysis, KrKwic was used for selecting top 30 keywords, and Ucinet6.0 was employed to obtain meaningful relationships among keywords in the whole network. Then we built and visualized a network by using Netdraw. In this study the contents of analysis include the frequency of keywords, the network degree centralization index. The results of this study can be summarized as follows: First, the words students associate with science are "experiment, chemistry, physics, scientist, biology, life, etc." Second, the words students associate with technology are "machine, home economics, robot, science, , invention, technician, etc." Third, the words students associate with engineering are "machine, technology, robot, computer, mechanical engineering, science, college of engineering, engineer, etc." Fourth, the words students associate with the arts are "art, music, painting, beauty, dancing, song, dance in Korean, etc." Fifth, the words students associate with math are "calculation, function, numbers, difficulty, equation, formula, etc." Sixth, With regard to STEAM, middle school students recognize science as experiment, technology and engineering as machine, arts as art, math as calculation. Seventh, Each network of STEAM turns out to be a complicated one. It is difficult to find a meaningful creation of images due to their lack of learning experience in combined knowledge. This explains the need of learning experience in the STEAM programs. The fact that all of middle school students consider STEAM difficult supports this explanation.

Keywords: middle school students, STEAM, recognition, network, semantic network analysis, network degree centralization index

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Contribution of this paper to the literature

- The purpose of this study is to describe how Korean middle schoolers conceive interdisciplinary conversion.
- The study shows that students recognize 'Science as an experiment', 'Technology and Engineering as a machine', 'Arts as the fine arts', 'Math as a calculation'.
- In this study, networks links one another through teachers, which means the role of a teacher in STEM, interdisciplinary conversion, is vital.

INTRODUCTION

We call our contemporary society 'liquid modernity', which means a fission-fusion society. We call it so because knowledge fusion and technology fusion, which break the barriers of monolithic education, such as one discipline, one technology, and one curriculum, are creating more unique and more competitive results. Recently, Korean education places greater emphasis on combined and fusion education in order to produce creatively gifted individuals equipped with humanistic imagination and scientific creativity by making them immersed in the foundational knowledge about humanity, sociology, science, and technology (Ministry of Education, 2015). The beginning of this approach can be traced back both to "The Reinforcement of STEAM Education at the Elementary, Middle, and High School Levels" from one of the 2010 Six Great Projects of the Ministry of Education called "Nurturing Gifted Students in Science and Technology," and to "The Second Foundation Plan for Nurturing and Supporting Gifted Students in Science and Technology (2011-2015)." Since then, Korea Foundation for the Advancement of Science and Creativity has been leading consistent efforts to vitalize the Science, Technology, Engineering, Arts, and Math (STEAM) programs. In addition, STEAM education in Korea is closely related to STEM programs in the U.S., a term made by the National Science Foundation (NSF) to stand for Science, Technology, Engineering, and Math in the 1990s. Since then, the term has been widely used to mean an integrated approach to science, technology, engineering, and math in the field of education (Hong, K.H., 2012). One of the reasons for the need of the arts in STEAM in Korea, which is born as a strategy, can be found in our efforts to motivate creative thinking and innovative ideas in science through imagination, creativity, communication, and sensibility, which are usually obtained from arts education (Noh, S.W. and Ahn, D.S., 2012). Another reason is that we are trying to equip certain individuals with abilities to put together even artistic sensibilities in the field of science and technology, so that they will be leaders of this age of fusion.

Our attempt as a fundamental and interactive approach is considered a desirable and timely research in that it investigates how middle school students think about and have relationships with science, technology, engineering, arts, and math as elements of knowledge fusion in school education.

Therefore, this study will survey the general outline of STEAM education, investigate specific images Korean middle school students have regarding each subject of S/T/E/A/M, and analyze both the keywords and the relationships among keywords recognized through a semantic network analysis.

Based on the results of this analysis, we will investigate the application of STEAM education and explore ways to improve the effectiveness of STEAM education for middle school students.

THEORETICAL BACKGROUND

The Outline of STEAM in Korea

As mentioned above, STEAM in Korea is a term coined by combining the initials of science, technology, engineering, arts, and mathematics, which first appeared officially in a report to the Ministry of Education, Science, and Technology in 2011 (Choi, Y.H., Lee, E.S., Kim, D.H., 2013). The background of the execution of STEAM education can be found in the fact that the level of Korean students' confidence, delight, voluntariness, and interest in math and science is among the lowest, lagging far behind that of their overseas peers, and that there is a marked tendency, as a consequence, for them to avoid entering into these fields of studies. Since national competitiveness

in current society of science and technology is affected by how quickly we adapt to an age of rapid innovation, especially in the areas of science, technology, and engineering, the educators in these fields are now making every effort to change their curricula by fusing and integrating diverse disciplines in order to meet the need of change for the future society (Park, H.J., 2014). In this situation, the objective of STEAM is to nurture those with integrated creativity, who will lead our future development of science and technology, by restructuring the curriculum of science-technology-engineering-math with strong emphasis on core capacities, so called 4C (Creativity, Communication, Convergence, and Caring) and by combining diverse courses together and grafting them with artistic skills. In this regard, the Korean version of STEAM works as a policy implemented to provide an instrument to solve the problems involved in science and technology education in Korea, give our students dreams and visions, and enhance their interest and understanding in these fields (Ministry of Education, Science, and Technology, 2010).

According to Baek, Y.S. et al.(2012), a class formation for STEAM is composed of three big components as demonstrated Emotional Touch, Creative Design, and Content Integration—and has a structure with a virtuous circle that motivates students, nurtures them to be able to solve problems comprehensively, and gives them a sense of challenge. That is to say, STEAM means a shift from the perspective of "what to teach" to "what experience to give," so that it places emphasis on the content, design, and emotional convergence.

In addition, the study of STEAM also has moved from the study of STEM-related overseas literature at its initial stage now to curriculum-centered STEAM content research which deals with the effects of its application to students. It has been confirmed that most of STEAM researches conclude that the application of STEAM in education is effective in directing students to positive changes like improving creativity, problem solving skills, self-directed learning ability, integrated consciousness, and students' interest and confidence in science and technology (Kim, J.W., 2016).

Semantic Network Analysis

A semantic network analysis is a method of analyzing the content of the communication message by making it a target of text network analysis. It is a kind of method that encodes the relationships among keywords, construct a network among related keywords, and analyze the result of the findings (Doefel & Connaughton, 2009; Yang, S.D., 2013). Content analysis through a semantic network analysis not only helps us comprehend the frequency of keywords, but also demonstrates visually the relationships among keywords. This gives us a chance to see at a glance the important concepts, as well as the relationships and their strengths among concepts (Suh, J.I., 2015).

There is a limitation in a traditional method of content analysis in that a significant difference among researchers in classifying and interpreting data could occur (Kim, S.Y., Kim D.W., & Choi, M.I., 2013; Park, H.W. & Leydesdorff, 2004). As a way of supplementing this limitation, a semantic network analysis can find a regulation, which used to be hidden in the information or unrevealed visually, by performing a job of transferring the information into data (Jung, Y.I., 2005). In other words, it focuses not only on the combination of each individual word, but also on how keywords are combined in a specific way, where they are located after being combined in a particular way, and what kind of structure they have. Then it finds out a specific meaning, while an analysis category from the data (a conceptual grouping) is naturally formed in the process (Park. H.W. & Leydesdorff, 2004; Wasserman & Faust, 1994). Especially, visualization in this method makes it possible to comprehend the outline of the entire, gigantic, and complicated data in a short time, which makes analysis more meaningful.

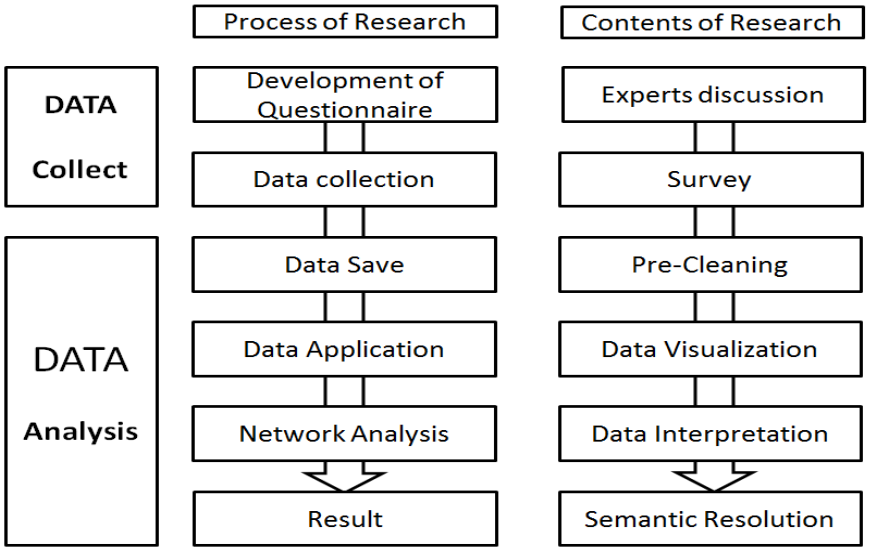

Figure 1. A process of research

Table 1. General characteristics of the survey respondents

Sex	1st Grade	2nd Grade	3rd Grade	Total
Female	154	159	133	446
Male	202	177	159	538
No Answer	7	11	7	25
Total	363	347	299	1009

METHODS

Process of Research

This research has been performed separately in two stages, data collecting and data analyzing. At the data collecting stage, a questionnaire was developed and a survey was conducted based on the developed questionnaire. The data analyzing stage was composed of coding of the questionnaire, a process of purifying terminologies and transferring data for analysis, visualizing and interpreting the network, and finding out the meaning of the result. The **Figure 1** above is graphically provided for your reference.

In order to achieve the goal of this study, we have developed a questionnaire in consultation with survey research experts. The questionnaire asks each student to write down three words that come to his or her mind in each area of subject: science (S), technology (T), engineering (E), the arts (A), and math (M).

Data Collecting

The survey was conducted among middle school students in the Daejeon area in South Korea during the period between July and September, 2016, and the results were collected directly from the target groups. The results show that a total number of 1,009 students participated in the survey.

Analyzing of the Networks

For the analysis of the research, we used MS Excel 2016, KrKwic, Ucinet 6.0 and Netdraw. By using Excel 2016, we did data Pre-Cleaning in order to combine keywords with the same meaning into a common keyword, and by using KrKwic, we selected the top 30 keywords, and by using Ucinet 6.0, a link filtering was employed to

Table 2. Division of centrality

Division	Degree centrality
Measuring Method	Measuring by the number of directly connected neighboring nodes
Characteristics	•Proper to measure the direct effectiveness •The more neighboring nodes are connected, the higher degree centrality becomes.

Sah, I.R. (2016). Excerpted and summarized from the analysis of social network using NetMiner

obtain meaningful relationships among keywords in the whole network. Then we built and visualized a network by using Netdraw. The content of analysis includes the degree of keyword frequency and the analysis of the centralization index. The analysis of the centralization index figures out which node is the most important one, and how much the network is concentrated in the minor nodes. This study tries to figure out degree centrality.

Interpreting of the Networks

In the network between keywords, the keyword is node, and the connection between nodes is represented by Link. Such a network can grasp the overall shape at a glance. In this case, the thickness of the line means that the degree of connection between the keywords is high, and the size of the node means a large intersection point between the sub-structures.

FINDINGS

Middle School Students' Recognition about Science and Their Recognition Network

With regard to the term, science, a total number of 533 image words occurred to middle school students participating in the survey. The following is the list of top 30 keywords among their responses in the survey. (Refer to **Table 3**)

"Experiment" is the most frequently occurring word to middle school students with regard to the term, science. As scientific activities, they recognize "experiment, research, exploration, observation," and as a subject of science, they recognize "chemistry, physics, biology, the universe, technology, earth science, robot, math" in order of frequency. As a job in the field of science, they recognize "scientist, teacher, and researcher" in order of frequency. As for feelings about science, they consider it "difficult and interesting," while they place the value of practical use of science in the "future and development."

For the top 30 keywords, the semantic network was analyzed. As a result, the network's degree centrality turned out to be 0.2412, making it a complex network. The network is presented as follows. (Refer to **Figure 2**)

Table 3. Image words occurring to mind about science

Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Keywords	experiment	chemistry	physics	scientist	biology	life	difficulty	research	universe	technology
Degree	366	257	175	108	92	61	58	58	49	47
Rank	11	12	13	14	15	16	17	18	19	20
Keywords	earth science	exploration	teacher	earth	Invention	robot	earth	observation	math	cell
Degree	47	41	37	37	35	34	34	29	28	28
Rank	21	22	23	24	25	26	27	28	29	30
Keywords	future	beaker	fun	development	plant	chemical symbol	machine	researcher	exam	research institute
Degree	28	27	23	23	22	20	18	17	16	16

(Mean of Degree centrality: 0.008)

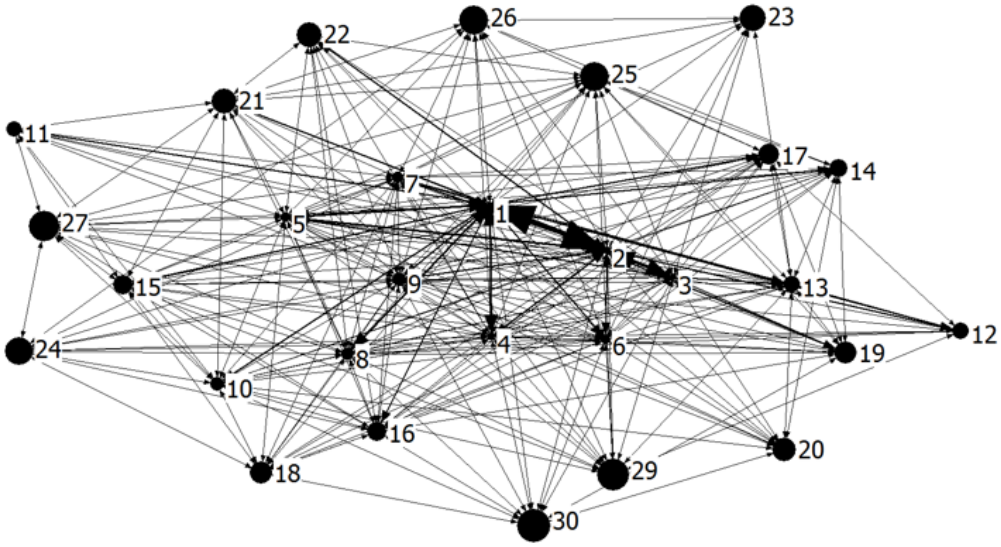

Figure 2. Middle school students' recognition network about science (The numbers of network are rank keywords of **Table 3**)

Middle School Students' Recognition about Technology and their Recognition Network

With regard to the term, technology, a total number of 661 image words occurred to middle school students participating in the survey. The following is the list of top 30 keywords among their responses in the survey (Refer to **Table 4**).

"Machine" is the most frequently occurring word to middle school students with regard to the term, technology. As products of technology, they recognize "a robot, computer, car, and smartphone" in order of frequency, and as technology-related subjects, they identify "home economics, science, and engineering" in order of frequency. It is assumed that the term, called "home economics," appears in the list because students are taught "technology and home economics" as two subjects in the area of technology education. "Development, future, and convenience" appear in the list as values of technology, while "invention, architecture, construction, manufacturing, skillfulness, patent, research, and producing" are recognized as technical activities.

Table 4. Image words occurring to mind about technology

Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Keyword	machine	home economics	robot	science	invention	technician	teacher	computer	development	architecture
Degree	216	147	113	66	65	63	57	53	52	51
Rank	11	12	13	14	15	16	17	18	19	20
Keyword	factory	technology education + home economics	making	engineering	construction	car	difficulty	manufacturing	electricity	skillful-ness
Degree	45	44	42	34	33	32	30	29	28	24
Rank	21	22	23	24	25	26	27	28	29	30
Keyword	convenience	ability	future	tool	making	patent	scamper	science + technology	technology	research
Degree	24	23	23	18	18	17	17	17	17	16

(Mean of Degree centrality: 0.012)

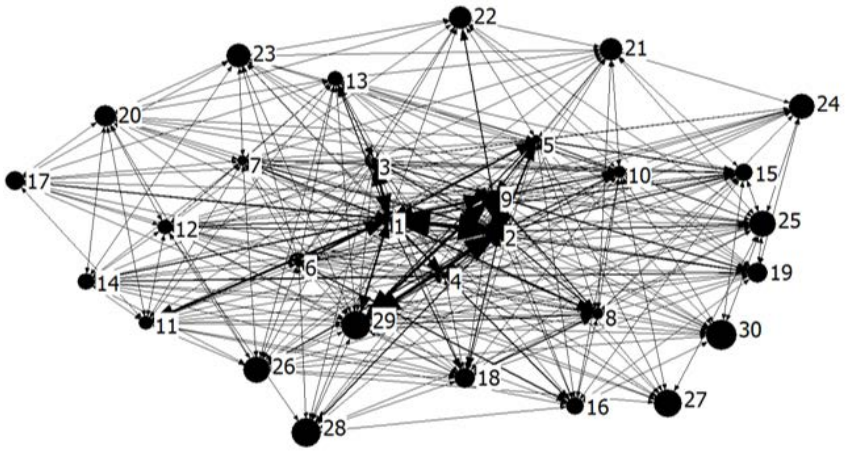

Figure 3. Middle school students' recognition network about technology (The numbers of network are rank keywords of **Table 4**)

For the top 30 keywords, the semantic network was analyzed. As a result, the network's degree centrality turned out to be 0.2001, making it a complex network and it appeared to be relatively less complex than science. The network is presented as follows. (Refer to **Figure 3**)

Middle School Students' Recognition about Engineering and their Recognition Network

With regard to the term, engineering, a total number of 536 image words occurred to middle school students participating in the survey. The following is the list of top 30 keywords among their responses in the survey. (Refer to **Table 5**)

"Machine" is the most frequently occurring word to middle school students with regard to the term, engineering. As for the products of engineering, their answers include a "robot, computer, and car" in order of frequency, and as engineering-related subjects, they identify "technology education, mechanical engineering, science, electronics, electricity, math, life, biotechnology, and architecture." As other images about engineering, they recognize "college of engineering, engineer in Korean, factory, design, engineer, and fields of science." This can be interpreted that students have two kinds of images about engineering: one is an image of research by an engineer through college of engineering in the fields of science; and another is an image of technician working in the factory. In addition, engineering appears to them "difficult and complicated." As engineering activities, they choose "design, invention, research, making, and assembly."

One thing unusual in this survey is that "coeducation" is included in their recognition network because coeducation has the same phonetic sound as engineering in Korean, though its Chinese character is different.

Table 5. Image words occurring to mind about engineering

Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Keyword	machine	technology	robot	computer	mechanical engineer	science	college of engineering	difficulty	electronics	engineer in Korean
Degree	382	170	132	108	81	77	53	49	44	42
Rank	11	12	13	14	15	16	17	18	19	20
Keyword	electricity	math	car	life	factory	coeducation	biotechnology	design	architecture	engineer
Degree	37	36	35	33	31	30	27	26	23	23
Rank	21	22	23	24	25	26	27	28	29	30
Keyword	robotics	invention	research	electronic engineering	chemistry	complexity	fields of science	making	assembly	university
Degree	23	22	20	20	19	19	17	16	16	14

(Mean of Degree centrality: 0.019)

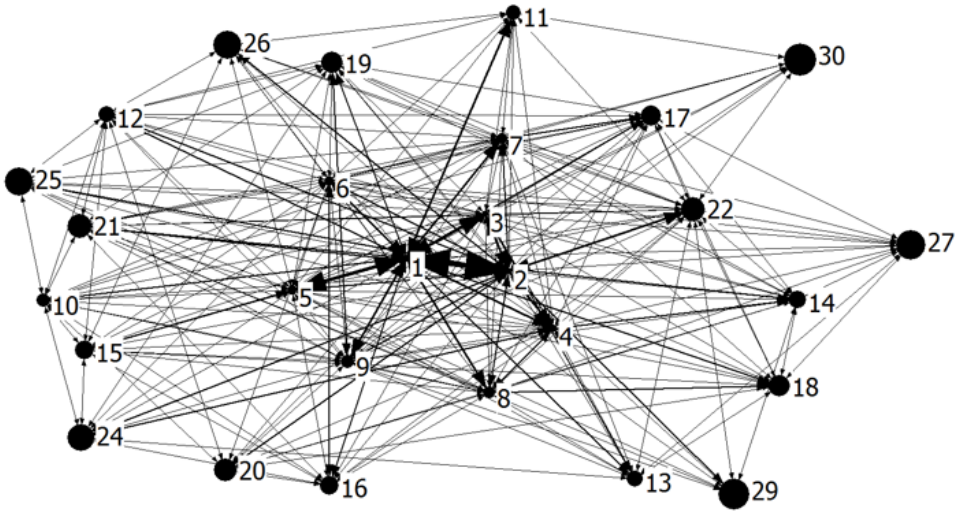

Figure 4. Middle school students' recognition network about engineering (The numbers of network are rank keywords of **Table 5**)

For the top 30 keywords, the semantic network was analyzed. As a result, the network's degree centrality turned out to be 0.2028, making it a complex network so that its level appeared to be similar to that of science. The network is presented as follows. (Refer to **Figure 4**)

Middle School Students' Recognition about Arts and their Recognition Network

With regard to the term, arts, a total number of 486 image words occurred to middle school students participating in the survey. The following is the list of top 30 keywords among their responses in the survey. (Refer to **Table 6**)

"Art" is the most frequently occurring word to middle school students' mind with regard to the term, arts. As arts-related majors, they recognize "art, music, dance, physical education, sculpture, ballet, and movie," and as artistic activities, they include "painting, dancing, singing, creative writing, performance, making, and creating." As for occupational clusters which are related to arts, "a painter and an artist" stand out as the most representative ones. And the rest of the words related to arts include "art gallery, Picasso, brush, creativity, and culture."

It is quite remarkable that words like creativeness and creativity are highly ranked in the list, making students' recognition about art distinguishable from their recognition about science, technology, engineering, or math.

Table 6. Image words occurring to students about arts

Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Keyword	art	music	painting	beauty	dancing	dance in Korean	work of art	physical	painter	singing
Degree	548	380	260	103	80	64	52	51	51	48
Rank	11	12	13	14	15	16	17	18	19	20
Keyword	carving	pigment	art gallery	Picasso	sculptor	creativeness	performance	ballet	creativity	design
Degree	40	32	31	24	23	23	21	19	19	18
Rank	21	22	23	24	25	26	27	28	29	30
Keyword	brush	artist	culture	musical instrument	art, music, physical	making	interesting	movie	creating	difficulty
Degree	18	18	17	17	17	15	16	15	15	14

(Mean of Degree centrality: 0.026)

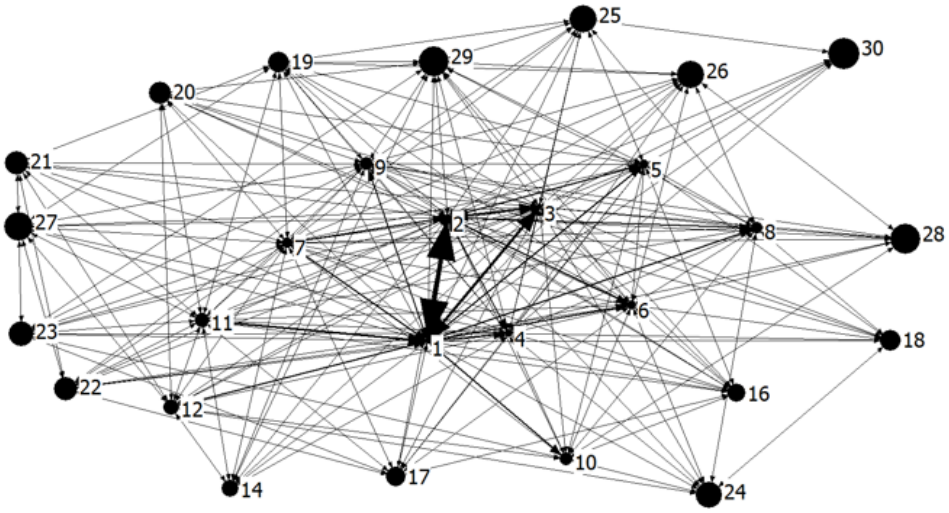

Figure 5. Middle school students' recognition network about arts (The numbers of network are rank keywords of **Table 6**)

For the top 30 keywords, the semantic network was analyzed. As a result, the network's degree centrality turned out to be 0.1157 which means a complex network. The network is presented as follows. (Refer to **Figure 5**)

Middle School Students' Recognition about Math and their Recognition Network

With regard to math, a total number of 492 image words occurred to middle school students participating in the survey. The following is the list of top 30 keywords among their responses in the survey. (Refer to **Table 7**)

"Calculation" is the most frequently occurring word to middle school students with regard to the term, math. Their recognition about math is composed of certain words related to solving mathematical problems like "calculation, function, numbers, equation, formula, calculation steps, unknown quantity, Pythagoras, addition, arithmetic, graph, and subtraction."

On the top of their recognition list about math, there is no recognition related to other fields of study like science, technology, engineering, or arts. As math-related activities, they recognize "problem solving and application."

For the top 30 keywords, the semantic network was analyzed. As a result, the network's degree centrality turned out to be 0.1674, which means a complex network with its level similar to that of arts. The network is presented as follows. (Refer to **Figure 6**)

Table 7. Image words occurring to mind about math

Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Keyword	calculation	function	numbers	equation	difficulty	formula	figure	teacher	calculation steps	addition
Degree	208	206	156	151	150	132	68	56	47	46
Rank	11	12	13	14	15	16	17	18	19	20
Keyword	calculus	complexity	mathematician	Pythagoras	unknown quantity	graph	problem	arithmetic	exam	subtraction
Degree	45	43	42	41	41	35	35	35	32	31
Rank	21	22	23	24	25	26	27	28	29	30
Keyword	multiplication	symbol	problem solving	hakwon	x value	linear equation	calculation	annoying	application	numbers
Degree	27	27	27	25	24	24	21	21	21	20

(Mean of Degree centrality: 0.021)

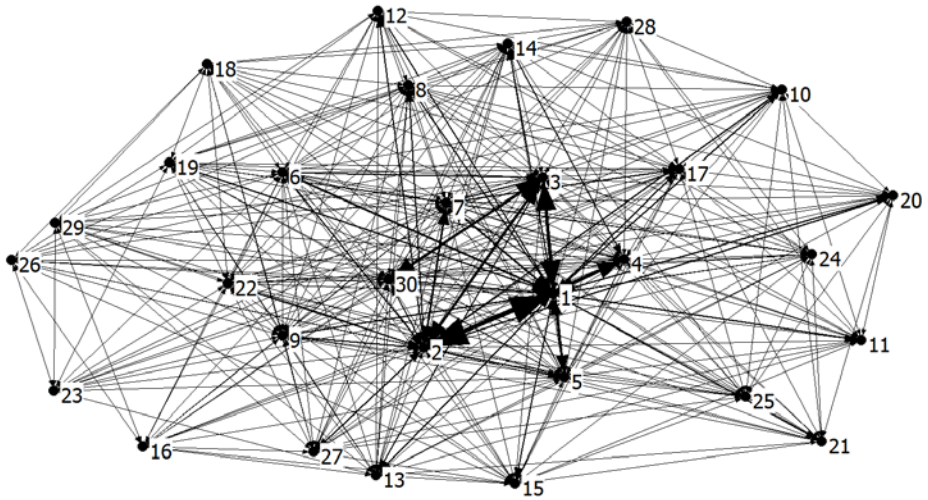

Figure 6. Middle school students' recognition network about math (The numbers of network are rank keywords of **Table 7**)

Comprehensive Recognition of Keywords about STEAM

When we put together those keywords from science, technology, engineering, arts, and math, and present them as a network, the result is as follows. (Refer to **Figure 7**)

The following is a chart presented based on the common elements of the whole network (Refer to **Table 8**)

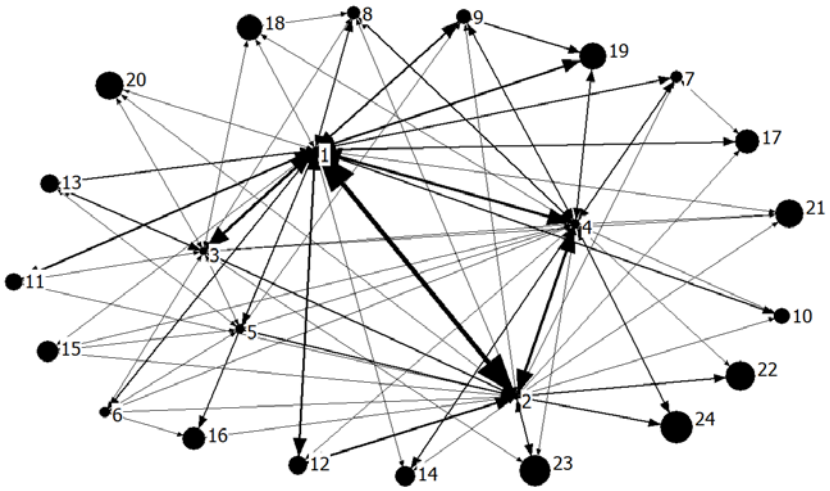

Figure 7. Middle school students' recognition network about S-T-E-A-M (The numbers of network are rank keywords of **Table 8**)

Table 8. Image words occurring to mind about S-T-E-A-M

Classification			Science	Technology	Engineering	Arts	Math
Key word	1	Science		○	○		
	2	Technology	○		○		
	3	Math	○		○		
	4	Engineering					
	5	Arts					
	6	Difficulty	○	○	○	○	○
	7	Machine	○	○	○		
	8	Robot	○	○	○		
	9	Making		○	○	○	
	10	Invention	○	○	○		
	11	Teacher	○	○	○		○
	12	Research	○		○		
	13	Fun	○			○	○
	14	Architecture		○	○		
	15	Factory		○	○		
	16	Future					
	17	Development					
	18	Complex			○		○
	19	Life	○		○		
	20	Exam	○				
	21	Fields of Science			○		○
	22	Car		○	○		
	23	Electricity		○	○		
	24	Computer		○	○		

Middle school students recognized that Science and Technology were linked to each other, and Science was conceptually related to Mathematics and Engineering. Technology has been linked to science and engineering. In particular, the conceptual link between Science, Technology and Engineering has been linked to key words such as 'machine, robot, invention'. The keyword 'teacher' appears to work in a way that conceptually connects mathematics to science - technology - engineering.

In other words, it is difficult for middle school students to associate mathematics with science-engineering-technology on their own, so it is necessary to provide a method of linking mathematics based on the professionalism of the teacher. The way of linking art is possible through 'production and enjoyment'. For this reason, it seems that STEM education, which is difficult to understand, may be transformed into enjoyable activities by utilizing art.

IN SUMMARY

First, there is a common recognition among middle school students that STEAM is difficult to them all; Second, a network of technology-engineering-arts is formed through the element of making; Third, some elements in the common network of science-technology-engineering turn out to be "robot, invention, machine, teacher, and difficulty." Fourth, technology and engineering are recognized very similarly, while some elements in the common network of technology-engineering turn out to be "science, robot, invention, machine, factory, car, computer, architecture, electricity, teacher, making, difficulty." Fifth, by the element of teacher, a network of science-technology-engineering-math (STEM) is formed.

CONCLUSION

The ultimate purpose of this study is to investigate individual images that Korean middle school students have regarding each subject of S/T/E/A/M, and analyze the recognized keywords and the relationships among keywords through a semantic network analysis. The conclusion of this study is as follows:

1. With regard to STEAM, middle school students recognize science as experiment, technology and engineering as machine, arts as art, math as calculation. The result shows that they recognize each subject of STEAM through their learning experience at the level of middle school students. Especially, the fact that they recognize both engineering and technology as machine, arts as art, and math as calculation means they form their concept at a general level.
2. Each network of STEAM turns out to be a complicated one. It is difficult to find a meaningful creation of images due to their lack of learning experience in combined knowledge. This explains the need of learning experience in the STEAM programs. The fact that all of middle school students consider STEAM difficult supports this explanation.
3. Technology, engineering, and arts are formed in a common network through an element of "making," while science-technology-engineering are formed in a common network through "robot, invention, and machine." This means that they get certain images about combined network with technology, engineering, arts, and science. We conclude that significant issues like making as a method, and common topics like robot and invention, have been drawn from this study.
4. Technology and engineering appear to be so similar to each other that dividing them into two subjects could cause students some confusion.
5. By the element of "teacher," STEM is found to be connected within itself, which makes the role of the teacher important in STEM.

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Validation of the UTAUT Model: Re-Considering Non-Linear Relationships of Exogeneous Variables in Higher Education Technology Acceptance Research

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ABSTRACT
Over the years, The Unified Theory of Acceptance and Use of Technology (UTAUT) has served many researchers in unravelling technology acceptance intentions. What has become a chasm in the literature has been the seeming exclusion of non-linear relationships of UTAUT exogeneous variables (Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions) in model formation and the overall determination of construct predictive relationships. Secondly, there is a dearth in technology acceptance research in distance-based higher education settings. In an attempt to bridge these gaps, this study adopted the UTAUT model and utilized the Partial Least Squares approach to evaluate a combined linear and non-linear relationships based UTAUT model. The survey design was employed in which a questionnaire was used to obtain data from a sample of 267 respondents (tutors) from a distance-based higher education milieu with a country-wide distribution. Results obtained indicated that non-linear relationships exist between exogeneous factors to better explain constructs' behaviour in the model. A new relationship between facilitating condition and social influence was also discovered. The study thus concluded that in technology acceptance research, there is the need to include non-linear relationships in the UTAUT model to augment the predictive effects and explanations of the constructs' relationships. It further recommended a comparative analysis between a proposed comprehensive UTAUT model with non-linear relationships and moderators to the original UTAUT model for further empirical analysis. This is to compare results in terms of coefficient of determination (R^2) and predictive relevance (Q^2).

Keywords: UTAUT exogeneous variables, linear relationships, non-linear relationships, technology acceptance, distance higher education

INTRODUCTION

It is an undeniable fact that the 21st century has been awash with technologies beyond fathom. Reminiscing the age trail of distance education and its development of technologies over three to four generations (Anderson & Dron, 2010), it is apt to qualify this age as a techno-centric era where technology has been ubiquitous. Technological integration has bedevilled every nook and cranny of our society and seems to be the chief hub of performance.

The infiltration has not spared the classroom locale as the current educational environments have made technology an epicentre of pedagogical and andragogical practices. This has enrolled the terms educational

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Contribution of this paper to the literature

- The study advanced new non-linear relationships to the original relationships within the UTAUT key constructs which could further best help explain user technology acceptance intentions and decision-making.
- Furthermore, it unravelled a new significant and relevant relationship between Facilitating Conditions and Social Influence (FC > SI) which is very important for decision making by implementers of new technologies in organizations.
- Finally, it proposed a comprehensive linear and nonlinear relationship- based UTAUT model with the original moderators, that could be further verified for comparison in model predictive power, effect size and relevance.

technology, instructional technology, online learning and e-learning, blended learning, to mention but a few. The permeating of these disruptive technologies has also awakened the acceptance phenomenon in the education circles, whether on the part of instructors or students both being direct stakeholders in this campaign. Of particular interest has been the study of intentions to accept Learning Management Systems (LMS) for either blended or fully online learning.

However, in investigating the acceptance or otherwise of usage intentions of LMS technology by instructors and students, a plethora of models and theories (modified, adapted or adopted) have been employed. From the old age Innovation Diffusion Theory (IDT) to Model of Personal Computer Usage (MPCU), the Unified Theory of Acceptance and Use of Technology (UTAUT) seem to be the preferred and widely used theory (Attuquayefio & Addo, 2015), especially in the higher education LMS technology acceptance research. UTAUT has by far seemed to be an explanatory of intent behaviour utilized by researchers in most quarters of LMS acceptance studies. The model, as developed by Venkatesh et al., (2003), boasts of the four exogeneous variables [Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI) and Facilitating Conditions (FC)] influencing an endogeneous variable, Behavioural Intention (BI) which ultimately induces Use Behaviour (UB) with a discourse of four moderating variables (Age, Gender, Experience and Voluntariness).

By far, the model's agility in explaining usage intentions has ranged from a low of 36% (without moderator) to as high as about 76% (with moderators) (Khechine et al., 2014) albeit in different settings. This depicts an over-performance of all other technology acceptance models. Nevertheless, the proponent of this model did not deem it a finite model but made suggestions that exposed the model to modifications deemed at improving the predictability power. The concern of this paper is not to add a new variable, but rather unravel the missing non-linear relationships that may exist among the key exogeneous variables in the UTAUT model which are omitted in the model as well as in most LMS acceptance research.

Building on the argument of nonlinear relationships, Kock (2016), supports Roberts (1986) who stated that "the practicality and importance of nonlinear modelling is supported by the emergence of the predicted types of relationships and the substantial proportions of variance that they account for. Moreover, the fact that similar relationships emerged across methods supports the general nature and the underlying concept of nonlinearity. They enable researchers to capture the explicit differences and similarities in outcomes for various components of a construct. Thus, becoming a useful conceptual exercise and a necessary preliminary to generating causal explanations" (pg.4). He contends that, the building of non-linear models accurately reflects the nature of major developmental phenomena and produce outcomes that provide a powerful heuristic, summarizing and integrating present knowledge and forming the basis for the construction of detailed causal and process models. In addition, nonlinear models can yield predicted relationships that hold across methods and account for substantial portions of variance. In cases of inconsistent findings, such models can serve as tools for reconciling and integrating research from diverse sources (Roberts, 1986). This underpins the necessity for this study.

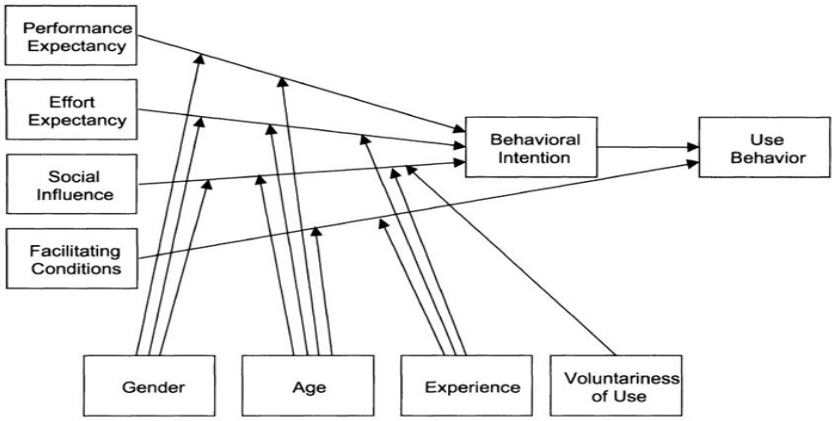

Figure 1. Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003)

Problem Statement

The UTAUT model developed by Venkatesh et al., (2003) depicts a model metamorphosis of eight other technology acceptance models. The model assumes that, only a linear relationship exists between the key exogeneous variables [Performance Expectancy (PE), Effort Expectancy (EE) and Social Influence (SI) influencing the dependent variable, Behavioural Intention (BI) which in turn together with Facilitating Conditions determine actual behaviour (FC)]. This is depicted in **Figure 1**.

For over thirteen years, researchers adopted this model to measure key antecedents based on these four exogeneous variables in explaining potential users' intentions and subsequent usage. When all four predictors were significant, they are retained, on the contrary when one or two fail to predict BI, they are discarded. This trend in the literature seems worrying against the backdrop that exogeneous variables in a model assumes roles of either predictors, mediators or the mediated. What seems missing from the model is the discounting of the non-linear relationships that exist between and amongst the exogeneous variables that are neglected in most analysis. However, in a real-world situation, interaction or interplay of variables can never be assumed to be a straight jacket linear but important inter-variable relationships exist to better understand and explain variable behaviour.

Earlier studies in proposed models such as Technology Acceptance Models (TAM1, TAM2 and TAM3) emphasize the important interactions between Social Norm (SN) [similar to SI in UTAUT], Perceived Usefulness (PU) [akin to PE in UTAUT], Perceived Ease of Use (PEOU) [likened to EE in UTAUT] and Facilitating Conditions (FC) in explaining acceptance intentions. The missing link of these variables' interactions in UTAUT call for an inquiry into whether the inclusion of non-linear relationships amongst the variables in the model help better place an in-exhaustive variable synergy. Kock (2016) opine that the nonlinear modelling help researchers account for the existence of underlying nonlinearity when estimating coefficients of association among linked variables. This is supported by earlier stance of Kock and Gaskins (2014) when they indicated that, considering nonlinearity sometimes leads to findings that are distinctly different from their consequent linear results. According to Kock (2016), there is an added advantage of using non-linear based models as they tend to produce very high segment-specific path coefficients, having the potential of otherwise being grossly underestimated. This better help understand variable relationships and provide solid basis for decision making based on path relationship results. It is in view of this that this paper projects the objectives below.

Research Objectives

1. To find out non-linear relationships that may exists amongst UTAUT key exogeneous constructs.
2. To find out how non-linear relationships better help to understand behaviour of constructs in a model for decision-making.
3. To find out factors that best determine behavioural intentions of distance education tutors in accepting technology based on both linear and non-linear relationships.

Research Questions

Based on the above objectives this paper is guided by the following research questions:

1. What non-linear relationships exist among UTAUT exogeneous variables?
2. How do non-linear relationships better help understand behaviour of constructs in a model for decision-making?
3. What factors best determine behavioural intentions of distance education tutors in accepting technology based on both linear and non-linear relationships.

TOWARDS A CONCEPTUAL MODEL AND HYPOTHESES DEVELOPMENT

Original UTAUT Linear Relationships

The construct performance expectancy defines the degree to which an individual believes that using a system will enable him or her attain gains in job performance (Venkatesh et al., 2003). The construct explains that prior to the acceptance of any new technology, individuals project a weighting of the intended benefits to be gained in the event of using that technology with respect to job performance or personal improvement towards discharging responsibilities before making their final decisions of intention to use. The construct is deemed to be a key and strongest predictor of LMS acceptance intentions. Other authors such as Khechine, Lakhal, Pascot and Bytha (2014); Percy and Belle (2012); as well as Ain, Kuar and Waheed (2015) who adopted UTAUT in their studies confirmed this relationship. However, in some instances such as Ambali and Bakar, (2014) PE was not the highest predictor of BI and in Nicholas-Omoregbe, Azeta, Chiazor, and Omoregbe (2017), the construct did not predict BI at all, a result consistent with earlier findings from Jairak, Praneetpolgrang, & Mekhabunchakij (2009). This posed a sharp contradiction to earlier stance by other researchers based on results obtained from different settings.

The second construct that is postulated in the model as a direct predictor of BI, is effort expectancy. The construct explains to some extent the degree of ease associated with the use of a new system (Venkatesh et al., 2003), which will warrant new adjustment strategies by individuals and hence their emphasis on ease of use or otherwise. The constructors of the model proposed that the impact of this construct is strongly felt at the initial stages of LMS technological integration or innovation, where application of new skills is highly required. Studies such as Raman and Don (2013), Maina and Nzuki (2015) and Evans (2013) confirm the effect of effort expectancy on behavioural intention.

In addition to performance expectancy and effort expectancy, Venkatesh et al., (2003) further added that the social influence construct also has a linear relationship with behavioural intention. Venkatesh, Thong and Xu (2012) explained social influence as the extent to which "consumers or new users perceive that important others (eg. family, friends etc.) believe they should use a particular technology" (p.159). In the words of Taiwo and Downe (2012), "besides an effective and easy to use information system, end-users might not be obliged to use the system until they are motivated by important others (people) that can influence their attitude and behaviour. They opined that with the way peoples' lives are moulded around role models … an encouragement by such important referent others to use the system can motivate potential users to accept an information system" (Taiwo, Downe & Mahmood, 2013 p.54). This is consistent with results from Pardamean and Susanto (2012) and Ambali and Bakar, (2014) and Šumak et al. (2010). Earlier studies by Macharia and Nyakwende (2010) indicate the important role that vice-chancellors as role models play in faculty member's decisions to use LMS for e-learning. This was later supported

by Chen, Shang, Yu Hou, and Humaour (2012) who emphasized that if information system use is supported by leaders of institutions, it elicits a positive feeling from users to use it. Nevertheless, the effects of social influence on intentions were non-significant in earlier studies by Al-Gahtani, Hubona & Wang (2007) and later Nassuora (2012).

Modelled to directly influence use behaviour, the construct facilitating conditions, is explained as the "degree to which an individual believes an organizational and technical infrastructure exist to support use of the system" (Venkatesh et al., 2003 p.453). The introduction of new technologies arouses certain instabilities and anxieties. In order to leapfrog the mental instability and working frustrations, individuals expect that organizations will provide the needed support (both administrative and technological) to ease the use of the system. Thus, ICT infrastructure made available and reliable while institutional policies present opportunities and incentives for use of LMS technology influence the use by tutors. The attachment of importance to these conducive or otherwise environments produces a direct effect between facilitating conditions and usage and not behavioural intention (Venkatesh et el., 2003). Though theorized as not to have a direct relationship with behavioural intention, other authors like Mtebe and Raisamo (2014) opined that the initial perception of students on the availability of support services and resources to deliver mobile learning and vice versa, will to a greater extent influence their decision to adopt and subsequently use mobile devices for learning. Other authors have subsequently proven that prior knowledge of facilitating conditions trigger prior intentions to use as opposed to only actual usage.

For instance, Kihoro, Oyier, Kiula, Wafula and Ibukah, (2013) have justified that the awareness of the presence or otherwise of favourable conditions surrounding the use of a potential new information system, can at the initial state prompt a mental state of intentions to use prior to actual use. This is evidenced by the results they obtained in their studies where facilitating conditions predicted behavioural intentions. This is consistent with results obtained by Mtega, Bernard, Msungu, & Sanare (2012). Interestingly, all three studies were carried out in developing countries in Africa where resource for usage of technology is perceived as inadequate. Attuquayefio and Addo (2014) Oye et al., (2012) Ain et al., (2012) opine that Facilitating conditions thus becomes a crucial element of concern in LMS acceptance research especially in developing countries where conditions for technology use may not be at optimum levels. However, in Malaysia, Ambali and Bakar (2014), also found facilitating conditions to be the highest predictor of behavioural intention. Owing to the aforementioned premise on linear relationships in the UTAUT model, the study hypothesizes that:

H01: Performance Expectancy will predict Behavioural intention

H02: Effort Expectancy will predict Behavioural intention

H03: Social influence will predict Behavioural intention

H04: Facilitating conditions will predict Use behaviour

H05: Facilitating conditions will predict Behavioural intention (not original hypothesis in UTAUT)

Proposed Non-Linear Relationships within UTAUT Exogeneous Variables

The study resides heavily on the presence of non-linear relationships amongst the key UTAUT constructs in addition to their original linear relationships with Behavioural intention. The effects of Perceive Ease of Use (PEOU) (similar to Effort Expectancy in UTAUT) on Perceive Usefulness (PU) (similar to Performance Expectancy in UTAUT), has long been argued in TAM 1 (Davis 1989), TAM2 (Davis, Baggozzi & Warsaw, 1989) and relatively recently, TAM3 (Venkatesh & Bala, 2008). The proponents of this relationship opine that exposure to new technology breeds in a perception of how easy or otherwise it will be to the potential user. Thus, individuals at the least experienced stage of acceptance, tie a relationship between the effort to exert in using the technology and performance outcomes. Hence an initial significance tied between effort and performance. Since technology acceptance is mainly focused on new technologies, where user experience is at the minimum, it is important to consider this relationship. According to Venkatesh and Bala (2008), even after initial experience with new system

usage, users will still value perceived ease of use in forming perceptions about its usefulness in later usage. Thus, the hypothesis:

H06: Effort expectancy will predict Performance Expectancy

The effect of Social Norm (SN) on Perceive Usefulness (PU) which are of a similitude to social influence (SI) and Performance Expectancy (PE) respectively in UTAUT, was an additional relationship proposed within the TAM 3 model developed by Venkatesh and Bala (2008). The positive or negative influence of important referent others on potential adopters' intention decisions raises a consciousness on how important or useful a new technology may be. For new technology and less experienced users, the advice by important social acquaintances on whether to use the technology or not point to the performance expected to be derived from the usage of the said technology. In TAM2, Davis et al., (1989) theorized that subjective norm and image are the two determinants of perceived usefulness that represent the social influences processes (Venkatesh & Bala, 2008). The social influence in turn, positively influences perceived usefulness through processes of internalization (Venkatesh & Davis, 2000) and identification (Warsaw, 1980). Against this background, it can be hypothesized that:

H07: Social influence will predict Performance Expectancy

The presence or otherwise of facilities in support of the use of any technology is crucial to its acceptance. The degree to which an individual believes that organizational and technical resources exist to support the use of the system (Venkatesh et al., 2003) explains the Perception of External Control (PEC) construct which is akin to Facilitating Conditions (Venkatesh & Bala, 2008). Potential adopters of new systems may expect varying degrees of effort to be exerted anchored on the perception they have about the availability of various resources in place in support of its usage. Initial attitude towards usage of the system and its usefulness will largely depend on the resources at the disposal of the user towards usage. Availability of such resources eases the expectation of individual's in terms of effort required to use the system and vice versa. Since the perception of ease of use is closely tied with usefulness (Davis et al., 1989), perceived resource availability will have an effect on performance expectancy.

Similarly, the effect of social influence on individuals could also be attributed to perceptions of conducive environment surrounding system use. If individuals are certain about the enabling environment for usage of a system, it is likely that the views of referent others may have a minimal or no effect as they will be tempted to try out for curiosity sake. The positive attitude adopted by way of the presence of resources to help in system usage, shifts them to the innovators category that are poised to experience new technology just for trying sake (Rogers, 2003). The other aspect to this effect is that, if important others realize that conditions are favourable in the usage of a new system, they are likely to encourage potential adopters. In view of this, this study hypothesizes that:

H08: Facilitating Conditions will predict Effort Expectancy

H09: Facilitating Conditions will predict Performance Expectancy

H10: Facilitating Conditions will predict Social Influence

Finally, Behavioural intention defines the extent to which potential users are willing to accept or adopt a particular technology for use practices (Venkatesh et al., 2003). Earlier authors such as Davis (1986), Davies, et al., (1989) agree that individuals form intentions prior to actual usage based on certain antecedents. When these determinants are satisfied, then individuals extend their motives now to actual use behaviour. Use behaviour on the other hand explains the extent and dimension to which a technological system is utilized in an organization after implementation. Since the key intentions of technological integration is to stimulate performance at optimum levels beyond what is achieved at the traditional mode of task accomplishment, the results can only be achieved at the post usage stage in order to compare results for the old and new paradigm (traditional vs. technology). Davies et al., (1989), Venkatesh et al., (2003), as well as Venkatesh and Bala (2008) confirmed that, the formation of intentions of individuals to accept a particular technology will eventually lead to usage practices. Thus, an eventual linear relationship exists between these two constructs. As such, this study hypothesizes:

H11: Behavioural intention will predict Use behaviour (original UTAUT hypothesis)

The research model based on the hypotheses formulated is depicted in **Figure 2**.

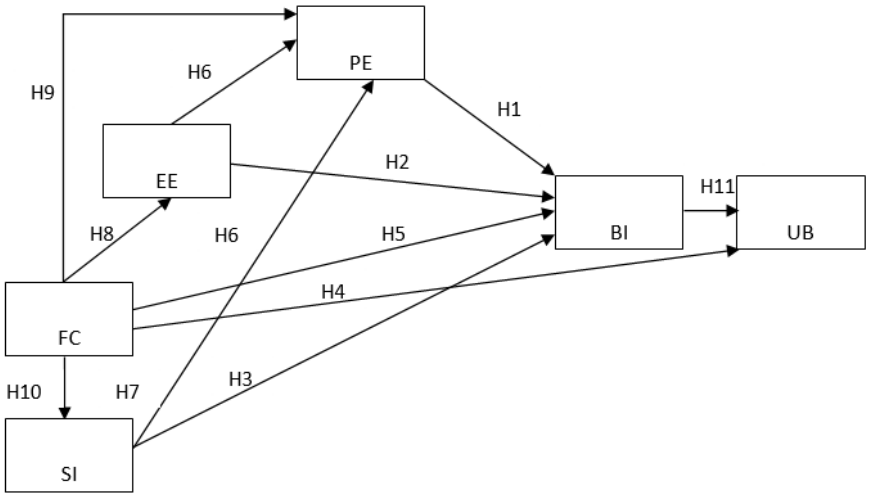

Figure 2. Combined Linear and Non-Linear Relationships-Based UTAUT Model

METHODOLOGY

Sampling, Sample and Data Collection

The study was mainly based on LMS acceptance by tutors in distance education settings in a higher education institution across the country. However, the target total population for the study was about 400 tutors Out of this number; a cluster sampling technique was used to select respondents from across the ten regions of the country to ensure a representative sample. Employing a survey method, 267 respondents were obtained for the study. Responses were obtained from these respondents based on a structured questionnaire. The questionnaire contained two broad sections. The first was for the demographic data (age, gender and face to face experience) and the subsequent based on other continuous variables of interest for the study (performance expectancy, effort expectancy, social influence, facilitating conditions, behavioural intention and use behaviour). The questionnaire was based on a five point Likert scale (1-strongly disagree to 5-strongly agree) measuring the key variables. Items were adapted from Venkatesh et al., (2003), Khechine et al., (2014), and Evans (2013).

DATA ANALYSIS

Respondents' Profile

Respondents comprised 164 males and 103 females, representing 61.4% and 38.6% respectively with males having the higher percentage. Participants' age groups ranged between (≤35) 67; (36-46) 102; (47-57) 64 and (≥58) 34. The age category (36-46) had the highest frequency recording 38.2%. Finally, tutors' experience in terms of face to face experience was ascertained. Their years of experience raged from (≤5yrs) 98; (6-11yrs) 112 and (≥12yrs) 57. Most of the participants had face to face experience between 6-11yrs representing about 41.9% of the entire sample of 267.

Results for Model

The study utilized the SmartPLS 3.2.6 software developed by Ringle et al., (2016) to run the analysis for both the measurement and structural models. According to Hair et al., (2015), this two-stage approach is the standard for evaluating models and their relationships in Partial Least Squares (PLS). As criteria for reflective

models, the study first evaluated the measurement model based on validity and reliability coefficients of Cronbach's Alpha (CA), Composite Reliability (CR), Average Variance Estimates (AVE), Discriminant Validity and Heterotrait-Monotrait (HTMT). This was followed by examining the significance of the structural model based on, hypothesized relationship testing, Effect size (f^2), Predictive relevance (Q^2) and Importance –Performance Map Analysis (IPMA).

Assessment of Measurement Model

The first stage approach for testing the reflective measurement model was to assess the convergent validity, reliability and AVE. With reference to **Table 1**, all outer loading results from bootstrapping were higher than the threshold of 0.708 as recommended by Hair et al., (2014). This corresponds with a Composite reliability values of between 0.826-0.923, all higher than 0.7 (Hair et al., 2014). The average variance estimates values were within the range of 0.626-0.749, higher than the acceptable minimum value of 0.5 (Hair et al., 2017). Hence the measurement model achieved the validity and reliability standards.

Table 1. Convergent Validity and Reliability of Measurement Model

Construct	Item	Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
BI	BI1	0.814	0.826	0.884	0.657
	BI2	0.836			
	BI3	0.772			
	BI4	0.817			
EE	EE1	0.837	0.85	0.899	0.69
	EE2	0.823			
	EE3	0.848			
	EE4	0.816			
FC	FC1	0.779	0.743	0.852	0.658
	FC2	0.818			
	FC5	0.837			
PE	PE1	0.821	0.899	0.923	0.665
	PE2	0.806			
	PE3	0.839			
	PE5	0.818			
	PE6	0.845			
	PE7	0.761			
SI	SI1	0.775	0.851	0.893	0.626
	SI2	0.796			
	SI3	0.819			
	SI4	0.799			
	SI5	0.764			
UB	USE1	0.844	0.888	0.923	0.749
	USE3	0.884			
	USE4	0.871			
	USE5	0.863			

a AVE = (summation of squared factor loadings)/(summation of squared factor loadings) (summation of error variances)
b Composite reliability = (square of the summation of the factor loadings)/[(square of the summation of the factor loadings) + (square of the summation of the error variances)] (Yeap, Ramayah & Soto-Acosta, 2015; Hair et al., 2014)

Table 2. Discriminant Validity of Model

	BI	EE	FC	PE	SI	UB
BI	**0.81**					
EE	0.473	**0.831**				
FC	0.414	0.506	**0.811**			
PE	0.405	0.658	0.417	**0.816**		
SI	0.284	0.421	0.499	0.332	**0.791**	
UB	0.523	0.446	0.415	0.414	0.287	**0.865**

Diagonals (bolded) represent the square root of the average variance extracted while the off-diagonals are correlations among constructs. Diagonal elements should be larger than off-diagonal elements in order to establish discriminant validity (Yeap, Ramayah & Soto-Acosta, 2015; Hair et al., 2014) *BI(Behavioural Intention), EE(Effort Expectancy), FC(Facilitating Conditions), PE(Performance Expectancy, SI(Social Influence), UB(Use Behaviour)*

Table 3. Heterotrait-Monotrait Ratio (HTMT)

	BI	EE	FC	PE	SI	UB
BI	0					
EE	0.562	0				
FC	0.52	0.629	0			
PE	0.468	0.748	0.497	0		
SI	0.337	0.491	0.617	0.374	0	
UB	0.607	0.511	0.501	0.461	0.322	0

Heterotrait-Monotrait Ratio (HTMT), which is the average of the correlations of indicators across constructs measuring different phenomena, relative to the average of the correlations of indicators within the same construct (Henseler, Ringle & Sarstedt ,2015)

Discriminant Validity

Discriminant validity measures the degree to which items in a construct differ from that of other constructs. This displays the distinctiveness of item to construct measures across various constructs in a model (Hair et al., 2017). In determining this measure, the correlations of constructs were compared with the square root of the average variance estimates for a particular construct (Fornell & Larcker, 1981). The criterion is to have all diagonal loadings greater than their vertical counterparts. With reference to **Table 2**, all bolded loadings in the diagonal dimension were higher than the vertical loadings. This indicates that the items in the constructs measured discriminately from other constructs. Thus the discriminant validity criterion has been satisfied.

Heterotrait-Monotrait Ratio (HTMT)

As suggested by Henseler et al., (2015), a more robust approach for measuring discriminant validity is the Heterotrait-Monotrait Ratio (HTMT). This measures the average correlations of the indicators across constructs measuring different phenomena, relative to the average of the correlations of indicators within the same construct (Henseler et al., 2015). The criterion from the aforementioned authors is to have HTMT values less than 0.85 (in the strict sense) or less than 0.90 (an acceptable parameter). From **Table 3**, the HTMT results of constructs were all lower than the 0.85 strict criterion; meaning HTMT higher standard has been met.

Common Method Bias (CMB) Detection through a Full Collinearity Assessment Approach

For PLS-SEM, Common Method Bias (CMB) is detected through a full Collinearity assessment approach (Kock, 2015). The results of the VIF statistics are indicated in **Table 4**. From the table, CMB was not an issue because, the VIF values were all lower (between 1 and 1.981) than the 3.3 threshold (Hair et al., 2017, Kock, 2015). This is indicative that the model is free from common method bias.

Table 4. Collinearity (VIF) Statistics

	BI	EE	FC	PE	SI	UB
BI						1.217
EE	1.981			1.369		
FC	1.637	1		1.62	1	1.217
PE	1.765					
SI	1.526			1.524		
UB						

Results of the Structural Model

Hair et al., (2017) recommended that structural model assessments should be based on the R^2, beta coefficients and their corresponding t-statistic values for significance. A bootstrapping procedure of 5000 samples was used to calculate for significance of models hypothesis in PLSEM (Hair et al., 2015). The results of the bootstrapping computations are graphically presented by **Figure 3** and statistically reported in **Table 5**.

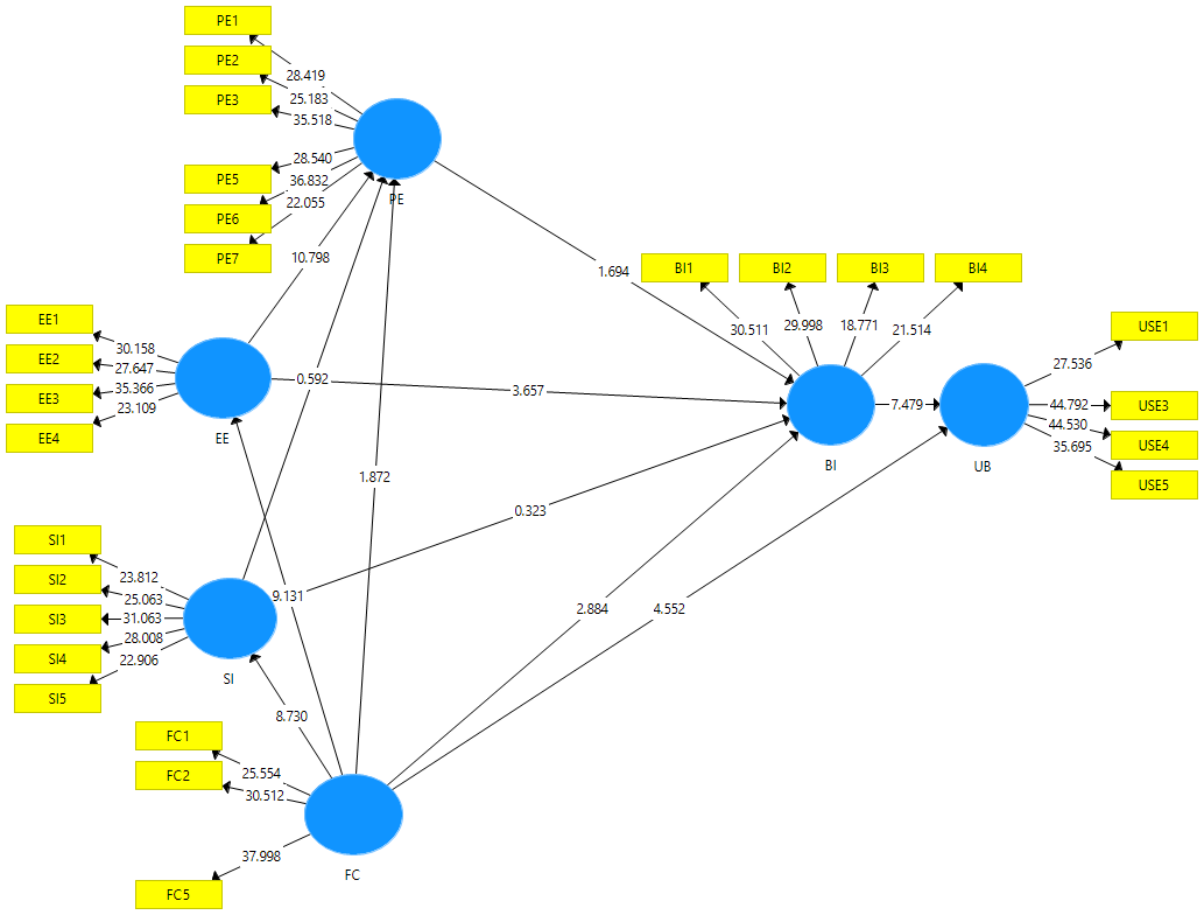

Figure 3. Bootstrapping results with factors and construct relationship t statistics of the structural model

With Reference to **Table 5**, we first assessed the determinants of behavioural intention, followed by use behaviour, performance expectancy, effort expectancy and social influence. From the results, PE (β=0.133, p≤0.10), EE (β= 0.269, p≤0.01) and FC (β=0.212, p≤0.01) were all positively related to behavioural intention (BI). However, PE was only significant at an error level of 10%, which was very weak. Social influence (SI) (β=0.021, p>0.05) was

Table 5. Results of the Structural Analysis and Hypotheses Testing

Hypothesis	Relationship	Std. Beta	Std. Error	t-value	Decision	f^2	CI	
							LL	UL
H1	PE -> BI	0.133	0.078	1.694*	S	0.014	0.03	0.19
H2	EE -> BI	0.269	0.074	3.657***	S	0.052	0.05	0.30
H3	SI -> BI	0.021	0.064	0.323	NS	0	-0.02	0.09
H4	FC -> UB	0.24	0.052	4.552***	S	0.07	0.08	0.34
H5	FC -> BI	0.212	0.075	2.884***	S	0.043	0.07	0.33
H6	EE -> PE	0.593	0.055	10.798***	S	0.456	0.41	0.62
H7	SI -> PE	0.032	0.053	0.592	NS	0.01	-0.13	0.11
H8	FC -> EE	0.506	0.055	9.131***	S	0.344	0.40	0.60
H9	FC -> PE	0.101	0.053	1.872*	S	0.012	0.04	0.21
H10	FC -> SI	0.499	0.058	8.730***	S	0.332	0.29	0.57
H11	BI -> UB	0.424	0.056	7.479***	S	0.221	0.10	0.35

*P≤0.01***; p≤0.05**; p≤0.10*; f^2 denotes the effect size;* S=*Supported;* NS=*Not Supported*
CI=*Confidence Interval*

not significant in determining BI. Interestingly, Effort expectancy was the strongest predictor of BI with a relatively higher beta value, followed by facilitating conditions.

In respect of Use behaviour (UB), the constructs BI (β=0.424, p≤0.01) and FC (β=0.24, p≤0.01) were the main predictors with BI as the stronger.

The construct PE was significantly predicted by EE (β=0.593, p≤0.01) with FC (β=0.10, p≤0.10), having the weaker relationship. SI (β=0.032, p>0.05) however, did not indicate any significant relationship with PE.

Facilitating conditions FC (β=0.499, p≤0.01), was a strong antecedent to Social influence and Effort expectancy at FC (β=0.506, p≤0.01). Thus, from the **Table 5**, hypotheses H1, H2, H4, H5, H6, H8, H9, H10 and H11 were all supported with the exception of H3 and H7.

The predictive significance of the construct to construct relationship was further assessed for their effect sizes using the f^2 statistics as suggested by Hair et al., (2017). This was important because the p value can only provide information on the presence or otherwise of an effect but without any indication of the actual size of the effect (Sullivan & Feinn, 2012). Hair et al., (2014) suggest an effect size of 0.02, 0.15 and 0.35 to represent small, medium and larger effects respectively (Cohen, 1988). However, Hair et al., (2017) cite Kenny (2015) who recommended the effect sizes of 0.005, 0.01 and 0.025 to represent small, medium and larger effect sizes respectively. With reference to the f^2 statistics column in **Table 5**, the effect sizes ranged from 0.012, 0.014 representing medium effect sizes; 0.052, 0.07, 0.043; 0.221, 0.332, 0.344 and 0.456 having relatively higher effect sizes.

Furthermore, the model was examined on the R^2 values and the predictive relevance. **Table 6** captures the results. Most importantly, the overall model performance for variance in BI was 35.1%. This was mainly due to the fact that only two exogeneous variables (EE and FC) predicted strongly BI, without moderators in the model. Variance in UB was 32% by a single predictor BI. PE was predicted by EE and FC at a variance of 44% with SI and EE being at 25% each with a single predictor each. Of further importance to the coefficient of determination is the predictive relevance. This was assessed by a blindfolding procedure which is recommended only for endogeneous constructs of reflective models as suggested by Hair et al., (2017). As a rule of thumb, the Q^2 value of more than 0 is required to indicate model predictive value or otherwise (Hair et al., 2014). From **Table 6**, all figures were larger than 0 and ranged between 0.22 to 0.343, indicating medium to high predictive relevance for the endogeneous variables at the recommended threshold of 0.02, 0.15 and 0.35, representing small, medium and high predictive relevance respectively (Hair et al., 2014).

Table 6. Coefficient of Determination and Predictive Relevance

Construct	R^2	Q^2 (=1 SSE/SSO)
BI	0.351	0.26
EE	0.25	0.263
FC		
PE	0.44	0.22
SI	0.25	0.224
UB	0.32	0.343

Q^2 denotes predictive relevance, R^2 denotes coefficient of determination

Importance Performance Map Analysis (IPMA)

The Importance Performance Map Analysis (IPMA) provides further emphasis on the PLS estimates of the structural model relationships providing additional clues to the performance and relevance of each latent variable in the model (Hair et al., 2014, Yeap et al., 2015). According to Ringle and Sarstedt (2016), total effects represent the sum of direct and indirect effects and so the IPMA draws on unstandardized effects to facilitate a ceteris paribus interpretation of predecessor constructs' impact on the target construct. This means that an increase in a certain predecessor construct's performance would increase the target construct's performance by the size of its unstandardized total effect (Ringle & Sarstedt, 2016). To ascertain the importance and relevance of the relationships in the model, the PLS IPMA analysis was calculated separately for the constructs BI and PE as endogeneous variables. The results are shown in **Table 7** and **8** respectively.

Table 7. Performance Index Values and Total Effects

Construct	Total Effect (Importance)	Index Values (Performance)
EE	0.31	68.88
FC	0.41	56.53
PE	0.14	72.98
SI	0.02	55.61

Table 8. Performance Index Values and Total Effects

Construct	Total Effects (Importance)	Index Values (Performance)
EE	0.59	68.88
FC	0.41	56.53
SI	0.04	55.61

Performance Analysis for Behavioural Intention (BI)

The performance values indicate that PE had the strongest performance but yet not relevant in predicting BI in the model with a total effect (importance) of 0.14. Two key constructs were relevant in predicting BI i.e., facilitating conditions and effort expectancy, with a total effect (importance) of 0.41 and 0.31 respectively as indicated in the performance map in **Figure 4**.

Performance Analysis for Performance Expectancy (PE)

The results in **Table 8** denotes that effort expectancy did not only have a stronger performance (68.88) on performance expectancy, but also was the most important (0.59) predictor. This was followed by facilitating conditions, with 0.41 importance and 56.53 performance level. It is thus inferred that the two aforementioned constructs were the key detectors of performance expectancy contrast to SI which was non-significant. **Figure 5** shows the graphical representation.

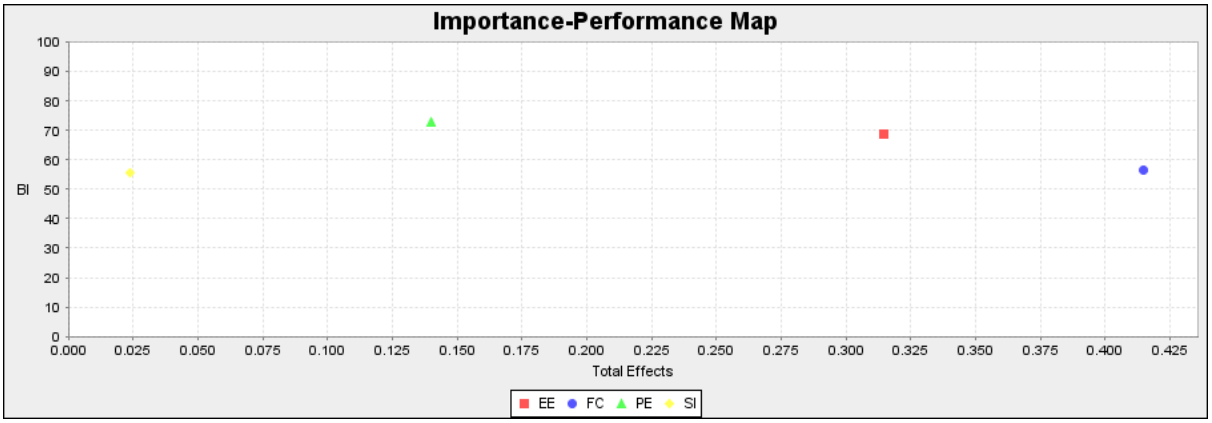

Figure 4. Importance and Performance Map for BI

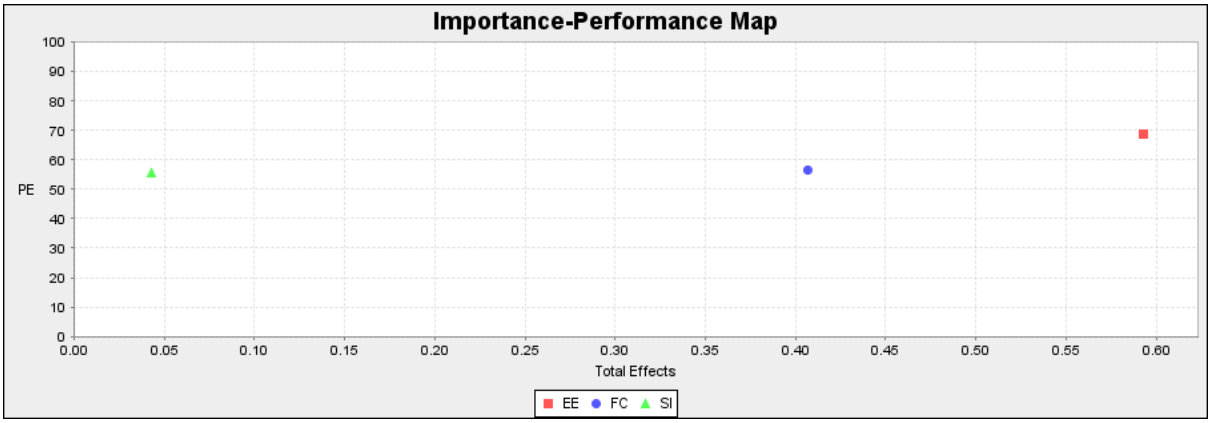

Figure 5. Importance and Performance Map for PE

Graphical Representation of the PLS Path Model and IPMA Results

The overall IPMA result for the path model is depicted graphically below in **Figure 6**. Ringle and Sarstedt (2016), strictly caution readers and analysts to detect the differences in the graphical representation of IMPA results and that of the graphical PLS-SEM results illustration in SmartPLS. For instance, IPMA displays the performance values of each latent variable, instead of the R^2 values of the endogenous latent variables in the PLS path model. Secondly, the IPMA results depict the unstandardized and rescaled outer weights of the measurement models (formative or reflective) and not the standardized outer loadings or weights. In terms of this study, the beta values at the outer model in **Figure 6** indicate the importance of each item to the construct and not the loadings. The inner values in the individual constructs however, depict the performance values of each construct in relation to an endogeneous variable.

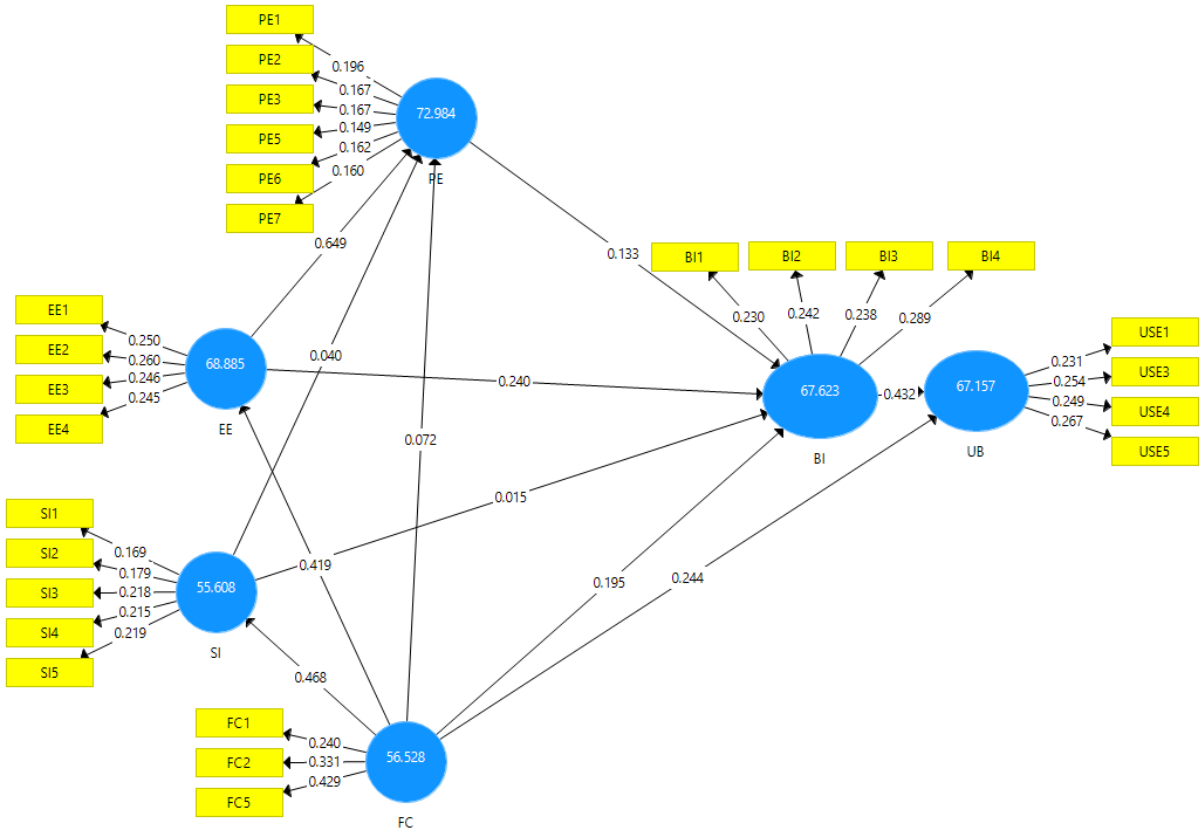

Figure 6. IPMA results for the path model

DISCUSSION AND CONCLUSION

Summary of Findings

The paper expounded the seeming non-linear relationships that could characterize the exogeneous factors of UTAUT in distance education tutors' acceptance of LMS. Formed on the premise that possible non-linear effects exit in between the variables which could further improve upon the overall model relationship indicators in the wake of the determination of usage intentions of tutors for better decision making. The paper focused initially on the original predictive role of exogeneous variables of the main UTAUT endogenous variables. PE, EE, SI and FC assumed the main faces of predictors of BI and subsequently UB. It further included non-linear relationships based on the reviewed literature.

Results of the hypothesized linear relationships indicated that the main determinants of behavioural intentions by tutors in distance education were Effort Expectancy and Facilitating Conditions. The effect of Effort Expectancy on Behavioural Intention, confirms earlier studies by Pardamean and Susanto (2012), Šumak et al. (2010) and Venkatesh et al., (2003). However, the construct being the strongest predictor of Behaviour of Intention by tutors in this study, was in contrast with Venkatesh et al., (2003), and Khechine et al., (2014). The predictive nature of Facilitating conditions on intention was in consonance with results by Ambali and Bakar (2014) and Nicholas-Omoregbe et al., (2017) though not in agreement with the original UTAUT postulation. The effect of Performance expectancy was not relevant to tutors. It is however important to add that PE was only significant at an error of 10% but insignificant to BI at $p<0.05$, which is consistent with results by Jairak et al., (2009), while the effect of Social influence being insignificant to BI, confirmed the findings of Nassuora (2012). These results disagree with that of Venkatesh et al., (2003), Khechine et al., (2014) and Ain et al., (2015).

The findings from the original UTAUT linear relationships inherent in this study define a direction that, acceptance of LMS by distance education tutors is motivated by their perception of the presence of facilitating conditions needed to enhance easiness to usage, as efforts to be exerted (Effort expectancy) was prime to them. The views of others and usefulness of the system were not of interest to them. The non-impact of Social Influence on them, was partly because tutors in this study were all mature in terms of age and outlook, hence were independent thinkers and so influence of peers played very little role in their intention formations. In terms of LMS usefulness, they were yet to have the full impact after the pilot stage of the LMS technology, having gone the traditional way for over a decade.

Most importantly, the non-predictive nature of performance expectancy and social influence in this study is better explained by the non-linear relationships within the model. The results from the non-linear relationships indicated that, performance expectancy was determined by effort expectancy. This result is in support with Davis (1986) and Venkatesh and Bala (2008). For instance, Davis (1986) opined that when individuals are exposed to new technologies, they need to internalize the novel procedures by way of assimilation and accommodation. The ease with which they form this adjustment is based on how liberal or otherwise the use of the system is, which is eventually tied to how useful the system will be. Maina and Nzuki (2015) and Raman and Don (2013), suggest that it is in the ability to use, that individuals find outcomes, usefulness, and importance. This resonates the age long debate between Clarke, (1994) and Kozma, (1994) on the effect of technology in learning. It is not the technology per se, but how it can be used to achieve the intended goal in instruction or job outcomes. For Venkatesh and Bala, (2008), this perception may persist even after initial experience with the system usage. Invariably, tutors in this study depended on the amount of effort they expect to exert before eventually judging the usefulness of LMS.

Furthermore, the non-significance of SI in determining usage intentions is explained by the non-linear relationship result where Facilitating Conditions strongly predicted Social Influence. This was a new and intriguing finding. The perception of presence and availability of support systems and resources have a positive effect on how referent others may influence tutors to use LMS. The positive relationship suggests that when there is a positive outlook towards resources and support needed to use LMS, there will be a corresponding positive influence from peers to form intentions for LMS acceptance. The reverse of this situation could also be true. Thus, the effects of influence imposed on tutors by their peers depend to a larger extent environmental conduciveness for usage of LMS for teaching and learning.

Another important result from the non-linear relationships model was the direct positive effect between Facilitating Conditions and Effort Expectancy. Facilitating conditions was also a strong predictor of the extent to which tutors perceive the easiness of LMS usage. This is supported by Lee (2008), who stressed that the intra and extra-organizational support such as computing support, training, equipment availability and accessibility, go a long way to provide the needed help to reduce the task burden on individuals toward system usage. Availability of such incentives was seen as important to tutors in this study in forming their expectations of effort towards LMS use for blended instruction. Tutors believed that if expected incentives (training, technical support, motivation etc.) are in place, then there is the likelihood that needed effort to use LMS will be at the barest minimum.

Additionally, the positive effect between Facilitating Conditions and Behavioural Intention and Use Behaviour raises a concern on how tutors tend to associate the availability of perceived support to intention to use and actual use. This is supported by Kihoro et al., (2013), Mtega et al., (2012) and Ambali and Bakar (2014) who suggested that self-awareness of favourable environment surrounding the use of new technology is able to psych up novel users to form positive usage intentions which eventually results in actual system use. Thus, tutors heavily rely on necessary conditions for usage to determine intentions before usage. There is the need to pre-inform tutors on the necessary motivational incentives and support surrounding the use of LMS prior to actual practice to form their intentions which they will later assess in use behaviour experiences to determine how well they will employ LMS.

The original postulations by Venkatesh et al., (2003) with regard to FC and BI as antecedents of UB, were in consistence with the results in this study. However, in this study, BI proved a stronger effect on UB than FC

though both were very relevant. In effect, tutors attached much importance to their overall BI in determining their actual usage of LMS.

It is worth noting that two non-linear relationships hypothesized in this study i.e., FC and SI were not significant antecedents of PE. Distance education tutors did not believe that the presence or other wise of favourable conditions towards system use and that of social influence were indicators that LMS was useful for their instructional purposes. This result is consistent with Davis et al., (1989) and Venkatesh and Bala (2008) in their TAM postulations. To tutors, Facilitating Conditions did not necessarily mean that LMS usage outcomes will be useful, it was to only help them judge how much effort was required to use it. Neither did social influence warrant a sure proof that LMS was useful. It will take some time for them to accentuate the usefulness of LMS to their pedagogical processes after considerable use overtime and the sharing of positive outcomes.

Implications for Theory

The study proved that non-linear relationships exist between and among UTAUT exogeneous constructs. This was necessary to provide better insights into the behaviour of the constructs (especially linear relationships) in the model. The findings depicted that intention to accept LMS by tutors in distance education was a product of two key factors: Effort Expectancy and Facilitating conditions. Of most importance is the intricating relationships that existed among PE, EE, FC and SI. Of particular interest is the new relationship found between FC and SI.

This study sets precedence for other studies to model non-linear relationships in UTAUT in order to better explain their effects. The analysis from the study was further extended to include the predictive relevance of the non-linear relationships and their effect sizes as well as their performance and importance index analysis, all of which were excluded in earlier studies.

The findings from the study also implies that different societies and cultural contexts produce different results of variable behaviour, thus, it is academically not apt to generalize results of variable relationships across cross-cultural boundaries. Hence specificity of context is often the modest way to approach study findings.

Finally, the study proposes a combination of linear and non-linear relationship-based UTAUT model with all the initial moderators. This is depicted in **Figure 7**. Though the initial UTAUT model is a bit parsimonious than the comprehensive one proposed in this study, both parsimony and comprehensiveness have their own value in theory development. While comprehensiveness ensures that all relevant factors and relationships are involved in

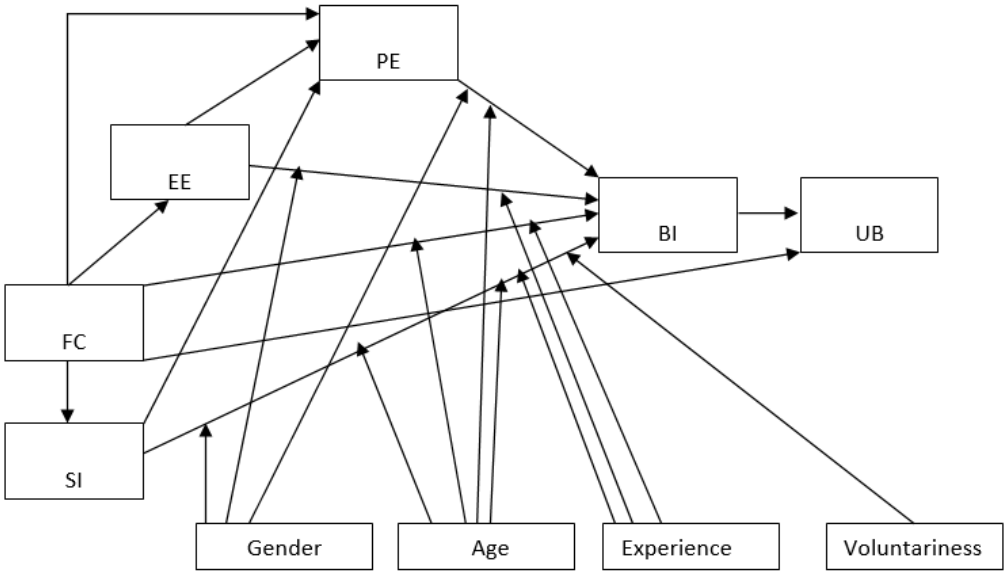

Figure 7. Proposed Linear and Non-linear Relationships-Based UTAUT Model with moderators

a theory (Whetten, 1989, Bacharach, 1989, Venkatesh & Bala, 2008) to better understand the phenomenon under study without missing out important details or nitigrities, parsimony dictates whether some factors should be deleted because they add very little or no value to understanding of phenomenon. In effect, parsimony is only achieved after comprehensiveness based on empirical testing.

Implications for Practice

The outcome of the study pointed out most of the hypothesized relationships to be significant. Irrespective of this, some were highlighted by the Importance Performance Map Analysis (IPMA) as crucial in the formation of intentions of use and actual use of LMS by distance education tutors. The prioritization of these factors will enable authorities at the college of distance education and other decision–makers to focus on certain determinants that need to be well managed or improved because they both have explanatory effects on other important factors and those that have low performance.

Tutors have already shown some positive signs of intention to accept LMS; however, the compelling elements were facilitating conditions and effort expectancy. Accordingly, authorities and decision makers must now focus on how to improve upon enabling conditions since they significantly determine how easy tutors envisage usage of LMS, intention behaviour, social influence and use behaviour. In light of this, they should improve upon technical and administrative support initiatives that will enable tutors see the easiness in using LMS and its usefulness to influence them and their peers to have the intentions to use and subsequently use LMS for pedagogical purposes. Motivation packages such as promotion and increase in allowances should be tied to LMS usage.

Additionally, authorities and decision makers should strive to make the system usage as easy as possible for tutors. This can be achieved through the provision of user manuals, more interactive tutorials, frequent training opportunities and forum for discussion for tutors to share experiences and frustrations, for immediate provision of antidotes. Standby technical support teams should be always ready and willing to pick up calls or reply messages that warrant help from tutors with regards to LMS usage. This is because tutors' expectation of effort required to usage is attached to performance expectations and usage intentions.

Limitations

The study was conducted without moderators and so other studies can replicate it by adding the moderators to the non-linear relationships to compare the original UTAUT model (with moderators) in terms of the coefficient of determination (R^2) and predictive relevance (Q^2).

Additionally, only two exogeneous variables significantly predicted behavioural intentions at ($p \leq 0.01^{***}$ *and* $p \leq 0.05^{**}$) thereby preventing a high level of total variance explained by the model.

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Factors Shaping Qatari Students' Career Expectations in STEM, Business or Public Sector Fields

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ABSTRACT
The purpose of this study was to identify factors shaping career expectations of Qatari students. The study examined individual and motivational variables likely to influence career expectations in STEM fields, the public sector, and business. This study used survey data of 802 Qatari students and 543 parents from the 2012 Qatar Education Study. The results suggest a varied, context-dependent portrait of career expectations. The results indicate that the education system in Qatar influenced students' STEM career expectations and demonstrate that operating a private business or seeking a job in the public sector continues to rival their expectations about STEM careers in Qatar. The paper concludes with some important implications for policy as well as recommendations for further study and research.

Keywords: students' career expectations, parental involvement, STEM, Qatar

INTRODUCTION

The need for a highly skilled workforce that is adaptable in the face of evolving technologies and globalized competition has been projected to rise rapidly in the years to come (Ewers, 2007; Malecki & Ewers, 2007). STEM careers, in particular, have been singled out as especially critical to the labor force of the future (Greenwood, Harrison, & Vignoles, 2011), and building a pipeline for the STEM workforce has been elevated as a top policy agenda for several countries around the world, such as South Korea, Malaysia, Rwanda (Kramer, Tallant, Goldberger, & Lund, 2015) and at both the national and state level in the United States (EOP, 2013; Hall, Anderson, Metty, Rosenstein, & Whatley, 2016). There are few places with more need for STEM professionals than countries

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Contribution of this paper to the literature

- The results this study generates can enhance our understanding of students' career expectations in a Middle Eastern, non-Western context.
- The focus of this study is to explore a varied, context-dependent portrait of students' career expectations.
- Operating a private business or seeking a job in the public sector continues to rival students' expectations about careers in STEM fields in Qatar.

rich in natural resources, such as the states of the Arab Gulf, where the pool of citizens trained in the occupations needed to sustain the oil and gas industries is relatively small and demand especially high (Jiwaji, 2014; Shediac & Samman, 2010). Among the Gulf states, Qatar in particular has taken wide strides to modernize its education system and to nurture local talent into STEM careers (Barnett, 2015; Weber, 2014, 2015). However, unlike other countries with significant resources devoted to STEM education, Qatari students' interest in STEM fields has declined since the government prioritized STEM as part of a series of education reforms in 2003 (Said & Friesen, 2013), leading to the closure of science and mathematics programs at the leading national university (Said, 2010) and increased reliance on highly skilled workers from outside the country to fill STEM-related positions in the natural resource industry (Malecki & Ewers, 2007). Some estimates place the share of migrants at 87% of the total population (World Bank, 2013) in Qatar.

Although the natural gas sector and related enterprises currently dominate areas needing qualified STEM professions, the government has been transitioning to a "knowledge economy," which seeks to graduate future workers in the fields of medicine, computer science, and engineering (Qatar General Secretariat for Development Planning, 2011). In order to realize this vision, it is important to understand what is driving educational aspirations and career expectations related to STEM fields early in life so policymakers can target evidence-based programs that educators can then implement to build a future pipeline (Wiseman, Alromi, & Alshumrani, 2014). There is innumerable evidence that early interest in STEM is critical to later career choices (Ing & Gibson, 2013; Miller & Kimmel, 2012; Tai, Liu, Maltese, & Fan, 2006), but the preponderance of this research focuses on students in educational systems outside the Arab Gulf.

The purpose of this study is twofold. First, we seek to unpack which occupations are the main competitors to a STEM career in Qatar. Second, we explore the degree to which factors known to influence career expectations in previous studies conducted outside the region – the U.S. and Western Europe in particular – apply in the Arab Gulf. The focus on Qatar is important for several reasons. First, it is characteristic of many resource-rich states in the region where the government has devoted significant resources to foster interest in STEM careers. Second, because the population is extremely heterogeneous and overwhelmingly foreign-born, the student population in the education system is far more diverse and multicultural than studies examining the drivers of STEM career expectations in other settings. Thus, factors known to predict student expectations regarding a STEM career may or may not apply to the same degree or in the expected direction. Using data from the 2012 Qatar Education Study, we provide one of the first analyses of the factors shaping student expectations about STEM professions and other occupations with data from schools representing the full spectrum of educational offerings – both public and private – in Qatar. As countries in the Arab Gulf and around the world continue to invest in STEM education, it is important to understand the extent to which factors that shape expectations related to STEM careers in other countries also apply in the Middle East and North Africa.

COMPETITORS TO A STEM CAREER IN QATAR

When examining the factors related to student STEM career interest and expectations, researchers typically dichotomize the choice in the data analysis; that is, either the student expects or is interested in a career in a STEM field or any other career (Crisp, Nora, & Taggart, 2009; Miller & Kimmel, 2012). This is in part driven by research convention and in part for practical reasons: researchers are interested in explaining variation in STEM career expectations rather than explaining expectations related to other occupations. Yet, in Qatar, there are two major

rivals to a STEM career that are worth additional scrutiny: 1) operating one's own private business, and 2) public service employment.

State-owned industries related to the petroleum and natural gas sector have long dominated Qatar's economy. Efforts to promote entrepreneurship began in earnest with the implementation of the Qatar National Vision 2030 as part of a long-term strategy to train citizens in financial services, education, and the health sector (Silatech/Gallup 2010, 2012). Small and medium-sized firms along with start-ups have been targeted by the Qatari government in recent years, and recent polling data suggests this has been impacting attitudes and perceptions among citizens. According to one report, slightly more than half of Qataris queried in an annual survey of entrepreneurship said they intend to start a new business in the next three years (Coury, Chidiac, Sayre, & Al Zaatari, 2014). In addition to support from the government, there are several non-governmental organizations that encourage entrepreneurship in the country specifically targeted to secondary and university students (Greene, Brush, Eisenman, Neck, & Perkins, 2015). There is preliminary evidence that these efforts may be coming to fruition with approximately one-in-three Qatari citizens between the ages of 15 and 29 saying they plan to start a business (Silatech/Gallup, 2012).

The government sector in Qatar has traditionally been a significant employer of Qatari citizens, and when queried in 2015, many nationals indicate a strong preference for public over private sector employment (Benchiba-Savenius, Mogielnick, Owens, & Scott-Jackson, 2016). In several countries in the Arab Gulf, government jobs have been an industry of choice for young adults (Behar & Mok, 2013; World Bank, 2013). Young people with adequate resources will wait for public sector jobs to open, rather than taking a job in the private sector, given the differentially high pay offered in public sector jobs and the corresponding low expected productivity (World Bank, 2013; Bunglawala, 2011; Stasz, Eide, & Martorell, 2008; Shediac & Samman, 2010).

LITERATURE REVIEW: FACTORS INFLUENCING STEM CAREER EXPECTATIONS

For purposes of this study, we focus on expectations related to how a student's individual attributes and attitudes (e.g., gender, individual educational aspirations, motivation) and characteristics of the household (e.g., parent education, parent occupation) shape students' career expectations. However, we rely on literature that has focused not only on career expectations but also career interest and aspirations.

Individual-level factors. Numerous studies have found a relationship between gender and aspirations for a career in a STEM field. The direction of this relation has been mixed. Some researchers have found girls less likely to aspire to a STEM career than boys (BouJaoude & Gholam, 2013; DeWitt et al., 2013) whereas others say the opposite holds in Qatar (Abdulwahed, Ghani, Hasna, & Hamouda, 2013).

Student educational expectations and academic achievement are directly associated with the types of careers to which they can aspire and eventually attain. Previous studies of STEM careers have found an association between educational aspirations and career choice and entry (Sadler, Sonnert, Hazari, & Tai, 2012; Tyson, Lee, Borman, & Hanson, 2007; Whalen & Shelley, 2010) and students who planned on obtaining a Baccalaureate degree or higher while in high school were substantially more likely to eventually be a STEM professional than those who did not plan on graduating from college (Miller & Solberg, 2012). There are linkages in the existing literature between early academic achievement and eventual employment in a STEM field (Benbow, 2012; Crisp, Nora, & Taggart, 2009; Miller & Kimmel, 2012). For instance, Miller and Kimmel (2012) found students with higher science and mathematics achievement scores were more likely to enroll in a STEM major when they entered college, and were more likely to be a STEM professional by age 40.

Age of the child has also been found to matter, with many studies finding children tend to lose interest in STEM fields as they grow older (Baram-Tsabari & Yarden, 2011; George, 2006). Numerous researchers have examined the flow of individuals out of the STEM pipeline with dropouts occurring as the child progresses through primary, secondary, and post-secondary grades (Chen, 2013; Maltese & Tai, 2011; Rask, 2010). This may be compounded in part by student motivation, especially in Qatar. Student motivation has been singled out as an important factor for understanding interest in school and post-secondary education (SESRI, 2012; Baker, Kanan, &

Al-Misnad, 2008). Educators who teach Qatari students are less likely to be satisfied with student motivation than educators at schools with a more diverse student body, and approximately half of students from Independents Schools – which are government run and attract primarily Qatari nationals – report being bored "most of the time" at school in the 2012 Qatar Education Study (SESRI, 2012). A study conducted by Baker, Kanan and Al-Misnad (2008) revealed that family affluence, parents' involvement in their child's education, and the general school atmosphere are strong determinants that draw the line between students who are motivated to achieve academically and those who are not.

Contextual-level factors. Features of the household, especially parent education and parent occupation, have been used to explain variation in STEM career expectations. Parents' level of education has been found to have a significant and positive relationship with to their aspirations for their children's educational and occupational pursuits (Ing, 2014; Raque-Bogdan, Klingaman, Martin, & Lucas, 2013; Hill & Tyson, 2009). Research on the perceived relationship between the parent's profession and their child's career pursuit has shown that the father or mother's field of work is a predictor of students' choice of STEM (Leppel, Williams, & Waldauer, 2001; Moakler, & Kim, 2014).

RESEARCH HYPOTHESIS/QUESTIONS

A combination of these personal and contextual factors informs what we believe predicts expectations regarding a particular career, and we expect there to be significant relationships among personal characteristics, a student's household demographics, and expectations about a STEM occupation. We also build on previous research by broadening the scope beyond a simple dichotomy of STEM careers versus all others in our operationalization of career expectations to include what are in our view the main competitors to a STEM career in Qatar (i.e., starting a business and government employment). Our aim is to provide a holistic view both in terms of what predicts career expectations (i.e., individual and contextual) which is based on prior research and also recognizing that students do not view career expectations as an "either/or" choice. Specifically, we seek to answer the following broad research questions: (1) Do students' personal and household characteristics have a significant relationship with their expectations of a STEM career in Qatar and (2) How do the factors influencing expectations of a career in STEM differ from those of a career in business or the public sector?

METHODOLOGY

The design of this study is observational with data obtained via a nationally representative survey of central stakeholders in K-12 education in Qatar. The data collected for this study originate from the 2012 Qatar Education Study (QES), a nationally representative survey that was conducted by the Social and Economic Survey Research Institute (SESRI) in December 2012. The QES is comprised of four surveys administered to students, parents, teachers, and administrators.

Crafting the questionnaires began with consultations with teachers, academic advisors, school principals and parents, and subsequent focus group discussions with key stakeholders. Debriefings were also conducted with randomly recruited members of the public. This process was useful in allowing researchers to obtain the perspectives of relevant stakeholders and elicit information on different aspects of the school system in Qatar. Next, two educational experts who were also senior faculty members at Qatar University developed the questionnaires, and forward- and back-translations were conducted by translation experts. These draft questionnaires were evaluated using pre-tests in four randomly selected schools and the result was a refined survey instrument. In this study, we use data from the student and parent questionnaires. The mode of data collection involved self-administered paper-and-pencil questionnaires completed by students in the classroom and by parents in their home.

Table 1. Demographic Composition of Participants

Group	
1. Students (Qatari)	802
Gender	
Boys	406 (51%)
Girls	396 (49%)
Average Age	
8th grade	13
9th grade	14
11th grade	16
12th grade	17
Grade Level	
Preparatory	
8th grade	182 (23%)
9th grade	211 (26%)
Secondary	
11th grade	178 (22%)
12th grade	231 (29%)
2. Parents (Qatari)	543
Gender	
Male	320 (59%)
Female	223 (41%)
Average Age	41

Participants

Participants included in this article are Qatari students (n=802) and one of their parents (n=543). The students are from two primary and two secondary grades and their race-ethnicity is 100% Qatari. **Table 1** provides the demographic characteristics of the participants involved in the current study.

Procedure

This study used data collected from students and parents from the 2012 QES (SESRI, 2012). The school system in Qatar is organized into the following categories: 1) independent; 2) international; 3) community; and 4) Arabic private. The majority of Qatari students attend government-financed independent schools, which are all single-gender schools. In our study, the distribution of Qatari students across school type is as follows: 1) 93% independent schools (n=742); 2) 4% international schools (n=28), 3) 4% Arabic private schools (n=31) and 4) <1% Community schools (n=1). Due to the small sample size for the other school types, we did not include a system-level test of differences between or among schools.

The Qatar Education Study (QES) is based on a two-stage probability school sample of Qatari students. The sampling frame for the survey is based on a comprehensive list of public and private schools provided by the Qatar Supreme Council of Education (replaced by the Ministry of Education and Higher Education in early 2016 as part of a government reorganization). The first stage sample was a proportionate sample of schools based on school size, school type (i.e. independent, international, community, and Arabic private), gender (boy, girl, or coed) and grade (8th, 9th, 11th, or 12th). Schools were randomly selected within each of these subgroups (school type, gender, and grade) so that the school size selected from each strata was relative to its incidence in the entire sampling frame. In stage two, one class from each grade in a school was randomly selected and all students in the class were included in the survey. Students were given a printed parent questionnaire to give to one of their parents at home.

Table 2. Student Career Expectations

Occupation	Proportion (%)
Join the military	15.5
Join the police	7.0
Accountant	1.3
Teacher	3.4
Lawyer	5.1
University professor	1.7
Medical doctor	4.1
Nurse	1.0
Clerk	6.0
IT technician	.1
Physical therapist	.1
Chef	.3
Scientist	1.8
Businessman/businesswoman	13.4
Diplomat	8.1
Other	14.1
I do not know	16.8

Question: What kind of work do you expect to be doing in the future? (1) join the military; (2) join the police; (3) accountant; (4) teacher; (5) lawyer; (6) university professor; (7) medical doctor; (8) nurse; (9) clerk; (10) IT technician; (11) physical therapist; (12) chef; (13) scientist; (14) businessman/businesswoman; (15) diplomat; (16) other ("please specify"); (98) don't know.

Upon receiving approval from the Internal Review Board at Qatar University, official letters requesting permission to conduct the study were sent to the schools. Parents/guardians and students were informed in advance about the aim of the study, that participation in the survey was voluntary and that all of their answers would be confidential. No questionnaires were distributed until consent for the study was obtained.

Forty-three schools were initially sampled, with four schools refusing to participate, resulting in a response rate of 90.7% at the school level. Classrooms were randomly selected in 39 schools and all students in selected classrooms fully participated in the survey. However, we do not have information on the actual class sizes to calculate a response rate at the classroom level. This design resulted in 1,848 students (both Qatari and non-Qatari) and 1,472 parents. The response rate of parents was 79. 6%. For purposes of this article we use only data from the Qatari national students (n=802) and their parents (n=514). The maximum sampling error was calculated at +/- 2 percentage points for the student survey and +/- 2.7 percentage points for the parent survey.

Measures

Student Career Expectations. This is the main dependent variable for the statistical analysis. In the student questionnaire students were asked: "What kind of work do you expect to be doing in the future?" and were instructed to select one answer from a list of 15 options: 1) join the military; 2) join the police; 3) accountant; 4) teacher; 5) lawyer; 6) university professor; 7) medical doctor; 8) nurse; 9) clerk; 10) IT technician; 11) physical therapist; 12) chef; 13) scientist; 14) businessman/businesswoman; and 15) diplomat. (see **Table 2**). The list also included an "Other" option (with an open-ended, "please specify" space) and an "I do not know" option.

The career options were developed as part of the questionnaire construction process described above, and resulted from the consultations, focus groups, and questionnaire development by educational experts, as well as the eventual pilot testing and revision of the questionnaire. Knowing the list was not exhaustive, an "other" option was included. The open-ended responses to the other "please specify" option were coded into the original categories (including "other").

Responses were collapsed into four categories:

- STEM = (7) medical doctor; (8) nurse; (10) IT technician; (11) physical therapist; and (13) scientist,
- Public sector = (1) join the military; (2) join the police; (15) diplomat,
- Business = (3) accountant and (14) businessman/businesswoman, and
- Other = (4) teacher; (5) lawyer; (6) university professor; (9) clerk; (12) chef; (16) other; and (98) I do not know.

Overall, 13.9% of the students expect a STEM career, 16.8% a career in business, 37.8% a public sector career, and 31.4% some other career (see **Table 4**). Summary statistics for the four-category dependent variable and all of the independent variables described below are listed in **Tables 3** and **4**.

Individual-level factors. Gender, attitudes and attributes related to educational aspirations and performance, and age in school were all examined as individual-level predictors of career expectations.

Gender. This was reported by students, and it is placed in the model as a dichotomous variable (female=1, male=0). Qatari students were almost equally split between female (49%) and male (51%).

Grade Level was used as a proxy for age of the child and was obtained from the original list provided by the Supreme Council of Education. 8th and 9th grades were collapsed into preparatory and 11th and 12th grades into secondary. Like gender, Qatari students were divided equally between preparatory (49%) and secondary (51%).

Student Motivation Issues. We measure motivation using a series of questions in the student questionnaire: 1) "How many times were you late for school over the past four weeks?" (response options of none, 1 to 2 days, 3 to 4 days, 5 to 10 days, 11 days or more, and I do not remember); 2) "In a typical week, how many days do you miss school (absent from school)?" (response options of never, one day, two days, three days, four days, or all week); 3) "How often do you feel bored when you are at school" (response options of most of the time, once in a while, never); and 4) "I do not put in my maximum effort in studying" (response options of strongly agree, somewhat agree, somewhat disagree, and strongly disagree). The summary student motivation issues variable ranges from zero to four and assigns one point to a student for each of the following: (1) coming to school late three or more days in the past four weeks; (2) being absent from school two or more days in the past week; (3) feeling bored most of the time when at school; and (4) strongly or somewhat agreeing that they do not put their maximum effort into studying. The measure has a mean of 1.3. In the model, the top two categories (3 and 4) are collapsed into 3 due to a small number of responses in the highest category.

Student Educational Expectations. Students were asked "How far in education do you think you will go?" and were offered the following response categories: 1) will not finish secondary or high school; 2) will graduate from secondary or high school, but will not go any further; 3) will join the community college; 4) will join a BA program at a university; 5) will graduate from a university; 6) will finish postgraduate studies; and 7) I do not know. From these responses, an indicator for planning to attain a Baccalaureate degree or higher was created. Overall 62% of the students aspire to a Baccalaureate degree or higher.

Table 3. Descriptive Statistics of Variables in Analysis

Variable	Source*	Mean/Proportions	SD	N
Gender	SQ	51% male	0.50	802
Grade Level	AD	51% secondary students	0.50	802
Father with BA or higher	PQ**	25% with B.A. or higher	0.43	785
Mother with BA or higher	PQ**	26% with B.A or higher	0.48	779
Parent in STEM Career	SQ	2.4% in STEM career	0.17	782
Count of Student Motivation Issues	SQ	1.30 out of 4	0.91	795
Student Educational Aspirations	SQ	62% aspire to B.A. or higher	0.49	790
GPA	SQ	2.5 out of 4.0	0.88	779
Homework Time	SQ	4.90 hours	2.53	788

* SQ=Student Questionnaire; PQ=Parent Questionnaire; AD=Administrative Data.

** If the parent questionnaire was missing, the student report of parent education was used for the analysis.

Table 4. Career Expectations of Qatari Students, 2012 Qatar Education Study

Group	STEM	Business	Public Sector	Other	N
All Qatari students	13.9%	16.8%	37.8%	31.4%	785
Gender					
Boys	11.2	15.4	52.4	21.0	397
Girls	16.9*	18.4	21.9***	42.9***	388
Grade Level					
Preparatory (8th and 9th grades)	13.8	11.8	44.3	30.1	387
Secondary (11th and 12th grades)	14.0	21.9***	31.3***	32.9	398
Parent in STEM Career					
Neither	13.4	16.5	38.4	31.7	746
One or both	26.8	16.9	10.7***	45.7	19
Mother's Education					
Less than B.A.	12.2	14.9	41.1	31.8	579
B.A. or higher	18.9*	23.8**	27.1***	30.2	200
Father's Education					
Less than B.A.	12.0	14.7	41.3	32.0	591
B.A. or higher	20.1*	24.4**	27.7***	27.8	194
Student Educational Aspirations					
Less than B.A.	7.6	7.6	49.4	35.4	301
B.A. or higher	18.1***	22.8***	30.6***	28.5*	489

***p<.0001, **p<.01, *p<.05 as measured by a difference in proportion test.

GPA. The QES does not include direct measures of student academic achievement such as scores on standardized tests or matched transcripts. We use a combined measure of self-reported grades from the student questionnaire as a surrogate for academic performance in this analysis. We recognize that while self-reported grades are used frequently in educational research, there are some questions about their reliability with actual grades. However, a meta-analysis of self-reported grades found that self-reported grades generally predict outcome variables in the same manner as actual grades (Kuncel, Crede, & Thomas, 2005). The student questionnaire asked students, "What is your average grade in each of the following subjects?" Students were presented with a grid that included four subjects: mathematics, science, English, and Arabic. The response options for each of the subjects were: 1) Mostly A(s) (90-100%); 2) Mostly B(s) (80-89%); 3) Mostly C(s) (70-79%); 4) Mostly D(s) (60-69%); 5) Mostly below D(s) (below 60%); and 6) Not applicable. We converted the response for each subject to a standard GPA ranging from 0 (Mostly below D(s) to 4 (Mostly A(s). An overall GPA – the variable used in the models – was created as the mean of the GPA for the four subjects. On a 0- to 4-point scale the students had a mean GPA of 2.5.

Homework Time. The student questionnaire asked students to report how much *time they spent each week on homework* for math and for science. We combined the amount of time spent on math and science homework, resulting in a variable ranging from 0 (no time spent) to 16 (20 or more hours). The students reported spending on average 4.9 hours per week on homework.

Contextual-level factors. Parent education and parent occupation were the two sets of family household characteristics used in the analysis, and this information was obtained from the student and parent questionnaires. The parent questionnaire asked parents both for their and their spouse's highest level of education and occupation.

Parent education. Parents were given the following education options: 1) Primary (1-6); 2) Preparatory (7-9); 3) Vocational; 4) Secondary (10-12); 5) Post-secondary (Diploma); 6) University Graduate/BA/BCOM/BSC; 7) Masters' degree; 8) Ph.D.; 9) Other (specify); and 10) Never attended any school. We were interested in the effect of parents having a college degree on their child's career expectations, and collapsed the responses to Baccalaureate degree or higher versus less than Baccalaureate degree. Separate measures of mother's and father's education are entered in the models as 0= parent does not have a Baccalaureate degree or higher, 1=parent has a Baccalaureate degree or higher. If a student's parents did not complete the parent questionnaire, we used the student report of their mother's and father's education. Overall 25% of the fathers had a Baccalaureate degree or higher while 26% of the mothers had a similar level of education.

Parent Employment in STEM Occupation. The student questionnaire asked students: "What is your father/male (mother/female) guardian's main occupation?" We were specifically interested in the influence of having a parent employed in a STEM field on the likelihood that the student would select a STEM career, and created a dichotomous variable measured as 0=neither parent employed in a STEM field, 1=one or both parents employed in a STEM field. Only 2.4% of the students reported having a parent employed in a STEM field.

DATA ANALYSIS AND RESULTS

A weighted maximum-likelihood multinomial logit model was constructed for the four-category career expectation variable using STATA 13. The *svyset* command was used in Stata to account for the two-stage sampling design and clustering of students within schools. In this analysis, the choice of Business as a career expectation is treated as the reference category; therefore, we are modeling the odds of a student picking one of the other options versus picking business.

Table 4 provides the distribution of selected groups of Qatari students who expect a career in STEM, business, the public sector, and all other occupations. Looking first at gender, girls are more likely (16.9%) to expect a STEM career than boys (11.2%). Conversely, boys are more likely to expect a career in the public sector (52.4%) than are girls (21.9%). Girls are also more likely to expect "other" careers (42.9%) than boys (21.0%). When grade level is considered, secondary students (21.9%) are more likely than preparatory students (11.8%) to expect a career in business, while preparatory students (44.3%) are more likely to expect a career in the public sector than secondary students (31.3%). There is no difference based on grade level in STEM or "other" career expectations.

The home background of the students appears to matter, as students whose mother has a B.A. or higher are significantly more likely to expect a career in a STEM field (18.9%) or in business (23.8%) and are less likely to expect a career in the public sector (27.1%) than those whose mother has less than a baccalaureate. Similarly, students whose father has a Baccalaureate degree or higher are more likely to expect a career in a STEM field (20.1%) or in business (24.4%) and are less likely to expect a career in the public sector (27.7%) than are those whose father has less than a Baccalaureate degree.

Students who have at least one parent employed in a STEM field are less likely to expect a career in the public sector (10.7%) than are those with neither parent employed in a STEM field (38.4%). While twice as many students who have one parent employed in a STEM field (26.8%) expect a career in a STEM field than those who do not have a parent similarly employed (13.4%), the difference is not significant given the small number of Qatari students with a parent employed in a STEM field.

Table 5. Multinomial Logit Model of Factors Related to Career Expectations in Qatar

		STEM		Public Sector		Other	
Variables	***Category***	**Beta**	**(S.E.)**	**Beta**	**(S.E.)**	**Beta**	**(S.E.)**
Gender	*Female*	0.433	(0.398)	-0.957**	(0.293)	0.825*	(0.297)
Grade Level	*Secondary (11th and 12th grade)*	-0.647	(0.360)	-0.806*	(0.293)	-0.540	(0.269)
Parent Level of Education	*Father with BA or Higher*	-0.057	(0.352)	-0.622*	(0.281)	-0.359	(0.331)
	Mother with BA or Higher	0.236	(0.303)	-0.650*	(0.283)	-0.103	(0.316)
Parent in STEM Career	*At least one Parent*	0.227	(1.031)	-0.462	(0.929)	0.997	(0.977)
Count of Student Motivation Issues	*0*	-0.131	(0.415)	0.180	(0.465)	-0.197	(0.371)
	1	-0.333	(0.485)	0.00284	(0.457)	-0.515	(0.291)
	2	-0.293	(0.755)	-0.0458	(0.744)	-0.222	(0.468)
	3 or 4	-0.576	(0.335)	-1.392***	(0.294)	-1.302***	(0.236)
Student Educational Aspirations	*BA or Higher*	0.348*	(0.132)	-0.252*	(0.121)	-0.218	(0.160)
GPA	*NA[1]*	0.0339	(0.0549)	-0.0451	(0.0416)	-0.0353	(0.0456)
Homework Time	*NA[1]*	-0.121	(0.842)	0.283	(0.785)	-0.167	(0.530)
Intercept		-0.513	(1.160)	3.409**	(0.984)	2.566**	(0.899)

Students who plan to obtain a Baccalaureate degree or higher are significantly more likely to expect a STEM career (18.1%) or a career in business (22.8%) and less likely to plan on a career in the public sector (30.6%) or other careers (28.5%) than are those who do not plan to graduate from college.

Table 5 shows the results from the multinomial logistic model discussed above. For each career choice, we show the odds of a Qatari student expressing a desire to enter that career field rather than enter into a career in business. Standard errors are in parentheses. When comparing student expectations regarding STEM careers versus business careers, only educational attainment aspirations reach statistical significance. Students who expressed a desire to attain a B.A. or higher degree were more likely to report a desire to enter a STEM career than a business career, perhaps because many STEM careers are known for having strenuous education requirements. Given the results of **Table 2**, it is perhaps unsurprising that the rest of the indicators fail to show significant differences between STEM and business field expectations. Gender (female), grade level, and parent's career and education choices all positively affected the likelihood of both business and STEM career expectations. The results of the logistic regression do not suggest that these indicators push students to consider a STEM career any more than a business career. Rather, the results taken overall may mean that students from elite educational backgrounds are more likely to choose high status careers with high educational requirements overall.

When comparing public sector to business career expectations, the results support previous work relating higher socioeconomic student backgrounds and expectations to more rigorous careers. Females, secondary students, and those whose parents have at least baccalaureate degrees are significantly less likely to choose public sector careers versus business careers. Students who expressed expectations for advanced educational degrees are also less likely to expect to enter a public sector career. Females are more likely to report expectations regarding other career options relative to a career in business.

Interestingly, students with more motivation issues are less likely to report expectations related to public sector careers or other careers relative to the business sector. Although the results fail to reach statistical significance, students with motivation issues are also less likely to report expectations for a STEM career relative to

a business career. These results perhaps signify that business is seen as a less demanding career field after educational goals have been achieved. Indicators of school workload or effort fail to reach significance for any career group.

DISCUSSION

The aim of this study is twofold. First, we examine whether factors that have been found to influence student expectations related to STEM careers in other research also apply in the State of Qatar. Second, we also try to unravel the occupations that constitute the main rivals to STEM careers in Qatar. What started as an investigation into the determinants of students' STEM career expectations in Qatar has evolved into an examination of the factors guiding career expectations related to STEM, the public sector, and business fields. Using previous studies of STEM career expectations as an organizing framework, we identified individual and contextual variables likely to influence career expectations in Qatar. The analysis of the data from the QES 2012 points to a varied and context-dependent portrait of the motivations underlying student expectations regarding STEM occupations versus one in the public sector or business.

The results concluded from this study reveal that individual attributes and attitudes, including gender and individual educational aspirations and motivation, are the main drivers behind students' career expectations. Previous studies have found mixed results regarding the impact of gender on student career expectations in a STEM career. Our results indicate that in Qatar, girls are more likely to aspire to a STEM career than boys which is consistent with another study conducted in Qatar (Abdulwahed, Hasna, & Hamouda, 2013) but differs from results found in an overall Arab study (BouJaoude & Gholam, 2013). Similarly, our results regarding the influence of educational aspirations and motivation are consistent with previous findings in other research (Crisp, Nora, & Taggart, 2009; George, 2006; Rask, 2010). Student household characteristics, specifically parent education and parent occupation, are also found to be important predictors of Qatari students' career expectations. These results corroborate similar findings concluded in other studies (Ing, 2014; Raque–Bogdan, Klingaman, Martin, & Lucas, 2013; Leppel, Williams, & Waldauer, 2001).

Taking a closer look at the results, it is apparent that operating a private business or seeking a job in the public sector continues to rival expectations to have a STEM career, regardless of government initiatives to grow a STEM pipeline from school to the workforce. This is revealed partly in the bivariate comparisons between career expectations and individual-level and motivational factors. Girls are more attracted to STEM careers, whereas boys tend to be drawn to occupations in the public sector. Although student education aspirations are the only significant result in the multinomial model for STEM, the contrast between business and public sector is significant for several of the bivariate-level results, notably gender, grade level, and parent education. Taken together, the individual-level factors suggest that students coming from households with highly educated parents are more likely to expect careers with higher status, regardless of the overall educational requirements in the long-term. The results from the motivational factors suggest that those with less motivation have fewer expectations about public sector careers or other careers compared to those in business. While at first this may seem contrary to our expectations, it could, in fact be the stereotypes associated with a career in the public sector (i.e., adherence to rules and regulations, rigidity) that may drive students with motivational issues to consider alternative career paths.

Throughout the Middle East and North Africa there is a prevailing belief that youth will continue to be attracted to public sector careers. While there may be evidence to support this in several states in the region, our results paint a more nuanced picture of the underlying factors motivating students to pursue occupations outside the public sphere. We find that female students in younger grades who have parents with a B.A. or higher are less likely to pursue a career in the public sector. Those students who already expect to pursue a B.A. or higher also are less likely to look at a career in the public sector.

The implications of our study are two-fold, including both policy-level issues for the Qatar government and potential future directions for researchers in other country. First, it is clear that despite extensive efforts by the Qatar government to increase the number of students attracted to a STEM career, much work remains to be done.

Based on our study, only a small percentage of Qatari students are interested in a career in a STEM field, while a large percentage remain attractive to jobs in the public sector and business. Second, most researchers have focused solely on the dichotomy between student interest in a STEM career versus all other careers. Within the context of Qatar, we have found major competing occupations – business and the public sector – that attract a larger percentage of students. It may be useful for researchers in other countries, particularly in non-western countries interested in increasing the flow of students into the STEM pipeline, to explore the major competitors for a STEM career.

LIMITATIONS OF THE STUDY

This study sought to identify the factors that shape students' career expectations using data from the QES student and parent questionnaires. As described earlier, the QES questionnaires were developed through a careful process involving focus groups and interviews with key educational stakeholders in Qatar. The resulting questionnaires were then pre-tested with students, parents, and key stakeholders and revised as needed. However, our analyses as described here would be enhanced with additional information. Resources permitting, follow-up interviews with a sample of students who indicated they aspired to careers in business, STEM, and the public sector would have allowed for in-depth exploration of what their understandings were of these occupations. Second, if not concerned for respondent burden and the length of the student questionnaires, it would have been interesting to include questions that include subscales for each separate subject area.

With regard to the analysis, it is possible that school type also shapes student STEM career expectations in Qatar, but we are unable to explore this because the predominant school type in our study is the publicly funded independent school, which comprises the majority of the Qatari students in our sample (93%). Finally, we cannot compare how similar or different this study is to those carried out in non-Arab countries, for a nation's social and cultural norms and values influence its education system (Barbour, Barbour, & Scully, 2008).

DIRECTIONS FOR FUTURE RESEARCH

This study is important in unveiling what shapes students' expectations regarding careers in STEM, business, or the public sector. However, future research is needed to better understand the extent to which Qatar's education system shapes expectations about these career pathways, and in particular STEM careers, for all students. Schools in Qatar attract different groups in society that tend to cluster along nationality and linguistic cleavages, and future work should broaden the focus beyond Qatari students to include the full spectrum of students participating in the school system. Furthermore, additional research needs to evaluate in greater depth how those students who say they want to pursue a STEM career differ from students who want to go into business or the private sector. In other words, we need to investigate what precisely motivates these students to go into fields that have historically been dominated by immigrant workers and expatriates and take on the additional coursework needed to fulfill these jobs. Additional research is required to establish in greater detail the personal motivations and other context-specific factors that foster interest in STEM careers in Qatar. Finally, further study and research are needed to understand the extent to which these findings generalize to other societies with extremely heterogeneous and predominantly immigrant student populations.

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Test of Understanding Graphs in Calculus: Test of Students' Interpretation of Calculus Graphs

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ABSTRACT

Studies show that students, within the context of mathematics and science, have difficulties understanding the concepts of the derivative as the slope and the concept of the antiderivative as the area under the curve. In this article, we present the Test of Understanding Graphs in Calculus (TUG-C), an assessment tool that will help to evaluate students' understanding of these two concepts by a graphical representation. Data from 144 students of introductory courses of physics and mathematics at a university was collected and analyzed. To evaluate the reliability and discriminatory power of this test, we used statistical techniques for individual items and the test as a whole, and proved that the test's results are satisfactory within the standard requirements. We present the design process in this paper and the test in the appendix. We discuss the findings of our research, students' understanding of the relations between these two concepts, using this new multiple-choice test. Finally, we outline specific recommendations. The analysis and recommendations can be used by mathematics or science education researchers, and by teachers that teach these concepts.

Keywords: concept of the derivative, concept of the antiderivative, context of calculus, reliable evaluation instrument, students' graph understanding

INTRODUCTION

The comprehension of various concepts used in science requires students to have an adequate understanding of a function, its first derivative and its second derivative in their graphical representations. For example, a complete comprehension of the kinematics concepts requires students to have an adequate understanding of the graphs of position (function), velocity (first derivative) and acceleration (second derivative). It is important for students to be able to understand, in the context of kinematics, the concept of the derivative as the slope in the relationships between position and velocity, and between velocity and acceleration. Similarly, students should be able to understand, in the context of calculus, the concept of the derivative as the slope in the relationships between a function and the first derivative (f(x) to f′(x)), and between the derivative and the second derivative (f′(x) to f′′(x)). In the same way, it would be important for students to be able to understand, in the context of kinematics, the

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Contribution of this paper to the literature

- In this article, we present a test that evaluates students' understanding of the concept of the derivative as the slope and the concept of the antiderivative as the area under the curve in the context of calculus, and show that it is a content-valid and reliable evaluation instrument with satisfactory discriminatory power.
- We analyze students' understanding of the concepts evaluated in the test and outline recommendations, based on this analysis, for the instruction of these concepts.
- The analyses, recommendations and the test presented in the Appendix can be used by mathematics or science education researchers, and by instructors teaching these concepts.

concept of the antiderivative as the area under the curve in the relationships between the acceleration and the change velocity and between the velocity and the change in position. Correspondingly, in the context of calculus, the concept of the antiderivative as the area under the curve in the relationships between the second derivative and the change of the first derivative ($f''(x)$ to $\Delta f'(x)$) and between the first derivative and the change of the function ($f'(x)$ to $\Delta f(x)$). In this article, we study university students' understanding of these two concepts (slope and area under the curve) in the context of calculus, using a new multiple-choice test. Tests with this feature are highly valued in the area of mathematics and science education research since they allow the evaluation of conceptual learning of large populations (Redish, 1999; Gurel, Eryilmaz & McDermott, 2015).

Many researchers have analyzed students' understanding of the concepts of slope and area under the curve in the context of science, specifically in physics (McDermott et al., 1987; Beichner, 1994; Woolnough, 2000; Meltzer, 2004; Pollock, Thompson & Mountcastle, 2007; Nguyen and Rebello, 2011), while others have studied this understanding in the context of mathematics (Orton, 1983; Leinhardt et al. 1990; Hadjidemetriou & Williams, 2002; Bajracharya et al. 2012; Christensen & Thompson, 2012; Epstein, 2013). However, to date, no study has presented a multiple-choice test that evaluates students' understanding of these concepts in the context of calculus, with a design that follows the steps recommended by mathematics and science education researchers (Beichner, 1994; Ding et al. 2006, Engelhardt, 2009).

To address this need, we conducted a research study with four objectives: (1) to present a multiple-choice test that evaluates students' graph understanding of the concepts of the derivative and the antiderivative (as the slope of the tangent line to the curve at a certain point and as the area under the curve for a given subinterval, respectively) in the context of calculus and its design process; (2) to show that it is a content-valid and reliable evaluation instrument with satisfactory discriminatory power according to the analysis recommended by science education researchers (Beichner, 1994; Ding et al. 2006, Engelhardt, 2009); (3) to conduct a detailed analysis of students' understanding of the concepts evaluated in the test; and (4) to outline specific recommendations, based on the previous analysis, for the instruction of these concepts. It is important to mention that in previous short articles (Pérez, Domínguez & Zavala, 2010; Perez-Goytia, Dominguez & Zavala, 2010), we have presented results of preliminary versions of the test.

PREVIOUS RESEARCH

This section is divided into three subsections. In the first and second sections, we present the most important findings of the studies that have analyzed students' understanding of the concept of the derivative as the slope and the concept of the antiderivative as the area under the curve, respectively. In the third section, we describe the tests designed to evaluate these concepts in the context of mathematics, discussing the differences between those tests and our own. The two first subsections are related to the incorrect options that we established in our test, and the third subsection presents a detailed justification for the need of our study and our test.

Students' Understanding of the Concept of the Derivative as the Slope

Several studies have analyzed students' understanding of the concept of the derivative as the slope in the context of physics: the majority of them use the context of kinematics (McDermott et al., 1987; Beichner, 1994;

Planinic, Milin-Sipus, Katic, Susac, & Ivanjek, 2012; Planinic, Ivanjek & Susac, 2013), while some of them use other contexts (Woolnough, 2000; Planinic, Ivanjek & Susac, 2013). Several studies also analyze this understanding in the context of mathematics (Leinhardt et al. 1990; Hadjidemetriou & Williams, 2002; Christensen & Thompson, 2012; Planinic, Milin-Sipus, Katic, Susac, & Ivanjek, 2012; Planinic, Ivanjek & Susac, 2013; Epstein, 2013).

In this subsection, we focus on the two studies that present an overall classification of students' difficulties with the understanding of the concept of the derivative as the slope (Leinhardt et al. 1990; Beichner, 1994). Leinhardt et al. (1990) classified students' difficulties into three categories: (1) interval/point confusions, in which students focus on a single point instead of on an interval; (2) slope/height confusions, in which students confuse the height of the graph with the slope; and (3) iconic confusions, in which students incorrectly interpret graphs as pictures. Beichner (1994) designed the "Test of Understanding Graphs in Kinematics (TUG-K)" and applied it to 895 high school and college students. He pointed out the most frequent errors that students make regarding understanding the slope concept and notes that these errors are directly related to the three categories, classified by Leinhardt et al. For instance, regarding the first category of Leinhardt et al., Beichner found that students often compute the slope at a point by simply dividing a single ordinate value by a single abscissa value, essentially forcing the line through the origin.

Students' Understanding of the Concept of the Antiderivative as the Area under the Curve

Several studies have analyzed students' understanding of the concept of the antiderivative as the area under the curve in the context of physics: the majority of them use the context of kinematics (McDermott et al. 1987; Beichner 1994; Planinic, Ivanjek & Susac, 2013), although some of them use other contexts (Meltzer, 2004; Pollock, Thompson & Mountcastle, 2007; Nguyen and Rebello, 2011; Planinic, Ivanjek & Susac, 2013). In addition, several studies analyze this understanding in the context of mathematics (Orton, 1983; Bajracharya et al. 2012; Planinic, Ivanjek & Susac, 2013).

Beichner (1994) presents an overall analysis of students' difficulties with the understanding of the concept of the antiderivative as the area under the curve and classifies them into three categories: (1) not recognizing the meaning of areas under the graph, (2) calculating the slope rather than the area, and (3) area/height confusions in which students confuse the height of the graph in the last point of the interval with the area. It is noteworthy that Nguyen and Rebello (2011) found that, when presented with several graphs, students had difficulties in selecting the graph in which the area under the graph corresponded to a given integral, although all of them could state, "the integral equals to the area under the curve."

Related Tests

Our test evaluates students' graph understanding of the concept of the derivative as the slope and the concept of the antiderivative as the area under the curve in the context of calculus, each concept in two different steps using the function, the first derivative, and the second derivative. In the literature, there are two tests previously designed that relate to the present study. The first is the "Calculus Concept Inventory (CCI)" designed by Epstein (2013). The second is the mathematics version of a test designed by Planinic, Ivanjek & Susac (2013). We will briefly describe these tests and identify the differences between those and our test.

The "Calculus Concept Inventory (CCI)" designed by Epstein (2013) is a 22-item multiple-choice test of conceptual understanding of the most basic principles of differential calculus. The test has three dimensions: (1) functions, (2) derivatives, and (3) limits, ratios, and the continuum. Although the test is for calculus students, this inventory does not focus on evaluating students' understanding of the concept of the derivative as the slope and the concept of the antiderivative as the area under the curve.

The mathematics version of the test, designed by Planinic, Ivanjek & Susac (2013), evaluates students' understanding of graphs and focuses on the same concepts as our test. This test has eight questions: five of them refer to the concept of the slope and three to the concept of the area under the graph. However, there are three major differences between this test and ours. The first difference is that not all the questions designed by Planinic

et al. are multiple-choice questions: only four of them have this format, and the other four are open-ended questions. We believe that instruments in which there are open-ended questions are important for research; however, our goal is to obtain an instrument that not only can be used for research but can also be used to assess large student populations and be as easy to analyze as many other multiple-choice instruments available in the literature (i.e., Epstein, 2013). The second difference is related to the objective of the study and the design of the mathematics version of the test. Their study focuses on comparing the graphical understanding of the slope and the area under the curve in mathematics with two other contexts. The third difference, and the most important one, is that the context of Planinic et al.'s test is mathematics, while our test belongs to the context of calculus specifically. Planinic et al. use the context of mathematics and ask directly to find "the slope in a point" or "the area under a curve in an interval" in graphs plotted in the x and y axes. In contrast, we use the context of calculus in our study, and we ask to find the *derivative* of a function at a point or the change of the *antiderivative* of a function in an interval. As mentioned before, we evaluate these concepts in two steps using the function, the first derivative and the second derivative. This assessment in two steps is not possible in the context of mathematics used by Planinic et al. We believe that the differences between our test and the two related published tests justify the need for our study and our test.

METHODS AND TEST DEVELOPMENT

In this section, we cover the first objective of this study: to present a multiple-choice test that evaluates students' graph understanding of the concepts of derivative and antiderivative (as the slope and as the area under the curve, respectively) in the context of calculus, and its design process.

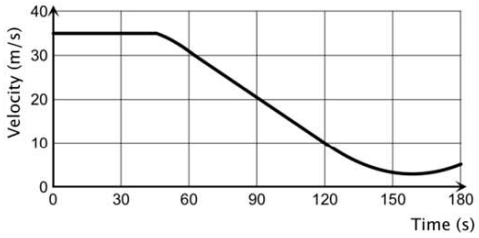
Test Development

We decided to base our new test on the "Test of Understanding of Graphs in Kinematics (TUG-K)" by Beichner (1994), since it is a content-valid and reliable evaluation instrument with satisfactory discriminatory power widely used in the area of science education (see, for example: Chanpichai & Wattanakasiwich, 2010; Bektasli & White, 2012; Tejada Torres & Alarcon, 2012; Maries & Singh, 2013; Mesic, Dervic, Gazibegovic-Busuladzic, Salibasic, & Erceg, 2015; Hill & Sharma, 2015), and also in our modified version of the TUG-K (Zavala et al., 2017). The original version has been a well-received assessment. However, when analyzing this test, we detected several potential improvements, mainly regarding the parallelism between related objectives and the parallelism between the items of some objectives, but also, the representation of the most common alternative conceptions as distractors. To generate those improvements, we decided to modify the test, adding new items and modifying some distractors in some of the original items that remained. That process is described in another study (Zavala et al., 2017). Note that the original version of the TUG-K has 21 items and our modified version of the TUG-K has 26 items. The general idea to design the test presented in this article was to rewrite the items of the TUG- K, removing the context of kinematics and replacing it with the context of calculus. **Figure 1** shows an example of this translation.

To create the test described in this article we designed two preliminary versions of the tests and the final version of the test, which we present here. To design the first preliminary version, we rewrote the 26 items of our modified version of the TUG-K removing the context of kinematics and replacing it with the context of calculus. This version was reviewed by physics and mathematics professors, and special care was put into preserving the original structure of the items. This version was administered to university students of introductory courses in physics and mathematics. The results of this administration (Pérez, Domínguez & Zavala, 2010) showed that, while most of the problems of the test had an almost perfect "translation" from kinematics to calculus, there were some items that lost their meaning or were too difficult for the students to answer. Those items corresponded to objectives 6 and 7 of the TUG-K, which focused on the relationship between a kinematics graph and a textual description. Based on this analysis, it was decided that the second preliminary version of the test would have only 16 items from the remaining objectives of the original test. The results of this second version, which was our pilot study, were analyzed briefly in a previous short article (Perez-Goytia, Dominguez & Zavala, 2010). In that work, we proved that the 16 items in the context of calculus behaved satisfactorily. That is, the results indicated that the TUG-C had

Item of the modified Test of Understanding of Graphs in Kinematics (TUG-K): The following figure shows the velocity versus time graph of an object. At $t = 90$ s, the acceleration of the object is:

(A) -0.22 m/s^2
(B) -0.33 m/s^2
(C) -1.0 m/s^2
(D) -2.0 m/s^2
(E) 20 m/s^2



Item 11 of our Test of Understanding Graphs in Calculus (TUG-C): The following figure shows the graph of $f'(x)$, the first derivative of a function. At $x = 90$, the second derivative of the function is:

(A) -0.22
(B) -0.33
(C) -1.0
(D) -2.0
(E) 20

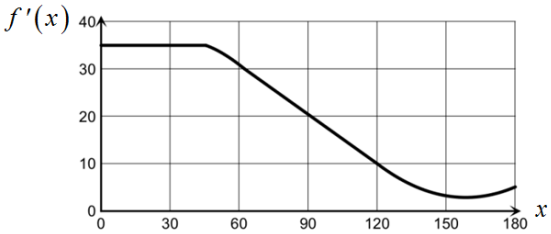


Figure 1. Example of the translation of item 11 of our "Test of Understanding Graphs in Calculus (TUG-C)"

potential to become an appropriate instrument to measure conceptual understanding and graphical interpretation of a function and its derivative.

After this last analysis, we decided to design the final version of the test with the same 16 items, adding some modifications to improve the parallelism of the items. As we will see in the next section, there are several items in the test that are directly related to each other. In this version, we performed several modifications with the distractors and graphs of some items so that the items directly related to each other had the same type of distractors and graphs. This allows us to make direct comparisons between these items (as we will do in the analysis section). In the **Appendix** of this article, we show this last version of the test, which is referred to as the "Test of Understanding Graphs in Calculus (TUG-C)." Note that the order of items in this version is different from the previous versions, since we decided to establish a random item order.

Characteristics of the Test

Table 1 shows a description of the TUG-C (the complete test can be found in the **Appendix**). The table presents a description of the five dimensions of the test, the items included in each dimension, the concept evaluated (the derivative as the slope, the antiderivative as the area under the curve, or either of them) and the specific step evaluated. Moreover, **Table 2** shows a detailed description of the test's 16 items grouped in each of the five dimensions.

Table 1. Description of the Test of Understanding Graphs in Calculus (TUG-C)

Dimension	Description	Items	Concept	Steps evaluated
1	Determine f′(x) from the graph of f(x)	1, 6, 13	The derivative as the slope	*f(x) → f′(x)*
2	Determine f′′(x) from the graph of f′(x)	7, 11, 3		*f′(x)→ f′′(x)*
3	Determine Δf(x) from the graph of f′(x)	5, 14, 15	The antiderivative as the area under the curve	*f′(x) → Δf(x)*
4	Determine Δf′(x) from the graph of f′′(x)	12, 8, 10		*f′′(x)→ Δf′(x)*
5	Determine the corresponding graph from a graph	16, 9, 2, 4	Either of the two concepts can be used	The four steps are evaluated in each of the items: *f(x) → f′(x); f′(x)→ f′′(x); f′(x) → f(x); f′′(x)→ f′(x)*

Table 2. Description of the items of the Test of Understanding Graphs in Calculus (TUG-C)

Dimension	Items (Description)
1	**1.** Determine the positive value of f′(x) from the graph of f(x)
	6. Determine the negative value of f′(x) from the graph of f(x)
	13. Identify the interval in which f′(x) is the most negative in the graph of f(x)
2	**7.** Determine the positive value of f′′(x) from the graph of f′(x)
	11. Determine the negative value of f′′(x) from the graph of f′(x)
	3. Identify the interval in which f′′(x) is the most negative in the graph of f′(x)
3	**5.** Establish the procedure to determine the Δf(x) from the graph of f′(x)
	14. Determine the value of the change the Δf(x) from the graph of f′(x)
	15. Identify the f(x) with the greatest change from several graphs of f′(x)
4	**12.** Establish the procedure to determine the Δf′(x) from the graph of f′′(x)
	8. Determine the value of the change of the Δf′(x) from the graph of f′′(x)
	10. Identify the f′(x) with the greatest change from several graphs of f′′(x)
5	**16.** Determine the corresponding graph of f′(x) from the graph of f(x)
	9. Determine the corresponding graph of f′′(x) from the graph of f′(x)
	2. Determine the corresponding graph of f(x) from the graph of f′(x)
	4. Determine the corresponding graph of f′(x) from the graph of f′′(x)

As shown in **Table 1**, the first four dimensions contain three items, and the fifth dimension contains four items. Dimensions 1 & 2 of both tests are directly related, since both evaluate the understanding of the concept of the derivative as the slope, and dimensions 3 & 4 are also directly related, since both evaluate the understanding of the concept of the antiderivative as the area under the curve. The difference in these related dimensions lies in which step is evaluated. Dimension 1 evaluates the step from f(x) to f′(x), while dimension 2 evaluates the step from f′(x) to f′′(x). On the other hand, dimension 3 evaluates the step from f′(x) to Δf(x), while dimension 4 evaluates the step from f′′(x) to Δf′(x).

Table 2 shows that the related dimensions (dimensions 1 & 2 and dimensions 3 & 4) have related items that evaluate the same concept in the same way, with the only difference being the step evaluated. For example, item 1 of dimension 1 evaluates the determination of the positive value of f′(x) from the graph of f(x), while the related item 7 of dimension 2 evaluates the determination of the positive value of f′′(x) from the graph of f′(x). The three items of the related dimensions 1 & 2 ask: (1) to determine the positive value of a derivative, (2) to determine the negative value of the derivative, and (3) to identify the interval in which the derivative is the most negative. On the other hand, the three items of the related dimensions 3 & 4 ask: (1) to establish the procedure to determine the

change of an antiderivative, (2) to determine the value of the change of an antiderivative, and (3) to identify the variable whose antiderivative has the greatest change in a specific interval. Furthermore, in an overview of the test it is possible to observe relations between the three items of dimensions 1 & 2 and the three items of dimensions 3 & 4. The first two items of each of the dimensions focus on obtaining a value of a variable, and the third item focuses on finding a maximum of this variable.

As shown in **Tables 1** and **2**, dimension 5 evaluates selecting, among different graphs, the correct graph according to the relationships that each item requests. The items in this dimension evaluate each of the steps evaluated in the other four dimensions: (1) from f(x) to f′(x); (2) from f′(x) to f′′(x); (3) from f′(x) to f(x); and (4) from f′′(x) to f′(x). Dimension 5 also has related items that evaluate the same concept in the same way, with the only difference being the step evaluated. Items 16 and 9 evaluate selecting the corresponding graph of the derivative from a graph, while items 2 and 4 evaluate selecting the corresponding graph of the antiderivative from a graph. The main difference, and the reason for it being a dimension in itself, is that dimension 5 is a process from understanding relationships from graph to graph. Dimensions 1-4 are processes from understanding the relationships from an operation of the graph (the slope of the area under the curve). In summary, the eight related items in the test are: 1 and 7, 6 and 11, 13 and 3 in the related dimensions 1 & 2; 5 and 12, 14 and 8, 15 and 10 in the related dimensions 3 & 4; and 16 and 9, 2 and 4 in dimension 5.

Participants

The research was conducted at a large private university in Mexico. The participants in this study were engineering students finishing their introductory calculus-based mechanics course and their first calculus course. The textbook used in the mechanics course was "Physics for Scientists and Engineers" by Serway and Jewett (2008). Students also used the "Tutorials in Introductory Physics" by McDermott, Shaffer, and the Physics Education Research Group (2001). The textbooks used in the calculus course were by Salinas et al. (2000; 2012). This course covers the following main topics: linear function, qualitative analysis of a function and its first and second derivative, quadratic function and Euler's method (interpretation of the area under the curve), analysis of the characteristics, the derivative and applications of different models (polynomial, exponential, sine), and basic integral with a change of variables. The test was administered as a diagnostic test to 144 students who were completing the courses mentioned above, and it did not count towards the final course grades.

ANALYSIS OF THE TEST

In this section, we cover the second objective of this study: to show that the TUG-C is a content-valid and reliable evaluation instrument with adequate discriminatory power according to the analysis recommended by mathematics and science education researchers (Beichner, 1994; Ding et al. 2006, Engelhardt, 2009). We divide this section into two subsections: (1) content validity, and (2) reliability and discriminatory power.

Content Validity

We checked the content validity of the items of the TUG-C. Content validity measures how well the test items cover the content domain they intend to test (Engelhardt, 2009). In evaluating the TUG-C, we asked eight experts (four mathematics faculty members and four physics faculty members) to rate each item with its corresponding objective (1 being the lowest and 5 the highest), in accordance with the procedure established by Engelhardt (2009). Each of the items on the TUG-C was rated with a high score regarding the match between the test item itself and its stated objective. The lowest average score for any item was 4.25 and the highest was 4.88. Moreover, the overall average score was 4.76. These results are evidence of the high content validity of the TUG-C.

Reliability and Discriminatory Power

We also evaluated the reliability and discriminatory power of the TUG-C, performing the five statistical tests suggested by Ding et al. (2006). The first three measures focus on individual test items: the item difficulty index, the item discrimination index, and the item point-biserial. **Table 3** shows these values for each item on the

Table 3. Item difficulty index (*P*), item discriminatory index (*D*), and point-biserial coefficient (r_{pbs}) for each item of the TUG-C

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
P	0.37	0.52	0.53	0.50	0.58	0.47	0.43	0.53	0.61	0.28	0.54	0.66	0.61	0.49	0.26	0.49
D	0.42	0.56	0.72	0.33	0.50	0.83	0.86	0.72	0.64	0.61	0.61	0.64	0.64	0.72	0.75	0.69
r_{pbs}	0.41	0.41	0.57	0.22	0.42	0.63	0.67	0.55	0.46	0.56	0.47	0.49	0.51	0.60	0.63	0.57

TUG-C. The other two measures focus on the test as a whole: the Kuder-Richardson reliability test and Ferguson's delta test. We discuss the results of these five statistical tests below.

Item difficulty index

The item difficulty index (*P*) is a measure of the difficulty of a single test question. A widely-adopted criterion, used by Ding et al. (2006), indicates that the difficulty index should be between 0.3 and 0.9. **Table 3** shows the difficulty index *P* values for each item on the TUG-C. Only two items, items 10 (0.28) and 15 (0.26), have item difficulty indexes slightly lower than desired. Ding et al. also recommended the calculation of the average difficulty value. The criterion range for the average difficulty value is also [0.3–0.9]. For the TUG-C, the average difficulty value is 0.49, which also falls within the suggested range.

Item discrimination index

The item discriminatory index (*D*) is a measure of the discriminatory power of each item on a test. Ding et al. (2006) established two criteria for this index: (1) eliminate items with negative indexes, and (2) the majority of the test items should have a good discrimination index ($D \geq 0.3$). Table 3 shows the discrimination index *D* values for each item of the TUG-C (using the 25%–25% method). We observe that the TUG-C satisfies these two criteria, since there are no negative items, and all of the items have a discrimination index over 0.3. Ding et al. also recommended the calculation of the average discrimination index, suggesting a value of ≥0.3. For the TUG-C the average discriminatory value is 0.64 (using the 25%–25% method), which meets this criterion.

Point-biserial coefficient

The point-biserial coefficient (r_{pbs}) is a measure of the consistency of a single item in relation to the whole test, reflecting the correlation between students' scores on an individual item and their scores on the entire test. A widely-adopted criterion, followed by Ding et al. (2006), is that an item with a satisfactory point-biserial coefficient must be $r_{pbs} \geq 0.2$. **Table 3** shows the point-biserial coefficient for each item on the TUG-C. We can see that all of the TUG-C's items satisfy this condition. Ding et al. also recommended the calculation of the average point-biserial coefficient, with a criterion range of ≥0.2. The average coefficient of the TUV is 0.51, which also satisfies this criterion.

Kuder-Richardson reliability index and Ferguson's delta test

The Kuder-Richardson reliability index is a measure of the self-consistency of a whole test. Ding et al. (2006) state that a test with a reliability index that is higher or equal to 0.7 is reliable for group measures. The index for the TUG-C is 0.81, which meets this criterion. Ferguson's delta test measures the discriminatory power of an entire test by investigating how broadly the total scores of a sample are distributed over the possible range. A widely-adopted criterion, followed by Ding et al., is that a test with a Ferguson's delta of higher than 0.9 offers a good discrimination. Ferguson's delta test for the TUG-C is 0.99, which satisfies this requirement.

Summary of the five statistical tests

We present a summary of the five statistical tests in **Table 4**. From the analysis, we can conclude that the TUG-C is a reliable test with satisfactory discriminatory power.

Table 4. Summary of the results of the five statistical tests suggested by Ding et al. (2006) for the TUG-C

Test statistic	Desired values	TUG-C
Difficulty index	[0.3, 0.9]	Average: 0.49
Discrimination index	≥0.3	Average: 0.64
Point-biserial coefficient	≥0.2	Average: 0.51
Kuder-Richardson reliability index	≥0.7 for group measures	0.81
Ferguson's delta test	>0.9	0.99

ANALYSIS OF STUDENTS' UNDERSTANDING OF THE CONCEPTS OF DERIVATIVE AND ANTIDERIVATIVE

In this section, we cover the third objective of this study: to conduct a detailed analysis of students' understanding of the concepts evaluated by the TUG-C. Specifically, we studied the results of 144 students who had completed their introductory calculus-based mechanics course and their first calculus course.

Overall Performance

The average of the scores of the TUG-C, from the sample of 144 students, is 7.88 of 16 possible points (each test item is worth 1 point). This average, expressed in percentage of the total possible points, is 49%, which corresponds to the average difficulty index value (0.49) shown in the previous section. The distribution of scores was significantly non-normal (Kolmogorov-Smirnov, D (144) = 0.093, p<0.01; Shapiro-Wilk test, W (144) = 0.965, p<0.01). The skewness of the distribution of scores is 0.152 (SE=0.202), indicating a pile-up to the right, and the kurtosis of the distribution is -0.991 (SE=0.401), indicating a flatter than normal distribution. The positive skew indicates that the test is difficult for the students. For this type of distribution, it is more useful to use quartiles as measures of spread. The median of the distribution is 8, the bottom quartile (Q1) is 4.25, and the top quartile (Q3) is 11, so the interquartile range is 6.75. In this overall analysis, it is noteworthy that the students at the median (8) had difficulty answering correctly eight questions (out of 16) on the TUG-C.

The overall results show that this is not an easy test. Students struggle with questions they may not familiar with. However, the concepts included in the tests are taught in their courses, but probably not in the same way, the test presents them. That the test's statistical tests are satisfactory means that students answer the questions engaged and with interest, even if the questions are not presented in the way they are used to.

Performance on Three Representative Items of the Test

In this subsection, we conduct a qualitative analysis regarding students' performance on three representative items of the test: 1, 14 and 16 (see **Table 5** and the **Appendix**). As shown in **Table 1**, item 1 evaluates the concept of the derivative as the slope, item 14 assesses the concept of the antiderivative as the area under the curve, and item 16 evaluates the use of either of the two concepts to determine the corresponding graph from a specific graph.

Table 5. The five dimensions evaluated in the TUG-C, the description of the items, and the percentages selecting a particular choice for each item. (Note that the correct answer is in boldface.)

Dim.	Items description	A	B	C	D	E
1	**1.** Determine the positive value of f′(x) from the graph of f(x)	12%	9%	**37%**	26%	15%
	6. Determine the negative value of f′(x) from the graph of f(x)	**47%**	11%	8%	24%	10%
	13. Identify the interval in which f′(x) is the most negative in the graph of f(x)	13%	**61%**	10%	11%	5%
2	**7.** Determine the positive value of f′′(x) from the graph of f′(x)	**43%**	6%	25%	17%	10%
	11. Determine the negative value of f′′(x) from the graph of f′(x)	15%	**54%**	9%	13%	8%
	3. Identify the interval in which f′′(x) is the most negative in the graph of f′(x)	6%	22%	10%	9%	**53%**
3	**5.** Establish the procedure to determine the Δf(x) from the graph of f′(x)	3%	**58%**	33%	3%	3%
	14. Determine the value of the Δf(x) from the graph of f′(x)	7%	**49%**	13%	24%	7%
	15. Identify the f(x) with the greatest change from several graphs of f′(x)	**26%**	29%	12%	31%	2%
4	**12.** Establish the procedure to determine the Δf′(x) from the graph of f′′(x)	**66%**	18%	7%	6%	3%
	8. Determine the value of the Δf′(x) from the graph of f′′(x)	15%	11%	10%	**53%**	10%
	10. Identify the f′(x) with the greatest change from several graphs of f′′(x)	8%	**28%**	4%	31%	28%
5	**16.** Determine the corresponding graph of f′(x) from the graph of f(x)	3%	27%	14%	**49%**	7%
	9. Determine the corresponding graph of f′′(x) from the graph of f′(x)	3%	13%	19%	**61%**	5%
	2. Determine the corresponding graph of f(x) from the graph of f′(x)	9%	**52%**	2%	24%	12%
	4. Determine the corresponding graph of f′(x) from the graph of f′′(x)	**50%**	3%	13%	6%	28%

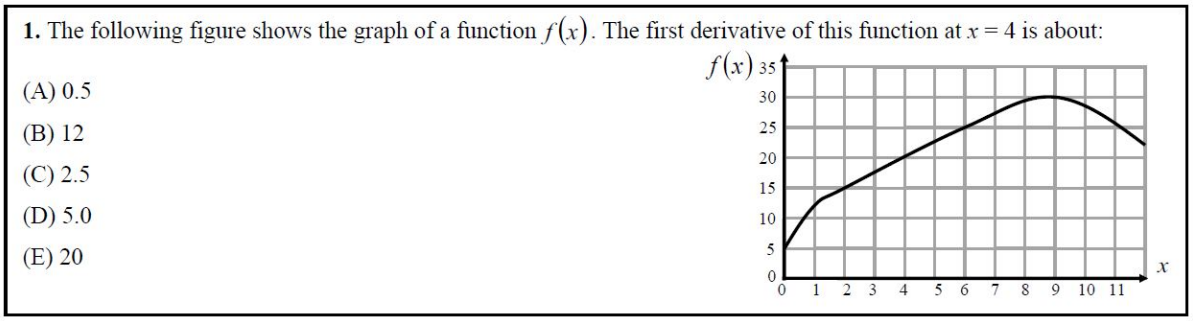


Figure 2. Item 1 of our "Test of Understanding Graphs in Calculus (TUG-C)"

Figure 2 presents item 1 that evaluates the concept of the derivative as the slope asking to determine the positive value of f′(x) at a point from the graph of f(x). Only 37% of students select the correct option C. The most frequent error is to obtain this value dividing the ordinate by the abscissa of the point on the graph that is not valid in this situation (option D, 26%). Moreover, two other incorrect options are selected in similar proportions, above 10%: selecting the ordinate of the point (option E, 15%), and calculating the value of a "slope" by counting squares (option A, 12%).

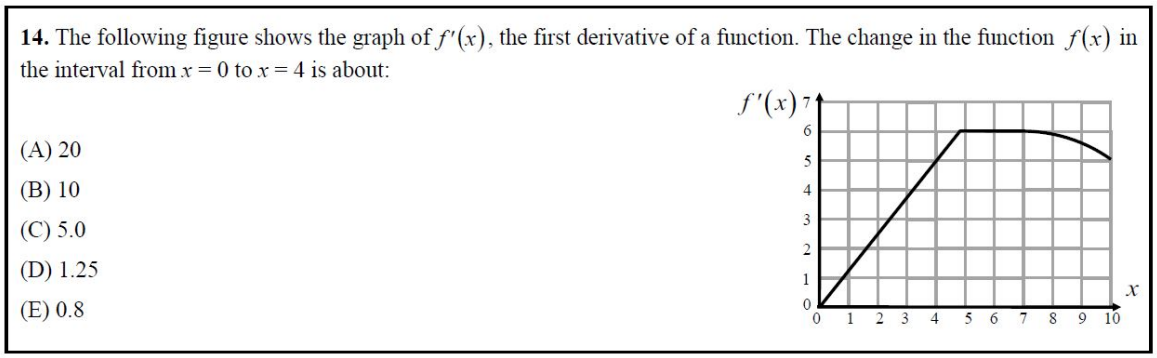


Figure 3. Item 14 of our "Test of Understanding Graphs in Calculus (TUG-C)"

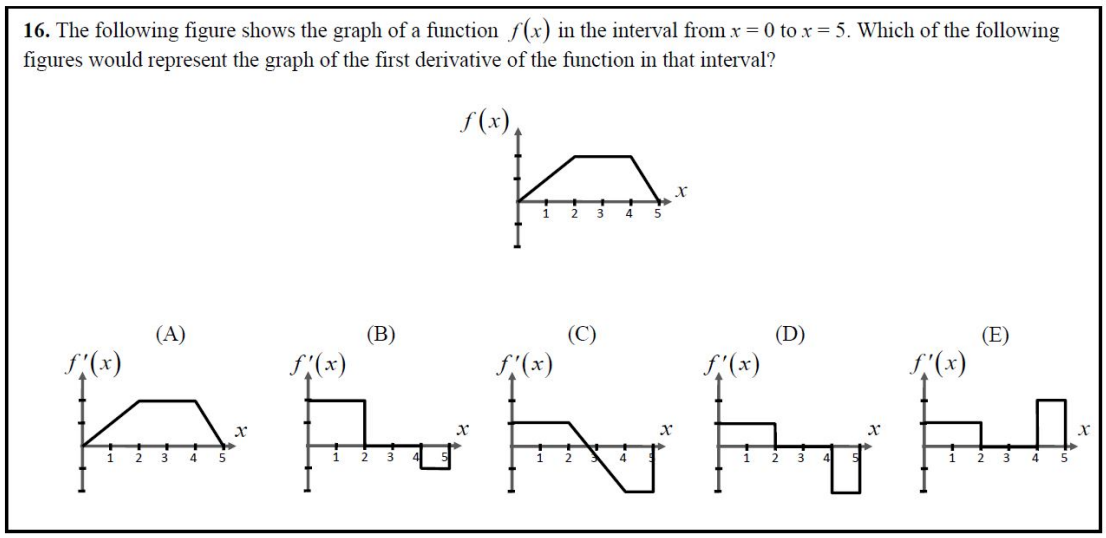


Figure 4. Item 16 of our "Test of Understanding Graphs in Calculus (TUG-C)"

Figure 3 presents item 14 that evaluates the concept of the antiderivative as the area under the curve asking to determine the value of the change Δf(x) in an interval from the graph of f'(x). In this item, 49% of students select B, the correct option. The most frequent error is to use the correct procedure to calculate the slope in the interval instead of the area under the curve (option D, 24%). The other three incorrect options are selected in similar proportions. In one of them, students select the ordinate value of the point on the right in the interval, $x = 4$ (option C, 13%). In another, students use an incorrect procedure to calculate the slope of the curve in the interval, dividing the abscissa by the ordinate of the point on the right in the interval (option E, 7%). On the other, students multiply the abscissa by the ordinate of the point on the right in the interval (option A, 7%). It is interesting to notice that the latter multiplication is part of the correct procedure to calculate the area under the curve, but students do not divide this multiplication by two.

Figure 4 presents item 16 that evaluates the determination of the corresponding graph of f'(x) from the graph of f(x). In this item, 49% of students select D, the correct option. In the most frequent error students seem to understand the shape the graph should have but have difficulties relating the relative values of the slopes of the graph, opting for a relationship opposite to the correct one (option B, 27%). In the second most frequent error, students make a mistake only in the section of the graph in which the derivative is zero. Instead of setting a step-type graph with a value of zero in this interval, students choose option C (14%), in which the derivative value decreases uniformly in that interval. Finally, in the third most frequent error (option E, 7%), students only make a mistake with the sign of the value of the slope in the last section of the graph.

Table 6. Correct answer percentages of the related items, correct answer percentages of students selecting the correct choice in both of the related items, and correct answer averages percentages of each dimension

Description of items that evaluate the concept of the derivative	**Item**	**Dim. 1**	**Item**	**Dim. 2**	**Both correct**
Determine the positive value of the derivative	1	37%	7	43%	24%
Determine the negative value of the derivative	6	47%	11	54%	38%
Identify the interval in which the derivative is the most negative	13	61%	3	53%	48%
Average of the dimension		**48%**		**50%**	

Description of items that evaluate the concept of the antiderivative	**Item**	**Dim. 3**	**Item**	**Dim. 4**	**Both correct**
Establish the procedure to determine the change of the antiderivative	5	58%	12	66%	48%
Determine the value of the change of the antiderivative	14	49%	8	53%	40%
Identify the variable whose antiderivative has greatest change in a specific interval	15	26%	10	28%	21%
Average of the dimension		**44%**		**49%**	

Description of items that can be solve using the concepts of derivative and/or the antiderivative	**Item**	**Dim. 5**	**Related to**	**Both correct**
Determine the corresponding graph of the derivative from a graph	16	49%	Dim.1	35%
	9	61%	Dim. 2	
Determine the corresponding graph of the antiderivative from a graph	2	52%	Dim. 3	30%
	4	50%	Dim. 4	
Average of the dimension		**53%**		

Items and Dimensions

Table 6 shows the proportion of students selecting the correct choice of the related items, the proportion of students selecting the correct choice in both of the related items, and the average of the correct choice of each dimension.

From **Table 6**, we can note three issues regarding these results. The first is that the five dimensions have very close average values, ranging from 44% to 53%. The second is that the value of these averages is relatively low, around 50%. These results show that students have similar difficulties with the concepts evaluated in the test. Moreover, the third is that individual results for the items range from 26% for item 15 to 66% for item 12. It shows that the concepts evaluated in all items of the test are difficult for students, since in the item with the highest percentage (item 12), a third of the students showed difficulties to answer the question correctly.

In the following subsection, we present two analyses. In the first, a comparison of the related items of the test; and in the second, we cluster the items of the test according to levels of difficulty.

Related items in the test

The related items evaluate the same concept in the same way, with the only difference being the step evaluated. Therefore, it is relevant for instructional reasons to perform a comparison of the correct answers to these related items. When we qualitatively compare the proportion of students answering the related items correctly, we observe that they are very similar. Moreover, comparing students' correct answers in these related items using the chi-square test following the procedure described by Sheskin (2007), we found no significant differences in choosing the correct answer in any of the related items.

When we observe that there is no significant difference in the selection of the correct answer in the related items, we could think that there is consistency in students' answers, that is, the majority of students who correctly answer the item that evaluates the first step, also correctly answer the item that evaluates the second step. However, when we perform a cross-analysis showing the proportion of students answering both related items correctly (see **Table 6**), we observe that in several related items this proportion is considerably lower than that for each of the items. Therefore, a considerable number of students correctly answer one of the items but incorrectly answer the other.

For example, for items 1 and 7 of dimensions 1 and 2 (37% and 43% of students answering correctly, respectively) we notice that 24% of the total students answered both items correctly, that is, 65% of students answering item 1 correctly, answer item 7 correctly. We also notice that 13% of students answered item 1 correctly, which evaluates the first step, but answered item 7 incorrectly, which evaluates the second step, and that 19% of students answered item 7 correctly but answered item 1 incorrectly.

For items 5 and 12 of dimensions 3 and 4 (58% and 66% of students answering correctly, respectively), we observe that 48% of students answered both items correctly, that is, 83% of students who answered item 5 correctly, answered item 12 correctly. We also observe that 10% of students answered item 5 correctly, which evaluates the first step, but answered item 12 incorrectly, which evaluates the second step, and that 18% of students answered item 12 correctly but answered item 5 incorrectly.

Finally, for items 16 and 9 of dimension 5 (49% and 61% respectively), we observe that 35% of students answered both items correctly, that is, 71% of students who answered item 16 correctly, also answered item 9 correctly. We also observe that 14% of students answered item 16 correctly, which evaluates the first step, but answered item 9 incorrectly, which evaluates the second step, and that 26% of students answered item 9 correctly but answered item 16 incorrectly.

We can hypothesize that only when a student answers the two related items correctly, he or she may have a complete understanding of the concept. From **Table 6**, we observe that the proportion of students having a complete understanding of the concept is quite low and range from 21% for items 15 and 10 to 48% for items 13 and 3, and 5 and 12. There is a considerable proportion of students showing only a partial understanding of the concept since they answer one related item correctly but the other incorrectly.

Cluster of items according to difficulty level

According to **Table 6**, the most difficult items are those from dimension 3 & 4, which evaluate the identification of the variable whose antiderivative has the greatest change in a specific interval. Only 26% of students answered item 15 correctly, which evaluates the first step (from $f'(x)$ to $f(x)$) and only 28% of students answered item 10, which evaluates the second step (from $f''(x)$ to $f'(x)$). These two items have in common that they assess the maximum value of an antiderivative in an interval.

These two questions ask students to choose a graph that has the greatest change of a function (the function for item 15 and the first derivative of the function for item 10) given the graph of the derivative (the first derivative for item 15 and the second derivative for item 10). As we have seen in other items, some students confuse the concept of the slope with the concept of the area under the curve. Therefore, these two questions have some items that might be attractive to those students since in option D for item 15 and option D for item 10 the slope changes continuously. Other students might be confused by the word change by thinking about the change of the function in the graphs. In that case, options C and E for item 15 and options A and C for item 10 change; moreover, in option B for item 15 and option E for item 10, the function changes more since it goes from zero to the maximum and then back to zero. What is not attractive for all those students is option A for item 15 and option B for item 10, which are the correct answers, since in those options neither the slope of the function nor the function change in the interval. These items could represent good discriminatory items for those who understand the concept of the antiderivative as the area under the curve. **Table 3** shows the item discrimination index, which is a measure of the discriminatory power of each item on a test. Item 15 is considerably above average (0.75 vs average = 0.64) and item 10 is slightly

below average (0.61). This index is the discriminatory power concerning the test as a whole; it would probably be better for item 10 if we take only the items that correspond to the concept of the antiderivative. On the other hand, the two items have an above average point-biserial coefficient, which is a measure of the correlation between students' scores on an individual item and their scores on the entire test (0.63 for item 15 and 0.56 for item 10 vs average = 0.51). Actually, item 15 is the second highest in the table.

Table 6 also shows the easiest items, which are two groups of related items. The first group is from the items of dimensions 3 & 4 (items 5 and 12 respectively, which evaluate the account of the procedure to determine the change of an antiderivative. Item 5, which evaluates the first step (from $f'(x)$ to $\Delta f(x)$), was answered correctly by 58% of students, and 66% of students answered correctly item 12, which evaluates the second step (from $f''(x)$ to $\Delta f'(x)$). The second group of related items comes from dimensions 1 & 2 (items 13 and 3 respectively), which evaluate the identification of the interval in which the derivative is the most negative. Item 13, which evaluates the first step (from $f(x)$ to $f'(x)$), was answered correctly by 61% of students, and 53% of students answered correctly item 3, which evaluates the second step (from $f'(x)$ to $f''(x)$). The items of these groups have in common that to solve them it is not necessary to make accurate calculations.

Items 5 and 12 (dimensions 3 & 4, respectively) correspond to items in which students have to choose, among different descriptions, the one that represents the concept of the antiderivative as the area under the curve. Items 14 and 8 are items that evaluate the same concept, but in these two cases, students are asked to calculate the change instead of choosing a procedure. The results of students in these two items are considerably better than those of items 5 and 12. It seems that the correct answer to items 5 and 12 attract not only those students able to do the procedure without saying what the procedure is but also, those students who, while presenting the question, would not be able to do it by themselves.

Finally, from **Table 6**, we observe that the other five groups of related items have a medium difficulty level. These groups of items evaluate the determination of the positive and negative value of the derivative (two groups, dimensions 1 & 2), the determination of the change of the antiderivative (one group, dimensions 3 & 4), and the determination of the corresponding graph of the derivative or the antiderivative from a graph (two groups, dimension 5). The items from these five groups have in common that, to solve them, it is necessary to make accurate calculations, unlike the items of the groups that were the easiest and the most difficult for students. This type of calculations are necessary in all of the items of dimension 5 while choosing the correct graphs, since in all items there are incorrect graphs very similar to the correct choice but with slight differences (e.g., the incorrect option B in item 16), and students need to do quality calculations to choose the correct answer.

Most Frequent Errors

In this subsection, we present an overall analysis of the most frequent errors in the items (a) from the related dimensions 1 & 2, (b) from the related dimensions 3 & 4, and (c) from dimension 5. **Table 5** shows the five dimensions evaluated in the TUG-C, the items' descriptions, the results for each option of the items. Note that the percentages of the correct answers correspond to the difficulty indices shown in **Table 3**.

Items of the related dimensions 1 & 2

The items of these dimensions evaluate students' understanding of the concept of the derivative as the slope. Dimension 1 evaluates the determination of $f'(x)$ from the graph of $f(x)$, and dimension 2 evaluates the determination of $f''(x)$ from the graph of $f'(x)$.

Dimensions 1 & 2 have two items that evaluate the determination of a positive and a negative value of a derivative at a point of a curve (dimension 1: items 1 and 6; dimension 2: items 7 and 11). **Table 5** shows that, for all the items, the most frequent error is obtaining this value by dividing the ordinate by the abscissa of the point in the graph (item 1: option D, 26%; item 6: option D, 24%; item 7: option C: 25%; item 11: option A, 15%). It is important to note that in the items in which the derivative is negative (items 6 and 11), students add a negative sign to the

obtained value. An interesting tendency is that the proportion of students answering correctly is higher for items with a negative derivative than it is for items with a positive derivative.

This error is also rather common in the context of kinematics (Beichner, 1994) but in that case, the misunderstanding comes from the conception that velocity (or acceleration) is distance divided by time (velocity divided by time). In this case, the error could come from the way in which students are interpreting the derivative, df/dx, which could be, as in kinematics, a ratio of two quantities, the function and x.

Dimensions 1 & 2 have a third item which evaluates the identification of the interval in which the derivative is the most negative. Dimension 1 evaluates the identification of the interval in which f′(x) is the most negative in the graph of f(x) (item 13), and dimension 2 evaluates the identification of the interval in which f′′(x) is the most negative in the graph of f′(x) (item 3). In these two items, we observe two frequent errors: the choosing of an interval in which the derivative is negative but not the most negative (item 13: option D, 11%; item 3: option B, 22%), and the choosing of the point in which the graph has a minimum value (item 13: option A, 13%; item 3: option C, 10%).

An interesting result is that these two errors, an interval in which the derivative is negative and has the most negative value, are connected. Some students choose the former because, in that interval, not only the slope is negative, but the function also becomes negative. The last point of the interval is the most negative value of the function in the graph for both items.

Items of the related dimensions 3 & 4

The items of these dimensions evaluate students' understanding of the concept of the antiderivative as the area under the curve. Dimension 3 evaluates the determination of Δf(x) from the graph of f′(x), and dimension 4 evaluates the determination of Δf′(x) from the graph of f′′(x).

Dimensions 3 & 4 have an item that evaluates the account of the procedure to determine the change of an antiderivative in an interval from a graph (dimension 3: item 5; dimension 4: item 12). Note that the slope of the curves is constant in the interval. As shown in **Table 5**, the most frequent error in these two items is to account for the procedure to calculate the slope of the curve instead of the area under the curve (item 5: option C, 33%; item 12: option B, 18%).

These dimensions also have an item that evaluates the determination of the value of the change of an antiderivative. Item 14 evaluates the determination of the value of Δf(x) from the graph of f′(x) (dimension 3), and item 8 evaluates the determination of the value of Δf′(x) from the graph of f′′(x) (dimension 4). We observe a pattern: the sum of the percentages of the two answers in which students use correct or incorrect procedures to calculate the slope of the curve, instead of the area under the curve, are similar in the two items, and these two answers are the most frequent errors in both items. The first incorrect choice is to use the correct procedure to calculate the slope in the interval instead of the area under the curve (item 14, option D: 24%; item 8, option B: 11%). The second incorrect choice is to use an incorrect procedure to calculate the slope of the curve in the interval (item 14, option E: 7%; item 8, option A: 15%). The sum of these percentages is 31% for item 14 and 26% for item 8. The difference between these sums is minimal (only 5%), and these two choices together are the most frequent errors in both items.

It seems that the most important challenge for instruction is that the concept of the antiderivative as the area under the curve is misunderstood for that of the derivative as the slope. For students, and probably more commonly for first-year students, the slope is the concept they learn. Thus, they resort to it even in cases in which it does not apply.

Dimensions 3 & 4 have a third item that evaluates the identification of the variable whose antiderivative has the greatest change in a specific interval (dimension 3, item 15; dimension 4, item 10). In these two items, we found the same two most frequent errors. In the first most frequent error, students do not choose the graph of the curve with the greatest area under the curve in the interval, but rather the graph of a curve whose slopes in the

interval are always increasing (item 15 option D, 31%; item 10: option D, 31%). In these items, students seem to be thinking in terms of the slope as in the previous items of these dimensions. This item asks for a variable with the greatest change in the interval and students choose the curve that has the greatest change in positive slopes. The second most frequent error in these items is choosing a graph of a curve that increases in the middle of the interval and decreases in the other half (item 15: option B, 29%; item 10: option E, 28%). (The curve is like an inverted parabola. The left point of the interval is (0, 0) and the right point of the interval is (constant, 0); therefore, the vertical change of the curve in the interval is zero).

In these errors, students seem to be thinking in terms of two resources, which are different ways of thinking about a situation (Hammer, 2000). The first resource is to think in terms of the slope: this item asks for a variable with the greatest change in the interval, and students choose the curve that has the greatest change in slope as it begins in a high positive value and ends at the same value, but negative. The second resource is to think in terms of the vertical value. Although the vertical change is zero in the curve of the graph, students seem to think in terms of the vertical value, and conclude that this curve has the greatest vertical change since it "rises and falls" (as interviews with some students have revealed).

Items of dimension 5

The four items of dimension 5 evaluate the determination of the corresponding graph from a graph. Students can solve these items using either of the two concepts evaluated in the first four dimensions: the concept of the derivative as the slope and/or the concept of the antiderivative as the area under the curve.

As shown in **Table 6**, two items of this dimension evaluate the determination of the corresponding derivative graph from a graph (items 16 & 9). Item 16 evaluates the determination of the corresponding f′(x) graph from the f(x) graph, and item 9 evaluates the determination of the corresponding f′′(x) graph from the f′(x) graph. The two most frequent errors in these two related items are very similar (see **Table 5**). In item 16, the most frequent error corresponds to a graph in which students seem to understand the shape the graph should have, but have difficulties relating the values of the slopes of the graph, opting for a relationship opposite to the correct one (option B, 27%). In item 9, the most frequent error corresponds to a graph in which students also seem to understand the shape the graph should have, but have difficulties relating the values of the slopes of the graph, choosing absolute values for the slopes (option C: 19%; see item 9 in the **Appendix**). In these two items, the second most frequent errors are the same (item 16: option C, 14%; item 9: option B, 13%). In these choices, students make mistakes only in the sections of the graph in which the derivative is zero. Instead of setting a step type graph with a value of zero in this section, students choose the option in which the constant values are connected by a straight line.

Interestingly, the differences in the first most common error in both items appear to be due to slight differences in the graph shown. The first section of the graph of item 9 goes from negative values to positive values, which is different from what happens in the first section of item 16, which has only positive values. This subtle difference between the graphs (which is not important to the expert) seems to have a certain effect on the errors that are triggered in students. This is consistent with studies of science education that mention that superficial features of problems are very important for novices (Leonard, Gerace & Dufresne, 1999).

There are two other items of dimension 5, which evaluate the determination of the corresponding graph of the antiderivative from a graph (items 2 & 4). Item 2 evaluates the determination of the corresponding f(x) graph from the f′(x) graph, and item 4 evaluates the determination of the corresponding f′(x) graph from the f′′(x) graph. These two related items have the same most frequent error (item 2: option D, 24%; item 4: option E, 28%). In this choice, students seem to understand the shape of the antiderivative graph, but have difficulties relating the absolute values of the slopes of the sections with slopes different from zero, opting for a relationship opposite to the correct one (see items 2 & 4 in the **Appendix**).

RECOMMENDATIONS FOR INSTRUCTION

This section addresses the fourth objective of the study: to establish recommendations for instruction of the concepts of derivative and antiderivative based on the results obtained from the TUG-C. McDermott (2001) suggests that every curricular change should originate from the research on students' understanding. The previous analysis of student performance presented in this article is part of such research on students' understanding of the concept of the derivative as the slope and the concept of the antiderivative as the area under the curve in the context of calculus. Also, it allows us to establish specific recommendations for instruction on these concepts. Next, we summarize the most important findings derived from our analysis of the students' performance, and then we make some recommendations for instruction.

Since the distribution of the students' scores in the test shows a positive skew, we can state that the test presents numerous challenges for students. We noticed that students who are at the median of the distribution (8) had difficulty answering correctly 8 out of 16 items on the test. Since the topics covered on the test are concepts that the students should have learned in early mathematics and science courses at the university level, this result shows the need to modify instruction in order to increase students' conceptual understanding of the concepts of the derivative and the antiderivative.

Moreover, we observe that the value of the average of correct answers for every dimension is relatively low, tending to 50%, and that students have similar difficulties in these five dimensions. This shows that the need to modify the instruction should be done in the instruction of the skills and concepts evaluated in all of the five dimensions of the test.

Interestingly, in our analysis we found no significant differences when choosing the correct answer in any of the related items of the test. From this we notice: (a) that students' performance in the items of the dimension 1, that evaluate the determination of $f'(x)$ from the graph of $f(x)$, is similar to students' performance in the items of the dimension 2, that evaluate the determination of $f''(x)$ from the graph of $f'(x)$; (b) that students' performance in items of the dimension 3, that evaluate the determination of $\Delta f(x)$ from the graph of $f'(x)$, is similar to the students' performance in the items of dimension 4, that evaluate the determination of $\Delta f'(x)$ from the graph of $f''(x)$; (c) that students' performance in the items that evaluate the determination of the corresponding graph of the derivative from a graph in the two steps evaluated in the test is similar, and (d) that students' performance in the items that evaluate the determination of the corresponding graph of the antiderivative from a graph in the two steps evaluated in the test is also similar. These results could be positive, since we can infer that students are learning no matter whether we talk about the function, its first derivative or the second derivative. This could mean that students have a level of understanding of the relationships of derivatives and antiderivatives no matter the derivative order, which is encouraging. However, taking into account the low performance of students in the test we can also think that they are similarly lacking in understanding of the relationships in calculus, particularly in graphs. Also, if we take into account that only a student who answered the two related items correctly, has a complete understanding of the concept, from **Table 6**, we observe that the proportion of students having a complete understanding of the concept is quite low and range from 21% for items 15 & 10 to 48% for items 13 & 3 and 5 & 12. There are a considerable proportion of students showing only a partial understanding of the concept, since they answer one related item correctly but the other incorrectly.

According to the classification of items by difficulty level, the most difficult items for students are the items of dimensions 3 & 4 that evaluate the identification of the variable whose antiderivative has the greatest change in a specific interval. These items have in common that they assess the maximum value of the antiderivative in an interval. Therefore, a general instructional recommendation is to specifically focus on teaching the skills to solve this type of items.

McDermott (2001) proposes also that persistent conceptual errors must be explicitly addressed during instruction. We identified the most frequent error for the related items of the test. Mathematics and Science teachers can use this catalog of errors when planning their instruction for the concepts of the derivative and the

antiderivative. Moreover, analyzing the most frequent errors identified in the previous section, we noticed that there are four errors that have a percentage of selection higher than 20% in both related items. The first error is to obtain the value of a derivative at a point of a curve (that is positive derivative) by dividing the abscissa by the ordinate of the point in the graph (item 1: option D, 26%; item 7: option C: 25%). The second and third errors are in the two items that evaluate the identification of the variable whose antiderivative has the greatest change in a specific interval. In these two items, we found that students don't choose the graph of the curve with the greatest area under it, but a graph of a curve whose slopes in the interval are always increasing (item 15: option D, 31%; item 10: option D, 31%), and a graph of a curve that increases in the middle of the interval and decreases in the other half (item 15: option B, 29%; item 10: option E, 28%). Finally, the fourth error can be found in the items that evaluate the determination of the corresponding graph of the antiderivative from a graph. In this error, students seem to understand the general shape of the antiderivative graph, but have difficulties relating the absolute values of the slopes of the sections with slopes different from zero, choosing a relationship opposite to the correct one (item 2: option D, 24%; item 4: option E, 28%). We recommend that mathematics and science teachers focus on these errors in particular when planning their instruction. The instructional materials that help to teach these topics should include sections in which students reflect on their own learning to realize that the concept and procedure of calculating a first derivative from a function are the same as that of calculating a second derivative from the first derivative of the function. The materials should also include sections in which students reflect to realize that the concept and procedure of calculating a change in a function from the graph of the first derivative are the same as calculating the change of the first derivative from the graph of the second derivative.

CONCLUSION

In this article, we first presented the "Test of Understanding Graphs in Calculus (TUG-C)" and its design process. Later, we showed that the TUG-C is a content-valid and reliable evaluation instrument with satisfactory discriminatory power according to the analysis recommended by mathematics and science education researchers (Beichner, 1994; Ding et al. 2006, Engelhardt, 2009). Then, we conducted a detailed analysis of students' understanding of the concept of the derivative as the slope and the concept of the antiderivative as the area under the curve evaluated in the TUG-C. Finally, we outlined specific recommendations, based on the previous analysis, for the instruction of these concepts.

This article has two main implications. The first is that the test presented in the **Appendix** can be used by mathematics or science education researchers, and by teachers covering these concepts. It is important to note that the TUG-C is the first test for evaluating students' understanding of the concept of the derivative as the slope and the concept of the antiderivative as the area under the curve in the context of calculus that satisfies all the criteria recommended by mathematics and science education researchers. The test could be used to analyze students' understanding of these concepts in different institutions, to investigate students' learning performance, and to test the effectiveness of new instructional material based on research designed to increase student knowledge and understanding (Hake, 1998; Redish, 1999). The second implication is that the instructional recommendations established in this article could also be taken into account by researchers and teachers, and could guide the design of new instructional material intended to increase students' understanding of these concepts.

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APPENDIX

DIAGNOSTIC QUESTIONNAIRE

Notice that all the graphs in this questionnaire refer to a function f which depends on x, that is $f(x)$. Also, note that $f'(x)$ corresponds to the first derivative of the function with respect to x, and $f''(x)$ is the second derivative of the function with respect to x. Moreover, $f(x)$, $f'(x)$ and $f''(x)$ are graphed with respect to x, this means x is the variable on the horizontal axis.

1. The following figure shows the graph of a function $f(x)$. The first derivative of this function at x = 4 is about:

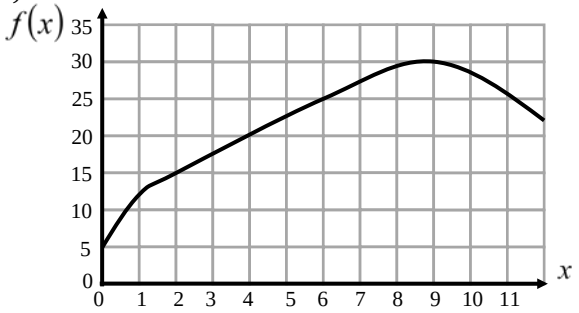
(A) 0.5

(B) 12

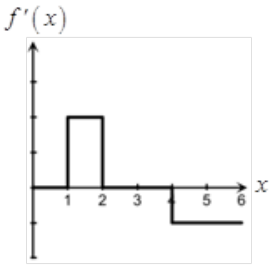
(C) 2.5

(D) 5.0

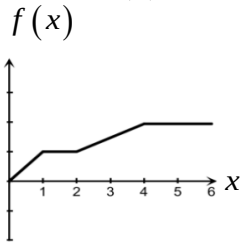
(E) 20



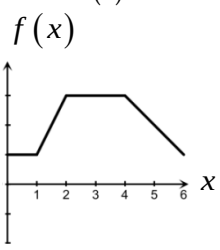
2. The following figure shows the graph of $f'(x)$, the first derivative of a function, in the interval from x = 0 to x = 6. Which of the following figures would represent the graph of the function $f(x)$ in that interval?



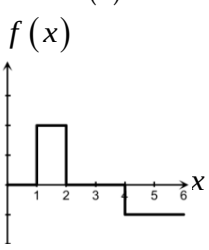
(A)



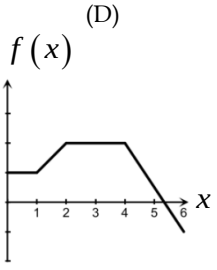
(B)



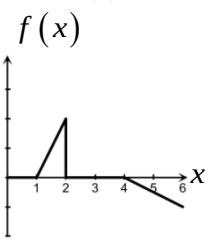
(C)



(D)



(E)



3. The following figure shows the graph of $f'(x)$, the first derivative of a function. Which of the following options corresponds to the case when the second derivative of the function is the most negative?

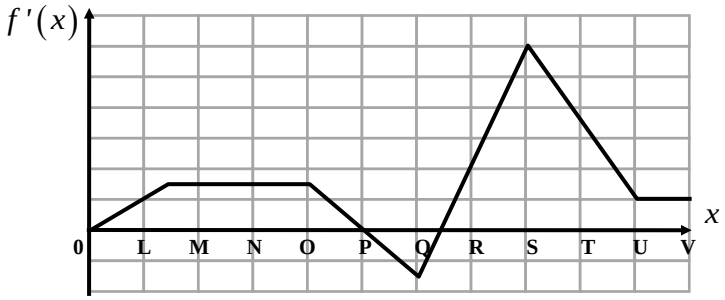
(A) Q to S

(B) O to Q

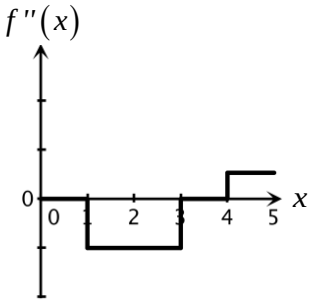
(C) at Q

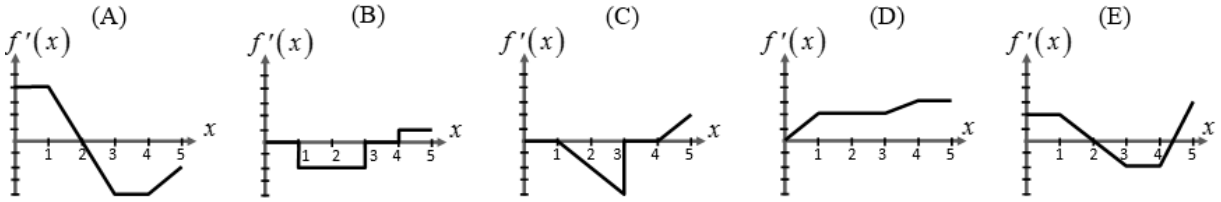
(D) at S

(E) S to U



4. The following figure shows the graph of $f''(x)$, the second derivative of a function, in the interval from $x = 0$ to $x = 5$. Which of the following figures would represent the graph of the first derivative of the function in that interval?





5. The following figure shows the graph of $f'(x)$, the first derivative of a function. If you wanted to know the change in the function $f(x)$ in the interval from $x = 0$ to $x = 2$, from the graph you would:

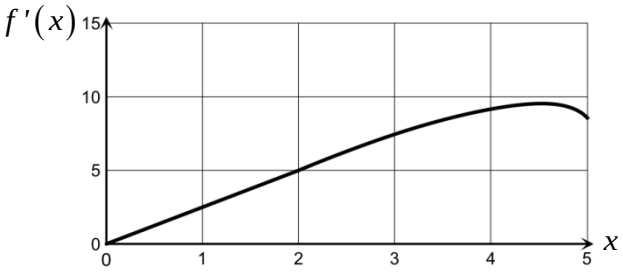
(A) Read 5 directly off the vertical axis.

(B) Find the area between the line and the horizontal axis by calculating $\frac{5*2}{2}$.

(C) Find the slope of that line segment by dividing 5 by 2.

(D) Find the value multiplying 5 by 2.

(E) Find the value by dividing 2 by 5.



6. The following figure shows the graph of a function $f(x)$. The first derivative of this function at $x = 8$ is about:

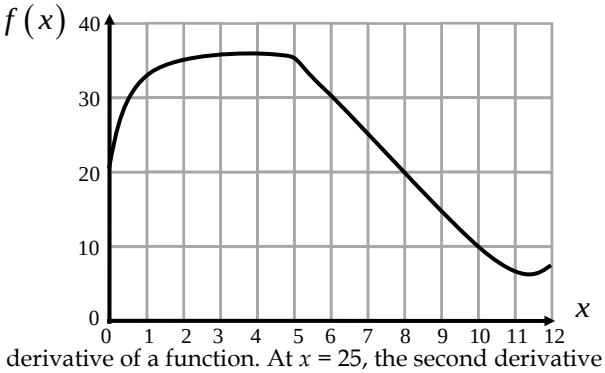
(A) -5.0

(B) -2.0

(C) -0.5

(D) -2.5

(E) 20



7. The following figure shows the graph of $f'(x)$, the first derivative of a function. At $x = 25$, the second derivative of the function is about:

(A) 8.0

(B) 2.0

(C) 4.0

(D) 100

(E) 60

8. The following figure shows the graph of $f''(x)$, the second derivative of a function. The change in the first derivative of the function in the interval from $x = 0$ to $x = 3$ is about:

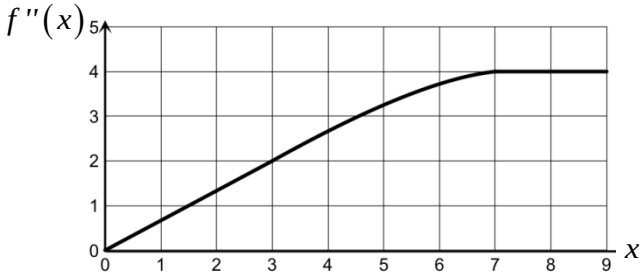
(A) 1.5

(B) 0.67

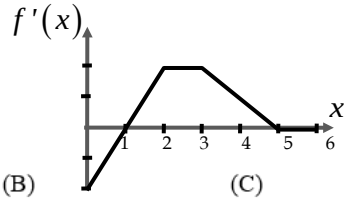
(C) 2.0

(D) 3.0

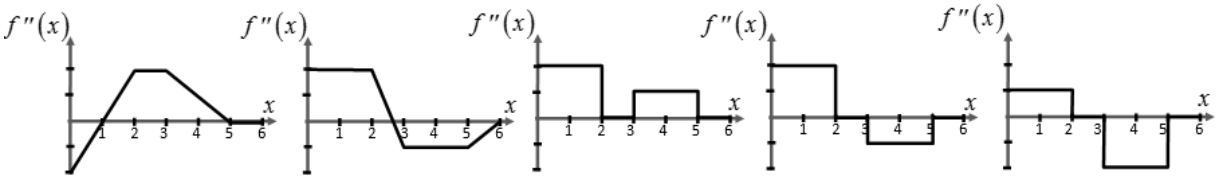
(E) 6.0



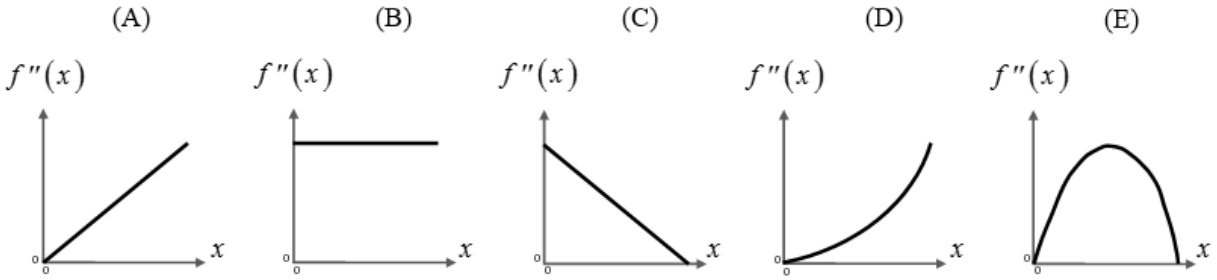
9. The following figure shows the graph of $f'(x)$, the first derivative of a function, in the interval from $x = 0$ to $x = 6$. Which of the following figures would represent the graph of the second derivative of the function in that interval?



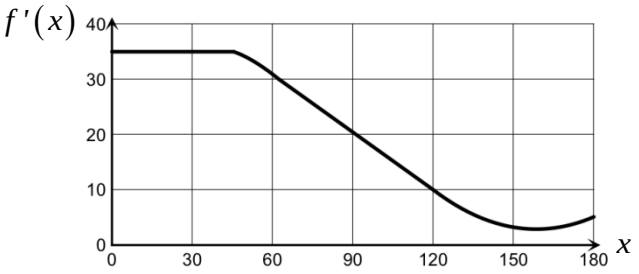
(A) (B) (C) (D) (E)



10. Graphs of the second derivative for five functions are shown below. All axes have the same scale. Which of the following graphs corresponds to the function with the greatest change in its first derivative in the interval?



11. The following figure shows the graph of $f'(x)$, the first derivative of a function. At x = 90, the second derivative of the function is about:



(A) -0.22

(B) -0.33

(C) -1.0

(D) -2.0

(E) 20

12. The following figure shows the graph of $f''(x)$, the second derivative of a function. If you wanted to know the change in the first derivative of the function in the interval from x = 0 to x = 3, from the graph you would:

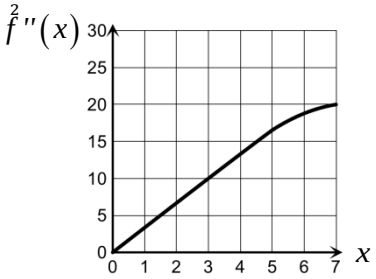
(A) Find the area between the line and the horizontal axis by calculating $\frac{10*3}{2}$. $\frac{10*3}{2}$

(B) Find the slope of that line segment by dividing 10 by 3.

(C) Read 10 directly off the vertical axis.

(D) Find the value by dividing 3 by 10.

(E) Find the value by multiplying 10 by 3.



13. The following figure shows the graph of a function $f(x)$. Which of the following options corresponds to the case when the first derivative of the function is the most negative?

(A) at I

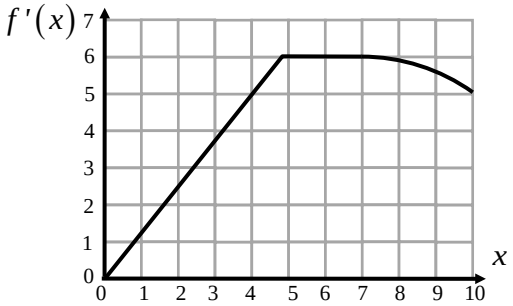
(B) P to Q

(C) M to P

(D) G to I

(E) at P

14. The following figure shows the graph of $f'(x)$, the first derivative of a function. The change in the function $f(x)$ in the interval from $x = 0$ to $x = 4$ is about:



(A) 20

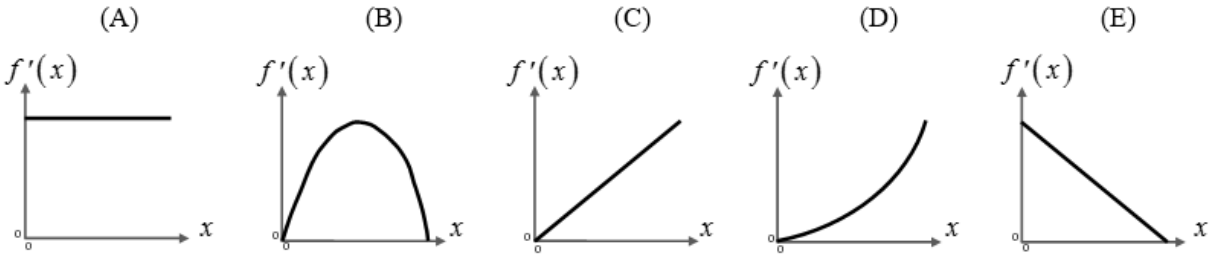
(B) 10

(C) 5.0

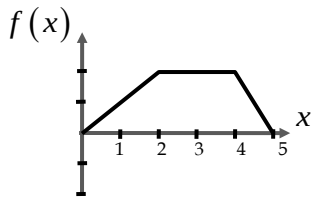
(D) 1.25

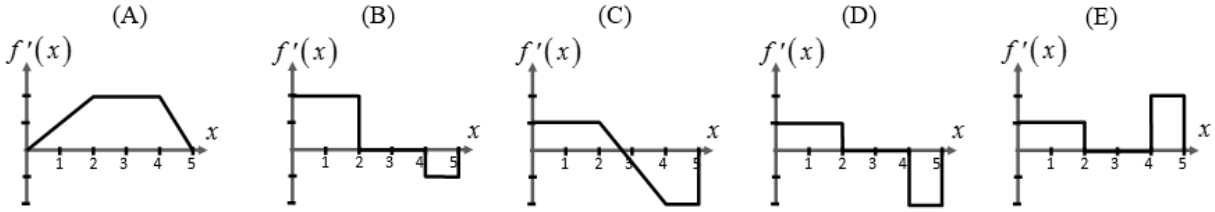
(E) 0.8

15. Graphs of the first derivative for five functions are shown below. All axes have the same scale. Which of the following graphs corresponds to the function $f(x)$ with the greatest change in the interval?



16. The following figure shows the graph of a function $f(x)$ in the interval from $x = 0$ to $x = 5$. Which of the following figures would represent the graph of the first derivative of the function in that interval?



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Analysis of Ambiguous Information about Chemical Compounds in Online Databases

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ABSTRACT
The Wolfram applications enable direct access to several main information sources (databases) and enable the data to be analysed easily. This offers developing information literacy on authentic material in chemistry education. For chemical compound identification: CAS, CID and Beilstein Numbers are used. In this paper, the authors focused on the ambiguousness of carbohydrate identification using these numbers. Altogether, there are 1498 compounds listed under the CAS Number, whereas CID and Beilstein Numbers are not assigned to every compound with CAS. During the analysis, several hundred entries with duplicate records were found, providing ambiguous information about the compounds. The authors focus on ambiguous database records, further analyse the physical properties of two compounds with several assigned identification numbers. This approach offers a suggestion on how to work with this topic in education, offering fruitful educational content.

Keywords: chemical compounds, big data, database search, ambiguities

INTRODUCTION

To prepare students for their integration into the contemporary information society, modern technologies should be integrated into individual school subjects. Separating ICT has been proven ineffective e.g. by the last ICILS (International Computer and Information Literacy Study), where the students with the best scores were reported not to be due to ICT education (Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014). It seems that making ICT a natural part of every school subject would be more effective. When considering the role of technology more broadly in science education Bell, Gess-Newsome, and Luft (2008, p. 4) argue that "much of the value... can be found in its capability to allow students to work with data, to enhance visualization of complex concepts and to facilitate communication and collaboration. The students encounter real data from a particular field which require certain skills in order to be processed. The data then not only serve as natural subject matter, processing skills come naturally too.

Chemical data are not an exception. The question how to find desired data and how to verify their accuracy rises. This skill has become one of the crucial skills of a responsible member of contemporary society. With the massive development of the Internet and the time students spend on it daily, school education needs to focus on using the Internet too.

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Contribution of this paper to the literature

- The paper provides an example of possible use for databases of chemical compounds in education.
- The example is given on the database of organic compounds, which contains several duplicities and also errors. They can serve as a motivational problem for students.

This paper is another contribution to the topic on integrating Mathematics and Science education (see Kim & Aktan, 2014). The authors focus on using data primarily intended for mathematical processing in the Wolfram Alpha internet application, which draws the data from several chemical databases and the Wolfram Mathematica app, designed for mathematical calculations. The authors of this paper chose these applications as they are a suitable tool for further calculations with the obtained data and are also used in education.

Connecting education with mobile technology moves the whole process into another dimension. Besides formal education, informal and non-formal education are distinguished (see Filippoupoliti & Koliopoulos, 2014; Greenhow & Lewin, 2016) as the process of learning enhanced by mobile technology, no longer depending on a school classroom. Nevertheless, even at school students can, almost instantly, gain a view of almost all compounds' basic physical and chemical properties. There is then more time to have students engaged in tasks based on more difficult cognitive processes.

One new educational goal is to teach students to orientate themselves in the maze of information. Its reliability and accuracy as well as the ethics behind the use of the information is very important.

Chemistry-oriented proven data are collected by several databases accessible either online via special portal or via special programmes such as Wolfram Alpha. The databases contain inexhaustible amount of information. In this study, the authors chose the topic of alkanes. When searching for a certain compound by its name, several entries are usually found, identified by various identification numbers. This fact may, not only in education, cause misunderstanding, sometimes even students' demotivation. The authors of this text therefore decided to map the database entries and analyse some discrepancies.

THEORETICAL BACKGROUND

The aim of science education may be seen in the development of scientific literacy, "the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen" (OECD, 2016). It is evident frontal education is unusable to achieve these goals as learner activity is crucial. There are several solutions to promote education in order to develop students' scientific literacy. Among others is the use of complex tasks, experiments (Anonymous, 2015), laboratory works, project-based education or inquiry-based education (Anonymous, 2011).

The potential of information and communication technology (ICT) cannot be ignored (see e.g. Král & Řezníčková, 2013). With enough evidence of its efficacy, teachers seem to be likely to adopt ICT in their education (see Anonymous, 2017). The most developing field – mobile technology – should not be excluded at schools either (Libman & Huang, 2013; Sha, Looi, Chen, & Zhang, 2012). Apart from native functions such as calculator, camera GPS, etc., they offer to run apps which widen the usability of an ordinary smartphone and enable a various range of operations with it. ICT is inherently associated with the Internet. Connectivity is the trend of modern time moving the place of education into a different position. E-learning (more precisely Massive Open Online Courses), instructional videos – separate or under a movement such as the Khan Academy – attract more and more learners. The movement of users on the Internet generates so called big data (Pence & Williams, 2016). They find use not only in marketing, financial engineering or advertising, they may be used in education as well.

Chemistry education does not stand aside in this process. Chemistry as a scientific discipline has developed rapidly in the last three decades. Not only have new elements been discovered and the periodic table of elements filled, the number of discovered compounds grows exponentially. The selection of the core subject matter is therefore more challenging than any time before. In this respect, ICT enables an interesting alternative to

searching for information about various compounds (Lebedeva & Zaitseva, 2014). This is the field the authors of this text focus on in this paper.

Despite IUPAC (International Union of Pure and Applied Chemistry) periodically issues recommendations for chemical compounds' nomenclature, naming especially the more complicated compounds is sometimes ambiguous (trivial names, systematic names, semi-trivial names). The rules for naming more complex compounds are not strict and are being applied differently. For this reason, an identification number is being used for these purposes. There are several such numbers: CID (PubChem Compound Identidication), CAS (Chemical AbstractsServices) or the Beilstein number. In various databases, an overview of a compound's properties, both empirical and structural formulas, boiling point, melting point etc. can be found. This also offers new possibilities for education. The ability to use these databases, which contain links to compounds, seems to be one of the modern aims of chemistry education (cp. Pence and Williams, 2010).

When analysing compounds and their indication in the databases, certain variances can be found. They are the subject of this text. A database entry in schools is offered, for example, via a Wolfram Mathematika program (Abramovich, 2014; Lebedeva & Zaitseva, 2014; Weisstein, 2014). It is a Computer Algebra System which, as well as Wolfram Alpha, allows access to all sorts of databases, including chemical databases. To be precise, 24 significant chemical databases are used in order to get data about chemical compounds.

Except for general information about a particular compound, compounds' formulas as well as molecule models are available. These visual aids can improve the efficacy of education (cp. Eilks, Wittec, & Pietzner, 2009; Anonymous, 2017).

The Mathematika program is being used mostly at technical universities. For primary and secondary school education, applets programmed in this software are used. They are available within the Wolfram demonstration project. This project offers contemporarily more than 10 000 educational materials, out of which more than 800 are focused on chemistry education. All these applets are free to use by both teachers and students via a program called Wolfram CDF Player.

AIMS AND METHODS

The primary impulse which led to a further literature review were data acquired via the Wolfram Alpha program. This Computational knowledge engine can search for data and further perform calculations, see **Figure 1**.

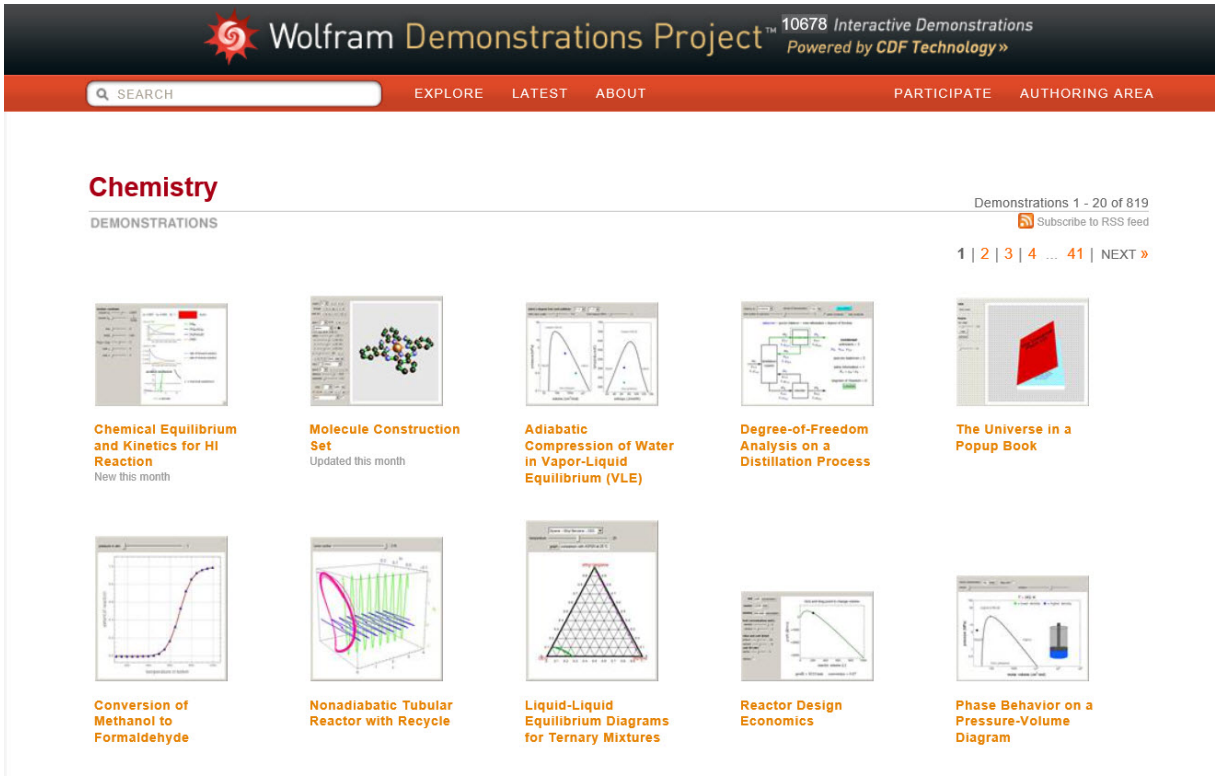

Figure 1. Wolfram Demonstration Project

Because of that it has become a popular tool for Mathematics as well as Science education (Abramovich, 2014; Ersoy & Akbulut, 2014). When working with the program, the authors realised several duplicities. Therefore, they focused on one part of organic chemistry compounds – hydrocarbons. For this group of chemical compounds, the program offers two undistinguishable formulas within isomers. After a closer look, the authors discovered that the reason is the results represent a joint database search. The compounds, which are identical according to their structural formula, were marked with different identifiers. Therefore, they were provided as two separate search results, see **Figure 2**.

Nevertheless, the entries of compounds listed under different identifiers (identification numbers, see above) contained different physical property values. The focus then became to find out such duplicities, and how much the data about "the same" compounds differ. Despite the original idea coming up when working with Wolfram Alpha, software Wolfram Mathematica was used for this research.

Figure 2. Wolfram Alpha – Isomers

METHODOLOGY

The data in Wolfram Mathematica were selected and further processed using the ChemicalData function. This function enables a search for compounds and simultaneously accesses dozens of different features for this compound according to the request (**Figure 3**).

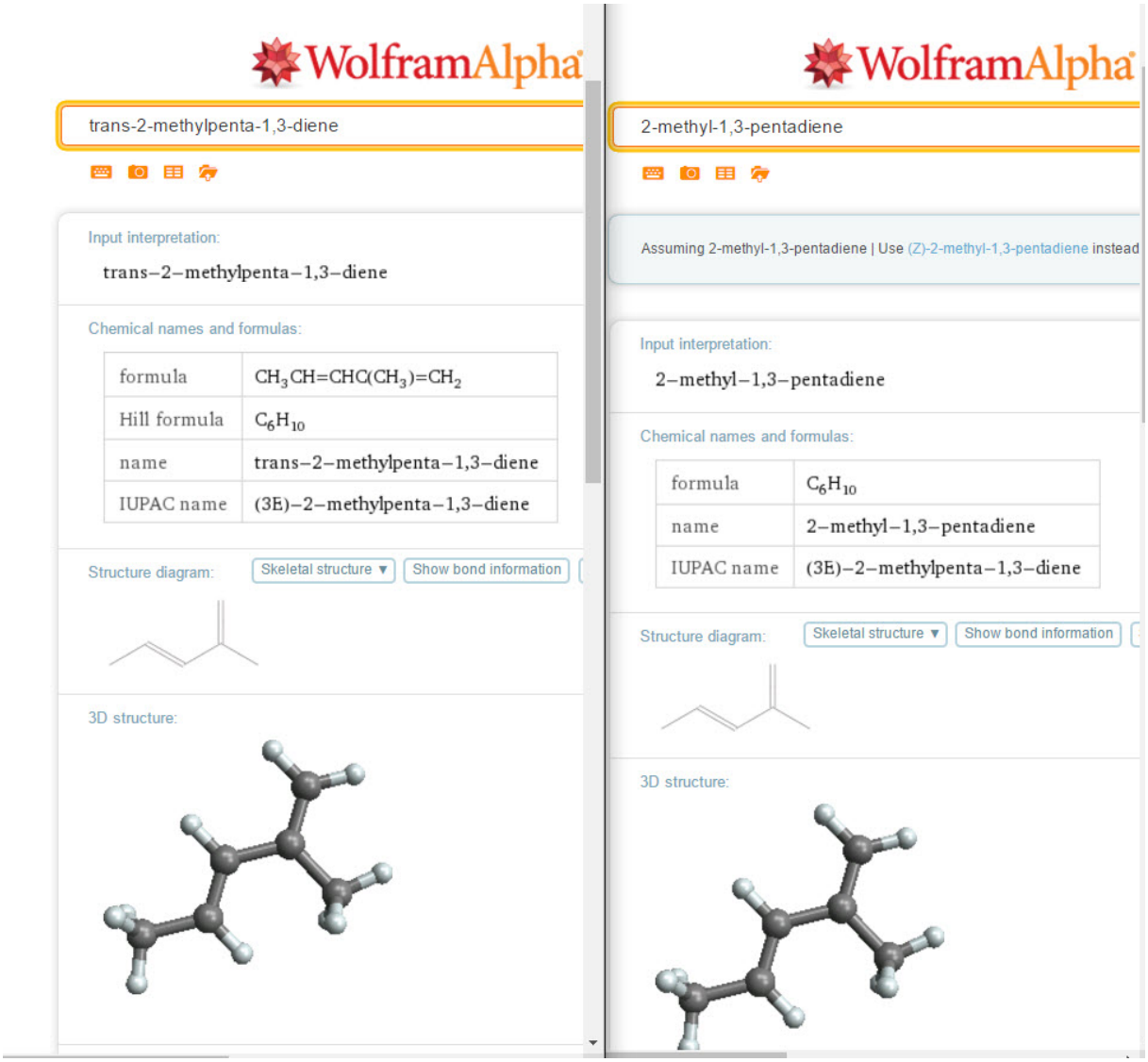

Figure 3. Wolfram Alpha – results

As seen in **Figure 3** above, even though the compounds are identical, the NFPA labels (National Fire Protection Association) are different, which is clearly a mistake. Also, the flash point as well as other physical properties differ (not displayed in **Figure 3**).

The selection of the compounds was based on the grounds of their feasibility, limited only to hydrocarbons. Every hydrocarbon was analysed according to the reference of its record in one of the 3 basic databases (using CAS Number, CID Number and Beilstein Number). Further, its three physical properties significant in chemistry, boiling point, flash point and melting point were recorded. The data acquired this way were saved into a table in which the duplicities were analysed.

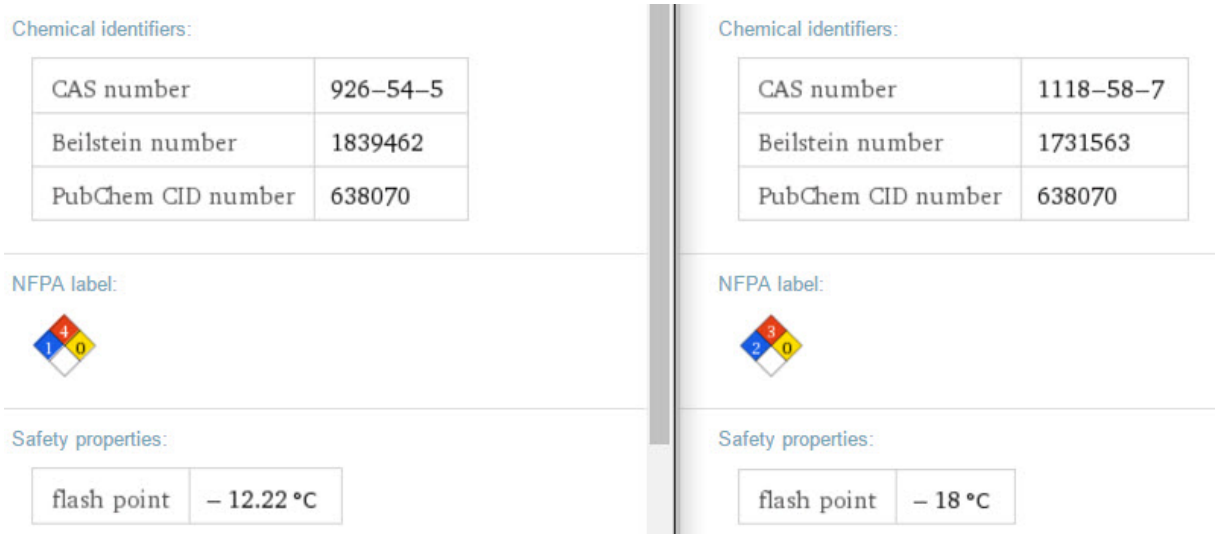

Figure 4. Wolfram Alpha – results

Table 1. Number of compounds found in the databases

Identificator	CAS	CID	Beilstein
Number of items	1498	1449	1088

Table 2. Numbers of duplicities

Identificator	CAS	CID	Beilstein
Number of duplicates	0	96	6

Table 3. Occurrence of particular duplicities

Items of one CID	Occurrence
6	1
5	1
4	1
3	13
2	80

RESULTS AND DISCUSSION

Overall 1499 compounds were identified by the Mathematika program. Every compound was identified by a CAS Number, some of the records did not contain complete data. Concretely, 410 were missing a Beilstein Number and 49 of them a CID Number. The final results for the hydrocarbons found are shown in **Table 1**.

Numbers of Duplicities

Based on the data analysis, the authors of this text conclude CAS is a number describing every compound separately. On the contrary, one CID number may indicate various compounds, see **Table 2**).

While the Beilstein number indicates only six duplicities, every one including two compounds, the CID number includes more compounds (see **Table 3**). This may naturally cause students' confusion when searching for a compound's properties. However, there is also a motivation aspect to this, as students usually like to disclose discrepancies.

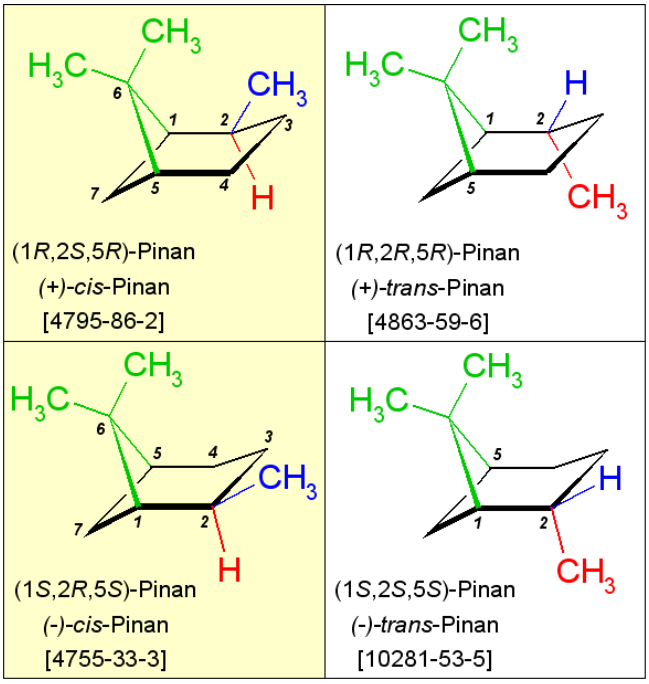

Figure 5. Isomers of pinane, source: wikimedia commons

When analysing the compounds and the identifiers, the authors indicated cases where compounds under the same CID are listed under different CAS and/or Beilstein number with different characteristics, such as boiling point, flashpoint, melting point or name. Thorough analysis of all the 96 cases is not the subject of this paper. Therefore, only several examples are given.

2-methylpenta-1,3-diene

The case will be sketched on a selected compound, see **Figure 3**. Even though it is listed under one CID, there are two different CAS and Beilstein numbers. Nevertheless, the compound at stake is just one *2-methylpenta-1,3-diene*. The difference was found in the name (one of the entries was listed under a name according to the old organic chemistry nomenclature: CAS1118-58-7, the new one CAS926-54-5). Although it may seem the entry CAS926-54-5 is newer, the CAS number is not as great as expected. Melting point has also been added, which is missing under the CAS926-54-5 entry. The boiling points stated in both entries differ from each other by only 0.5 (the CAS926-54-5 entry is more accurate).

It is not possible to say one entry is newer, therefore more detailed than the other. Apparently, the browser draws the information from several databases which are not being updated. A search for such cases may again be motivating for students.

Pinane

This CID number indicates a compound named *pinane*. There are six entries under this particular CID. The common molecular formula is $C_{10}H_{18}$. After a closer look at the entries, the authors found out one of them refers to pinane (CAS6876-13-7, Beilstein5237941), another to cis-pinane (CAS473551, Beilstein1280394) and the four other entries to particular *R* and *S* enantiomers of different optical activity (+/-). Even here, all theoretically possible combinations have not been found in the database. A more thorough study of the molecule (bicyclic molecule based on a six-carbon ring naturally in favoured chair conformer) offers only two positions for methyl group attachment in both of these offer *cis*- and *trans*- stereoisomers. These are listed under different CAS and Beilstein numbers, **Figure 5**.

Examining these compounds' other properties, the authors found that these compounds, with the exception of (+)-*trans*-pinane with a boiling point of 51.5°C, have the boiling point listed as 164, 165, 167, 168, 169°C (The differences are explainable by a typical span in the databases – boiling point is a range of temperatures). Yet it is unclear why the isomers differ in ones of degrees among each other, instead of all having a range of temperature entered. The structure of (+)-*trans*-pinane does not suggest such a big difference in the boiling point. The authors assume this is a mistake in the database.

Another discrepancy was found in the other following categories – the flash and melting point. Only the *cis*-pinane (CAS473552, Beilstein1847301) entry contains both values, while (+)-*cis*-pinane contains only the melting point. The melting point values of the aforementioned are equal.

The compound is more complicated and therefore suitable to be examined in higher secondary school grades. It could be examined by younger students too, however the activity would lose its interdisciplinary aspect between chemistry and IT.

Pellandrene

The compound under this CID appears in the database under five different CAS numbers, only two of them have a Beilstein number assigned. They represent a compound called *a*-phellandrene. The only systematic name which enables the creation of the formula is CAS4221-98-1, Beilstein 2487824. Boiling point values differ from 155°C to 176°C. Two entries (CAS34448-33-4 and CAS99-83-2) of the same name *alpha pellandrene* contain further information; the first about the melting point, the second about the flash point. The compound named *p*-menthadiene (CAS1329-99-3) also contains a boiling point record. It differs by 18°C from the value under CAS34448-33-4. In education, this could easily be approximated for the students with the use of a well-known example of alcohol. The difference between the boiling point of methanol and ethanol is about 14°C, which enables the distillation of one liquid from another. This is the process of liquor production. Discrepancy in the boiling point value as big as in case of pelladrene would lead to severely jeopardising health, as poisonous methanol not distilled from the ethanol mixture would cause the death of a consumer.

The databases offer a great number of possibilities which enable teachers to focus on more complicated (complex) cognitive processes instead of wasting time by making the students look up some properties in books or random websites. (Nevertheless, the authors of this study assume this skill is still also very important. The main focus, however, should not be put on this.) Searching the online databases, however, leads to several ambiguities among the search results.

This could lead to further investigation of the correct values, which is more suitable for chemistry classes. Also, the search engine's functionality could be examined in order to trace a possible source of the discovered discrepancies, which is more suitable for IT classes. An important aspect is the emphasis on critical data analysis when searching for information.

Strong points and limitations of the research

Although the mentioned search tools are being used widely, the duplicities and discrepancies have not been given appropriate attention. Connecting this discovery with the need to practice students' ability to search for information and evaluate them critically is a novel approach.

The results of this paper are affected by the authors' focus on only one group of chemical compounds. More examples could be found if all the compounds in the databases were reviewed. Also, complete analysis and selection of compounds where the discrepancies found exceed normal tolerances (therefore meaning an error) could set certain examples for the students to examine. This would save the time and a teacher would be able to guide their students' learning process better.

Advantages and disadvantages of the approach

The aforementioned approach offers several directions where to guide students' learning process. As far as problem solving, information literacy development or critical thinking are concerned, the activities are suitable for all, preferably secondary school, students. However, the compounds comparison activity, it is advised to be used for the group of students who focus on chemistry or science as too much emphasis on formulas and structure of compounds can easily demotivate students with different interests. This approach serves as a demonstration of information literacy development within a scientific subject. Bearing STEM conception in mind it therefore brings the two important components together in terms of the unifying thought.

CONCLUSION

Using Wolftam Alpha as a search tool also proved feasible and suitable for educational purposes. Based on the search analysis it is possible to distinguish:

- duplicities,
- obsolete or out-of-date information,
- error.

They may be caused by the human factor or by non-current information being kept in the database and new simply added.

These, when not identified and reported, may cause misunderstandings not only at school but also in pure chemistry. Also, it could cause problems in terms of safety (see the above mentioned NFPA labels). If the databases are supposed to serve science and scientists, it is necessary to keep them updated.

However, the educational potential of this discovery is also interesting. Students motivated by unexpected discrepancies are led to further investigate the results. This enables them to focus either on the chemical/physical properties and compound identification or on the IT part, in terms of the possible origins of the discrepancies discovered.

The number of compounds found may differ as new compounds are being discovered and enlisted into databases. **Figure 2** serves as an example. During final corrections to this paper, the authors found the error has been detected and this entry corrected in the database.

The work's further steps could be in detailed inspection of the hydrocarbon-search results, with the aim of searching for errors and unexpected values among the physical properties of the same compound. The authors also tend to elaborate the idea of combinatorics-organic chemistry into more depth.

Endnotes

The number 1498 represents compounds found by the authors during the work on this paper. As research in organic chemistry produces new compounds, the number may be greater by the time the paper is published.

The database mentioned in the text is available on this link: http://reference.wolfram.com/language/note/ChemicalDataSourceInformation.html and http://demonstrations.wolfram.com/.

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The Way to Deepen Reform of School Physical Education in the Background of "Healthy China"

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ABSTRACT
"Healthy China" has always been a major project of great concern in China, and also an important foundation to fulfill the Chinese dream of a great rejuvenation. School physical education is an important basis for students' lifelong physical education, nationwide fitness, national health and construction of healthy China. In this paper, literature consultation and expert interview methods were mainly used to discuss the profound connotation of "Healthy China", and deepen reform of school physical education in the construction of "Healthy China" was studied-analyses of the guidance of "Healthy China" construction on deepen reform of school physical education and the way to such reform were done by relying on the functions of school physical education.

Keywords: healthy China, school physical education, health education

INTRODUCTION

In "Opinions on strengthening school physical education and facilitating students' all-around development with both physically and mentally health from the General office of the State Council" issued in May.6th, 2016, strategic deployment as "strengthening physical education course and extracurricular exercises, and facilitating youth mental and physical health and fitness" has been made. The youth being both physically and mentally healthy, strong-willed and full of vigor is a manifestation of national vitality, a symbol of social civilization and progress and also a major reflection of the national comprehensive strength (Zhang & Li, 2017). Physical exercise is one of the effective ways to enhance students' quality of health, which plays an indispensable role in the formation of youth ideology and morality, intelligence development, aesthetic accomplishment and healthy lifestyle (Yang, 2016; Gao & Wang, 2017). Strengthen school physical education is an important way to the implementation of quality-oriented education and promotion to all-around development of students. This is very important for advancing modernization of education, construction of healthy China and strong human resources nation, and realization the Chinese dream of the great rejuvenation of the Chinese nation.

On Oct.25th, "Healthy China 2030" planning outline (hereinafter referred as outline) was issued by the Central Committee of the Communist Party of China. The outline is a program of action that boosts construction of healthy China in the future 15 years and also a major measure to ensure national health and even all-around well-being. Everyone should participate in and be healthy and take responsibility in the construction of healthy China. It is mentioned in the outline that the standardized rate of school sports grounds and facilities configuration would reach 100%, young students would go in for moderate sports activities for over 3 times every week, and excellent

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Contribution of this paper to the literature

- Healthy China is a national strategy and so we should profoundly understand the connotation of Healthy China.
- The development of school physical education has been highly concerned by the nation and the way to deepen reform of school physical education is crucial.
- Strategy of Healthy China promotes reform of school physical education, and in turn the reform drives the realization of construction goals of healthy China.

rate of fitness and health standards of national students would be over 25% by 2030 (Lin, 2012).As an important part of national sports development, school physical education surely step into an important opportunity period of strategic development in the all-around deepening reform under the guidance of national building "Healthy China" in an around-way. "Healthy China" is a national health undertaking that belongs to our national level, however, the field of school physical education should make a due contribution to realize national shared "Healthy China" through closely following advanced global governing theory and practices, as world is closely linked by informatization (Yang, 2013).

CONNOTATION OF "HEALTHY CHINA"

Xi Jin-Ping, General Secretary, highlighted in the national health and hygiene congress that "All-around well-being could not be realized without national health", which fully reflected the development idea of Chinese party as people-centered (Zhou et al., 2012). The hosting of national health and hygiene congress, an important congress in the crucial period of realizing the objective of struggle- "Two Centenary Goals", has blown the times horn of building healthy China. Physical education is an important part in the construction of healthy China and it is very important for improving people's physical quality and healthy level, facilitating people's all-around development, enriching their spiritual and cultural life, stimulating their spirits of pursuing excellence and exceeding oneself. When met Chinese sports delegation of the 31st Olympic Games, Xi pointed out that sports are an important sign of social development and human progress, an important reflection of comprehensive national strength and soft power. He stressed that they should fully realize the positive significance of sports in improving people's health level, implement the national strategy of nationwide fitness, popularize nationwide fitness exercises and impel the construction of healthy China. Such an important speech from Xi put forward clear demands on the sports development serving to the construction of healthy China from the height of the overall progress of the cause of the Party and the Nation, and sports system should therefore combine with the practice of work, thoroughly implement and strive for boosting the construction of healthy China.

"Suggestions on formulating the 13th five-year plan regarding national economy and social development from the Central Committee of the Communist Party of China" deliberated and passed in the Fifth Plenary Session of the 18th Central committee of CPC, has clearly put forward the promotion of construction of "Healthy China", and released planning outline "Healthy China 2030" immediately. The outline is a program of action to promote "Healthy China" in future, a major measure to carry out the spirits of the Session and ensure people's health, and of important significance in building a moderately prosperous society and speeding up the construction of socialist modernization. "Healthy China", a social system project, has a significant benefit on the contemporary era and the future generations, which shows a general trend of national demands on development and masses desire for health and needs common participation of the whole national people undertaking their own liabilities. Deepen reform of school physical education is a key point of present China's school physical education administration, which is the origin of the cultivation of "idea of lifelong physical education". The school physical education has unconsciously influenced students' excellent quality beyond physical education, such as ideology and morality, sense of collectivism, and spirits of solidarity and cooperation. Xi pointed out that people's health should be preferentially developed, emphasis in future work should be laid on the popularization of healthy life, further optimization of health service, further perfection of health security system and efforts on construction of healthy environment. To speed up the construction of healthy China, all should base on nationwide health (Ye, 2012). This shows the

connotation of the construction of healthy China is not only to ensure physical health of the whole national people, but also to create healthy environment and facilitate the forming of people's healthy lifestyle under the joint efforts of the nation and society. This concept of "comprehensive health" is a concept of rather comprehensive, systematic and scientific health, and a mode of systemized health interference that promotes people to guarantee physical health by participating in physical exercise. The health mode follows and leads the trends of era development.

SCHOOL PHYSICAL EDUCATION BEARS THE FUTURE OF HEALTH EDUCATION

Presently, the number of China's adolescent students accounts for around 20% of the whole population. Their healthily growth is closely linked to nation's hope and future. Therefore, it should focus on the cultivation of adolescent students' health literacy. Adolescent is the foundation of a society, their physique and conditions of physical health have directly connections with their capacity of undertaking the momentous historical tasks – making nation strong and prosperous (Wang & LI, 2010). Strengthening school physical education regards the improvement of adolescent sports accomplishments and development of healthy behavioural patterns as important content of school education. It would implement plans of promoting adolescent's sports activities, organize colourful adolescents' sport activities widely to enhance their physical quality, master sports skills and cultivate interests of exercising and form into good habits of lifelong fitness. With the rapid development of Chinese economy, deepen reform of school education and the development of the cause of national sports have advanced with times and physical education in China has advanced sharply in a short term (Wang & Pan, 2013). School physical education, an important part in both school education and Chinese' sports cause, is crucial to China's social development.

School physical education has a profoundly and permanently promotion to adolescents' physical health. In recent two years, nationwide fitness and lifelong sports development strategy put forward by nation are important measures to enhance physique of the whole national people, which reflects national recognition of the importance of people's physical health on the basis of status of declination in physical health levels of adolescent. School physical education has its unique advantages in promoting adolescent students' participation in physical exercises as follows: Firstly, it conducts vigorous propaganda on the knowledge of physical exercise by utilizing the impacts of physical education class, in which it employs multiple modern media to promote the modern functions of modern physical education, and makes an utmost efforts to support the development of sports and cultural undertakings, encourages sports consumption so as to improve the awareness of adolescent students' participation in physical exercises. Secondly, in doing so, correlative learning and guiding on school physical education, social physical education and competitive physical education has been invisibly reinforced, sustainable development of physical education science had been promoted that provides wider development space for the progress of adolescent physical education. School is a growth cradle of adolescents, a living place for them most of the time, and so environment and education of school is crucial to the growth of adolescents. School physical education offers sufficient physical exercise time and scientific exercise methods for adolescent students, the good physical exercise environment and atmosphere from school has created beneficial conditions for fostering adolescents' habits of physical exercises, which plays an indispensable role in improvement of adolescent students' physical health levels.

Functions of Physical Education

Physical education is always closely linked to the social development in some periods and there are interactive development connections among social civilization, material civilization and sports own development. Physical Education Law, issued by China in 1995, divides physical education into school physical education, competitive physical education and social physical education, from which school physical education is the basis of the two letters, and its development even reflects demands and orientations of social physical education (Li, 2016; Cao et al., 2017). Adolescent students are fast in physical growth, physical exercise plays a remarkable promoting role in their physical and mental development. Functions of school physical education mainly reflect as follows:

Cultural aggregation functions of school physical education. Having experienced several curriculum reforms, China's school physical education is the combination of the East and West physical education now. That is to say, it combines advanced physical education thoughts of developed countries with China's national conditions, and also inherits and develops of China's traditional national sports events. In the beginning of the founding of new China, former Soviet Union physical education thoughts had a profound influence on China's school physical education that advanced China's school development. Since the opening up and reform, with the beneficial reference of the guiding thought "Health first", China's school physical education has been moved toward to a new stage, formation of teaching consciousness as teachers-led and students-oriented has built a good foundation for teaching mode of China's school physical education, and fully reflected school physical education's centripetal and cohesive forces.

Moral education functions of school physical education. The ultimate goal of school education is to let students to master rich science and technology knowledge and cultivate students to form into good ideology and morality. School physical education has its unique advantages in such cultivation. Physical education rules in school physical education activities, exerts a subtle influence on adolescent students. At the same time, it contributes to the unified and standardized behaviours of adolescent students. In some group events, it impels adolescent students to firstly regulate their behaviours and learn to discipline themselves, develop a good consciousness of cooperation, while in individual events, it develops the spirits of adolescents' as fair competition and hardworking. Morality education function in school physical education bears an important task- education of students' ideology and morality.

Education function of school sports. School track and field games, fully embody the function of education, the essence of which include: one is to cultivate students the unity cooperation, positive, dare to fight the thought quality, campus athletics sports game as the carrier, through the stages of psychological reaction, is revealed to all of the students "work together, unite as one" team spirit, "faster, higher, stronger" spirit of striving, and persevere in endure, bear hardships and stand hard work quality; Second, raises the student good moral sentiment, in track and field sports competitive game, the students' emotion and mood will be affected by a variety of shocks, which requires the students to do to win without pride and lose with grace, the vital experience better internalizes for own ideological quality;3 it is to train students' correct outlook on life and values, the campus sports meeting of "friendship first, competition second" to the students fully display the values of friendship, tolerance and respect for others, to guide students happy, happy life outlook on life.

"Lifelong physical education" functions of school physical education. School physical education not only teaches students' physical education skills, methods of physical education, and moreover promotes students to form into habits of physical exercise. In physical growth, adolescents are in the peak period of physical development, they would grow faster by participating in physical exercise. School physical education contributes to adolescent students' body capacity in daily sports activities; they will achieve good development in their body by doing so. In psychology, most of group events have positive cultivation functions on the psychological quality of adolescent students, their cooperation and aggressiveness as well as other fine quality could be therefore developed. In sports habits, school physical education plays a certain promoting role in fostering students' good sports habits, students would develop into "lifelong sports" habits through physical education class, extracurricular physical exercise and amateur sports training.

Sociality of School Physical Education

School physical education itself is a part of spiritual civilization, and plays an important role in the construction of social material civilization and spiritual civilization. Socialization of human is a process that people should master some life skills and social norms in the procedures of social survival so that be capable of adapting to the law of life. Teaching contents and means in school physical education plays a subtle role in human's procedures of socialization.

Family effect of school physical education. Family has always been an environment, from a person's birth to death. Sports meeting of parent-child in kindergarten have a significant family effect in school physical education. It is nature that parents live child. Kindergarten requests parents and children to common participate in sports meeting of school organization, which attaches equal attention to both children and parents and makes positive preparation. In the earlier stage, exercises of sports events are processes of physical and mental training for both children and parents. Among them, school physical education's functional effects –promotions to family education are very remarkable. As an important part in physical education, school physical education has inherent functional values of sports-enhancing students' physical health. School physical education contributes to students, members of society, to own good sports habits and rather strong physique through physical education and cultivation procedures on students in a collective and systematic manner. School physical education facilitates students to develop into good sports habits in teaching process. As core members in family, students would exert their influences on other family members with such habits, the influence effects would greatly promote the family school physical education.

Social benefits of school physical education. School physical education provides builders of good quality and strong will for society that makes contribution to social progress and harmony. As the most special course in school, school physical education takes unique physical exercises as main teaching contents. In learning process, students should overcome numerous problems thereof, and their willpower would be greatly improved during the fighting process with these drawbacks. In the organization, with characteristic physical education course cultivation, school physical education enables students to bilateral interact with society, gradually learn social mental orientation and social mental mode, and perform the role in society. In the organization of School physical education, recognition of view of value –connections among social norms, social roles demands, social development objectives and social development, students thereby gradually turn from a nature people to a social people and perfect themselves. In school physical education teaching process, these education and transmission on students make them better understand rules of society and further better connect with society. These education has great impacts on their whole life, and built a foundation for their better adapting to and serving the society.

WAY TO DEEPEN REFORM OF SCHOOL PHYSICAL EDUCATION

Promoting the construction of healthy China is, an important basis for building a well-off society in an all-round way and basically realizing socialist modernization, is a national strategy of enhancing Chinese national quality of healthy in an all-around way and realizing coordinated development among people's health, economy and society, and also a major measure of positively participating in global health governing, performing international commitment of sustainable development agenda in 2030 (Liu, 2013; Wu and Zhu, 2017). Strategy deployment of building healthy China puts forward a new requirement for sports development. National sport front should further go deeper into learn and comprehend the spirits of congress in future work, comprehensively promote sports undertakings to move forward to a new step again, and contribute to the new achievement of the construction of healthy China, and make a due contribution to the realization of objectives of struggle as "Two centenary goals" and Chinese dream of a great rejuvenation of Chinese nation.

The school sports resources are abundant, and the use of the school sports time to provide the universal fitness service is the good strategy for the rational utilization of sports resources and the serious shortage of sports facilities in the whole people. The construction of healthy China needs the common health of the whole nation, and the implementation of the national fitness program is an effective means to promote the construction of healthy China. School physical education not only plays an important role in the construction of healthy China but also bears arduous task. School physical education is very important for fostering adolescent students' awareness of sports and habits of sports. Direct task of physical education is physical education on students, while the indirect one is sociality of school physical education. It focuses on forming students' conscientious social sports habits and daily sports lifestyle by switching school sports knowledge and skills into society, letting students walk out of campus and towards society. Deepen reform of school physical education and promote construction of healthy China should mainly start from aspects as follows:

Change of Thought

Efforts should have made to strengthen inheritance of China's unique health value system by school physical education and organic connect with beneficial results of mainstream value concept of health in western countries. Physical education has always been a concern of nation, government and society. Guiding thoughts of China's physical education has experienced different phases: in the beginning of the founding of new China, emphasis was laid on military Physical education training in physical education; with the development of society, the guide thought of replacing physical exercising by labor emerged; by the beginning of 21st century, China's competitive sports has attracted unprecedented attention, and been a " one branch alone" in the development of domestic sports for a long time; in the middle and later 21st century, the thought of happy sports has begun to guide school physical education, and exerted the steps of reform of school physical education to a certain level; afterwards, interest sports, health first and other guiding thoughts have rapidly become popular and been the main guiding thoughts of China's school physical education. In the future, the value of orientation of the reform of China's school physical education should implement closely centre on the construction of sports core accomplishment system, and fulfil joint building of the blueprint of China's school physical education undertaking.

As China performs strategy of "Healthy China", physical education firstly should, give unique function s of the construction of "Healthy China" into play, and school physical education bears even important link role. This may request leaders at all levels and even all related personnel in school to change thoughts of school physical education, school physical education is not only students' sports activities at school but moreover an important phase that promotes students to foster habits of physical exercise, daily sports lifestyle, and set up lifelong sports idea during school. School should pass along scientific methods of physical exercises for students and function as a good conductor of social physical education. Students not only focus on the beneficial impacts of physical exercise on themselves during school, but moreover continue to take such exercises when leaving school and working, and should drive and affect people around to go in for scientific fitness.

Course Reform

Efforts should be made to enhance China's right of speech in school physical education during the process of formulating global health undertaking rules so as to form into a governing mode of "Healthy China" in China's school physical education. School physical education has a decisive position in both sports function and its role in social development. Chinese school physical education curriculum reform has started since the beginning of 21st century, and greatly promoted the development of school physical education in the recent 20 years' development process. Formulation of the "Criterion of physical education" in a new round would surely achieve greater social profits on the basis of good effects in the earlier stage. However, under the circumstance of all-round consideration and arrangements in whole nation, development of national school physical education tends to extremely imbalance, any social reform would be well developed in economic developed regions and provincial capital cities, economic less-developed regions, remote regions, in particular, are slower developing, which becomes block zones in national school physical education development.

To boost balance development in school physical education, emphasis should be laid on economic less-developed regions and remote regions' school physical education development status, make inclination towards these regions in local policies at national level, increase investment and management in physical education of schools in these regions to speed up their development in school physical education. In the process of reforming school physical education " curriculum standards", it should formulate curriculum standards targeted at economic less-developed and remote regions' school physical education and compile special textbook-editing local folk-custom into physical education, reflect local sports characteristics on the basis of wholly conforming to national unified requirements, compile such characteristics into school physical education textbook, and replace contents of school physical education with the development of society.

Facilities Perfecting

Efforts should be made to promote modernization of comprehensive guarantee supporting of Chinese school physical education facilities and playgrounds, realize regional equalization development in school physical education public services. School physical education cannot develop without supporting of its facilities. Make a rational allocation on school physical education playgrounds and equipment-state and government would make a uniform configuration on partial school's sports equipment, regarding economic less-developed regions and remote regions as key supporting objects, and utilizing special funds on school physical education of uniform configuration to perfect school physical education facilities. For instance, allocate sports lotteries funds for school physical education special funds, invest partial funds of nationwide fitness into school physical education facilities' construction, and advance national fitness and school physical education resources sharing; local government and schools should widely attract social capital to invest school physical education construction, utilize investment of outside working villagers or successful entrepreneurs in hometown school physical education construction, use the way of naming school after main investor to push forward economic less-developed and remote regions' school physical education to closely advance with the development of China's society.

Schools make sports equipment according to local folk and custom sports actual demands, such as school launches own teachers and local villagers to make sports equipment. Self-making school physical education equipment according to local customs and folk and sports events features firstly should make equipment with consumable items with low capital input. If high-priced consumable items are really needed during the making process, school should endeavour to government special fund investment and also social funds. Applying folk custom sports equipment into local school physical education, not only could fill up the gap of school sports equipment, but also promote folk custom sports items to be characteristic items of local school physical education. This will help to promote folk custom sports items to develop from campus to society and attract social attention to local school physical education's construction and development.

Mode Diversification

Efforts should be made to speed up the transformation of promotion way of government unitary "Healthy China" policy and realize multiple subjects benefit sharing in Chinese physical education public resources. Besides, consolidate functional area of school physical education objects led by clearly and steady "Healthy China", steadily eliminate restrictions as inherent shortage of development conditions. "We should build a mechanism that negotiates and coordinates benefits among government itself, social non-profit organizations and market commercial organizations, and fulfil multiple supply for school physical education, and provide urgently needed sports facilities and corresponding government supporting facilities for adolescent students and local residents to maximum degree." "Macro-control function of government should reflect in enhancement of overall control ability rather than all kinds of sports public service manufacturing and specific operation activities. Therefore, government should input more funds and vigor into satisfying basically school physical education demands and local residents' fitness demands and other public sports resources supply."

We suggest to pair urban schools and rural ones and carry out overall development. Let local universities support rural primary and secondary schools in its region, and continuously arrange students of sports major to take internship at rural schools, and present old school equipment to rural schools. Really perform "two schools common practice", raise funds to support rural school physical education resources. Make overall distribution on sports teachers-local government formulates multiple preferential policies as encouraging sports major talents to work at these regions, requiring city teachers to go through one year teaching at rural schools for promotion, or encouraging teachers of high professional title to guide rural school's education, offering college students graduating opportunities to directly promote to high professional title by defined years' of working at rural schools. These would promote sound progress of school physical education.

CONCLUSIONS

"Healthy China" has been a major project of nation's concern and a foundation to realize Chinese dream of a great rejuvenation of Chinese nation since the 18th National Congress of the Communist Part of China. School bears hope and future of billions of Chinese people, and school physical education is a important basis for students' foundation of lifelong sports, all-round fitness and healthy China. School physical education undertakes huge responsibilities to realize nationwide health and the construction of healthy China. To fulfil a great project of healthy China, firstly, it should give sports unique advantage-promoting health into play, take school physical education as carrier, start from concepts and realize qualitative leap from school physical education to healthy China; To deepen reform, explore deeply integrated mechanism between healthy China and school physical education, capture positioning of school physical education, exert accurate power, perform systemized school physical education and promote deeply integration between school physical education and healthy China. At present, the realization of school physical education systemization is an urgent demand and task for promoting the construction of healthy China.

"Sports" plays a prominent role in the process of building healthy China, and functions of school physical education would be moved toward to a brand new step again. At first, features of mass and equality would be approved again, efforts should therefore be made to let whole social members to enjoy the pleasure of sports and promote the formation of people's sports lifestyle; Secondly, lifelong value of school physical education would be further manifested. School physical education fosters people's awareness of lifelong sports, guarantees for people's lifelong sports, and makes sure that sports activities and practices would run through the whole life of everyone; Thirdly, school physical education would be more personalized. School physical education is a tool of education rather than purpose, it enables individuals' liberation, development and perfection to be the foundation and starting point of construction of healthy China; Fourthly, School physical education has universality and diversification. Introducing folk custom sports into campus, promoting sports resources sharing and coordinated development between school physical education and masses could guarantee for masses various sports demands, and satisfy individual demands. In doing so, deepen reform of school physical education would be done and process of construction of "Healthy China" be promoted.

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Educational Evaluation Based on Apriori-Gen Algorithm

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ABSTRACT
The issue of educational evaluation has long been a research hotspot. Using big data analysis method to conduct educational evaluation can improve the pertinence and effectiveness of education. Conventional Apriori algorithm has certain limitations in the application of educational evaluation. This paper introduces an improved Apriori-Gen algorithm and describes its application in evaluation of actual effectiveness of ideological and political course of colleges and universities. Through conducting correlation analysis of network questionnaire data, the study requirements of college students can be acquired, so as to improve the teaching effectiveness of ideological and political course. Results show that it is effective to apply the proposed study method in educational evaluation.

Keywords: big data, effectiveness evaluation, Apriori, ideological and political course

INTRODUCTION

Implementation of reasonable educational evaluation is the premise for education decision making. An effective education evaluation relies on a comprehensive and solid evaluation basis. Big data stresses on in-depth mining and analysis of multidimensional data so as to seek the implication relation and value behind data, which is beneficial for transforming educational evaluation from prediction based on small data to evidential decision based on comprehensive data. With the aid of big data technology, educational evaluation is no longer made to support the decisional requirement of education management departments or education institutions only, but for all groups and individuals that are concerned about education or taking parts in education. Through analyzing students' study requirements via big data, the pertinence and effectiveness of education can be improved.

The information found by data mining is normally meaningful knowledge that is impossible to be found by manual power. Data mining algorithms are many, including Apriori (Agrawal and Shafer, 1996; D'Angelo et al., 2016), K-means (Scitovski and Sabo, 2014), SVM (Support Virtual Machine) (Hu et al., 2015; Mu et al., 2017), EM (Expectation-Maximization) (Enders, 2003), Pagerank (Chen et al., 2007), Adaboost (Adaptive Boosting) (Hu, 2017a), KNN (K-Nearest Neighbor) (Hu, 2017b), Naive Bayes (Sitthi et al., 2016), etc.

Data are regarded to be associated when there is a certain regularity among them. The types of association are various, including simple association, chronicle association, causality association, quantitative association, etc. The purpose of association analysis is to find the correlation relation behind data. The association rule mining is to find meaningful and valuable association relation between item and set in database. In 1993, Agrawal et al.

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Contribution of this paper to the literature

- This paper introduces an improved Apriori-Gen algorithm and describes its application in evaluation of actual effectiveness of ideological and political course of colleges and universities.
- The improved Apriori-Gen algorithm modified the bias during the teaching process and improved the teaching effectiveness of ideological and political education.

proposed for the first time the item-item association relation in mined database. Since then, many researchers conducted further studies on the association rule proposed by Agrawal et al. such as algorithm optimization, and introducing sampling and concurrent thought to improve algorithm efficiency.

The association rule mining proposed by Apriori contains two main parts: (1) to find all frequent itemsets in database according to a given minimum support; (2) to produce association rules. The key of the first part is to efficiently list all qualified frequent itemsets, which is also the most important issue in association rule mining technology. The improvement trend of association rule mining algorithm is to find all frequent itemsets that meet minimum support threshold.

To optimize Apriori's method, many research teams successively proposed various improvement thoughts. Holt et al. proposed IHP algorithm (Holt and Chung, 2002), in which the thought was to disperse the to-do-list into a hash table; Zaki et al. proposed Max Clique serial algorithm (Zaki, 1997), in which the thought was to utilize a clustering technique; Orlando et al. proposed DCP algorithm (Orlando et al., 2001), which can store and count candidate itemsets in a new way and integrate a more efficient pruning technique; Park et al. proposed DHP algorithm (Park et al., 1995), which can reduce the cost for generating candidate itemsets using the hash technology; Agarwal et al. proposed Tree Projection algorithm (Agarwal et al., 2001), in which ordered tree and mine frequent itemsets were constructed using database mapping technology; Savasere et al. proposed PARTITION algorithm (Savasere et al., 1995), which can cut database into random blocks, allowing each block individually to generate frequent itemsets; Toivonen et al. proposed Sampling algorithm (Toivonen, 1996), which can reduce the scale of frequent itemsets via a sampling technique. All these algorithms can improve data mining efficiency to a certain extent.

The bottleneck problem of itemsets generation may be encountered when using conventional Apriori algorithm, because there may generate too many candidate itemsets as well as massive amount of rule algorithms caused by repeatedly scanning the database (Song et al., 2006). How to select out interesting and valuable rules to be applied in practical situation has become a difficult issue. On the basis of analyzing the conventional algorithm, this paper proposes an improved Apriori algorithm, and elaborates the design thought, main problems and implementation method of the improved algorithm. Finally, the application of the improved Apriori association rule algorithm in ideological and political course is illustrated according to the actual educational environment of ideological and political course.

TECHNOLOGIES RELEVANT TO BIG DATA ANALYSIS

Big data mining is to mine valuable and potentially useful information and knowledge from massive, incomplete, noisy, fuzzy, and random database, which is also a decision support process. Big data mining is mainly based on artificial intelligence, machine learning, pattern learning, and statistics. Common big data mining methods include classification, regression analysis, clustering, association rule, neutral network method, Web data mining, etc. These methods realize data mining from different perspectives. Association rule refers to the association and mutual relation between data items, which means that the generation of one data item can be used to deduce the generation of another item. The mining process of association rule mainly includes two stages: The first stage is to search all high-frequency itemsets from massive amounts of original data; the second stage is to generate association rule from these high-frequency itemsets.

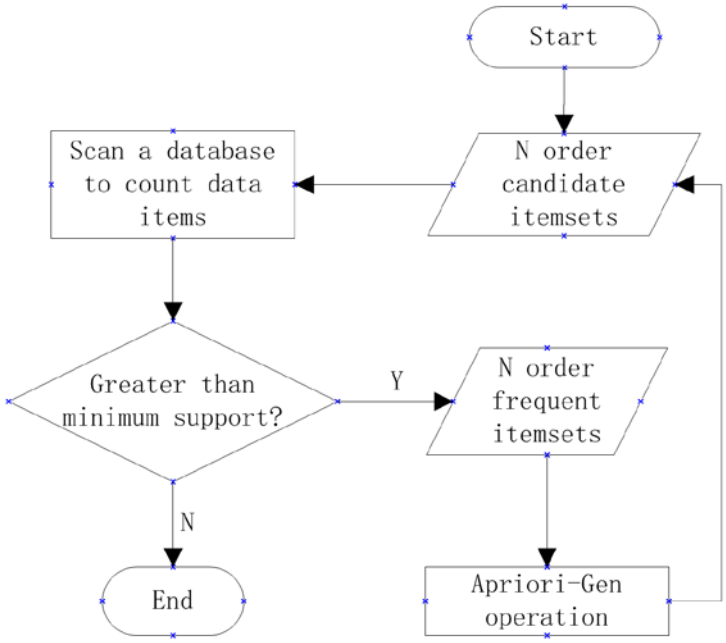

Figure 1. The flow chart of Apriori-Gen algorithm

Apriori algorithm is the most classic method for association analysis, in which the principle is as follow: If one itemset is frequent, then all its subsets must be frequent, i.e., if the current itemset is not frequent, then its superset will no longer be frequent.

The algorithm steps are described as below:

(1) At the beginning stage of the algorithm, determine the support degree of each item through one-pass scanning of the dataset. After finishing this step, all frequent 1 itemsets and set F1 can be obtained;

(2) Subsequently, this algorithm generates new candidate k itemset using frequent (k-1) itemset found by the last iteration;

(3) To count the support degree of candidate itemset, the algorithm needs to re-scan the database, and use subset function to determine all candiate k itemsets in C_k of each object t;

(4) After calculating the support degree count of candidate itemset, the algorithm will delete all candidate itemsets with support degree count less than minsup;

(5) Algorithm stops upon no generation of new frequent itemsets.

Concrete algorithm is shown as **Figure 1**.

METHOD

In the association analysis-based data mining algorithm, the three most important procedures are data collection, data preprocessing, and data analysis:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Serial nu	grade	major	Gender	Political	NO.5 A	NO.5 B	NO.5 C	NO.5 D	NO.5 E	NO.6	NO.7	NO.8
2	1	2	1	2	3	1	1	1	1	1	1	1	1
3	2	3	1	1	3	1	1	1	1	1	1	2	1
4	3	3	2	2	2	0	1	0	0	0	2	2	2
5	4	3	1	2	2	1	1	1	1	1	2	2	2
6	5	3	2	2	3	1	1	1	1	1	1	2	1
7	6	3	2	2	3	1	1	1	1	1	1	2	1
8	7	3	2	2	1	1	1	1	1	1	1	2	1
9	8	3	1	1	3	1	1	1	1	1	1	1	3
10	9	3	1	2	3	1	1	0	1	1	2	2	3
11	10	3	1	2	3	0	1	1	1	1	1	1	1
12	11	3	2	2	3	0	1	1	1	1	2	2	1
13	12	3	1	2	2	1	1	1	1	1	2	2	1
14	13	3	1	1	3	1	1	0	1	1	1	2	1
15	14	3	1	1	3	1	1	1	1	1	1	2	3

Figure 2. Original questionnaire dataset

Collection of Data

College students' basic evaluations on the teaching effectiveness of ideological and political course were obtained by means of a questionnaire. The questionnaire included 47 questions, covering learner factors, teacher factors, and environment factors, etc. The questionnaire was implemented on website and the resulting data were exported in an Excel form as shown in **Figure 2**.

The first line is the name of each question, below which is the index value of item. To reduce the redundancy of storage, the content of each item is stored in another file.

Data Preprocessing

First, the questionnaire data in excel was subjected to processing treatment, wherein the question code was added in front of index value of each question, so that the index value of different questions can be distinguished from each other. After that, the questionnaire data was imported into RStudio using excel toolkit of R language. Data set is shown in **Figure 3**.

mydataEng

Filter

	number	question 1	question 2	question 3	question 4	question 5	question 6	question 7	question 8	quest
1	1	question 1-2	question 2-1	question 3-2	question 4-3	question 5-1	question 6-1	question 7-1	question 8-1	qu
2	2	question 1-3	question 2-1	question 3-1	question 4-3	question 5-1	question 6-1	question 7-1	question 8-1	qu
3	3	question 1-3	question 2-2	question 3-2	question 4-2	question 5-0	question 6-1	question 7-0	question 8-0	qu
4	4	question 1-3	question 2-1	question 3-2	question 4-2	question 5-1	question 6-1	question 7-1	question 8-1	qu
5	5	question 1-3	question 2-2	question 3-2	question 4-3	question 5-1	question 6-1	question 7-1	question 8-1	qu
6	6	question 1-3	question 2-2	question 3-2	question 4-3	question 5-1	question 6-1	question 7-1	question 8-1	qu
7	7	question 1-3	question 2-2	question 3-2	question 4-1	question 5-1	question 6-1	question 7-1	question 8-1	qu
8	8	question 1-3	question 2-1	question 3-1	question 4-3	question 5-1	question 6-1	question 7-1	question 8-1	qu
9	9	question 1-3	question 2-1	question 3-2	question 4-3	question 5-1	question 6-1	question 7-0	question 8-1	qu
10	10	question 1-3	question 2-1	question 3-2	question 4-3	question 5-0	question 6-1	question 7-1	question 8-1	qu
11	11	question 1-3	question 2-2	question 3-2	question 4-3	question 5-0	question 6-1	question 7-1	question 8-1	qu
12	12	question 1-3	question 2-1	question 3-2	question 4-2	question 5-1	question 6-1	question 7-1	question 8-1	qu
13	13	question 1-3	question 2-1	question 3-1	question 4-3	question 5-1	question 6-1	question 7-0	question 8-1	qu
14	14	question 1-3	question 2-1	question 3-1	question 4-3	question 5-1	question 6-1	question 7-1	question 8-1	qu
15	15	question 1-3	question 2-1	question 3-1	question 4-3	question 5-1	question 6-1	question 7-1	question 8-1	qu
16	16	question 1-3	question 2-2	question 3-1	question 4-2	question 5-1	question 6-1	question 7-1	question 8-1	qu
17	17	question 1-3	question 2-2	question 3-1	question 4-3	question 5-1	question 6-1	question 7-1	question 8-1	qu
18	18	question 1-3	question 2-2	question 3-1	question 4-3	question 5-1	question 6-1	question 7-1	question 8-1	qu
19	19	question 1-3	question 2-1	question 3-1	question 4-3	question 5-1	question 6-1	question 7-0	question 8-1	qu
20	20	question 1-3	question 2-1	question 3-1	question 4-3	question 5-1	question 6-1	question 7-1	question 8-1	qu

Figure 3. Data imported into RStudio

Before association analysis, the questionnaire data should first be converted into transaction data form. Therefore, the data was first converted into List form, then converted into transaction form. Key codes are shown below:

```
dataList <- split(data, f)
  dataList <- lapply(dataList, function(x){
    rst <- unlist(x)
    names(rst) <- NULL
    rst <- unique(rst)})
  transaction <- as(dataList, “transactions”)
```

Data Analysis

After being converted into transaction form, the association analysis of data was conducted. The key statement of apriori algorithm is as below:

```
rules = apriori(transaction, parameter = list(sup = 0.2, conf = 0.9))
```

where the minimum support degree was set to 0.2, the minimum confidence coefficient was set to 0.9, and the results are shown as follows:

```
> summary(rules)
set of 165077 rules
rule length distribution (lhs + rhs):sizes
2         3         4         5         6         7         8         9
75        2432      18618     53274     61087     26739     2847      5
Min.      1st Qu.   Median    Mean      3rd Qu.   Max.
2.000     5.000     6.000     5.602     6.000     9.000
```

We can see that there are over 160,000 qualified association rules, of which there are only 75 rules with a length of 2, and more than 2000 rules with a length of 3; rules with length of over 3 are too many, which will not be analyzed in this research. The algorithm parameters were modified, where the maximum number of association rules was set to 3, which means only association rules like A->B and A&B->C can be exported.

```
> myrules = apriori(transaction, parameter = list(maxlen = 3, sup = 0.2, conf
  = 0.9))
> myrules.sorted <- sort(myrules, by = “lift”)
> inspect(myrules.sorted)
```

The key codes are shown above. The analysis results were ranked according to their lift degrees and the following rules can be obtained:

```
      lhs                                rhs             support   confidence lift
[1]   {question 1-1,question 7-0}   => {question 8-0}  0.2136752 0.9174312  3.799627
[2]   {question 4-3,question 8-0}   => {question 1-1}  0.2179487 0.9714286  2.789132
[3]   {question 6-0,question 8-0}   => {question 1-1}  0.2222222 0.9629630  2.764826
[4]   {question 5-1,question 8-0}   => {question 1-1}  0.2222222 0.9629630  2.764826
[5]   {question 7-0,question 8-0}   => {question 1-1}  0.2136752 0.9345794  2.683332
[6]   {question 8-0}                => {question 1-1}  0.2222222 0.9203540  2.642489
[7]   {question 4-3,question 8-0}   => {question 7-0}  0.2158120 0.9619048  2.074523
[8]   {question 1-1,question 8-0}   => {question 7-0}  0.2136752 0.9615385  2.073733
[9]   {question 5-1,question 8-0}   => {question 7-0}  0.2200855 0.9537037  2.056836
[10]  {question 1-1,question 8-0}   => {question 6-0}  0.2222222 1.0000000  2.052632
[11]  {question 8-0}                => {question 7-0}  0.2286325 0.9469027  2.042168
[12]  {question 6-0,question 8-0}   => {question 7-0}  0.2179487 0.9444444  2.036866
[13]  {question 5-1,question 8-0}   => {question 6-0}  0.2286325 0.9907407  2.033626
[14]  {question 4-3,question 8-0}   => {question 6-0}  0.2222222 0.9904762  2.033083
[15]  {question 1-1,question 7-0}   => {question 6-0}  0.2286325 0.9816514  2.014969
```

The first 15 rules ranked in descending order of lift degree are given above, where the largest lift degree reaches 3.800.

RESULTS

First, the visualization analysis of all rules was carried out, where all 2507 effective rules were grouped and displayed in the form of a bubble diagram.

As shown in **Figure 4**, the x-coordinate represents the left operation of grouping rule, y-coordinate represents the right operation of grouping rule, the circle size represents support degree (the larger the circle, the larger the support degree), the color represents the lift degree of rule (the darker the color, the higher the lift degree). The relative frequencies of rules with support degree over 0.5 were recorded, as shown in **Figure 5**.

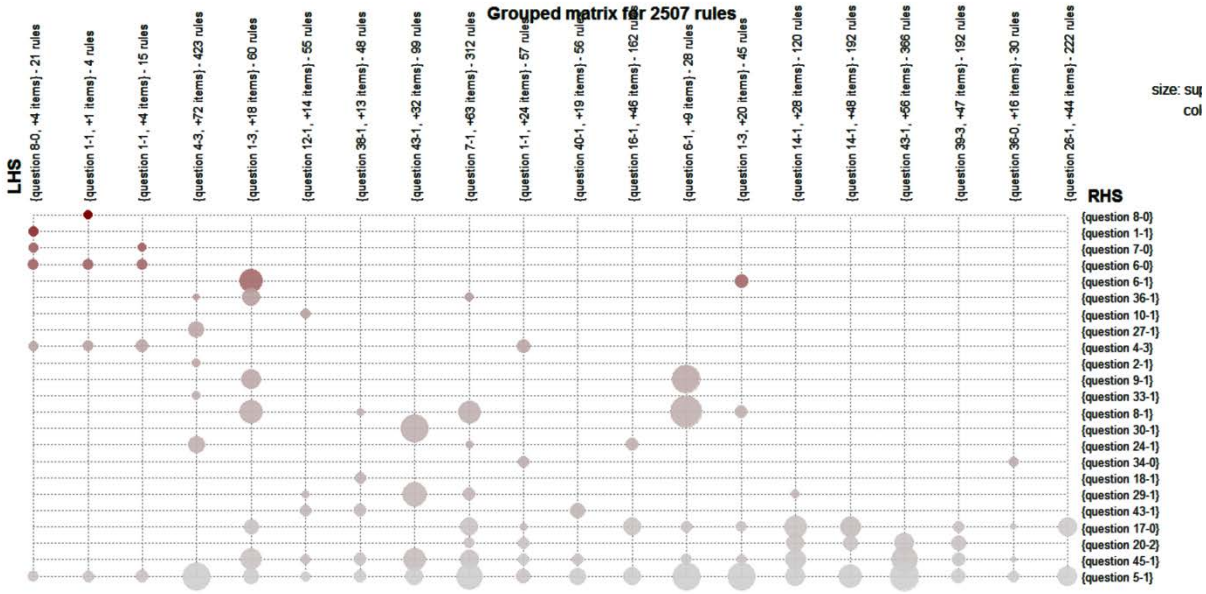

Figure 4. Bubble diagram of grouped rules

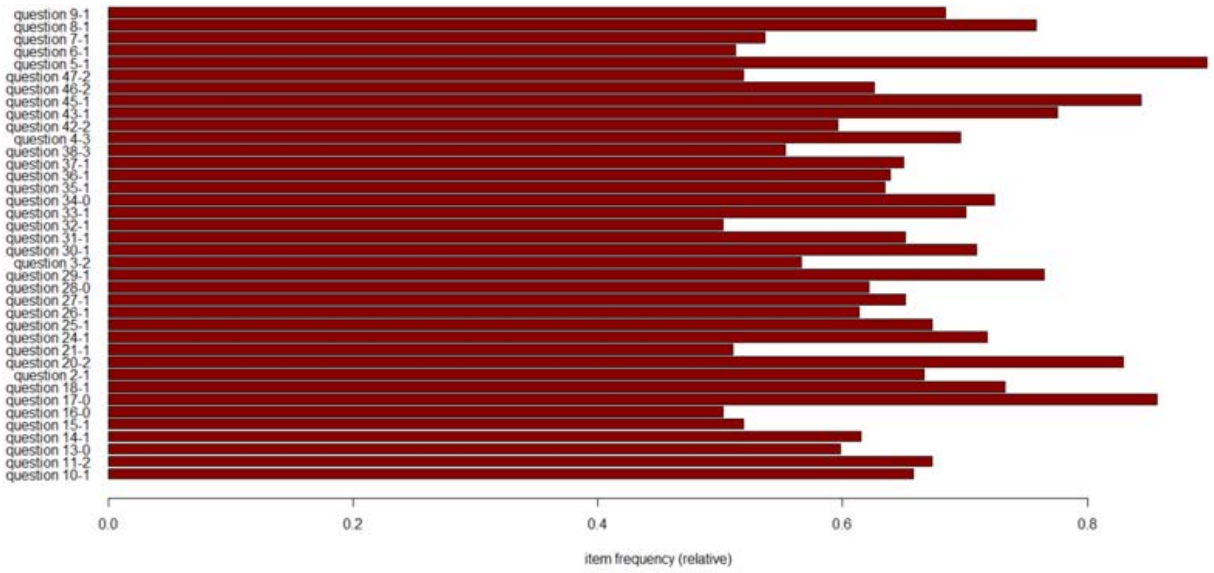

Figure 5. Relative frequencies of rules

```
> itemFrequencyPlot(transaction, support = 0.5, cex.names = 1, xlim = c(0,0.9),
  + type = 'relative', horiz = TRUE, col = 'dark red', las = 1)
```

We can conduct rule analysis for a single particular result. For example, the representative informant in question 1-1 is a college student, his/her association rules was specifically analyzed, and the results are shown below:

```
> rstRule <- Rhs_Selecet(myrules, "question 1-1")
> inspect(rstRule)
```

```
     lhs                              rhs             support   confidence lift
[1] {question 8-0}                 => {question 1-1} 0.2222222 0.9203540  2.642489
[2] {question 7-0,question 8-0}    => {question 1-1} 0.2136752 0.9345794  2.683332
[3] {question 6-0,question 8-0}    => {question 1-1} 0.2222222 0.9629630  2.764826
[4] {question 4-3,question 8-0}    => {question 1-1} 0.2179487 0.9714286  2.789132
[5] {question 5-1,question 8-0}    => {question 1-1} 0.2222222 0.9629630  2.764826
```

Figure 6 is a directed graph analysis of few key rules of a college freshmen student, where the arrow points to the direction of rule deduction. **Figure 7** is the scatter plot of rules, where the x-coordinate represents support degree, the y-coordinate represents confidence coefficient, the color of scattered point represents the lift degree (the darker the color, the higher the lift degree). Based on these rule analyses, the association relation between question and answer can be obtained combined with questionnaire results.

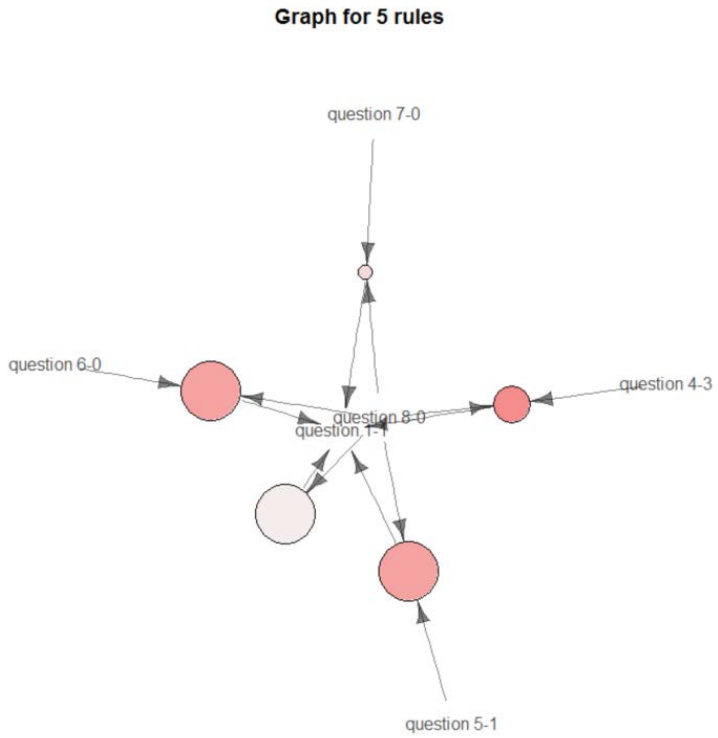

Figure 6. Digraph of specialized analysis of rules

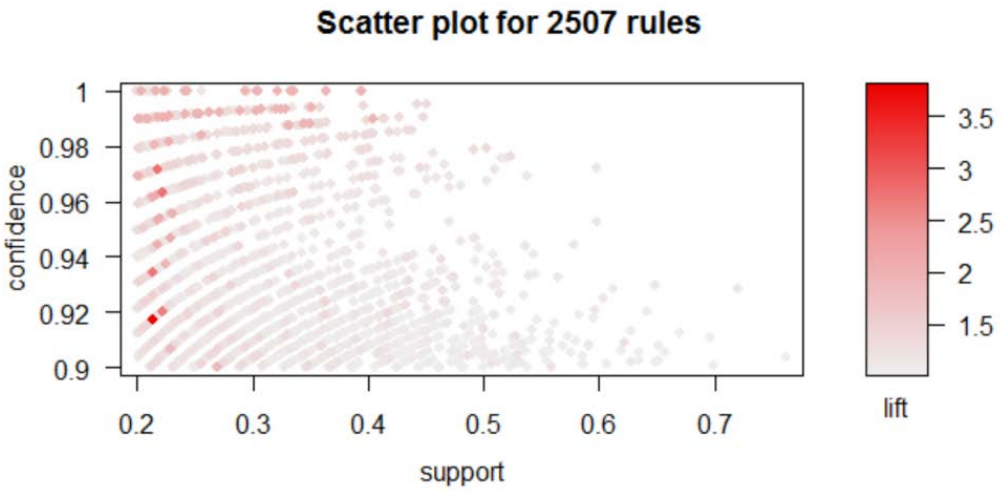

Figure 7. Scatter plot of rule analysis

DISCUSSION AND CONCLUSION

The evaluation of the effect of education has always been a focus of research. Varank et al. investigated the effectiveness of an online automated evaluation and feedback system that assessed students' word processing assignments (Varank et al., 2014). Öztürkler examined the current situation of the quality improvement in higher education institutions (Öztürkler, 2017).

Due to the limitation in evaluation conditions, traditional education evaluation normally collects only segmental evaluation information, and therefore may easily and passively ignore some evaluation points. During the implementation of educational evaluation, it will be over-reliant on subjective evaluation due to a lack of reliable evaluation basis. In contrast, big data-based educational evaluation does not rely on one-dimensional evaluation of a single evaluation object, but includes all contextual data related to education, not only using evaluation data, but also focusing on process data. The thought of seeking association via big data technique meets educational evaluation's true requirement for rich basis and valid evidence. The introduction of big data expands the content and function of educational evaluation, making it not only an evaluation, but also an important evidence for educational decision making. Peng used the big data processing technology on the online learning behavior analysis model (Peng, 2017).

However, due to the complexity of educational data, it is difficult to describe and analyze educational big data with general data analysis tools. With the development of higher education, it is ever more necessary to analyze and evaluate educational data so as to guide the formulation of educational policy and students' learning behavior. In this paper, 160000 association rules are extracted from educational data, which is too large for analyzing and evaluating data, so it must be condensed. By using the Apriori method, these association rules can be reduced to 2507 or even to 75. Although 75 seems simpler, this article uses 2507. After streamlining, these rules must be analyzed to group them to see which rules are more effective for evaluation, which rules may be redundant, which rules can be merged, and the set weights of the rules. The results of this study show that the research results are very satisfactory.

In this paper, an improved Apriori-Gen algorithm was applied for effective evaluation of ideological and political education, not only realizing overall evaluation, but also presenting individual situation effectiveness. The improved Apriori-Gen algorithm modified the bias during the teaching process and improved the teaching effectiveness of ideological and political education. By fully utilizing technical approaches, this new algorithm collected both students' study process and result data, and integrated various evaluation data (expert evaluation,

teacher evaluation, student self-evaluation, mutual evaluation), so as to realize multi-dimensional, comprehensive, in-depth evaluation of ideological and political education.

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The Application of Empirical Study in Accounting Education: An Example of Internal Control and Cash Dividend

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ABSTRACT

As an important development trend for accounting higher education, accounting empirical teaching plays a fundamental role in enriching and improving researching methods in accounting fields. This paper starts from the relationship between internal control and cash dividend policy, combines with author's accounting teaching experience for years, follows the general research ideas of questions raising, questions analysis, questions solving, and from the aspects of theoretical analysis, literature review, research hypothesis, research methods, empirical process and results discussion to make a detail description on accounting empirical teaching methods and process. The results show that there is a significant positive correlation between internal control and cash dividend policy, and this kind of correlation shows different influence intensity according to the difference of company nature. Through the research of this paper, it can make the relevant educator further clarify the process and methods of the accounting classroom empirical teaching, which is of great significance to popularize and enhance the application of accounting empirical research methods in accounting field.

Keywords: empirical research, accounting education, internal control, cash dividend

INTRODUCTION

In recent years, accounting empirical study has developed into a mainstream field of accounting study in the world (Apostolou et al., 2017). However, the promotion and teaching of accounting empirical research methods are still weak, especially in China, such a country where accounting study is developing rapidly (McPeak et al., 2012). Accountancy students in colleges as an important driving force in the field of accounting, play a critical role in mastering accounting empirical research methods (Paisey & Paisey, 2004). Therefore, based on the experience of accounting teaching in many years, we take the research on the relationship between internal control and cash dividend policy as the breakthrough point, combine with the relevant financial data of China capital market, to make a detail description on the process, existing problems and some other difficult problems in accounting empirical teaching. By doing so, this paper hopes to make some contribution on enhancing and application of accounting empirical teaching.

Besides to master the specific empirical research methods, previous theoretical derivation and question raising are also important parts of accounting empirical study, which should gain special attention for students who are major in accounting (Guo, 2011; Beatty & Liao, 2014). This paper takes the relationship between internal

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Contribution of this paper to the literature

- This study introduces the general process of empirical accounting research and enriches the contents and means of accounting education.
- The empirical research in this paper tests the relationship between internal control and cash dividend, and clarifies the role of internal control in profit distribution decision.
- The research of this paper not only enriches the research literature of accounting education and internal control, but also has important significance for accounting theory and practice.

control and cash dividend policy as an example to explore how to quickly elicit research questions and conduct preliminary theoretical analysis.

Cash dividend is an important decision of corporate profit distribution and has always been valued by Chinese government regulators and investors (Powell et al., 2012). Especially the "On Further Implementation the Related Matters of the Cash Dividend of the Listed Companies" published in May, 2012 by CSRC combined the cash dividend policies and the original public offering to further strengthen supervision of the cash dividend policies of the listed companies. Why the government regulators, as a means of administrative intervention, violate the economic development laws to continually emphasize the importance of the cash dividend policy? According to "the Riddle of Dividend Payment" proposed by Black in 1976, we feel sorry to find a perfect explanation for such a phenomenon by any theory. Whereas the principal-agent theory put forward of the cash dividend policy by Adjaoud and Ben-Amar in 2010 seems to give a most promising explanation. According to this theory, the cash dividend payment can lower principal and agent costs produced by the separation between the ownership and management of a company. To give a specific analysis, we know that the cash dividend payment reduce the level of companies' free cash flow, restrict the funds abuse of administrators who are compelled to enter the external investment market to finance so as to meet the demands of investment, leading to a severer external market regulation and eventually reducing the agent costs caused between owners and the administrators. As for the successful explanation of the cash dividend policy by the principal-agent theory, we know the deeper reason may go to the impact from the companies' governance mechanism on the cash dividend policy (Adjaoud & Ben-Amar, 2010). If it is true, the internal control, as a governance mechanism that public companies actively promote, is bound to have a significant influence on the cash dividend policy.

Because of the continuous development of the principal-agent theory, researches on the issues about the current internal control quality and principal- agent, cash dividend policy and principal-agent are appearing constantly. However, there's a lack of experimental evidence about the internal control quality and the cash dividend policy. The existing research shows that both the internal control quality and the cash dividend policy can be effective means to reduce the principal-agent costs of the listed companies (Fairchild, 2010; Ying, 2016). Taking the establishment of the dividend agent model of LLSV (La Porta et al., 2000) for reference, this study put forward the result model and substitution model about the internal control quality's impact on the cash dividend policy of the listed companies. On one hand, the result model thinks that the listed companies with higher internal quality will provide stronger protection for their shareholders, especially those medium and small shareholders. Including more transparent information, more normative management process and a stronger regulation, which in turn compels regulators to maintain a cautious attitude in capital using, and they are more inclined to grant the excess cash as dividends to shareholders (La Porta et al., 2000; Mitton, 2004). On the other hand, the substitution model thinks that companies with a higher level of internal control quality has a lower principal-agent costs, therefore , they are under motivation in reducing principal-agent costs through paying the cash dividend (La Porta et al., 2000), leading to the lower levels of cash dividend payment propensity and the payment.

The above two views are formed on the basis of learning from the west, especially from the research results of the American mature capital market. However the practicability in our capital market is subject to further test. Since the split-share reform in our country, there has been a big difference between our country and the western countries in ownership structure, the degree of investors protection and the efficiency of capital market (Yeh, 2005), especially the state-owned property controlling people of those listed companies in our country ha as become a key

factor that cannot be ignored in researching the issues on the Chinese capital market. The existing evidence shows that the ultimate difference controllers can lead to bigger differences of the listed companies on principal-agent problem, internal control quality and the cash dividend policy (Capalbo et al., 2014; Guo et al., 2017). Therefore, when studying the impacts of internal control quality of our country's listed companies on cash dividend policy, the difference caused by the ultimate controllers must be taken into consideration.

Therefore, Based on the Dibo internal control index, this study makes a comprehensive measure on the internal control quality of listed companies and takes 2004-2013 China's A-share main board listed companies as samples to check the relationships between internal control quality and cash dividend payment propensity and that with the payment level by making use the demonstration of panel logit model and panel tobit model. The research results support the result model of the dividend policy (La porta et al., 2000). They show that higher quality of internal control can strengthen the cash dividend propensity and payment level. The further test also found the nature of state-owned ultimate controllers has a reinforcement effect on such positive correlation. All of these results mean that under the background of the current system in China, the promotion of internal control quality in the listed companies objectively have an positive influence on enhancing the cash dividend propensity and the payment level, which just accord with the policy intention of the current government monitoring departments in raising cash dividend payment level and protect the interests of the medium and small investors.

THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

Theoretical analysis and research hypothesis as the key content in accounting empirical study, should cause the majority accounting educators attention. At present, some accounting empirical research papers have a series of problems, such as in the theoretical basis is not sufficient, hypothesis proposal is not so rigorous, all of these problems require to be basic educated and corrected in accounting classroom. In view of this, this paper mainly based on the dividend agent theoretical model, to make a comprehensive analysis and discussion on the two possible relationship between internal control and cash dividend from the positive and negative aspects. In the meanwhile, for the state-owned nature of enterprises is an important pillar to China's national economy, the state-owned nature of enterprises may have important impact on the relationship of internal control and cash dividend. Therefore, this paper takes the nature of enterprises as an important factor into the analysis framework when analysis the relationship between the two.

Internal Control and Cash Dividend Policy

Though there are many scholars have done researches on the cash dividend policy of the public companies from different angles and proposed influencing explanation models (Baker & Wurgler, 2004), there hasn't been a perfect explanation for the listed companies paying for dividend. And some financial scholars are making unremitting efforts to solve this problem. As stated in the introduction, the research on the relationship between the internal control quality and the cash dividend policy provides a new experimental evidence for solving the problem of "the riddle of dividend payment" proposed by Black in 1976.

Among those numerous theoretical perspectives on dividend payment policy, the principal-agent theory (Adjaoud & Ben-Amar, 2000) seems to draw the most attention. Especially after the result model and substitution model of the agency of dividend were proposed by La porta and other scholars in 2000, this research was pushed into a new climax. It is thanks to the proposal of this new research paradigm, some scholars conduct the research on the relationship between the company's governance mechanism and the cash dividend policy. It can roughly be summarized into two opposite research contexts. One believes company's governance including equity structure, state-owned holding, corporate governance index, etc. has a positive correlation with the cash dividend policy. According to the corporate governance index provided by CLSA, Mitton (2004) found a remarkable positive correlation relationship between a company's governance structure and the cash dividend payment. After that, Farinha (2003), by using the data of the UK capital market and American capital market successively in 2003 and 2004, obtained a similar research conclusion. Contrary to that, the other view believing a negative correlation relationship between a company's governance mechanism and the cash dividend policy. By utilizing the data from

American capital market in 2006, John and Knyazeva found that the better the governance mechanism of a company, the weaker the principal-agent conflicts are, therefore, their motivation to solve the principal-agent problem through strengthening the cash dividend payment level is becoming weaker. Which is similar to the findings from Short (2002) and other people. This research context supports the substitution model of the dividend policy.

Internal control, as an important governance mechanism that the current listed companies are actively carrying out, has a similar mode of action with the cash dividend policy. The existing research shows that the internal control, as a basic measure of power balance, can effectively lower the degree of information asymmetry between administrators and investors (Cheng et al., 2013; Gao & Wang, 2017) and ultimately reduce the principal-agent costs of the listed companies (Ge et al., 2017; Tsai, 2017). Therefore, incorporating the research models of LLSV in 2000 and the existing research theories, we think that firstly, the internal control quality of the listed companies has a positive correlation relationship with the cash dividend propensity and payment level. The high quality of the internal control can provide investors stronger protection, which is reflected in the relevant information disclosure including the financial position and operating results, and the improvement of regulation degree of regulators, which means an increasing probability of discovery if regulators abuse funds. Compelling administrators to pay investors the excess cash in the form of dividend so as to cater to demands of lower agent costs from investors ultimately lead to the increase of the cash dividend payment propensity and the payment level. In contrast, there's a negative correlation relationship between the internal control quality and the cash dividend payment propensity and the payment level. It is generally acknowledged that there's a remarkable negative correlation relationship between the principal-agent costs and the internal control quality. The higher quality of internal control of a listed company, the lower costs in principal-agent costs, resulting in a less motivation to reduce principal-agent costs through paying cash dividend and lower level in cash dividend payment propensity and payment. As for companies with lower level of internal control quality, investors think that their administrators have a high possibility of excessive investment and misuse of cash which result in a severer principal-agent problem. What's more, the external investors will depend more on the dividend payment signal released by the public companies to make investment decision. In order to effectively reduce the principal-agent costs caused between corporate insiders, that is managers and large shareholders, and outsiders-medium and small shareholders, the public companies will tend to pay the cash dividend. Under this logical analysis, the higher of the internal control quality of a listed company, the lower of the cash dividend payment propensity and payment level, and the vice versa.

Based on the above theoretical analysis, this passage proposes two competitive hypothesis:

H1a: Under other constant conditions, there's a positive correlation relationship between the internal control quality of a public company and the cash dividend propensity and payment level, and the higher level of the internal control quality, the stronger cash dividend payment propensity and the higher payment level.

H1b: Under other constant conditions, there's a negative correlation relationship between the internal control quality of a public company and the cash dividend propensity and payment level, and the higher level of the internal control quality, the weaker cash dividend payment propensity and the lower payment level.

Nature of Ultimate Controllers, Internal Control and the Cash Dividend Policy

Subject to the special institutional environment of China, the state-owned companies have played important roles in the process of the development of national economy of China for a long time. Since the reform of non-tradable shares, the ownership structure of the listed companies in China has had some extent of improvement, but the state-owned companies still play important roles in the national economy development of China. Due to many government interventions, the state-owned companies generally are supposed to bear some social functions and they show large differences in operating performance, financial decision-making and corporate

governance with non-state-owned companies (Aharoni, 1981). The existing research demonstrates that the different nature of ultimate controllers leads to differences to companies' different appeals for the cash dividend policy. According to the research by La Prota in 1999, the different interest motivations controllers of different natures of property rights result in their different demands for cash dividend payment, which was supported by the researches of Moh'd in 1995 and Allen in 2000. At the same time, along with the implementation of the basic norms of the internal control of a listed company, the difference of internal controlling field between state-owned companies and non-state-owned companies appears progressively. By making use of the data of the Chinese capital market, Lu found in 2011 that compared with non-state-owned holding companies, the internal control quality and the executives' salary-performance sensitivity in the state-owned holding companies is more significant. However, Tong's research in 2012 found that by depending on the special relationship with government to gain competitive advantage, the state-owned companies didn't have a strong motivation to gain competition advantage by disclosing the internal control quality, that is to say their motivations to actively improve the internal control quality were not strong. All in all, the existing researches show that the different ultimate controllers of listed companies lead to remarkable differences in internal control quality and the cash dividend policy.

Further analysis based on the principal-agent theory angel, research by Wang et al. (2007) showed that the control chain of the state-owned companies is longer than that of others, which usually results in neglecting supervision for administrators and owner absence phenomenon so that the principal-agent costs are higher than that of non-state-owned companies. At the same time, the long control chain and the lack of enthusiasm to implement the internal control specification is likely to lead to the weakening of the internal control system and further magnify their principal-agent problem, which may affect the relationship between internal control quality and the cash dividend policy. On the other hand, as the core of the national economy, the state-owned companies usually have exemplary effect in carrying out the government policies. In the process of carrying out" The enterprise internal control basic norm" and its complete guidelines, the state-owned companies start first once again. According to the requirement of "About 2012 notification of partial classification implementation of internal control standard system of main-board companies in 2012", the state-owned companies fully implemented prior to non-state-owned companies the corporate internal control standard. Which indicates from another side that the internal control quality of the state-owned companies is better than that of the non-state-owned companies. The strengthening of the internal control quality of the state-owned companies can effectively solve their principal-agent problems and further affect the cash dividend policy.

Based on the above theoretical analysis, this passage puts forth two competitive hypothesizes:

H2a: In certain conditions, Compared to the nature of the non-state-owned listed companies controllers, the nature of the state-owned listed companies' controllers whose effect of internal control quality on the cash dividend policy is more serious. That is to say, it is the nature of the state-owned ultimate controllers strengthens the degree of relationship between them both.

H2b: In certain conditions, Compared to the nature of the state-owned listed companies controllers, the nature of the non-state-owned listed companies' controllers whose effect of internal control quality on the cash dividend policy is more serious. That is to say, it is the nature of the non-state-owned ultimate controllers strengthens the degree of relationship between them both.

METHODOLOGY

The empirical research method of accounting mainly including the variable definition, model contribution, data collection and so on (Rebele & Pierre, 2015; Yuan et al., 2017). The authenticity of the data collection, the rationality of the model construction directly determines the objective and fairness of the follow-up empirical research conclusion (Gassen, 2014). This study will be discussed in detail for the above three aspects.

Table 1. Description Table of Internal Control Quality and Cash Dividend Policy

	All				State-owned				Non-state-owned			
Year	**N**	**ICI**	**DIV**	**DIVRATE**	**N**	**ICI**	**DIV**	**DIVRATE**	**N**	**ICI**	**DIV**	**DIVRATE**
2004	1100	6.495	50.3	0.278	806	6.514	53.5	0.305	294	6.436	41.5	0.206
2005	1143	6.483	50.7	0.328	827	6.501	53.7	0.353	316	6.432	43.0	0.254
2006	1139	6.522	47.7	0.248	787	6.540	50.1	0.270	352	6.480	42.3	0.198
2007	1142	6.528	48.5	0.214	784	6.541	51.4	0.230	358	6.499	42.2	0.178
2008	1159	6.509	47.7	0.340	803	6.519	52.2	0.389	356	6.485	37.6	0.220
2009	1156	6.527	49.6	0.213	797	6.540	53.7	0.243	359	6.500	40.4	0.147
2010	1159	6.542	53.1	0.201	802	6.554	56.7	0.207	357	6.516	45.1	0.185
2011	1135	6.544	57.1	0.265	781	6.550	61.1	0.274	354	6.531	48.3	0.230
2012	1260	6.523	55.0	0.281	807	6.527	59.7	0.302	453	6.517	46.6	0.240
2013	1312	6.484	62.3	0.293	826	6.499	65.4	0.293	486	6.459	57.2	0.284
Total	11705	6.515	52.4	0.267	8020	6.528	55.8	0.287	3685	6.487	45.0	0.217

Note: All the internal control quality, dividend payment propensity and dividend payment level in the table are annual means.

Data Source and Sampling Procedure

We selects 2004-2013 A-share main board listed companies as research objects and undergoes a filtering process on the original data like this: (1) get rid of the financial listed companies because of their particularity. (2) Get rid of the companies with unknown controllers and companies losing their financial data. (3) Get rid of ST, *ST and PT companies. (4) Get rid of companies with deficits but still issuing cash dividend. (5) In order to control potential influence of the extreme value on the regression results, we winsorize all the continuous variables from the top and bottom 1% to finally get a 10-year data and a research sample of all together 11705 measure values. From the **Table 1**, we know from the research samples there are 8020 observed values of the state-owned companies and 3685 observed values of the non-state-owned companies, which demonstrates that the state-owned companies still occupy an important position in the system of national economy of our country. In the last decade, the internal control quality of the sample firms has been relatively stable and presented little difference over the years, all hovering around 6.5 on the whole. While the cash dividend payment propensity and payment level have shown some volatility, which is mainly connected with profitability of sample firm over the years, therefore, presenting a certain regularity. But on the whole, the internal control quality, dividend payment propensity and payment level of the state-owned companies are all higher than those in non-state-owned companies.

In order to ensure the reliable of the data, all the data of cash dividend payment propensity and payment levels we need come from listed companies' annual reports, and arranged by author himself. Other internal control index and financial indicator are from the following database: (1) DIB internal control and risk management database. (2) CSMAR database. (3) Wind database.

Empirical Model and Variables Definitions

This paper measures the cash dividend policy through the cash dividend payment propensity and the cash dividend payment level (Bradford et al., 2013). In them, DIV is dummy variable. If a listed company pays in the very year the cash dividend, then we will 1 to mark, if not, zero will be marked. Whereas the DIVRATE is the ratio between the dividend per share and earnings per share. As for the internal control quality of a listed company, we will measure it through ICI provided by DIB internal control and risk management data. This index is based on five goals of the internal control including management, compliance, assets safety, strategy and report. Which has been continuously released for many years, and has gained recognition from the theoretical cycle and practice circle, and has been widely applied in the existing researches on internal control.

In addition, based on the existing documents (Pinkowitz et al., 2006; Sawicki, 2009; Huang et al., 2011), this paper sets the corresponding control variables of listed companies including the scale, profitability, balance sheets, growth, operation ability, the cash flow situation, Outstanding shares, ownership concentration and the

Table 2. Variable Definitions

Variables	Description
DIV	Dummy variable. If a listed company pays in the very year the cash dividend, then we will 1 to mark, if not, zero will be marked.
DIVRATE	Dividend per share/Earnings per share
ICI	Internal control index (Nature logarithm)
SIZE	Nature logarithm of ending total assets
ROA	Return on total assets
LEV	Gross liabilities/total assets
GW	(The very year operation revenue-last year operation revenue)/Last year operation revenue
TAT	Ending operation revenue/Ending total assets
FCF	(Net increase in cash and cash equivalents-The net cash flow generated by financing activities) The current value/The ending value of paid-up capital
LIQOID	Numbers of A-share in circulation/The total number of equity
TOP1	Shareholding ratio of companies' largest shareholder
AGE	The difference between the very year and listing year
YEAR	Year dummies
IND	Industry dummies

listed years. At the same time, it also controls the effect from years and industry. And the detailed variable definitions are as follows in **Table 2**.

In order to testify the two research hypothesizes in the above passage, here builds two regression models to examine impacts of the internal control quality of a listed company on the cash dividend policy.

$$Ln\left\{\frac{P(DIV)}{[1-P(DIV)]}\right\} = \alpha_0 + \alpha_1 ICI_{i,t} + Controls_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\text{DIVRATE} = \alpha_0 + \alpha_1 ICI_{i,t} + \alpha_2 Controls_{i,t} + \varepsilon_{i,t} \quad (2)$$

Model 1 mainly check the influence of the internal control quality on the cash dividend payment propensity. According to the feature that the DIV is the dummy variable, this passage adopts the panel logit model to unfold regression analysis. While model 2 is mainly to check the influence of the internal control quality on the cash dividend payment level. According to the feature of the limited dependent variable of DIVRATE being greater than zero, this passage adopts the panel tobit model to unfold regression analysis. When checking hypothesis 2, we divide our samples into the state-owned companies group and the non-state-owned companies group according to different nature of the ultimate controllers of the listed companies, to undergo regression analysis respectively on model 1 and model 2.

EMPIRICAL RESULTS

Descriptive Statistics and Variable Estimation

Table 3 provides the descriptive statistics of the key variables which were used in this study. As seen in **Table 3**, relative to the non-state-owned company, the propensity of the cash dividend payments of the state-owned companies seem to be much stronger, and the level is much higher. At the same time, the quality of internal control of state-owned companies is significantly higher than non-state-owned companies, in addition, these differences among the key variables also maintain a consistent with the theoretical analysis above. This conclusion also highlights the necessity of the validation of hypothesis 2, and it also shows the significant difference between the state-owned companies and non-state-owned companies in other control variables apart from the free cash flow (FCF) per share.

Table 3. Descriptive Statistics

Variables	Sample	Obs	Mean	SD	Min	Medium	Max
DIV	All	11705	0.524	0.499	0	1	1
	State	8020	0.558	0.497	0	1	1
	Non-state	3685	0.45***	0.498	0	0	1
DIVRATE	All	11705	0.267	0.493	0	0.072	3.333
	State	8020	0.286	0.506	0	0.116	3.333
	Non-state	3685	0.223***	0.459	0	0.000***	3.333
ICI	All	11705	6.515	0.156	5.928	6.533	6.854
	State	8020	6.528	0.152	5.928	6.538	6.854
	Non-state	3685	6.489***	0.160	5.928	6.521***	6.854
SIZE	All	11705	21.859	1.271	19.213	21.727	25.683
	State	8020	22.039	1.288	19.213	21.864	25.683
	Non-state	3685	21.482***	1.146	19.213	21.410***	25.543
ROA	All	11705	0.032	0.059	-0.238	0.030	0.200
	State	8020	0.032	0.057	-0.238	0.030	0.200
	Non-state	3685	0.033	0.065	-0.238	0.031**	0.200
LEV	All	11705	0.522	0.196	0.082	0.529	1.085
	State	8020	0.524	0.193	0.082	0.534	1.085
	Non-state	3685	0.514***	0.203	0.082	0.518***	1.085
GW	All	11705	0.248	0.710	-0.649	0.132	5.491
	State	8020	0.211	0.611	-0.649	0.137	5.491
	Non-State	3685	0.288***	0.888	-0.649	0.121***	5.491
TAT	All	11705	0.706	0.518	0.063	0.584	2.846
	State	8020	0.733	0.524	0.063	0.610	2.846
	Non-state	3685	0.649***	0.499	0.063	0.527***	2.846
FCF	All	11705	-0.313	1.724	-7.814	0.012	3.752
	State	8020	-0.327	1.784	-7.814	0.017	3.752
	Non-state	3685	-0.282	1.583	-7.814	0.005	3.752
LIQUID	All	11705	0.652	0.276	0.091	0.626	1
	State	8020	0.639	0.279	0.091	0.602	1
	Non-state	3685	0.682***	0.268	0.091	0.677***	1
Top1	All	11705	37.682	16.051	9.086	35.710	75.843
	State	8020	40.504	15.882	9.086	40.155	75.843
	Non-state	3685	31.574***	14.664	9.086	28.582***	75.843
AGE	All	11705	10.468	4.536	1	11	23
	State	8020	10.40	4.497	1	10	23
	Non-state	3685	10.62**	4.617	1	11**	23

Note: ***, **, * each means the significant level of means' different statistical test between state-owned companies and non-state-owned companies, which is 1%, 5%, 10%. The dummy variable DIV uses Chi-square test, the other variables use t-statistic test, medium test uses Wilcoxon test.

We made a further mean difference test on the variables (ICI), which are the key variables that influenced the propensity of the cash dividend payments of the listed companies. Firstly, we divided the sample groups into two categories according to whether the companies pay the cash dividend or not, and to test whether there is significant difference on the mean values of the internal control quality of the listed companies that from those two sample groups. Secondly, we can see if there is any differences among different propensity of the cash dividend payments between the state-owned companies and non-state-owned companies through different character of rulers. In **Table 4**, compared with the companies which don't pay cash dividend, the internal control quality is higher in the companies which pay cash dividend, it means the company with high quality of internal control has stronger cash dividend payment propensity, this conclusion partially proved hypothesis 1a. What's more, the PanelB showed that the difference of the internal control quality is more significant in state-owned companies but in non-state-owned companies is only weak significant, it indicates that the impact of quality of internal control on cash dividend payment propensity is strengthened in state-owned companies, which supports hypothesis 2a.

Table 4. Mean Difference Test

Panel A: Internal Control Quality Mean Difference Test						
Variables	Sample	DIV=1		DIV=0		T Test
		Obs	Medium	Obs	Medium	
ICI	All	6131	6.574	5574	6.451	45.391***
Panel B: Internal Control Quality Mean Difference Test—State Vs Non-state						
Variables	Sample	DIV=1		DIV=0		T Test
		Obs	Medium	Obs	Medium	
ICI	State	4473	6.581	3547	6.461	36.772***
	Non-state	1658	6.555	2027	6.435	25.106*

Note: Medium test uses t-statistic test; ***, **,* each means significant level, which is 1%, 5%, 10%.

Table 5. Correlation Coefficient

	DIV	DIVRATE	ICI	SIZE	ROA	LEV	GW	TAT	FCF	LIQUID	TOP1	AGE
DIV		0.516**	0.392**	0.362**	0.353**	-0.151**	-0.035**	0.098**	-0.070**	0.027**	0.171**	-0.113**
DIVRATE	0.916**		0.094**	0.122**	0.066**	-0.103**	-0.073**	0.039**	-0.021*	-0.028**	0.105**	-0.090**
ICI	0.383**	0.293**		0.485**	0.570**	-0.122**	0.095**	0.183**	-0.054**	-0.018	0.181**	-0.027**
SIZE	0.374**	0.297**	0.494**		0.162**	0.219**	0.026**	0.047**	-0.208**	0.079**	0.261**	0.072**
ROA	0.406**	0.289**	0.523**	0.157**		-0.332**	0.171**	0.136**	0.091**	0.008	0.122**	0.003
LEV	-0.136**	-0.156**	-0.024**	0.257**	-0.326**		0.052**	0.075**	-0.163**	0.016	-0.015	0.086**
GW	0.102**	0.038**	0.267**	0.116**	0.291**	0.059**		0.046**	-0.046**	-0.113**	0.071**	0.000
TAT	0.113**	0.094**	0.211**	0.033**	0.169**	0.063**	0.147**		0.105**	-0.003	0.061**	0.009
FCF	-0.049**	-0.036**	-0.012	-0.160**	0.136**	-0.141**	-0.076**	0.135**		0.011	-0.021*	0.048**
LIQUID	0.028**	-0.018	-0.044**	0.099**	-0.042**	0.025**	-0.116**	0.007	0.004		-0.335**	0.426**
TOP1	0.173**	0.178**	0.179**	0.235**	0.131**	-0.008	0.089**	0.070**	-0.016	-0.317**		-0.204**
AGE	-0.107**	-0.134**	-0.036**	0.113**	-0.029**	0.091**	-0.113**	-0.026**	0.064**	0.412**	-0.204**	

Note: The top right is Pearson correlation coefficient test, the lower left is Spearman correlation coefficient test, ** means there is significant correlation at 0.01 level (two-tailed), * means there is significant correlation at 0.05 level (two-tailed).

Correlation analysis

Table 5 is a correlation coefficient list of main variables. From it we can see, listed companies' internal control quality has positive correlation with cash dividend payment propensity and payment level no matter in Spearman correlation coefficient or Pearson correlation coefficient, which indicate that the improvement of listed companies' quality of internal control can strengthen cash dividend payment propensity and payment level, this conclusion proved hypothesis 1a at first step. In other coefficients, all the coefficients are in positive correlation except that debt level (Lev), free cash flow per share (FCF), listed years (AGE) and cash dividend payment propensity/level are in significant negative correlation.

Multiple Regression Analysis

The paper tests the relationship between listed companies' internal control quality and the propensity of cash dividend payment through logit model. Because that panel fixed effects logit model may delete the no variation in the independent variable individual observations (within the sample interval all 0 or all 1) in the entire sample may cause the loss of effective sample information, the paper will firstly consider to use random effects model as well in order to consistent with panel tobit model, and take the regression results of fixed effects model as a part of robustness test.

From the sample regression results in **Table 6** we can see, the coefficients of listed companies' internal control quality (ICI) and their cash dividend payment propensity (DIV) are significant positive at 1% statistic level, which indicated listed companies' internal control quality has significant positive correlation with their cash dividend payment propensity. The results show that under the same conditions, the logarithm odd ratios of sample companies' cash dividend payment propensity will increase 1.665 when their per internal control quality increased

Table 6. Panel Logit Regression of Internal Control Quality and Cash Dividend Payment Propensity

Variables	All		State		Non-state	
	Coefficient	Z Statistics	Coefficient	Z Statistics	Coefficient	Z Statistics
Intercept	-33.406	-16.81***	-33.295	-13.80***	-35.326	-9.48***
ICI	1.665	5.34***	2.047	5.34***	1.043	1.83*
SIZE	1.107	22.71***	0.967	16.62***	1.407	14.79***
ROA	15.818	16.90***	17.230	14.45***	14.236	8.86***
LEV	-3.341	-14.24***	-3.134	-11.09***	-3.784	-8.62***
GW	-0.387	-8.27***	-0.348	-5.78***	-0.480	-5.88***
TAT	0.452	5.31***	0.394	3.90***	0.585	3.59***
FCF	-0.083	-4.81***	-0.100	-4.93***	-0.032	-0.92
LIQUID	1.415	7.95***	1.378	6.38***	1.526	4.54***
TOP1	0.008	2.77***	0.010	2.84***	0.005	0.82
AGE	-0.120	-8.84***	-0.096	-5.82***	-0.162	-6.65***
Obs	11705		8020		3685	
YEAR	YES		YES		YES	
IND	YES		YES		YES	
Log likelihood	-5330.667		-3709.415		-1591.511	
Wald chi2	1403.54***		951.73***		463.07***	

Note: ***, **, * each means significant level is 1%, 5%, 10%.

one level (or 1 point), which means the sample companies' cash dividend payment propensity will increase 0.841, this supports the research hypothesis 1a. Next, we divided samples into state-owned companies and non-state-owned companies based on the different nature of listed companies' ultimate controllers, and did the regression analysis separately by using model 1. It shows, the internal control quality (ICI) has positive correlation with cash dividend payment propensity (DIV) at the level of 1% in state-owned companies samples, while in non-state-owned companies samples, this kind of positive correlation is significantly lowered, only be positive at level of 10%. In state-owned companies, the logarithm odd ratios of cash dividend payment propensity will increase 2.047 (the payment propensity increased 0.886) when per internal control quality increased one level (or 1 point); while in non-state-owned companies, the logarithm odd ratios of cash dividend payment propensity will increase 1.043 (the payment propensity increased around 0.739), which support the research hypothesis 2a, the state-owned nature of listed companies' ultimate controllers can strengthen the degree of relationship between the internal control quality and cash dividend payment propensity.

Table 7 shows the full samples of the listed companies' internal control quality and cash dividend payment level and the sub-samples of regression result. The full samples' regression results show that there is significant positive correlation (level of 1%) between listed companies' internal control quality (ICI) and their cash dividend payment level, which means high internal control quality can remarkably enhance the cash dividend payment level and agreed with our research hypothesis 1a. In regression of sub-samples, the internal control quality in state-owned companies' samples has significant positive correlation with cash dividend payment level at 1%, while in non-state-owned companies samples, this kind of correlation is not significant. The result also supports research hypothesis 2a.

Table 7. Panel Tobit Regression of Internal Control Quality and Cash Dividend Payment Level

Variables	All		State		Non-state	
	Coefficient	Z Statistics	Coefficient	Z Statistics	Coefficient	Z Statistics
Intercept	-6.030	-11.30***	-5.827	-9.16***	-7.164	-7.12***
ICI	0.249	2.84***	0.306	2.88***	0.178	1.12
SIZE	0.220	18.11***	0.189	13.13***	0.300	12.79***
ROA	1.227	5.32***	1.320	4.69***	1.128	2.73***
LEV	-0.904	-14.16***	-0.795	-10.45***	-1.156	-9.77***
GW	-0.131	-8.95***	-0.121	-6.51***	-0.152	-6.29***
TAT	0.101	4.44***	0.081	3.03***	0.166	3.80***
FCF	-0.018	-3.89***	-0.020	-3.70***	-0.006	-0.66
LIQUID	0.235	4.95***	0.289	5.13***	0.205	2.23**
TOP1	0.003	3.52***	0.003	3.02***	0.003	2.04**
AGE	-0.023	-7.11***	-0.019	-4.68***	-0.033	-5.59***
Obs	11705		8020		3685	
YEAR	YES		YES		YES	
IND	YES		YES		YES	
Log likelihood	-9564.416		-6832.311		-2701.744	
Wald chi2	1072.30***		669.06***		434.89***	

Note: ***, **, * each means significant level is 1%, 5%, 10%.

From the regression results of **Table 6** and **7**, the internal control quality in listed companies has significant positive correlation with cash dividend policy (payment propensity and level), and this correlation is being enhanced in listed companies that the nature of ultimate controllers is state-owned, while in the companies that he nature of ultimate controllers is non-state-owned, this kind of positive correlation is significantly lowed (the payment propensity) or nor notable (the payment level).

Potential Endogeneity Test

The paper mainly discussed the impact of listed companies' internal control quality on cash dividend policy, however, there may be a major dispute, the listed companies' cash dividend policy may cause the internal control quality changed by influencing agency costs, which means there may be potential endogeneity between internal control quality and cash dividend. Therefore, in this part, we will test the casual relationship between listed companies' internal control quality and cash dividend policy depending on Jiraporn and Ning (2006)'s research method. And construct following regression models by using Granger causality test proposed by Granger (1969).

$$\mathrm{DIV}(t) = \alpha_0 + \alpha_1 ICI_{i,t-1} + \alpha_2 DIV_{i,t-1} + \alpha_3 Controls_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$\mathrm{ICI}(t) = \beta_0 + \beta_1 ICI_{i,t-1} + \beta_2 DIV_{i,t-1} + \beta_3 Controls_{i,t} + \varepsilon_{i,t} \quad (4)$$

$$\mathrm{DIVRATE}(t) = \alpha_0 + \alpha_1 ICI_{i,t-1} + \alpha_2 DIVRATE_{i,t-1} + \alpha_3 Controls_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$\mathrm{ICI}(t) = \beta_0 + \beta_1 ICI_{i,t-1} + \beta_2 DIVRATE_{i,t-1} + \beta_3 Controls_{i,t} + \varepsilon_{i,t} \quad (6)$$

According to Jiraporn and Ning (2006)'s research, if the listed companies' internal control quality can cause the change of cash dividend policy, we expect that coefficient α_1 in model 3 and 5 should be significantly different from 0, and the coefficient β_2 in model 4 and 6 have no significant difference with 0. In contrast, if it is the cash dividend policy that causes the change of internal control quality, the coefficient β_2 should have significant difference with 0, while α_1 don't have significant difference with 0.

Table 8 is the estimation results of the above 4 models. The results of model 3 and 5 show, the lag one of listed companies' internal control quality (α_1) has positive correlation with cash dividend payment propensity and level (all at 1%). On the other side, the relationship between the lag one of cash dividend payment and level (β_1) and the internal control quality. This results show there isn't endogeneity between listed companies' internal control quality and cash dividend policy. From above we can see, the higher internal control quality in listed

Table 8. Granger Causality Test between Internal Control Quality and Cash Dividend Payment Propensity/Level

Variables	Model 3		Model 4		Model 5		Model 6	
	Coeff	Z	Coeff	T	Coeff	Z	Coeff	T
Intercept	-39.361	-19.86***	3.535	77.28***	-10.901	-20.65***	3.548	80.45***
ICI(t-1)	3.680	12.43***	0.334	41.96***	1.214	14.16***	0.332	42.49***
DIV(t-1)	1.191	16.59***	-0.002	-0.89	——	——	——	——
DIVRATE(t-1)	——	——	——	——	0.069	3.76***	-0.0002	-0.12
SIZE	0.708	15.01***	0.036	33.60***	0.149	11.87***	0.036	33.79***
ROA	15.270	17.76***	1.050	54.06***	0.946	4.23***	1.048	54.38***
LEV	-2.162	-9.46***	-0.022	-3.77***	-0.679	-10.04***	-0.022	-3.71***
GW	-0.229	-4.43***	0.010	6.31***	-0.103	-6.16***	0.010	6.37***
TAT	0.250	3.14***	0.016	7.59***	0.058	2.44**	0.016	7.57***
FCF	-0.036	-2.04**	-0.001	-2.28**	-0.009	-1.85*	-0.001	-2.24**
LIQUID	1.159	6.60***	0.014	2.79***	0.235	4.72***	0.014	2.72***
TOP1	0.007	2.66***	0.00004	0.59	0.003	3.48***	0.00004	0.56
AGE	-0.075	-6.34***	-0.0003	-1.05	-0.018	-5.32***	-0.0003	-0.94
Obs	10187		10187		10187		10187	
YEAR	YES		YES		YES		YES	
IND	YES		YES		YES		YES	
Log	-4465.658		——		-8300.730		——	
Wald chi2	1817.06***		15693.59***		1061.36***		15651.39***	
R^2	——		0.8404		——		0.8399	

Note: In order to ensure the comparability of research conclusion, model 4 and model 6 adopt random results model, R^2 is between R^2; ***, **, * each means significant level is 1%, 5%, 10%.

companies' has stronger propensity to pay cash dividend to their shareholders and the level of payment is higher too.

DISCUSSION

The paper take A-share listed company board of China during year 2004 to 2013 as samples, studies the relationship between internal control quality and cash dividend through panel logit model and panel tobit model. The paper proposes results model and alternative model about the impact of internal control quality on cash dividend based on analyzing principal-agent theory and incorporating the fruits of previous researches, and then deducts the main hypotheses. The regression results show: listed company's cash dividend payment propensity and the level of cash dividend payment have a statistically positive effect with internal control quality but with level of cash dividend payment is relative weaker when factors such as operation results are being controlled. In addition, this study uses Granger causality test and gains empirical evidence that internal control quality is one of the influencing factors of cash dividend payment policy in listed companies. In short, internal control quality in listed companies is an important factor that influences cash dividend payment policy and causes different cash dividend payment policies of in different natured ultimate controllers.

CONCLUSION

This study makes the general accounting educators clear the general methods and processes of accounting empirical research, and also understand the key points and difficulties in accounting education. In the accounting classroom education, we should consciously strengthen the students, especially the graduate students of accounting empirical course learning, which is to improve and enrich the field of accounting research methods and means of great significance.

The conclusion of this paper not only plays a certain role in promoting the theory of accounting empirical education, but also has some enlightenment significance for the practical circles, especially the government regulators and investors. The results of this paper also show, high internal control quality governance mechanism

can lower the agency conflict between listed company insiders and outsiders, further control the governors' opportunism on cash dividend payment policy and efficiently lifted the listed companies' propensity and level of cash dividend payment. At present, the conclusion provides new ways for China's regulators to make policies for they are strongly advocating to protect the small investors' interests and improving the listed companies' cash dividend policy. Considering the differences that different nature of ultimate controllers may cause, the regulators should adopt appropriate policy measures when they making relative policies.

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A Flipped Experience in Physics Education Using CLIL Methodology

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ABSTRACT

Physics' curricula of Italian Scientific High Schools in the last years have been enhanced by the introduction of Quantum Mechanics and Content and Language Integrated Learning (CLIL). Education monitoring reveals that last year's students are experiencing many issues in learning in their second language (L2) and advanced and counter-intuitive contents. Our experiment is aimed at understanding and then overcoming those problems using educational methodologies based on social aspects. Thanks to the Internet, a communicative style can be exploited where teachers could keep teaching, playing the role of semiotic mediators. Multimedia and simulations broadly available in MOOCS suggested a flipped classroom approach coping with the project of CLIL lessons. In our experience two classrooms of students were selected, starting from very similar performances and skills. The first one was taught with traditional lectures and tests; the second one, instead, attended to experimental lessons. Students could share their ideas and learning supports through a Facebook group, a blog, virtual classrooms and a website. Nevertheless, at the end of the experience an eTwinning exchange was planned, to spread the experiment towards foreign schools. The outcomes of the tests performed on the students were analysed and unexpected results were drawn. An extension to larger numbers of students, the introduction of different methodologies and the research about different topics in Physics could potentially develop this research.

Keywords: flipped learning, CLIL, peer learning, modern physics

INTRODUCTION

This work is the result of a teaching experimentation, through a Quantum Mechanics CLIL learning module presented to two last year's classes in an Italian Scientific High School. The rationale of our investigation is based on the fact that this topic has been introduced only recently in Physics' curricula of High Schools and it has been proven that students encounter quite a lot of problems in learning its advanced and counter-intuitive concepts (Deslauriers, L. et al.,2011; Tsaparlis, G. et al., 2009; Singh, C. et al., 2006). Trying to fix these issues, we founded the choice of our educational methodology on social considerations: nowadays knowledge transmission is widely supported by digital technologies, featuring large amounts of information conveyed at high speeds and a high grade of interaction. Digital Natives, exhibiting noteworthy changes in behaviour, cognition and communication skills, need new educational approaches (Prensky, M., 2001). Current cultural models are somehow centred on the

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Contribution of this paper to the literature

- Our idea is to put together these two methodologies, because, as specified before in this paper, teachers in CLIL are mainly guides and facilitators of knowledge as in Flipped Clasroom.
- Our challenge to make Quantum Mechanichs more friendly recalled the basic concepts of our experiment design.
- The possibility to try these methodologies in a classroom gave us a validation of our original ideas.

concept of "collective intelligence" (Woolley, A., 2010), where no one knows everything, everyone knows something and all knowledge belongs to all of mankind. Thanks to digital devices, constantly connected to the Internet the most colossal knowledge repository ever realized, a communicative style, strongly characterized by virtual interactivity, autonomous production and sharing of individual contents, speed and communication efficiency is now emerging. In this completely new background, however, teachers still holds the role of semiotic mediators. Therefore a flipped classroom approach seemed to cope with the project of CLIL Modern Physics lessons: multimedia and simulations broadly available in MOOCS, in cloud learning environments and in social educational platforms could help teachers in their scaffolding task. The most appropriate contents, properly selected by teachers and shared with students, could be a strategic tool for students to deepen their knowledge out of the classroom independently. So the classroom comes to be a lab, where even complex ideas are discussed and higher level thinking skills are exploited in order to project and realize concrete experiments and applications to actual study cases, with the side effect of a fluid cognitive and linguistic development. In our experiment two classrooms of students were selected, starting from very similar performances and skills. The first one, A, attended to experimental lessons; the second one, B, instead, was taught with traditional lectures and tests.

ACTIVITIES

To increase the interaction level, a Facebook group and a blog were founded, where students very easily shared their ideas and materials. Besides, a website was created, as a repository of contents contributed by students but revised and selected by the teacher. Specifically, flipped activities were organized so that one subgroup collected as many information as possible about a specific part of the topic and then shared it with the entire group.

Students discussed each part of the topic developing ideas and redefining in a more precise way the key concepts. Exhibits and models were built to leave a tangible footprint of the activities.

Besides, a laboratorial activity, focused on a simplified version of the double slit experiment, was carried out by students. "…Richard Feynman famously said that interference of particles captures the essential mystery of quantum physics; at the time, this was still mostly a thought experiment, but in the intervening fifty years, the exact experiment he discussed has been done numerous times, with numerous particles." (Orzel, C., 2015).

The double slit experiment, first performed by Thomas Young in the early nineteenth century, could be considered a key to understand the microscopic world and in particular the wave-like properties of light. In the original experiment, a point source of light illuminates two narrow adjacent slits in a screen, and the image of the light that passes through the slits is observed on a second screen. The dark and light regions that we can observe on the second screen are the interference fringes, the constructive and destructive interference of light waves. Also the matter produces interference patterns, as we can see by firing a stream of electrons instead of light.

Students performed this experiment using a piece of smoked glass scratched using a pin, drawing different couples of very thin lines, the slits (about 0.1 mm, 0.2 mm and 0.05 mm), to detect different interference patterns. After that, they illuminated the slits using a coherent light source, such as a laser beam from a laser pointer. So different Fraunhofer diffraction pattern appeared on a screen, placed 4 meters away (see **Figure 1**). The measurements should be taken in a darkened room or in constant natural light. If this is not possible, a longish tube about 4 cm in diameter and blackened on the inside (such as a card-board tube used to protect postal packages) can be used.

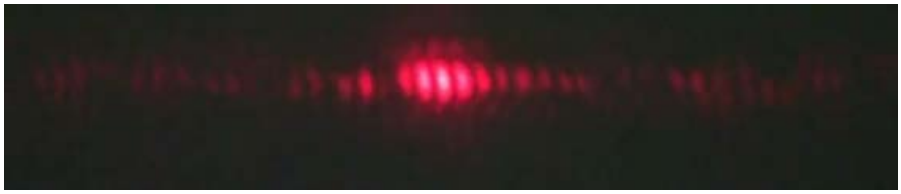


Figure 1. Interference pattern

Using the same experimental setup but with a single slit, they also proved the uncertainty principle: the thinner is the slit, the wider is the position of the photons on the screen.

TESTING AND OUTCOMES

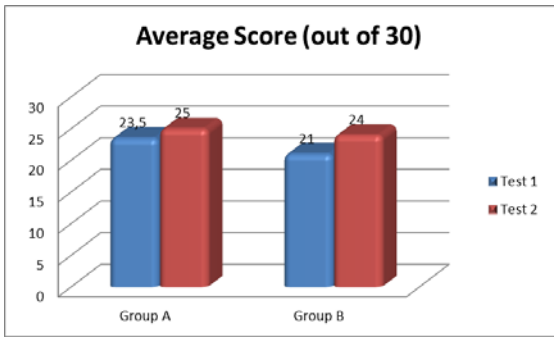
At the end of the module, both the classes A (flipped classroom) and B (traditional education) were tested using a similar online form. Two sets of 30 items were selected with the aim of detecting the skills obtained by the students. Besides, in order to limit cheating and other kinds of mutual influences, the testing system scrambles the multiple questions and answers and ask different questions to different students.

Testing procedure also included the production of a report of the experiments: the sharpness and the quantity of information of group A was largely higher than the one of the group B.

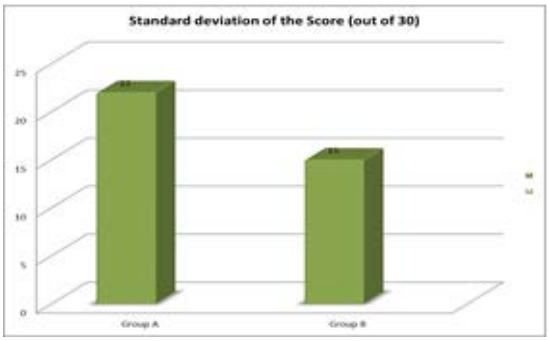
Finally, testing procedure also included the verification of the results after a month.

Also in this case, students were tested by an online form with 30 multiple choice questions and the results confirmed that the flipped classroom group A obtained a more persistent knowledge as in the next diagram.

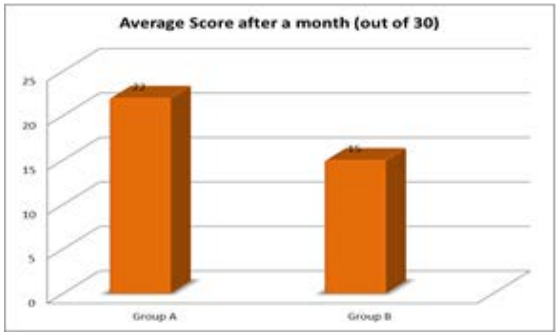
The histograms depicted in **Figure 2a**, 2**b** and 2**c** show a synthetic version of the results.



(a)



(b)



(c)

Figure 2. Testing outcomes: a) average scores of a multiple choice test; b) standard deviation; c) persistence of the results

CONCLUSIONS AND FUTURE DEVELOPMENTS

This experiment has shown that performance of secondary school students can benefit of flipped classroom strategy in learning difficult topics, such as quantum mechanics in CLIL methodology. These outcomes, very persistent in time, were gathered by a multiple choice questionnaire and reports.

Potential future developments of this experience are the extension to larger numbers of students, the introduction of different methodologies and the research of the similarity of the issues encountered in quantum mechanics with the ones encountered in other similar topics.

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Typologies of Didactical Strategies and Teachers' Pedagogical Beliefs: A Theoretical Review

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ABSTRACT
Didactical strategies are one of the most influential vehicles that directly contribute to transforming knowledge. Varying types of didactical approaches are being adopted and implemented in the preparation of future teachers in the initial teacher education set up. The current conceptual paper is based on rigorous literature review on the typologies of didactical strategies adopted in the initial teacher education. The purpose of this conceptual and theoretical study is to evaluate and contrast varying didactical approaches while navigating through literature. The study also aims at exploring the interrelationship of didactical approaches with teacher cognitions i.e., teacher pedagogical beliefs. The methodology of this study based on the selection of six types of didactical strategies by Van De Grift (2007) and to compare and contrast them with other typologies available in literature and to explore the interrelationship with teachers' pedagogical beliefs. The study concludes that the varying typologies of didactical strategies are being adopted and implemented in the ITE set up and these strategies have strong relationship with teacher's pedagogical beliefs. The study recommends that the teachers' cognitions i.e., teachers' pedagogical beliefs may be included in the curriculum when preparing future teachers in the initial teacher education setting. These findings are substantial for policy makers, curriculum developers, head teachers, and other stakeholders in the initial teacher education.

Keywords: didactical strategies, teacher cognitions, pedagogical beliefs, initial teacher education

INTRODUCTION

Didactical strategies are defined as concrete teaching approaches, consciously selected and implemented teacher actions in view of attaining learning objectives in students (see, e.g., Jones & Tanner, 2002; Valcke et al., 2010). The

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Contribution of this paper to the literature

- The current paper deals with the didactical strategies adopted in the initial teacher education settings. The current paper enriches the existing literature while providing a contrast and alignment of variety of didactical strategies adopted in the initial teacher education.
- The current paper is unique for its contribution to the existing literature in terms of interrelationship of didactical strategies and pedagogical beliefs. Hardly studies are found that establish this kind of relationship. Teacher cognitions are significant in the selection of didactical strategies.
- The typologies of didactical strategies presented in this paper are of varying types that give a clear picture to understand the teaching styles of teacher educators for the preparation of future teachers in the initial teacher education settings.

latter goes back to the different clusters of competences referred to by Zhu and Wang (2014) that require teachers to adopt a wide variety of strategies to be able to choose adequate behaviour to invoke learning, educational, technological and social competences or – when building on the TPACK model – to invoke technological and pedagogical content knowledge. Each cluster helps attaining the learning objectives in different ways. It is, therefore, obvious that teachers adopt and implement very different didactical strategies in the classroom in view of the attainment of specific learning objectives (Darling-Hammond, 2006).

Differences in didactical strategies can be identified in different ways. Chickering and Gamson (1989) base their distinction on seven principles that define didactical strategies. These principles refer gain to the critical need to guarantee that these strategies help attaining the learning objectives:

1. Encourage contact between student and faculty
2. Develop reciprocity and cooperation among students
3. Encourage active learning
4. Give prompt feedback
5. Emphasise time on task
6. Communicate high expectations
7. Respect diverse talents and ways of learning

Another way of specifying didactical strategies is by looking from a historical perspective. In this way, we observe a shift from teacher-oriented (also labelled as theory-oriented and rote learning) to student-centred didactical strategies (Darling-Hammond, 1996; Hermans, Tondeur, van Braak & Valcke, 2008).

Student-centred didactical strategies are often labelled as 'constructivist' and teacher-centred are labelled as 'traditional' teaching strategies. Describing the student-centred approach, Mayer (2010) explains this requires teachers invoking an active learning process in which learners are active sense-makers and seek to build coherent and organised knowledge. Cannon and Newble (2000, pp. 16-17) define student-centred didactical approaches as "ways of thinking about teaching and learning that emphasise student responsibility and activity in learning rather than content or what the teachers are doing". In the literature, student-centred didactical approaches are also labelled in different ways; i.e., student-activating didactical methods (Struyven, Dochy, Janssens, & Gielen, 2006), problem-based-learning (Dochy, Segers, Van den Bossche, & Gijbels, 2003), powerful learning (De Corte, 2000), discovery learning (Mayer, 2004) and collaborative/cooperative learning (Slavin, 1995).

In contrast to student-centred didactical approaches, teacher-centred didactical strategies mainly focus on lecturing methods, disciplined teaching methodology and strict teacher-based classroom decisions regarding teaching and learning (Orlich, Harder, Callahan, Trevisan, & Brown, 2009). Following traditional didactical strategies, teacher impart information and knowledge to the students who remain passive (Prince, 2004).

In the next paragraphs, we explain the teachers' cognitions and we base on Korthagen's (2005) onion model that reflects teachers' behaviour and beliefs.

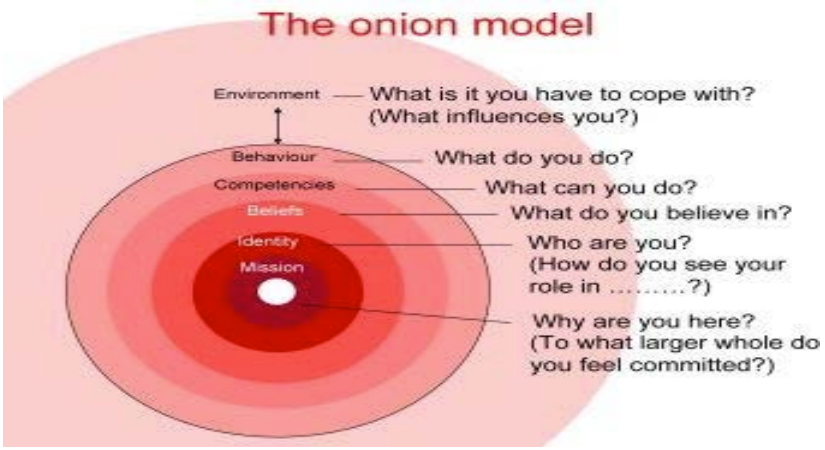

Figure 1. The onion model adapted from Korthagen (2005)

TEACHERS' COGNITIONS

Empirical research indicates that the adoption and implementation of didactical strategies is influenced by a variety of factors; such as teacher training, teacher beliefs, teacher's personal identity, and teacher's self-actualization (Struyven et al., 2010; Suleman, Aslam, Habib, Gillani, & Hussain, 2011). The latter factors refer to teacher cognitions, discussed in the next paragraphs.

Generally, teacher cognitions are described as the set of beliefs, self-perception and opinions of teachers about teaching. Defining teacher cognitions, Borg (1999) conclude that actually teacher cognitions are stores of beliefs, knowledge, theories, assumptions and attitudes that play a significant role in shaping teachers' instructional decisions. Burns (1992) is of the opinion that teacher cognitions are beliefs that foster the adoption of didactical strategies and smooth the teaching process. Authors also link teacher cognitions to various individuals' personal attributes such as personal pedagogical systems, theories, conceptions, theoretical beliefs, images and cultural attributes (Fishbein & Ajzen, 1975; Hermans, Tondeur, van Braak, & Valcke, 2008; Korthagen & Vasalos, 2005; Macalister, 2012; Nespor, 1987; Pajares, 1992; Sang, Valcke, van Braak, & Tondeur, 2009).

Teacher cognitions are influential elements that affect teacher behaviour in view of the effective adoption of didactical strategies (Zembylas, 2005). On the other side, teacher behaviour also significantly uplifts teacher cognitions, suggesting a mutual interrelationship between teacher cognitions and behaviour (Clarke & Hollingsworth, 2002). This is central to the onion model of a teacher's identity of Korthagen and Vasalos (2005).

According to the onion model, a teachers' identity is based on five layers, i.e., behaviour, competency, belief, mission, and identity. Behaviour and competences are the outer layers. Belief, mission and identity are the inner parts of the model that provide the base for a teacher's behaviour (Korthagen & Vasalos, 2005). All layers are interlinked with one another. This is, in particular, clear when it comes to the relationship between teacher cognitions (beliefs layer), teacher competences, and teacher behaviour.

Studies, set up in an initial teacher education context, reveal a positive connection between teacher beliefs and the adoption of didactical strategies and despite this relationship with the adoption of didactical strategies, they are hardly given due consideration in the preparation of future teachers (Valcke et al., 2010).

In the present paper, we based on beliefs (one of the onion model layers), and build on the following list of teacher cognitions in relation to the didactical strategies:

Pedagogical beliefs - teaching beliefs

The rationale for focusing on this list, is related to the available theoretical and empirical evidence, linking these cognitions to the adoption of didactical strategies by (student) teachers (Goldberg & Cornell, 1997; Kramarski & Michalsky, 2009).

METHODOLOGY

In view of the present study design, we build on an eclectic integration of types of didactical strategies. By comparing a number of key authors, we developed the following table in which we compare a typology presented by Van de Grift (2007) with typologies/distinctions presented by other authors.

Table 1. Comparison of different typologies for didactical strategies

Authors	Type1	Type 2	Type 3	Type 4	Type 5	Type 6
Van de Grift (2007)	Strategies that foster the learning strategies by learners	Matching student characteristics with teaching	Students' active engagement in the classroom	Effective teacher instruction strategies	Organising the teaching activities	Positive classroom climate
Horn et al., (2005)	Strategies to address complex learning problems		Developing students self-confidence for active participation	Developing connection between teaching and real life		Positive student-teacher relationship strategies
Perrott (2014)	Simplifying the complex problems	Student previous knowledge matching strategies			Orderly management of lessons	
Trees (2013)	Cooperative strategies by learners	Cater the needs of diverse students	Student group dynamics	Illustration of difficult content	Student formative assessment strategies	Comfortable class environment optimise learning
Westwood (2008)		Managing individual differences in learning	Interactive instructional methods	Developing liaison between student and teaching		Democratic class environment

From the table, it is clear most typologies/distinctions are interrelated. Most types reappear in the different classifications. In the column 'not aligned", we perceive especially very specific strategies that in fact could be translated into the more general other categories.

Secondly, it has to be stressed that distinguishing these didactical strategies does not imply that they are not related. The teaching process is a holistic endeavour in which didactical strategies are interlinked (Van de Grift, 2007). In the present paper, we build on the typology of van de Grift (2007), when discussing the different didactical strategies. In the next section, we discuss the different (aligned) types of didactical strategies and its relationship with teachers' pedagogical beliefs.

DISCUSSION

In the following paragraphs, we elaborate each didactical strategy of Van De Grift (2007) very precisely with the other key authors we found in the existing literature. We also develop a link between each type of didactical strategy with teachers' cognitions based on the existing literature.

Strategies that Foster the Adoption of Learning Strategies by Learners

Following this type of didactical strategies, (student) teachers adopt and implement strategies that enables the learners to understand the complex learning problems (Horng et al., 2005). The teacher introduces exercises removing difficulties in lesson content and help students to comprehend the knowledge (Westwood, 2008). Simplifying complex problems also helps students with lower level learning capabilities (Perrott, 2014). This type of strategies pushes students to check their solutions (Van de Grift, 2007).

Strategies to Match the Teaching and Learning Activities to Student Characteristics

Here, the focus is on individualising didactical strategies in the classroom. Since the classroom is a diverse place of learning, every student possesses a unique person. It is not wise to teach all the students through a single didactical approach (Westwood, 2008). To cater the needs of diverse students, didactical strategies have to address the nature of individual differences (Orlich, Harder, Callahan, Trevisan, & Brown, 2009; Trees, 2013). A competent teacher will apply strategies to analyse the abilities of each student in the class and arrange the lesson as per the individual requirements. This will require probing students' previous knowledge (Perrott, 2014).

Strategies to Make Students Actively Engaged in the Classroom

Following this type, didactical strategies activate students in the classroom. Teachers need therefore select, prepare and deliver challenging teaching materials (Orlich et al., 2009). The teacher can engage students in think-pair-share kind of activities, brainstorm activities and other ways to push innovative ideas (Chickering & Gamson, 1999). Especially choosing interactive strategies is helpful to make student actively engaged in the classroom (Van de Grift, 2007). This boosts students' self-confidence (Horng et al., 2005) and students' vigilance (Trees, 2013). Student-centred didactical strategies are more apt to keep students actively engaged in the classroom (Westwood, 2008).

Strategies that Centre on Effective Teacher Instruction

These didactical strategies invoke clear explanations of the learning content during instruction (Killen, 2012; van de Grift, 2007). The teacher helps and monitors students' learning activity while developing a liaison between teaching and student interest and his/her ability (Westwood, 2008). Students are encouraged to raise questions (Trees, 2013). The strategies also try to establish a connection between the teaching content and real life (Horng et al., 2005). And most of all, the teacher provides feedback to students and monitors whether lesson objectives have been achieved.

Strategies that Help to Organise the Teaching Activities

These strategies require teachers to consider the sequencing and order within and between activities. Orderly conducted lessons are critical (Van de Grift, 2007). This is often referred to as classroom management strategies and is considered as a type of very effective didactical strategies (Chickering & Gamson, 1999). It is also linked to a strict planning of (summative and formative) evaluation, (Perrott, 2014; Trees, 2013). It additionally requires strict of time management (Orlich et al., 2009).

Strategies to Develop the Positive Classroom Climate

Following this type of strategies, teachers focus on a positive and healthy teacher-student and supportive student-teacher relationship (Wubbels & Brekelmans, 2005; Wubbels, Levy, & Brekelmans, 1997). To optimise

learning, students are allowed to speak freely, share ideas, and take initiatives. This helps them feeling comfortable (Trees, 2013). Such a congenial and friendly learning environment plays a significant role in the mental boost up in students (Killen, 2012). It is also, labelled as developing a democratic environment ensuring the development of self-confidence of learners (Westwood, 2008).

Further, we base our paper on the three layers (behaviour, competencies and beliefs) of the onion model – discussed below - when talking about teacher's professional identity. The adoption and implementation of didactical strategies represents behaviour and competencies and is linked to specific teacher cognitions (i.e., pedagogical beliefs). We stress in this context the relationship between the adoption of didactical strategies and these teacher cognitions.

In the following paragraphs, we discuss this list of teacher cognitions (pedagogical beliefs) and how they can be related to the adoption of didactical strategies.

The Interrelationship between (Student) Teachers' Pedagogical/Teaching Beliefs and the Adoption of Didactical Strategies

Teachers' teaching/pedagogical beliefs are a source of a successful teaching–learning process and helps teachers dealing with ill-structured educational classroom conditions (Nespor, 1987). Van Driel, Bulte, and Verloop, (2007) clustered beliefs following their affective, evaluative, and episodic nature. But, a predominant typology of pedagogical-teaching beliefs in the literature builds on the distinction between traditional and constructivist pedagogical-teaching beliefs. Traditional pedagogical-teaching beliefs refer to didactical strategies focusing on teacher-centred teaching approaches where learners are supposed to follow strict teacher guidelines. On the other hand, constructivist pedagogical-teaching beliefs provide autonomy to the students and are therefore often called student-centred beliefs (Woolley, Benjamin, & Woolley, 2004).

Authors state that (student) teachers' pedagogical-teaching beliefs are persistent and therefore hard to change (Kagan, 1992; Korthagen, 2004; Pajares, 1992). This explains why – even after attending initial teacher education or professional development, (student) teachers continue adopting didactical strategies less favourable for the specific teaching-learning setting. Authors found that (student) teachers' pedagogical-teaching beliefs play a significant role in the acquisition and transmission of knowledge in classrooms (Borg & Al-Busaidi, 2011; Murphy, Delli, & Edwards, 2004; Norton, Richardson, Hartley, Newstead, & Mayes, 2005). Waters-Adams (2006) reinforced the association between teaching beliefs and classroom strategies, and stated "beliefs were found to be the determining factor in the teachers' decisions about classroom strategies" (p. 919).

Below we explain the interrelationship of pedagogical beliefs with the typology of didactical strategies introduced above.

Strategies that foster the adoption of learning strategies by learners

This type of strategies help learners to adopt specific learning strategies, i.e., solving the complex learning problems, overcoming difficulties in lesson content, and helping in comprehending the knowledge. Less literature is available as to the interrelationship of teaching beliefs with these specific types of didactical strategies. Nevertheless, Raymond (1997) could positively link the teaching beliefs with adequate selection of challenging lesson content (mathematics). Webster (2015) identified a clear link between teacher beliefs and the extent to which students were supported in developing regulation skills. He identified teacher beliefs that attributed inattentiveness and impulsivity to biological unchangeable factors, less likely to foster regulation. In contrast, teachers who stressed a student centred approach – as reflected in their attention paid to the classroom environment, their instructional style, and the fact they wanted to motivate learners - would pursue the development of these regulation strategies. Lastly, Burton and Frazier (2012) found how the adoption of strategies that foster inquiry learning strategies, seems to be strongly aligned with teacher beliefs and their perceptions about the need for teaching inquiry in their classrooms. This reiterates the findings of Ong, Hart and Chen (2016) who – on the base of observations, interviews and surveys – concluded that teachers who focus on deep level thinking,

foster questioning by students, engage in discussion with students, reflect particular beliefs about the nature of the learning process and the way pupils function in their classrooms. They state (ibid, p.12): "These beliefs and values to improve student's thinking appear to be significant influences in guiding the way he used questions and follow-up moves in class".

Strategies to match the teaching and learning activities to student characteristics

Teaching the diverse students always need careful planning and the adoption of appropriate didactical strategies while considering individual differences and student characteristics. Paying attention to student characteristics reflect a dominantly student-oriented approach. This could already be confirmed in an early study of Stanovich and Jordan (1998). Other authors focused on the extent to which teacher beliefs play a role when teaching low-achieving students and select didactical approaches that invoke higher level thinking. They conclude: "teachers' beliefs in this context are related to their general theory of instruction: viewing learning as hierarchical in terms of students' academic level was found to be related to a traditional view of learning, i.e., seeing learning as progressing from simple, lower order cognitive skills to more complex ones" (Zohar, Degani, & Vaaknin, 2001, p. 469). Ho and Liu (2015) identified two beliefs approaches: instructional and managerial. The latter led to a lesser extent of being able to cope with learner difficulties and disabilities. Also, Leyser (2002) found how teachers' beliefs did affect their capacity to cope with special education needs in both normal and special education learners. Again, student-centred beliefs were a defining factor in teachers.

Strategies to make students actively engaged in the classroom

This type of strategies focuses on activating students' engagement in the class, boosting students' self-confidence and applying specific didactical strategies. Authors show how teachers' self-reported beliefs directly influenced student academic engagement through their choices for specific didactical behaviour (Archambault, Janosz & Chouinard, 2012). Other authors explicitly state how a shift is needed from teacher-centred to student-centred beliefs in view of developing stronger engagement of students in the classroom (Larrivee, 1997). But, some others (see, e.g., van Uden, Ritzen, & Pieters, 2014) stress the interrelationship between teaching beliefs and student engagement in the classroom is complex. These authors state: "it is difficult to predict the extent to which teachers are able to foster student engagement, based on their beliefs" (ibid, p. 30). In a parallel study (ibid, 2013) they concluded that the linkage between teacher beliefs and learners' emotional engagement was stronger than the linkage between their beliefs and behavioural engagement.

Strategies that centre on effective teacher instruction

Central to this type of didactical strategy is teacher's focus on clear explanations of the learning content, invoking student questions and focused lesson planning. Research confirms how teacher beliefs influence teacher instructional choices and practices (Rubie-Davies, Flint, & McDonald, 2012). Already early studies linked teachers' theoretical beliefs and instructional practices to teacher beliefs. For example, Johnson (1992) linked beliefs to opting for effective instruction in literacy development contexts. Haney, Czerniak and Lumpe (1996) linked teacher beliefs to science education and stressed not to ignore teacher beliefs. They state how pointless it is to push all kind of effective learning materials, new programs and new projects unless teachers do not move beyond the status quo in science education. They rather emphasise how programs should push teachers to become innovative, to take risks in the classroom, to adopt hands-on/minds-on, … approaches.

The former exemplifies how this didactical strategy also incorporates a strong focus on opting for evidence-based strategies. In this context, many studies centre on the relationship between teacher beliefs and technology integration in the classroom. The title of the paper of Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur and Sendurur (2012) points at the critical nature of this relationship "Teacher beliefs and technology integration practices: A critical relationship". Their paper initially reviews how choices of teachers in math, reading and science are heavily influenced by their pedagogical beliefs. But they extend this literature by focusing on the link with educational technology. They stress how – even innovative learning tools and environments such as science labs,

computers, Internet usage, do not automatically prompt teachers to adopt more student-centered or constructivist teaching approaches. To the contrary, they state, "The assumption, then, is that increased or prolonged technology use will actually prompt teachers to change their practices toward more constructivist approaches. While this may be true, it has yet to be verified by empirical research" (ibid, p.27). And they further continue on the same page "Although changes in these structures might create more opportunities for teachers to use student-centered approaches, other second-order barriers (i.e., barriers that are intrinsic to teachers and that challenge their beliefs about current practice) may limit their efforts "This summarizes how teacher choices for didactical strategies are to be linked to their core values about teaching and learning.

Strategies that help to organise the teaching activities

The focus on orderly conducted lessons, classroom management, time management, and teacher planning is very strongly linked to teacher/pedagogical beliefs. For instance, Pajares (1992) states explicitly: "there is a strong relationship between teachers' (pedagogical) beliefs and their planning, instructional decisions, and classroom practices" (ibid, p.326). Other authors state "teachers who believed that students must be controlled and cannot be trusted were also more likely to believe that extrinsic rewards are necessary to motivate the students (Woolfolk, Rosoff, & Hoy, 1990, p, 137). The latter illustrates how teacher-centred beliefs influence classroom management strategies. Hoy and Weinstein (2006) list clear examples how teacher's thinking about difficulties in classroom of teachers affects their practices. They exemplify this with research involving Haitian teachers. Whereas most teachers did not have difficulties with a group, she observed how one teacher struggled with the same group. The authors concluded the difficulty could "not reside in the children" but in that teacher's thinking. This teacher adopted a tradition stance and stressed consequences of behaviour, the other teachers rather stressed group membership, stressed less immediate consequences such as bringing shame to the group or family. The same authors also stress how differences in background culture of learners require teachers to be sensitive as to their beliefs about the origin of classroom disruption, being disaffected from school.

In a more recent study, authors focused on the link between classroom management, beliefs and bullying. They put forward the idea that how teachers think about the nature and origin of student behavior will affect the way teachers manage students. They exemplify this for instance as follows (Allen, 2010): "On the humanistic end of the continuum are democratic models that see misbehavior as an opportunity to learn. On the behavioristic end of the continuum are strategies that make use of punishment, coercion, and rewards. Thus, how a teacher manages student behavior is impacted by his or her assumptions about children, the models he or she adopts, and the strategies that are commensurate with these models". Especially in critical classroom context, such as the former, teachers are affected by their beliefs. Coles, Owens, Serrano, Slavec and Evans (2015) point for instance, at the way teacher adopt integer classroom practices and clearly state how teachers must hold certain beliefs to achieve effective integrity of classroom management. How acceptable do they consider intervention process? What attributes do they link to disruptive behaviour, to what extent do they want to talk to students, etc? They stress how teacher development programs should therefore not only initiate teachers in adopting particular interventions, but these development initiatives should also address teachers' beliefs.

Strategies to develop the positive classroom climate

Central to this type of didactical strategy is a focus on developing healthy student-teacher relationships and a congenial learning environment. Authors have explored the positive interrelationship between teacher beliefs and classroom climate-related strategies (Deemer, 2004). In her dissertation, Loh (2012) stresses how such teacher ideologies explicitly affect classroom climate. In particular, she stresses – based on observations and interview data – how teachers focus on rigor of instruction or teacher caring and how this affects their choices in teacher behavior and interactions with students.

Hornstra, Mansfield, van der Veen, Peetsma and Volman (2015) distinguished in their study between "teachers who mainly reported autonomy-supportive strategies and teachers who mainly reported controlling motivational strategies" (p.363) and how this affected classroom climate. They established an empirical link

between choosing either of these strategies and external factors (e.g., standards) and internal factors. The latter reflect teachers' beliefs related to (negative) perceptions of students' abilities, their behavior, background characteristics or motivation. Also in her book chapter, Rubie-Davies (2015) stresses how teachers' beliefs about differences between learners, expectations about learner outcomes, … directly affect the socio-emotional climate and instructional climate. She emphasizes that the way teachers think about the need to respond to students' emotional and social needs directly attributes to the way they interact with their students. In their book chapter Hoy and Weinstein (2006) stress how teachers' willingness to be there for them, to listen, and show concern for their personal and classroom life seems critical developing a positive relationship with students. Their input emphasizes this not only from the perspective of the teacher but also from a student perspective.

Discussing congruency in ITE context, authors conclude that "in the congruent teacher education, the education of (student) teachers (curriculum and practice of teacher educators) in line with the principles that are preached" (Swennen, Korthagen, & Lunenberg, 2004, p. 17). In a study on teacher educators, Swennen, Lunenberg and Korthagen (2008) found that "when supported, not only teacher educators' ability to link their own teaching to theory is improved but also congruent teaching help teacher educators to overcome their problems" (p. 531). When it comes to link congruency with reciprocal peer tutoring (RPT) strategy, there is only one author (see, Valcke, 2013) who explicitly explain that " there is an urgent need to recognise teacher training models that reflect a congruency with the way teachers are expected to teach (evidence-based) in their future practice" (p. 53).

CONCLUSIONS AND RECOMMENDATIONS

The above detailed discussion clearly reflects that the typology of Van De Grift (2007) reappears in the literature and key authors in the field reiterates the same didactical strategies. Also, there is a strong interrelationship between the teachers' pedagogical beliefs and the selection of didactical strategies in the initial teacher education setting. There is a dire need to establish a very precise and integrated bunch of didactical strategies for the preparation of future teachers. In ITE curriculum, teachers' pedagogical beliefs may be given due consideration while preparing future teachers. This theoretical analysis also provide an insight for the policy makers, curriculum developers, head teachers, and teacher educators to revisit the adoption of didactical strategies in the initial teacher education setting.

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Cross-National Study on Relations between Motivation for Science Courses, Pedagogy Courses and General Self-Efficacy

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ABSTRACT

1799 prospective elementary and prospective science teachers from six countries (Croatia, Czech Republic, Lithuania, Slovakia, Slovenia and Turkey) participate in the study about the level of motivation toward science courses, pedagogy courses and self-efficacy. The most important findings were that choosing educational career as the first choice of prospective teachers depends on country and study track. The highest percentage of prospective teachers who choose teaching career and will probably stay teachers is in participating institutions from Slovenia and Croatia and the lowest in Slovakia and Turkey with Czech Republic and Lithuania in between. The percentages are higher for prospective elementary teachers than for prospective science teachers. Motivation of prospective teachers' regarding to the science courses and pedagogy courses vary. Differences between countries are small but as a rule future science teachers are more motivated for science courses than for pedagogy/didactics courses and the opposite is true for elementary

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teachers. Differences on general self-efficacy beliefs vary within and between countries? On average values falls in the upper third range what can be predictor of good teaching. Correlation between students' motivation toward science courses, pedagogy courses and their self-efficacy beliefs is statistically significant but low, showing that good students are generally motivated for all courses but differences between motivation toward science and pedagogy exists and depends on study track. Conclusion of our study is that science teachers are better equipped to cope with problems than elementary teachers, but elementary teachers will most probably work at the working place they choose as their first will.

Keywords: motivation level, pedagogical content knowledge, prospective science teachers, prospective elementary teachers, self-efficacy, comparative analysis, educational career, self-efficacy beliefs, science education

Contribution of this paper to the literature

- More than half of the prospective elementary teachers and less than half of the prospective science teachers declared that teacher education was their first study choice.
- There are some general trends but differences between countries are large and calls for more detailed studies within each country.
- Elementary teachers want to become teachers from the beginning and for them science is only one course among other courses. On the other hands, prospective science teachers are interested in science on the first place and teaching is only one of the options to work in the field of science.

INTRODUCTION

Science education is challenged by a society in many ways. Our civilization depends on a supply of professionals of disciplines rooted in science and technology, and many global problems (e. g. global warming; depletion of resources; loss of biodiversity; pollution) emerged where cooperation and understanding between science and social sciences and humanities is a must. All of this calls for first-class science education for all with a science and scientific literate citizen in mind as a general goal of such education. Development of science and scientifically competent citizens should start as early as primary or at least at elementary school level what calls for appropriately educated and motivated teachers at all school levels (Driver, Newton & Osborne, 2000; Kolsto, 2001, Sinatra, Kienhues, & Hofer, 2014). As a consequence, the important question becomes whether the same teaching methods and strategies toward increase of popularity and science and scientific literacy can be used internationally or whether every entity should develop these strategies individually. Van Driel Beijaard, and Verloop (2001) argue that teacher education reform efforts in the past were usually unsuccessful because they failed to take teachers' existing knowledge, beliefs, and attitudes into account (Bryan, 2003). Consequently, conceptions of good science teaching can remain unchanged throughout teacher education (Skamp and Mueller, 2001; Nadelson, Callahan, Pyke, Hay, Dance, & Pfiester, 2013, Ryan, Kuusinen, & Bedoya-Skoog, 2015).

Contemporary science teachers are confronted with many challenges. From a teacher perspective, it is expected to simultaneously prepare students to be successful at the high stakes exams and be competent lifelong learners who are going to solve interdisciplinary problems. Teachers must be able to follow trends such as changes in students, development of cognitive sciences, penetration of ICT in every pore of the society, growing body of knowledge in every discipline, and be able to balance between local and global important educational issues. To make things even more worrying and opposite to the needs of a society (Millar, 1996) young people's interest in entering science and engineering careers is dropping in many countries worldwide (Osborne, Simon, & Collins, 2003; Feinstein, Allen, & Jenkins, 2013; DeWitt, Osborne, Archer, Dillon, Willis, & Wong, 2013). It is granted that good teaching is based on good teachers and what teachers actually do in a classroom is most relevant to student learning (Kennedy, 2010; Hiebert, & Morris, 2012). It is well known that teachers' personal characteristics in a

combination of situational characteristics and content knowledge and craft-skills affect achievements of their students (Brophy, 1986; Shulman, 1986, 1987; Kennedy 2010). Among a plethora of different internal and external factors, motivation (Skinner & Belmont, 1993) and self-efficacy (Soodak & Podell, 1996; Bandura, 1993, 1997) were recognized by many (Sutton & Wheatley, 2003; Canrinus, Helms-Lorenz, Beijaard, Buitink, & Hofman, 2012) as the most important interconnected factors influencing teaching.

PCK (Pedagogical Content Knowledge) has been identified as an important component of teachers' professional knowledge. PCK is defined as the blend of knowledge of content to be taught and knowledge of pedagogy that results in teachers' understanding of how the teaching content can be best organized, adapted, and presented to students of diverse abilities and interests (Shulman, 1987). The notion of PCK was first introduced by Shulman (1986, 1987) and viewed as "teachers' ways of representing and formulating the subject-matter knowledge in the context of facilitating student learning". According to Shulman (1986, 1987), PCK refers to an understanding of the interplay between pedagogy/didactics and content. Thus, teachers need to possess pedagogical content knowledge in order to teach in an effective way. For instance, a science teacher teaching cell biology need to know both what the concept of cell structure is (content knowledge), and how this particular concept could be integrated into the lesson plan (pedagogical knowledge). In other words, the knowledge teachers need to possess is not a general idea of pedagogy or content knowledge; rather, it is the knowledge of pedagogy that is specific to a particular subject matter. Teachers with PCK can transform their subject matter knowledge into teachable content knowledge (Geddis, Onslow, Beynon, & Oesch, 1993; Usak, Ozden, & Eilks, 2011; Van Driel,, & Berry, 2012; Wahbeh, & Abd-El-Khalick, 2014).

According to Bandura (1997), modelling represents one of the main sources of information for self-efficacy appraisal. Students who observe peers who successfully perform a task can be more certain that they, too, are capable of accomplishing that task. As a consequence, the achievement of those students is higher. Self-efficacy therefore refers to beliefs about one's capabilities to learn or act in a certain way. Bandura also presents other sources of information in addition to vicarious-observational experience (modelling), which can contribute to the construction of self-efficacy beliefs. Those sources of information are: enactive mastery experiences, verbal persuasion and physiological and affective states.

Why people do what they do, is the question that the motivation theorists try to answer for many years. Despite the difficulties in defining the concept of motivation, most authors agree that motivation is an internal state that drives behavior and defines its direction, intensity and duration (Huitt, 2011, Glynn, Taasoobshirazi, & Brickman, 2007, 2009). By Pastuović (1999) motivation is defined as a psychological process of satisfying the needs and motives of the individual. Motives can be internal states of the organism (needs, cognition and emotion) and/or external stimuli. When asked what motivates people for certain behavior, content theories of motivation give an answer. They are older and more numerous, less abstract and closer to the experience and are therefore more popular (drive-reduction theory, need theories, incentive theory etc.). However, process theories of motivation provide an answer to the question of which elements people decide to take some action (Pastuović, 1999). Theoretical explanation of educational motivation takes structure of the model from the process theories of motivation, and a knowledge of human needs that govern the behavior of the content theories of motivation, because education is ''only a form of behavior that learn other behaviors for successful achievement of various goals, and they in turn satisfy different needs'' (Pastuović, 1999, 291).

In the field of education, the authors distinguish the general and specific motivation for learning. The general motivation for learning is permanent and broad disposition that manifests itself as a desire to acquire knowledge and skills in different learning situations, while the specific motivation relates to students' motivation for adoption of content in a given school area (Vizek Vidović, Vlahović-Štetić, Rijavec, & Miljković, 2003). The general motivation is stable, its source is in the student and depends on his/her experiences with school and learning, while specific motivation depends mostly on external factors, such as the behavior of teachers and content that is learned, and therefore it may be easier to change a variety of teaching strategies.

There are two reasons why motivation is important in education. On the one hand, the motivation is viewed as a key determinant of learning and academic achievement, because more motivated students invest more

effort and persist longer in academic tasks than students who are less motivated (Pintrich, & Schunk, 1996). On the other hand, the second biggest problem faced by teachers is precisely students' lack of motivation to learn (Vizek Vidovic et al., 2003).

In cognitive model of motivation, efforts and persistence in learning largely depend on a variety of beliefs, attitudes and perceptions of students (Weiner, 1990). Students' beliefs about the value of content and skills they are learning and beliefs about self-efficacy are factors that explain students' motivation. The task value, which reflects students' beliefs about content that is perceived as useful, important and attractive by the students, have proved to be related to students' behavior. For example, students who valued math skills more often go to additional classes in math than students who did not value the math skills (Wigfield & Eccles, 1992). Goals theories usually distinguish three types of goal orientations: the orientation to learning, orientation on performance and orientation on work avoidance (Niemivira, 1996; Liem et al., 2008), which determine the behavior of students in learning. Students focusing on learning want to improve their skills and understanding of the subject, students focusing on performance tend to demonstrate their high ability and to get positive assessment from the other, while students orienting to avoid the effort to learn invest less effort. These motivational orientations show different relationships with self-regulated learning and academic achievement. Beliefs about self-efficacy refers to students' beliefs about their own abilities that they can successfully perform a task (Bandura, 1997). Students with higher self-efficacy set higher goals, invest more effort and persist longer in the face with difficulties than students with lower self-efficacy. Zimmerman (2000) believes that self-efficacy is basic motive for learning and beliefs about self-efficacy are sensitive to subtle changes in the context of learning, interacting with the processes of self-regulation of learning and to mediate students' academic success.

Purpose of the Study

The purpose of the present study is to examine prospective teachers' level of motivation toward science and pedagogy-related courses and also analyse relationship between students' motivation and their self-efficacy beliefs in six countries. Research questions were as follows:

1. Is educational career the first choice of prospective teachers?
2. How do prospective teachers' motivation vary with regard to the subjects (science courses and pedagogy courses)?
3. How do prospective teachers' self-efficacy beliefs vary?
4. Is there any relationship between students' motivation toward science courses, pedagogy courses and their self-efficacy beliefs?

The results are going to be used as a baseline in improvement of teacher candidates' courses in participating institutions.

METHODOLOGY OF RESEARCH

Quantitative methods with questionnaires as the research instruments were used.

Sample and Sampling

Sample consisted of 1799 prospective teachers (596 males, 1203 females) enrolled in various departments (elementary school teaching and science teaching) in selected universities in Croatia, Czech Republic, Lithuania, Slovakia, Slovenia and Turkey.

The questionnaire based on instruments developed by Schwarzer, & Jerusalem (1995) and Glynn, Taasoobshirazi, & Brickman (2007, 2009) was compiled in English language and translated into the Croatian, Czech, Lithuanian, Slovakian, Slovenian and Turkish languages.

The questionnaire was administrated in a paper and pencil form to the participants in the summer semester of 2010 – 2011 academic year. Participation was voluntary and anonymity of the participants was

guaranteed. Questionnaires were administered prior or after the lessons by teaching staff. Collected data were filled in spreadsheet files in each country and merged in a master-file used for later statistical analyses. Initial data were cleared and items with large missing parts were removed from the pool.

Distribution of the participants across to the countries are as follows; Croatia 165 (9.2%, Czech Republic 458 (25.5%), Lithuania 427 (23.7%), Slovakia 103 (5.7%), Slovenia 310 (17.2%), and Turkey 336 (18.7%). Of all the participants, 962 (53.5%) were prospective elementary school teachers and 837 (46.5%) were prospective teachers of science or different science subjects (Biology, Chemistry, Physics). Ratio between elementary school teachers and science teachers varies between countries: e.g. Croatia 127 (77.0%): 38 (23.0%); Czech Republic 267 (58.3%): 191 (41.7%), Lithuania 180 (42.2%): 247 (57.8%); Slovakia -only prospective science teachers were in sample- 103(5.7%), Slovenia 143 (45.1%): 167 (53.9%), and Turkey 245 (72.9%): 91 (27.1%).

Data Collection Instrument

To address the first research question, whether educational career is prospective teachers' first choice, two questionnaire items were provided. The first was *'Teacher education was my first study choice'*, and the second was *'If given a chance I would prefer a job in non-educational enterprise.* They were given the chance to respond by circling 'yes' or 'no'. In the analysis, differences between countries are examined.

The second research question was 'how prospective teachers' motivation varies with regard to the classes that the subjects take (science courses and pedagogy courses) in six countries. In the analysis, differences between countries are examined. Science Motivation Questionnaire (SMQ) developed by Glynn, Taasoobshirazi & Brickman, (2007, 2009) with 30 items on a five point Likert type scale was used to examine motivation toward science and pedagogy/didactic courses. This instrument was designed as two separate forms. The difference between two forms was that in the first questionnaire (SMQ) the word science was used and in the second questionnaire (Pedagogy/Didactics Motivation Questionnaire – PMQ) it was replaced by a pair of words pedagogy /didactics. An example is a pair of statements: "I enjoy learning science", and "I enjoy learning pedagogy/didactics". Each of the instruments have the same instructions. Only the words science and pedagogy/didactics are changed. Respondents had to cross checkboxes on the scale: Never (1); Rarely (2); Sometimes (3); Usually (4); Always (5). For the purpose of statistical analyses they get values in parentheses.

In the context of building PCK (Shulman, 1987) interest was in differences between motivation toward science and motivation toward pedagogy/didactics. The differences between science and pedagogy/didactics motivation are presented as difference between means (Msc – Mped) and effect size calculated as Cohen's d (Nakagawa & Cuthill, 2009). Positive values of Cohen's d and the differences between means (**Table 4**) indicate that prospective teachers are more motivated for science courses than for pedagogy/didactics courses. The opposite is true for negative values.

Self-efficacy was measured using General Self-Efficacy Scale (Schwarzer, & Jerusalem, 1995). The General Self-Efficacy Scale is a 10-item psychometric scale that is designed to assess optimistic self-beliefs. The language versions available at the Frei University of Berlin's website (http://userpage.fu-berlin.de/~health/selfscal.htm) were used in the study. Response format is 1 = Not at all true; 2 = Hardly true; 3 = Moderately true; 4 = Exactly true.

Analysis

Prior to further analysis, data set was firstly subjected to descriptive statistics for checking missing case analysis and outliers. Additionally, data were also checked for normality using Kolmogorov – Smirnoff test at 0.05 significance level. All variables followed normal distribution, which allowed to test differences with parametric tests. Differences between means in individual items and between countries were tested by ANOVA. The differences between science and pedagogy/didactics motivation are presented as difference between means and as effect size calculated as Cohen's d (Nakagawa & Cuthill, 2007). Reliability of the questionnaires were tested by using Cronbach's alpha.

Reliability of the science motivation questionnaire (SMQ) expressed as Cronbach's alpha is 0.87. Reliability of the pedagogy/ didactics motivation questionnaire (PMQ) expressed as Cronbach's alpha is 0.91. Both values can be recognized as very good. Reliability of the self-efficacy scale is 0.77, what can be recognized as good.

RESULTS OF RESEARCH

Prospective Teachers' Choice of Teaching Profession

Table 1. Frequencies of responses concerning the statement 'Teacher education was my first study choice.' (N / %)

		Slovenia	Croatia	Czech Republic	Lithuania	Turkey	Slovakia	Total
Yes	N / %	243/79.2	106/65.0	277/60.5	191/44.7	124/36.9	32/31.1	973/54.2
No	N / %	64/20.8	57/35.0	181/39.5	236/55.3	212/63.1	71/68.9	821/45.8
Total	N	307	163	458	427	336	103	1794

As seen in the **Table 1** differences among the countries concerning the statement 'Teacher education was my first study choice.' were high ranging from 79.2 % positive answers in Slovenia to 31.1 % in Slovakia. Big differences exist between elementary school teachers and subject teachers. Among 959 prospective elementary teachers 615 (64.1%) declared that teacher education was their first study choice, the statement supported by only 358 (42.9%) of 835 prospective science teachers. Additionally, there are statistically significant differences in answers (values of χ^2 not presented) within countries, with the exception of Turkey where (χ^2 (1 336) = 0.705; p = 0.393) and Slovakia where only prospective science teachers are in the sample. The highest percentages of prospective elementary teachers who choose teaching profession as their first study choice are in Slovenia (87.9%), followed by Croatia (73.8%), Czech (71.2%), Lithuania (64.4%) and Turkey (37.6%).

Percentages of prospective science teachers who choose teaching profession as their first study choice are lower in all countries. The highest percentage of such prospective teachers are in Slovenia (71.7%). In all other countries (Czech (45.5%), Turkey (35.2%), Croatia (35.1%), Slovakia, 31.1%, and Lithuania (30.4%)) less than half of the prospective science teachers' study at faculties by their first choice.

Table 2. Frequencies of responses concerning the statement 'If given a chance I would prefer a job in non-educational enterprise' (N / %)

		Slovakia	Turkey	Czech Republic	Lithuania	Croatia	Slovenia	Total
Yes	N / %	90/87.4	293/87.2	264/57.6	189/44.3	54/32.9	87/28.4	977/54.5
No	N / %	13/12.6	43/12.8	194/42.4	238/55.7	110/67.1	219/71.6	817/45.5
Total	Total	103	336	458	427	164	306	1794

As presented in **Table 2**, the highest number of prospective teachers who are not planning to drop out from the educational career path at first suitable chance is in Slovenia (71.6%) and Croatia (67.1%). At the tail are Slovakian (12.6%) and Turkey prospective teachers (12.8%). There exists a difference between future elementary teachers where 55.9% are planning to stay teachers for the whole career. Among subject teachers there are only 33.7% teachers with such plans. Differences between elementary and science teachers exists within and between countries. Situation is the worst in Turkey where 88.6% prospective elementary and 83.5% prospective science teachers (χ2 (1 336) = 0.269; p = 0.147) is going to choose option to drop from teaching career. Among prospective elementary teachers the most optimistic situation is in Slovenia where only 2.9% will prefer career outside schools, followed by Croatia (22.0%), Lithuania (28.9%), and Czech Republic (45.7%). For Slovakia, we do not have such data. Completely different situation was found in prospective science teachers. Half or more than half of the subject teachers who will prefer teaching career is only in Czech (64.3%) and Slovenian (50%) sample. In all other countries teaching career is not the first choice. Results are as follows: Lithuania (55.5%), Croatia (70.3%), Slovakia (87.4%) and Turkey (88.6%).

Correlation between both statements (r = 0.392) is statistically significant (p = 0.01), however low, showing that lifelong teaching career is most probably a choice only for someone who had chosen his/her career in teaching as a first choice.

Prospective Teachers' Motivation to Learn Science Courses and Pedagogy Courses

Table 3. Differences between countries on motivation on science courses and motivation on pedagogy/didactics courses. Results are sorted by effect size. (MSc = motivation toward science courses; Mped = motivation toward pedagogy/didactics courses)

Country	N	Msc	SD	Mped	SD	Msc - Mped	Effect size
Lithuania	427	3.52	0.51	3.27	0.65	0.25	0.42
Slovenia	310	3.31	0.43	3.17	0.43	0.14	0.31
Slovakia	103	3.36	0.39	3.20	0.49	0.14	0.32
Czech Republic	458	3.36	0.39	3.32	0.52	0.04	0.10
Turkey	336	3.42	0.42	3.43	0.49	-0.01	-0.02
Croatia	165	3.15	0.53	3.41	0.62	-0.26	-0.46
Total	1799	3.38	0.45	3.31	0.55	0.07	0.15

Differences among countries (**Table 3**) are not statistically significant for both, science and pedagogy didactics instruments in all items except items 'I use strategies that ensure I learn the science well' (p = 0.026), and 'It is my fault, if I do not understand the science' (p = 0.015) in the science questionnaire.

Total motivation scores for science course is the highest in Lithuania (M = 3.52; SD = 0.51) and the lowest in Croatia (M = 3.15; SD = .53). Total motivation score for pedagogy/didactics course is the highest in Turkey (M = 3.43: SD =.49) and Croatia (M = 3.41; SD = 0.62) and the lowest in Slovenia (M = 3.17; .SD = 43). The results on both instruments are above median in all countries and differences among countries are small.

Values of effect size drops in the category of insignificant (below 0.2) to small (0.2 – 0.5) in all countries. Nevertheless, one can recognize that differences between samples exists, however they can be biased by a ratio of elementary and science teachers in samples from different countries.

Table 4. Differences between prospective elementary and prospective science teachers on motivation on science courses and motivation on pedagogy/didactics courses. (MSc = motivation toward science courses; Mped = motivation toward pedagogy/didactics courses)

Study track	N	Msc	Std	Mped	Std	Msc - Mped	Effect size
Elementary school teachers	962	3.20	.47	3.47	0.46	-0.15	-0.38
Subject teachers	837	3.46	.43	3.13	0.59	0.34	0.66
Total	1799	3.38	0.45	3.31	0.55	0.07	0.15

From the **Table 4** it is clearly seen a difference between prospective elementary and science teachers. While the prospective elementary teachers seemed to be more motivated in pedagogy/didactics and less in science the opposite was true for prospective science teachers where difference is close to large effect size (Cohen's d = 0.66).

Prospective Teachers' Self Efficacy Beliefs

Differences among countries on self-efficacy instrument are statistically significant (F (5, 1797) = 32.16; p <0.001). Values are presented in **Table 5**. Difference between prospective elementary school teachers and science teacher was not statistically significant (p = 0.086) with regard to self-efficacy beliefs. Values for elementary teachers were M= 30.56, SD = 4.34 and M = 30.92, SD = 4.65 for science teachers, and calculated effect size d =0.08, respectively. In both cases individual sums were in whole range from 10 to 40. From the high value of SD one can

Table 5. Differences between countries on General Self-Efficacy Scale

Country	N	Mean	SD	Min.	Max.
Slovenia	310	32.38	3.497	21	40
Croatia	165	31.74	5.006	12	40
Turkey	336	31.30	4.399	10	40
Lithuania	427	31.04	4.486	10	40
Czech Republic	458	28.96	4.263	16	40
Slovakia	102	28.77	4.501	10	40
Total	1798	30.72	4.493	10	40

conclude, that dispersion of results is big, so we cannot handle prospective teachers as a uniform group regarding self-efficacy.

The Relationship between Students' Motivation to Learn and their Self–Efficacy Beliefs

Table 6. Correlations between Science motivation, Pedagogy/ didactics motivation, and self-efficacy

	Pedagogy / didactics motivation	Self-efficacy
Science motivation	0.384	0.222
Pedagogy/ didactics motivation		0.118

All results are statistically significant at the p = 0.000 level (two tailed)

As presented in **Table 6** it can be recognized that relationship using pooled data revealed positive, statistically significant and moderate correlations. The highest correlation (r = 0.384) was between motivation for science and pedagogy/didactics motivation, showing that general trend was that students were motivated/unmotivated for both components of teaching. Self-efficacy was better connected with science courses than with pedagogy/didactics courses.

DISCUSSION

Results of present study opened more questions than giving answers concerning prospective science teachers motivation toward their future careers, motivation for study and their self-efficacy. There are some general trends but differences between countries are large and calls for more detailed studies within each country.

Prospective Teachers' Choice of Teaching Profession

From the results presented in **Tables 1** and **2** the first recognized problem can be recruitment of the future elementary teachers in most of the participating countries. When trying to answer question of whether educational career is the first choice of prospective elementary teachers, results can be regarded as satisfactory only in Slovenia, where for 87.9% of the respondents teaching career was their first choice. The situation can be regarded as unsatisfactory in other countries and further studies about underlying factors are needed. The situation is much worse in all countries when we are looking at prospective science teachers. With exception of Slovenia (71,7%) in all other countries less than half of the prospective science teachers' study at faculties by their first choice.

Worrying is the finding about the high number of pre-service teachers for whom teaching career will not be the first choice (**Table 2**). The highest number of prospective teachers who are not planning to drop out from the educational career path at first suitable chance is in Slovenia (71.6%). At the tail are Slovakian (12.6%) and Turkish prospective teachers (12.8%). This finding can be alarming for both countries. From the results of the present study the problem of the recruitment of the future teachers candidates can be outlined. The ideal situation is when teachers are recruited from a pool of high school students with teaching career as their main choice. It can be speculated that in the future teachers who choose teaching as their first study choice will be more motivated in a classroom than someone who has different aspirations. According to results of present study closer to such situation

are only in Slovenia. In fact, study choices offered in Slovenia in elementary and science education far exceed number of prospective students who want to elect these studies. As a result, most of the students who enter educational tracks seem to choose these tracks according to their preference and not because of lack of options. On the other hand because of limited selection teachers are at least partially recruited by lower achievement students rejected by some other faculty, a problem already recognized in Slovenia (Tomažič, & Vidic, 2009). The unanswered problem is how to attract larger number of higher achievers based on their grades on external exams (Tomažič, & Vidic, 2009). The opposite situation is in other participating countries especially in Turkey and Slovakia, where it seems that teaching and teaching career is not the first reason to enter educational study tracks. The reasons for such situation cannot be figured out from the results of our study. Socio-economic reasons for choosing teaching profession probably exists, but cannot be evaluated from the data of our study.

Prospective Teachers' Motivation to Learn Science Courses and Pedagogy Courses

The results on both instruments measuring motivation toward science (SMQ) and pedagogy (PMQ) courses (**Table 3** and **Table 4**) are above median in all countries and differences between countries are small. The results can be seen as optimistic, but they are not satisfactory, so further actions should be taken to raise motivation on science and pedagogy/didactics courses in all participating countries.

Values of effect size representing a difference between SMQ and PMQ drops in the category of small (Nakagawa, & Cuthill, 2009) nevertheless one can recognize that differences exists. In the first group, there are Lithuanian, Slovenian and Slovakian students, where motivation for science exceeds motivation for pedagogy/didactics. In the second group there are Czech and Turkish students, where differences between motivations are small. A separate group are Croatian students where motivation for pedagogy/didactics courses is higher than motivation for science course. If pedagogy/didactics knowledge is regarded as of similar importance than content knowledge in the context of PCK (Shulman, 1987) than serious measurements should be taken to rise motivation toward pedagogy/didactics courses, especially in Slovenia and Slovakia, and in raising motivation toward science in Croatian students.

Additionally, the differences on motivation can be recognized between prospective elementary and prospective science teachers (**Table 4**). The first seemed to be more motivated in pedagogy courses and the second in science courses. The differences probably arise from two sources. Future elementary teachers know from the very beginning that they are going to teach a rainbow of topics in a range of singing or painting to the math and grammar at the other end. As a result, their general interest is more on teaching than on teaching some specific topics. On the contrary, the interest of science teachers was more on science than on pedagogic/didactics. In building reasonable basis for development of PCK on science issues, elementary teachers should be motivated more on science, and science teachers on pedagogic/didactics. Socio-scientific issues and connection of theoretical science contents with practical every-day issues can be an approach to better teaching (Holbrook, & Rannikmae, 2007; Albe, 2008). More emphasis is need for raising interest and motivation in science at the elementary and lower secondary teachers levels. Reasons are many and exposed are only two of them. Inappropriate educated elementary and lower secondary school teachers are a probable source of misconceptions, which are hard to eliminate at the upper levels. In addition, they are possible distracters for their students who are searching their field of interest in science and/or technics (Ploj Virtič, & Šorgo, 2016). Knowing that student interest toward science is formed in early education, action is need to raise motivation toward science in early educators. Also knowing that secondary school students' interest in science decline by every additional year of science courses, resulting in decline of interest to enter university science, technology and engineering programmes.

Prospective Teachers' Self Efficacy Beliefs

Differences among countries on self-efficacy instrument are statistically significant (F (5, 1797) = 32.16; p <0.001). Values are presented in Self efficacy (**Table 5**). Good news are that high values on self-efficacy scale is regarded as one of the crucial factors for good teaching (Day, Elliot, & Kington, 2008). On average, most of the teachers from our sample falls into the upper third group on the general self-efficacy scale what can be regarded as

optimistic. Differences between countries are not so big to be alarming, but worth mentioning is that the most optimistic are Slovenian students, where nobody falls below 21 points and students from Czech Republic where nobody falls below 16 points. From the high values of SD one can conclude that results are dispersed, so one can find on the courses students with high and low level of self-efficacy and most of them falling in between. From the practical point of view and future career it can only mean that teachers who are going to disperse to the schools are different according self-efficacy. Especially these with low scores are probably going to need help and a lot of support during the courses and later at their working places.

The Relationship between Students' Motivation to Learn and their Self–Efficacy Beliefs

As presented in **Table 6** it can be recognized that relationship using pooled data revealed positive, statistically significant and moderate correlations. The highest correlation (r = 0.384) is between motivation for science and pedagogy/didactics motivation, showing that general trend was that students were motivated/unmotivated for both components of PCK. The results reveal that there is probably a connection between motivation to study or to be a good student regardless of course but motivation toward courses can be higher or lower. Self-efficacy was better connected with science courses than with pedagogy/didactics courses. Speculation is that science teachers are better equipped to cope with problems than elementary teachers. Open stays question if this finding is connected with the age of children with whom prospective teachers will be working and differences in the nature of work. Elementary teachers works with younger student, teaching them a variety of contents, so in that sense, they maybe feel less efficient. On the other hand correlations are low and do not allow to connect motivation for university courses and general self-efficacy without reserve. The findings are only partially in line with findings of other authors who connects self-efficacy with others predictors of successful school work (e.g. Zimmerman, 2000, Margolis & McCabe, 2006).

CONCLUSIONS

Choosing educational career as the first choice of prospective teachers depends on country and study track. The highest percentage of prospective teachers who choose teaching career and will probably stay teachers is in participating institutions from Slovenia and Croatia and the lowest in Slovakia and Turkey with Czech Republic and Lithuania in between. The percentages are higher for prospective elementary teachers than for prospective science teachers. From the study cannot be revealed about the reasons, but are most probably a mixture of study opportunities and socio-economic status of the participants. Especially in Turkey and Slovakia findings calls for measurements to make teacher profession more attractive.

Motivation of prospective teachers' regard to the science courses and pedagogy courses vary. Differences between countries are small but as a rule future science teachers are more motivated for science courses than for pedagogy/didactics courses and the opposite is true for elementary teachers. Interpretation is that elementary teachers wants to become teachers from the beginning and for them science is only one course among other courses. On the other hands, prospective science teachers are interested in science on the first place and teaching is only one of the options to work in the field of science.

Differences on general self-efficacy beliefs vary within and between countries? On average values falls in the upper third range what can be predictor of good teaching.

Correlation between students' motivation toward science courses, pedagogy courses and their self-efficacy beliefs is statistically significant but low, showing that good students are generally motivated for all courses but differences between motivation toward science and pedagogy exists and depends on study track. Conclusion of our study is that science teachers are better equipped to cope with problems than elementary teachers.

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Family Environment Impact on School Readiness of Children in China - Based on the Survey of Wuchuan Autonomous County, Guizhou

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ABSTRACT
In recent years, school readiness of children has become a hotspot issue in studies. School readiness refers to various key features and basic conditions required by children in the formal education. The study on school readiness plays an important value on early identification and timely intervention of potential development risks. To reflect family influence factors on children's school readiness, this paper compiles a set of evaluation tools with locally targeted school readiness of children in accordance with characteristics of children, combines them with SRTB-CV, and selects a total of 288 children in Wuchuan Autonomous County, Guizhou, China to carry out an individual test. The study compiles a measuring tool suitable for evaluating school readiness of Chinese children, conducts system inspection and profound analysis of family influence factors for school readiness of children, and proposes constructive recommendations on carrying out family education practices for school readiness of children.

Keywords: school readiness, cognitive development, family environment, influence factors

INTRODUCTION

School readiness refers to various key features or basic conditions required by children in the formal education (Gredler, 2000). According to the ecological model of children's school readiness proposed by NEGP (Emig, Moore & Scarupa, 2001), school readiness should include at least the following three aspects: children for readiness, schools for readiness, family and community support. Five important development areas are contained in children for readiness, including body and sports development, emotional and social development, learning styles, language development, cognitive development, and general knowledge base. The level of school readiness is an important indicator to predict children's adaptation to the future school. Foreign researches find that social economic status is one of the key factors impacting school readiness of children, but our minority areas relatively lag behind for a long time. Research shows that children who live in low socioeconomic status will have higher development risks in sociality and emotion, and the difference between them and children who live in high socioeconomic status will gradually increase (Roberts & Sobhan, 1992). Children who are raised in different socioeconomic status have an obvious difference in acquiring language input of parents. For example, children who live in low socioeconomic status only have a quarter of language input compared to children who live in high socioeconomic status (Hart & Risley, 1992). Family socioeconomic status has a large relation with health condition of children, cognitive and

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Contribution of this paper to the literature

- This paper reconsiders the measurement tool of school readiness of children.
- The analysis explores the theoretical assumptions for the dimension and its constituent elements of school readiness of children and considers later empirical data.
- This paper explores the impact of family environment variables on the different level of school readiness of children and the favorable reasons for promoting the development of school readiness of children.
- This paper can provide theoretical reference and practical guidance for the family education practice of children's school readiness.

social emotional development. Moreover, the influence will be lasting from the childhood to adulthood (Dodge, Pettit & Bates, 1994). Teachers have lower expectations and more passive consciousness of children who live in low socioeconomic status than children who live in high socioeconomic status (Philip, 2007). Studies on school readiness are just starting. This paper breaks through the limitation of research on "Ready For Primary School" compared to the literature. Also, the author of this paper had an adventurous and innovatory study about children's school readiness, and developed the Test Box suitable for Chinese children. The author also puts up a series of systematical survey and deep analysis, and also brings forward constructive points for carrying out family education practice for promoting children's school readiness. The results of this research provide a theoretical basis and practical guidance to evaluate children's school readiness in China, and have important theoretical value and realistic significance.

The study mainly uses five-domain model of children's school readiness proposed by NEGP for reference to design a test structure and content. Utilizing the recent children's school readiness tests developed for foreign countries, this study compiles a measuring tool to evaluate the school readiness of Chinese children between the ages of 4 to 7. This measuring tool is used to judge whether the development in five domains of learning styles, cognition and general knowledge, language, emotion and sociality, and movement skills for preprimary children (4-7 years old) can reach the school readiness status, which the children in this age group should be equipped with. By combining Bacbarach and Baumeiste's influential study of family environment (parent factor) on school readiness of children, a research framework of family environment influence factors and school readiness of children is confirmed (Verne & Alfred, 1993). This study verifies the following research hypotheses through empirical analysis:

Hypothesis 1: Characteristic variables such as age, occupation, educational background, reading habits and specialties, etc., have a significant influence on school readiness of children.

Hypothesis 2: Family cultural resources such as books, intelligence toys, multimedia resources, etc., have a significant influence on school readiness of children.

Hypothesis 3: Complete families or single parent families, core families or extended families, and types of guardians, etc., and related variables have a significant influence on school readiness of children.

THE RESEARCH METHOD

Research Objects and Data Collection

This questionnaire consists of children and parents. Respondents of the child questionnaire are senior kindergartens. Respondents of the parent questionnaire are parents of respondents in the child questionnaire. The questionnaire is matched correspondingly. The study adopts a method of a questionnaire. The investigation can be divided into two steps: The first step is to test the initial questionnaire. The collected data are mainly used for item analysis and exploratory factor analysis of the questionnaire. The second step is to test the survey range. The collected data is used for analysis of reliability and validity and hypothesis testing. The survey range extracts 8

Table 1. Family Basic Situation

Factors	Types	N	Percentages	Factors	Types	N	Percentages
Age	Below 20	0	0	Nationality	Han Nationality	248	85.7
	20-30	17	5.8		Minorities	41	14.3
	31-40	209	72.5	Occupation	Housekeeping	5	1.7
	41-50	50	17.5		Manufacturing industry	7	2.5
	Above 51	12	4.2		Catering industry	9	3.3
Educational background	Primary school or below	9	2.5		Construction industry	36	12.5
	Junior high school	26	9.2		Transportation	7	2.5
	Senior high school/technical secondary school	58	20		Entertainment	31	10.8
	Undergraduate / junior college	162	55.8		Wholesale and retail industry	34	11.7
	College or above	44	12.5		Public institutions	159	55.0

kindergartens by using a random sampling method. A total of 288 children participate in this survey. Age range of all samples is from 5.34 years old to 6.89 years old. Basic family situation of these children is shown in **Table 1**.

The Research Tool

This questionnaire consists of children and parents. Respondents of the child questionnaire are senior kindergartens. Respondents of the parent questionnaire are parents of respondents in the child questionnaire. The questionnaire is matched correspondingly. The study adopts a method of a questionnaire. The investigation can be divided into two steps: The first step is to test the initial questionnaire. The collected data are mainly used for item analysis and exploratory factor analysis of the questionnaire. The second step is to test the survey range. The collected data is used for analysis of reliability and validity and hypothesis testing. The survey range extracts 8 kindergartens by using a random sampling method. A total of 288 children participate in this survey. Age range of all samples is from 5.34 years old to 6.89 years old. Basic family situation of these children is shown in **Table 1**.

School readiness of children

School Readiness Test Battery (SRTB) is a measuring tool compiled for studying school readiness of children. The purpose is to identify whether the development in five domains, including learning styles, cognition and general knowledge, emotion and sociality, language ability, and sports skills, reach the school readiness status that should be equipped by children in this age for preprimary children (4-7 years old) (J'Lene & Daryl, 2005).

The compilation of child questionnaire adopts Likert Scale, and its reference count scoring is "5 very satisfied", "4 satisfied", "3 ordinary", "2 dissatisfied", and "1 very dissatisfied". Indicators of measuring school readiness include: sports skills, emotional and social ability, basic knowledge situation, painting, and language competence. Dimensionality in each item contains 10 questions on average. There are a total of 42 questions. Our trained teachers carry out a standardized individual test on respondents about 20 minutes in an undisturbed room.

Family environment of children

Trial version of SRHOME: The compilation of this questionnaire refers to Moss' Family Environment Scale (FES) and HOME compiled by Galdwe et al. The questionnaire includes characteristics of fosterers, family cultural resources, family structure, and status features. The questionnaire contains 29 questions. International consistency reliability is 0.88. SRHOME questionnaire is granted to parents by a class teacher of kindergartens, and parents are asked to return on the second day.

Table 2. Fitting Index of Two Models

	X^2	d_f	X^2/d_f	GFI	AGFI	NFI	CFI	TLI	RMSEA
Model 1: Single-Factor Model	2017.415	1288	1.566	0.84	0.84	0.422	0.655	0.640	0.37
Model 2: Two-Order Factor Model	1789.738	1263	1.495	0.921	0.921	0.933	0.923	0.919	0.035

All questionnaire data were in April 2016. All data were statistically analyzed using SPSS21.0. Before formal analysis, reverse questions have already been processed with reverse scoring, so these questions can be contrasted directly through dimensional scoring.

THE RESEARCH RESULT AND ANALYSIS

Evaluation of Children's School Readiness

Reliability analysis

The researcher analyzes 289 received questionnaire data of children and gives feedback in line with respondents. According to the specific item concerning school readiness of children in the questionnaire, the child questionnaire will ultimately conduct reliability analysis. The data display that Cronbach's Alpha coefficients of all items in school readiness of children are between 0.622-0.825. Generally speaking, $\alpha>0.080$ refers to excellent internal consistency. α is between 0.60-0.80, indicating good internal consistency. If $\alpha<0.60$, it indicates that internal consistency is extremely bad. Split-half coefficients concerning family environment in the questionnaire are between 0.615-0.825. It is thus clear that internal consistency reliability of the questionnaire is relatively good. It also indicates that feedback of this questionnaire has certain reliability.

Structural analysis of validity

When testing validity of the measuring test, two hypothesis models are firstly constructed. Hypothesis 1 is a single-factor model. The hypothesis thinks that questions measured in this test have the same features; namely, the test inspects general ability level of children. According to the concept of children's school readiness defined by NEGP, the hypothesis model 2 is constructed. This model is a two-order factor model. The hypothesis thinks that test questionnaires inspect different aspects of children's school readiness (Britto, Brooks & Griffin, 2006).

Amos 21.0 is adopted to conduct confirmatory factor analysis of the above model. According to Modification Index (MI) in Amos' result output, the model is modified. Fitting index of two models is shown in **Table 2**.

Generally speaking, when fitting index of GFI, AGFI, NFI, CFI and TLI, etc., is higher than 0.9, and RMSEA is lower than 0.05, the model receives good fitting. GFI index reaches above 0.8, so the model is acceptable. It can be observed from **Table 2** that RMSEA index has good fitting in two models. GFI index is located in an acceptable range, while the fitting of the other index is not ideal. Comparing the fitting indices of the two models, the fitting of two-two factor model is superior to single-factor model.

Statistical results of five dimensions in school readiness of children

By the survey on children's school readiness performed on kindergarten children in Wuchuan Autonomous County, Guizhou, it was found that the average score of respondents' school readiness is 4.17. Standard deviation is 0.59. Attitude of most of teachers is 4.1 and is about "good" in each dimensional index. Average score of five dimensions in children's school readiness includes (**Table 3**): overall situation of children's school readiness, learning styles, cognition and general knowledge, language, emotion and sociality, and sports skills, respectively.

Table 3. Average Score of Five Dimensions in Children's School Readiness

Dimensions	N	Mean	Standard Deviation
TSRCV	289	4.17	0.59
TSRCV_A	289	4.15	0.67
TSRCV_C	289	4.03	0.43
TSRCV_L	289	4.23	0.59
TSRCV_S	289	3.89	0.66
TSRCV_M	289	4.57	0.61

Notes: ACLSM test includes learning styles, cognition and general knowledge, language, emotion and sociality, and movement skills

Table 4. The Partial Correlation Coefficient of Parents' Age in Total Score of Children's School Readiness and Dimensional Score

	TSRCV	TSRCV_A	TSRCV_C	TSRCV_L	TSRCV_S	TSRCV_M
Father's age	-.1189*	-.1221*	-.0679	-.0458	-.0597	-.0429
Valid samples	106	106	106	106	106	106
Mother's age	-.1287*	-.0860	-.1106	-.0511	-.0769	-.0147
Valid samples	158	158	158	158	158	158

Note. * p < .05, ** p < .01, *** p < .001.

It is thus clear that the highest score of children in Wuchuan Autonomous County is sports skills and it reaches "excellence". Language and emotional development is relatively high. However, learning styles, cognition and general knowledge are relatively low. Social development ability of children is low. Thus, we need to attach importance to cognitive development, improvement of learning styles and social development ability of children in minority areas. Social development of children will impact interaction and communication between children and teachers, peer children and families or the crowds, and affect the development of children's habit and good characteristics. If learning styles, cognitive ability and general knowledge of children can be improved, it will promote entire admission level of children and improve effective education.

Influences of Parent Characteristic Variables on School Readiness of Children

Influences of fosterers' characteristics on school readiness of children can be analyzed from several aspects, including age, occupation, educational degree, reading habits and specialties, etc.

Influences of parents' age on school readiness of children

The partial correlation coefficient of parents' age in total score of children's school readiness and dimensional score is shown in **Table 4**.

It can be observed from **Table 4** that father's age presents negative correlation with total score of children's school readiness and testing score of learning styles. Mother's age present negative correlation with total score of children's school readiness. In addition, mother's age presents significant negative correlation with dimensional score of cognitive and general knowledge. According to related analysis, the relation between parents' age and school readiness of children can be analyzed. Dispersion degree of young parents' total score of school readiness is larger, while dispersion degree of elder parents' total score of school readiness is smaller.

Influences of parents' occupation on school readiness of children

By using a one-way analysis of variance, we can inspect influences of father's occupation on school readiness of children. The result shows that influences of father's occupation on total score of children's school readiness reach the margin significantly (F-2.77, df-=3, $p<0.05$). In the "cognitive development domain", F-1.911 ($p<0.05$), the effect of "manufacturing industry", "entertainment", "public institutions", etc., is lower than the other

Table 5. The Partial Correlation of Reading Habits on School Readiness of Children

	TSRCV	TSRCV_A	TSRCV_C	TSRCV_L	TSRCV_S	TSRCV_M
Book reading	.1567**	.1489**	.1412	.0931	.633	-.0528
Valid samples	285	285	285	285	285	285
Magazine reading	.1342**	.1035	.0937	.0914	.0767	-.0356
Valid samples	285	285	285	285	285	285

Note. * p < .05, ** p < .01, *** p < .001.

industries. In "language development domain", F=0.934 (P=0.000<0.001), the effect of "manufacturing industry", "entertainment" and "wholesale and retail industry" is lower than the other industries.

By using a one-way analysis of variance, we inspect influences of mother's occupation on school readiness of children. The result shows that influences of mother's occupation on school readiness of children are weaker than influences of father's occupation on school readiness of children. Only in cognitive and general knowledge domain, influences of mother's occupation come close to significance (F=2.36, df-=3, P.073). For children whose mother work in public institutions and entertainment industry, dimensional score of cognition and general knowledge is slightly higher than the other industries. As for other industries, influences of mother's occupation are not significant.

Influences of parents' educational background on school readiness of children

By using a one-way analysis of variance, we inspect the influences of parents' educational background on total score of children's school readiness. Though the total score of school readiness has the tendency to rise with the increase of parents' educational background, influences of parents' educational background on total score of children's school readiness reach no significance level (mother F=3.18, df=2, P>.11; father F=0.88, df=2, P>.43). There is no interaction effect either (F=2.84, df=2, P<.44).

We further inspect the influences of parents' educational background on each dimension of children's school readiness. The result shows that influences of mother's educational background come close to significance (F=2.83, df=2, p=.06). Influences of parents' educational background are significant in cognition and general knowledge of children (mother F=4.11, df=2, p<.05; father F=3.58, df=2, P<.05). However, in other dimensions, there are no significant influences.

Influences of reading habits on school readiness of children

It can be observed from **Table 5** that influences of book reading habits on total score of children's school readiness, learning styles, cognition and general knowledge reach the significance level, and influences of magazine reading habits on total score of children's school readiness also reach the significance level. However, considering that there is a correlation between reading habits and educational background, the correlation between reading habits and school readiness may be co-variation relation caused by educational background. Therefore, educational background is added to the control variable to further analyze the partial correlation of reading habits on school readiness of children. The result considers parents' specialties as independent variables and dimensional score of children's school readiness as dependent variables.

By using analysis of variance, we inspect the correspondence between parents' specialties and school readiness of children in each domain. The result shows that painting and calligraphy specialties of parents play a significant influence on learning styles of children (painting: F=9.77, df=1, P<.01; calligraphy: F=5.99, df=1, P<.05). Dance specialty of parents has no significant influences on sports skills (F=26.27, df=1). Moreover, the partial correlation between the number of specialties and learning styles of children reaches the significance level (P=.052). Thus, specialties play a positive influence on school readiness of children.

Specialties of parents are regarded as independent variables. Dimensions tested by school readiness of children are considered as dependent variables. By using analysis of variance, we inspect the correspondence

Table 6. Family Cultural Resources impact on School Readiness of Children

	Book Resources	Intelligence Toys	Multimedia Resources
TSRCV	-1.916	-1.497	-0.733
TSRCV_A	-2.844**	2.989**	-0.627
TSRCV_C	-3.577***	-0.428	3.75***
TSRCV_L	-1.916	-0.647	3.34***
TSRCV_S	0.899	0.433	0.645
TSRCV_M	-0.012	-2.243*	-0.028

Note. * p < .05, ** p < .01, *** p < .001.

between specialties and school readiness of children in each domain. The result shows that painting and calligraphy specialties play obvious significance on learning styles of children (painting: F=8.88, df=1, p<0.01; calligraphy: F6.33, df=1, P<.05), and dance specialties don't have significant influences on sports skills of children (F=225, 75, df=1, p<0.001.)

Influences of Family Cultural Resources on School Readiness of Children

Influences of family cultural resources on school readiness of children are analyzed from family book resources, intelligence toys and multimedia resources, respectively.

Influences of book resources on school readiness of children

Nearly 78% of families own over 20 children's books. Thus, in the further analysis, these 20 books are regarded as limitations to recode the variable, dividing them into above 20 books and 20 books or below, which are considered as independent variables. Total score of children's school readiness and various dimensions are deemed as dependent variables. The individual sample t test is conducted. Influences of book resources on learning styles of children's school readiness, cognition and general dimension reach the significance level. Influences on total score of school readiness and language reach the marginal significance. Influences of emotional and social development and sports skills are not significant.

Influences of intelligence toys on school readiness of children

According to questionnaire data analysis, intelligence toys are sensitive spots for about 5 resources. Moreover, its influences on sports skills are different from its influences on other dimensions. As a result, this variable should be coded above 5/5 due to the grouping limitation. Independent sample t test is applied to inspect influences of the number of intelligence toys on school readiness of children. The result shows that the number of intelligence toys plays a remarkable positive influence on learning styles of children. However, negative influences on sports skills reach the marginal significance. Combined with the analysis results in **Table 3**, it can be assumed that when the number of intelligence toys are over 5, it plays a positive influence on learning styles (flexibility solved in this situation), but plays a negative influence on sports skill. Thus, this will defer the development of motor skills.

Influences of multimedia resources on school readiness of children

First of all, frequency analysis is conducted on the number of multimedia resources. To avoid influences from statistical results on sample data grouping, groups of size 5 or below should be combined with groups of size 5-10 into groups of size 10 or below. By using a one-way analysis of variance, we inspect influences of multimedia resources on school readiness of children. The result shows that the number of multimedia resources plays a significantly positive influence on cognition and general knowledge and language development, but plays no significance influences on other aspects. **Table 6** displays influences of multimedia resources on school readiness of children. In sports skills, the mode of action is similar to the above-mentioned intelligence toys, and has a certain negative influence but it reaches no significance level.

Table 7. The Statistical Result Analysis of Family Structure and Children's School Readiness

Name	Types		TSRCV	TSRCV_A	TSRCV_C	TSRCV_L	TSRCV_S	TSRCV_M
Family types	Core families	Mean	4.172	4.17	4.02	4.33	3.86	4.43
		Standard deviation	0.587	0.536	0.482	0.555	0.521	0.567
	Extended families	Mean	4.177	4.14	4.04	4.23	3.92	4.58
		Standard deviation	0.552	0.571	0.578	0.452	0.654	0.55
	F values		0.78	0.25	0.69	0.31	0.17	0.41
Types of guardians	Old guardians	Mean	4.076	4.11	4.01	4.2	3.76	4.38
		Standard deviation	0.543	0.457	0.586	0.592	0.435	0.573
	Father's guardians	Mean	4.171	4.05	4.03	4.08	3.92	4.62
		Standard deviation	0.549	0.566	0.534	0.588	0.587	0.553
	Mother's guardians	Mean	4.18	4.18	4.07	4.26	4.01	4.47
		Standard deviation	0.578	0.672	0.493	0.546	0.521	0.623
	Parents' guardians	Mean	4.192	4.16	4.02	4.28	3.92	4.58
		Standard deviation	0.593	0.536	0.488	0.68	0.573	0.556
	F values		0.57	0.22	0.72	9.38***	0.33	3.256***

Influences of Family Structural Variable on School Readiness of Children

Family structural variable includes two types: core families or extended families (three-generation structure), and types of guardians. The statistical result of family structure and children's school readiness is shown in **Table 7**.

The status difference of children's school readiness in core families and extended families

The sample group contains 160 core families (parents and child (children)) and 118 expended families (Parents, children and older men). By using independent sample t test, it was found that there is no significant difference between children in these two families for total score of children's school readiness. Even if educational background is controlled, we find no significant tendency in these two families by carrying out analysis of covariance. The occurrence of such a result may be caused by insufficient sample quantity, so statistical test efficiency is lower. Such tendency will further be tested in the future sample study.

Influences of types of guardians on school readiness of children

The types of guardians can be divided into "old guardians", "mother's guardians", "father's guardians, and "parents' guardians". **Table 7** describes the status of guardian types in total score of children's school readiness in various domains. It can be observed from **Table 7** that old guardians have the lowest development level on the sports skills. Language development level of old guardians is the lowest, but is the highest in action development. Development of mother's guardians is relatively balanced in sports skills in all domains. By using analysis of variance to test, it was found that the judged difference between language and sports skills is obvious. Difference in other domains reaches no significance level.

CONCLUSIONS

This study has explicitly developed a SRTB. School readiness of children is an important development task that runs through 0-6 years old. The purpose of compiling SRTB is to evaluate various development levels of all kinds of ability for children and their school readiness. In order to test with pertinence, the compiled measuring tool is only suitable for 4-7 years old children. Younger children are not suitable for this test. Meanwhile, test

performance of children can't be regarded as the basis of admission. The explanation on testing performance should concentrate on the degree of possible developmental risks and required assistant types after children's enrollment. By comparing with the model table, kindergarteners and primary school teachers should give more attention to children having lower SRTB performance levels.

Based on a theoretical model of school readiness proposed by NEGP, the compilation process in each subtest should select items with different dimensions as much as possible. As for specific testing tasks, the proposed test incorporates research achievements of children development in recent years such as flexible task, wrong belief task, etc. These have been excluded from previously proposed tests. Thus, theoretical foundation and structural design of the proposed test embodies the leading edge of children's psychology study. The proposed test gives priority to picture selective tasks, and assists with question-answer tasks and actual operation. The requirements for language ability are relatively lower. The proposed test applies colorful pictures, has stronger enjoyment and attracts children. The total number of test items is few, requires less time, operates conveniently, and is easy to generalize.

The analysis of testing psychometrics index shows that the discrimination of the test item and difficult index are relatively ideal. The proposed test has relatively stable test-retest reliability, good split-half reliability, and internal consistency reliability. By analyzing test reliability, good construct validity can be found.

Influences of Family Environment on School Readiness of Children

First of all, sample selection in the study has a certain limitation. In the result, some environmental variables may play a role on middle class. Roles and functions of some variances may be different. For example, the study finds that influences of book resources on learning styles, cognition and general knowledge reach the significance level and also play a positive influence on the total score of school readiness and language development: "Parents going out with children for walking or playing" present significant positive correlation on children's emotional and social development. In the middle class or above families, parents' educational background will play an influence on school readiness of children through categories of book resources, reading time and reading habits of child. Moreover, parents' occupation and educational background also impacts it. As for quality of "parents going out with children for walking or playing", parents in middle (or above) class may communicate with children more significantly and positively in the process of walking and playing with children and play a positive influence on emotional and social development.

Sports competitions and movies, etc., activities, children independence, and father's participation in some aspects, etc., family upbringing activities play a significant influence on school readiness of children.

Secondly, the function of subsystems in the questionnaire can't be combined with specific domains as predicted. Therefore, in the result analysis, the division of subsystems in the questionnaire is disorganized. Beginning with specific family environment factors, the result is analyzed and discussed. The result shows that in family resource systems, occupation, educational background, age and specialties, etc., have a significant influence on school readiness of children.

Thirdly, the function of some variables in a family environment is two-ways. The result shows that parent-child reading, intelligence toys, and multimedia resources play a positive influence on cognitive level and language development, but hinder the development of sports skills. Therefore, in practice, parent-child reading activities should cooperate with sports skills to promote activities.

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Mode and Mechanism of Green Innovation Based on User Involvement Electronic Platform under Chinese Green Education Context

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ABSTRACT
By focusing on the Chinese green education context, this study analyzes the environment and the status quo of China's green innovation, presents a "4 Fundamental & 3 Supported Bodies" green innovation paradigm based on user involvement electronic platform under Chinese green education context, namely, enterprises, universities, research institutes and users as the four fundamental bodies, and government, intermediary and financial institutions as supported bodies involved in green innovation paradigm through electronic platform. By using game theory and system dynamics, the mechanisms of green innovation based on user involvement electronic platform under Chinese green education context are simulated. Moreover, this study puts forward three specific operational modes, including: (1) the operational mode of user proposal, which is to seek the views and suggestions of users dynamically in the entire process of green innovation decision-making phase, green innovation of pilot phase, and green innovation of try-out phase, and absorb into the optimization process of innovation decision and innovative products; (2) the operational mode of user experience, which involves users' product and service experience into the innovation activities, as well as users' R&D and production experience; and (3) the operational mode of user R&D, which invites the users' designs collection and users' involvement in R&D projects. Finally, the study takes NIU electric vehicle company in China as an example for case analysis.

Keywords: green innovation, user innovation, green education, incentive policy

INTRODUCTION

Nowadays, the environment protection and sustainable development related courses is gradually embedded in the whole process of education in China, which is named as "green education". It involves water sustainability education, waste reduction education, green energy education, and etc. During the green education, teachers should obey the natural rule of students to infuse the green concept to them smoothly.

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Contribution of this paper to the literature

- This research presents a "4 fundamental & 3 supported bodies" green innovation paradigm based on user involvement electronic platform under Chinese green education context.
- This research puts forward three specific implementation operational modes, and take NIU electric vehicle company in China as an example for case analysis.
- This research can help managers and scholars to recognize the importance of users involvement in green innovation.

Innovation exists consistently during the development of an individual or enterprise. Consequently, it is of vital importance to emphasis on green innovation in green education. Green innovation refers to the innovation during which energy and resource consuming, as well as waste, are reduced. While implementing the green innovation, the user involved electronic platform plays a pivotal role.

Currently, user innovation has become a significant way of open innovation. In China, many enterprises pay more attention to user innovation, and gradually carry out the practice of user experience and the user involvement in innovation. The government of China is strongly promoting the collaborative innovation among government-industry-university-research-user, making the user become an important choice for sustainable development. Nevertheless, green innovation in the process of practice encountered many difficulties in China, among which, the most important one is that the green innovation sometimes is not easy to get the user's understanding and support, making the lack of user's demand for the achievements and products of the green product innovation. Thereby producing propositions: In the Chinese green education context, whether the user innovation can be embedded with green innovation? What is the feasible operational modes of Chinese companies to accomplish the user involved green innovation?

As early as 1988, China put forward the policy of "science and technology as first productive force". In 1995, China initiated the "technology and education" strategy. In 2007, the Chinese government formally proposed that China should enter innovative country in 2020. In 2012, the Chinese government further pointed out that China's development mode to be driven by innovation instead of input and investment, and proposed the implementation of an innovation-driven strategy.

Chinese government attaches great importance to promote open innovation, and it has been promoting the construction of "technological innovation system with enterprises as the fundamental body, market-oriented, characterized by cooperation of industry-university-research." Moreover, Chinese government supports universities or research institutes to construct technological innovation platform to encourage enterprises carry out their R & D activities in technological innovation platform for universities or public research institutions. The public platforms for technological innovation including: national and provincial key laboratories, technical centers, testing centers; some local governments also geared to the needs of different industries to establish a regional integration of industry-university-research, an independent entity research institute of industrial technology. The Chinese government encourages the establishment of collaborative innovation research center, which relies on the strategic alliances of industrial Technological innovation, including enterprises, universities, research institutes, and even government departments involved.

Meanwhile, not only focusing on innovation, Chinese government takes measures to promote environmental protection and green innovation. For example, from 2016, Chinese government starts to implement the five-year plan of environmental protection technology to support green Technological innovation, then successively promulgated related specific technique policies, the key point of which is the technology research and development of the water environment and the atmospheric environment. Chinese Ministry of Science and technology and national environmental protection department are jointly launched the "Water Environmental Technology Project", invested heavily in research and development, and organized industry-university-research to carry out opening green innovation program.

Table 1. 2014 Open Innovation and User Innovation in China's Top Ten Green Innovative Companies

Company	Industry	Open Innovation	User innovation	Electronic Platform
Beijing Unisplendour Empvreal Environmental Engineering Technology Co..Ltd.	water treatment equipment and materials	joint innovation with Tsinghua University, Donghua University and Nanjing University; shared university innovation experimental platforms	company users involve in R&D projects	www.c-c.com
China Everbright International Limited	green energy, environmental protection water and new energy	cooperate with the user companies, local governments and overseas companies in innovation activities	the government users are involved in pilot innovation projects; local environmental agencies involved in test improvement	www.ebyunfu.com
Jiangsu Sunhome New Energy Co., Ltd.	development and manufacturing of energy storage, energy-saving technology	cooperate with Chinese Academy of Sciences, Qinghua University, Southeast University, Nanjing University of Technology, China Science and Technology, and the EU companies	the downstream of the power grid companies are involved in the R&D project of intelligent storage	www.c-c.com
Shandong Three Benefit Landscaping Co., Ltd.	landscaping, municipal, beach landscape design, construction and maintenance	cooperate and innovate with Shandong Forestry Science and Technology Research Institute to build experimental base	none	www.11467.com
Beijing Huasheng Hengye Technology Co,. Ltd.	R&D of Mechanical and electrical products	cooperate and innovate with German Lenze	the downstream of the machinery manufacturing companies involved in innovation activities	cn.made-in-china.com
Heilongjiang InterChina Water Treatment Co., Ltd	municipal water supply and drainage project and ecological environment management project	Joint innovation with Tsinghua University, Tianjin University, Harbin University, Beijing TIANDIREN Environmental Protection Technology Co., Ltd., Beijing China Sciences Environment Protection Co., Ltd	the water sector, as the downstream, involved in innovation activities	www.h2o-china.com
Société Générale de Surveillance Co., Ltd. (SGS)	testing, demonstration and technical services of agricultural, mining, petrochemical, industrial, consumer goods, automotive and life science inspection	cooperate with SGS(Switzerland) and many downstream companies	some downstream companies involved in standard-making	www.1024sj.com
Shenzhen Hyper Dot Technology Co., Ltd.	printing technology	cooperate with in-land companies and American companies	joint innovate with the downstream companies	cheung661.b2b.hc360.com
Tianjin Huatai Shenmiao Bio Engineering Technology Co., Ltd.	UHP biological treatment technology research and equipment manufacturing	cooperate with Qinghua University	none	www.caigou.com.cn
Beijing Air Energy Plants System Co., Ltd. (AEP)	environmental restoration, ecological building energy-saving	cooperate with overseas companies	the downstream companies in Vancouver, Canada, to carry out user experience plan in ecological counter and ecological oxygen bar	www.visacn.com

In terms of green innovation, for example, state and local governments provide all aspects of support for the research and development of new energy vehicles, for example, in terms of electric vehicles, China central government and local governments give consumers subsidies. Pure electric passenger cars, plug-in hybrid (with extended range) buses, pure electric vehicles and fuel-cell vehicles, the highest amount subsidies from China central government and municipal financial subsidies shall not exceed 80% of the vehicle sales price. In 2014, China adjusts its economic development strategy, and puts forward the "new normal" strategy, the strategic situation are: (1) By the high-speed economic growth (more than 7%) into the medium speed (less than 7%); (2) the industrial structure upgraded from extensive to intensive, saving resource and energy that will become an important part of the adjustment of industrial structure; (3) the Chinese economy transforms from the production investment-driven

model into an innovation-driven model, innovation and entrepreneurship become the main driving force for economy development; (4) the new normal state has some uncertainties and challenges, especially more emphases should be put on environmental protection. Obviously, under the "new normal", green innovation will absorb wide attention by the Chinese government and enterprises.

Implementing green innovation through open innovation, agglomeration, and integrated innovation resources, has become a trend of green innovation in China, which reflects the government's participation and support for this kind of opening green innovation. Taking "2014 China Top Ten Green Innovation Enterprises" as an example, we can see from **Table 1**, the ten representative of green innovation enterprises adopt an open innovation way, among them, the green innovation cooperation between enterprises and universities is of the most common, but there are also overseas enterprises, research institutes and even government departments involved in the green innovation activities. Nine of the top ten green innovation enterprises have the user involvement in green innovation, but eight of them involved only by enterprise users in the green innovation, only one of them involved both enterprise users and the terminal consumers in the green innovation, at the same time the user involvement in the 10 enterprises all have used the electronic platform. This shows that opening innovation has been very general in the mainstream of China green innovation enterprises, user involvement electronic platform in green innovation shows a significant start as well, but there is not enough for the end user involvement electronic platform in green innovation.

MODEL AND SIMULATION

This paper assumes that the government, enterprises and users are incomplete rational individuals. in the process of green innovation, those incomplete rational individuals play games with each other to maximize their own interests, which can be economic benefits or utility. This game can be divided into two sub-games, one is a company – consumer game, and another is a company-government game. For simplicity, this paper only considers the following situations: the game between companies and users on the issues of user involvement in innovation, and the game between companies and government enterprises on the issues of enterprises' achieving low-carbon and energy saving target by developing green innovation. To simplify the calculations, this paper assumes that, firstly, the user has two choices in terms of business innovation: high involvement, refers to user involvement in R&D development and user recommendations, and low involvement, refers to no participation or only participation in user experience. Secondly, enterprises have two options in terms of user innovation, one is giving high support, which includes building sound platforms and toolboxes for users to participate, carrying out institutional user training and giving rewards for user involvement, and the other is giving low support, in concrete, there is no support measures or merely the user experience and user recommendation system is provided. Thirdly, enterprises also have two choices towards green innovation: one is actively involved in green innovation to achieve low-carbon and emission reduction, and another is no development in green innovation. Fourthly, government has two actions towards green innovation: one is giving rewards or punishment, and another is no interfere. Based on these assumptions, this paper presents two payoff matrices as shown in **Table 2** and **Table 3**. Wherein, U is a high probability of innovative user involvement, EU is the probability of enterprises' high support for user innovation, G is the probability of the government's rewards and punishments for the enterprises involved in green innovation or not, EG is the probability of companies' carrying out green innovation.

Assume that, in the organization of user involvement in green innovation, when company gives high support to user involvement in green innovation, the company's cost is Ech, when company gives low support to user involvement in green innovation, the company's cost is Ecl; in addition, in terms of user involvement in company green innovation, when the users involve in green innovation to a great extent, the users' cost of high involvement is Uch, when the users involve in green innovation to a little extent, the users' cost of low involvement is Ucl. Suppose that, when the company is in high support and the user is highly involved in green innovation, the number of innovation achievements is N11; When the company is in low support but user is highly involved in green innovation, the number of innovation achievements is N12; When the company is in high support but user is lowly involved in green innovation, the number of innovation achievements is N21; When the company is in low support and user is lowly involved in green innovation, the number of innovation achievements is N22. Obviously,

Table 2. Game Payoff Matrix of Company and User

		Company	
		High Support (EU)	**Low Support (1-EU)**
User	High Involvement (U)	U_{11}, EU_{11}	U_{12}, EU_{12}
	Low Involvement (1-U)	U_{21}, EU_{21}	U_{22}, EU_{22}

Table 3. Game Payoff Matrix of Company and Government

		Company	
		Active in Green Innovation (EG)	**No Activity in Green Innovation (1-EG)**
Government	Incentive Policy (G)	G_{11}, EG_{11}	G_{12}, EG_{12}
	No Interfere (1-G)	G_{21}, EG_{21}	G_{22}, EG_{22}

we can get N11> N12> N22, N11> N21> N22. Furthermore, let the coefficient of user's earnings transferred from innovation achievements is K1 and the coefficient of company's revenue transferred from innovation achievements is K2. Additionally, the development degree of electronic market has a significant impact "L" on the efficiency K1 and K2. Based on the above-mentioned illustrations, it can be expressed as the follows:

$$U_{11} = N_{11} \times K_1 \times L - U_{ch}$$

$$U_{12} = N_{12} \times K_1 \times L - U_{ch}$$

$$U_{21} = N_{21} \times K_1 \times L - U_{cl}$$

$$U_{22} = N_{22} \times K_1 \times L - U_{cl}$$

$$EU_{11} = N_{11} \times K_2 \times L - E_{ch}$$

$$EU_{12} = N_{12} \times K_2 \times L - E_{ch}$$

$$EU_{21} = N_{21} \times K_2 \times L - E_{cl}$$

$$EU_{22} = N_{22} \times K_2 \times L - E_{cl}$$

Suppose Gc is the funds paid by the government when it implements real-time incentives for company's green innovation behavior, EGc is the company's cost of green innovation, and Ed is the company's emission reduction; moreover, the emission reduction produced from the company's green innovation can be regarded as government revenue, its conversion coefficient is set K3. Clearly, when the government does not interfere the company in innovation, companies generally do not take the initiative in developing green innovation. Based on the above assumptions, we can get:

$$G_{11} = E_d \times K_3 - G_C$$

$$G_{12} = -G_C$$

$$G_{21} = 0$$

$$G_{22} = 0$$

$$EG_{11} = G_C - EG_C$$

$$EG_{12} = G_C$$

$$EG_{21} = -EG_C$$

$$EG_{22} = 0$$

In terms of industry-university-research collaboration innovation, assume the impact coefficients of universities and research institutes' cost to the company's technological innovation are Un and Re. In addition, the impact coefficient of intermediaries and financial institutions' cost to the company's technological innovation are Ia and Fa. Moreover, the development degree of electronic market also influences on the variables, which is represented as M, N, and P. Then we can get:

$$E_{ch} = EG \times F_a \times I_a \times R_e \times U_n \times M$$

$$E_{cl} = EG \times F_a \times I_a \times R_e \times U_n \times N$$

$$EG_c = EU \times F_a \times I_a \times R_e \times U_n \times P$$

According to evolutionary game theory, duplicated dynamic equations on U are:

$$dU/dt = U(1-U)[(U_{11} - U_{12} - U_{21} + U_{22})EU + (U_{12} - U_{22})] \quad (1)$$

Duplicated dynamic equations on EU are:

$$dEU/dt = EU(1-EU)[(EU_{11} - EU_{12} - EU_{21} + EU_{22})U + (EU_{12} - EU_{22})] \quad (2)$$

Duplicated dynamic equations on G are:

$$dG/dt = G(1-G)[(G_{11} - G_{12} - G_{21} + G_{22})EG + (G_{12} - G_{22})] \quad (3)$$

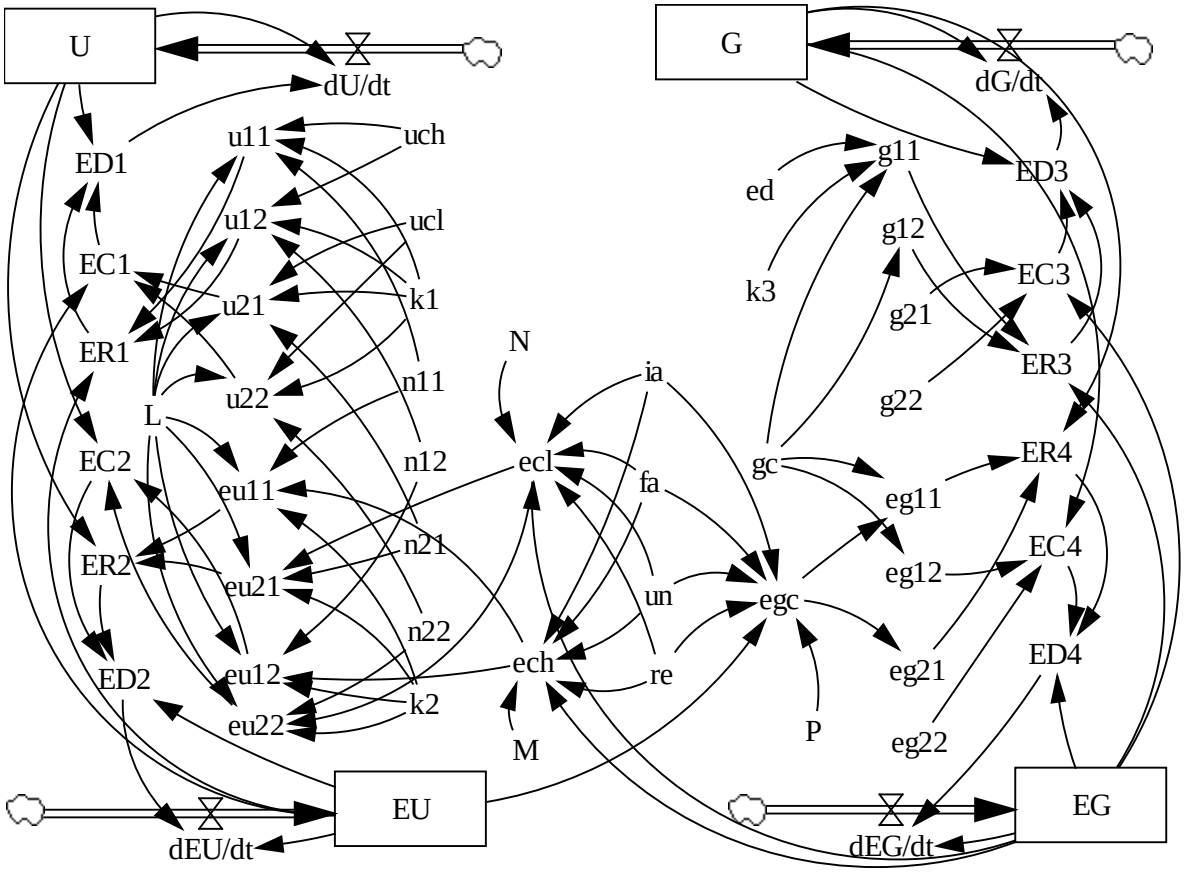


Figure 1. System flow diagram of Industry-University-Research-User game of users involvement in green innovation and electronic market

Duplicated dynamic equations on EG are:

$$dEG/_{dt} = EG(1-EG)[(EG_{11} - EG_{12} - EG_{21} + EG_{22})G + (EG_{12} - EG_{22})] \quad (4)$$

In order to carefully depict the decision evolution of all parties in the game, this paper simulates the above game evolution model by using the method of system dynamics. The system flow diagram is shown as in **Figure 1**.

The main equations are:

$$dU/_{dt} = ED_1 \times U$$

$$dEU/_{dt} = ED_2 \times EU$$

$$ER_1 = U_{11} \times EU + U_{12} \times (1-EU)$$

$$ER_2 = EU_{11} \times U + EU_{21} \times (1-U)$$

$$EC_1 = U_{21} \times EU + U_{22} \times (1-EU)$$

$$EC_2 = EU_{12} \times EU + EU_{22} \times (1-U)$$

$$ED_1 = ER_1 - U \times ER_1 - (1-U) \times EC_1$$

$$ED_2 = ER_2 - EU \times ER_2 - (1-EU) \times EC_2$$

$$dG/_{dt} = ED_3 \times G$$

$$dEG/_{dt} = ED_4 \times EG$$

$$ER_3 = G_{11} \times EG + G_{12} \times (1-EG)$$

$$ER_4 = EG_{11} \times G + EG_{21} \times (1-G)$$

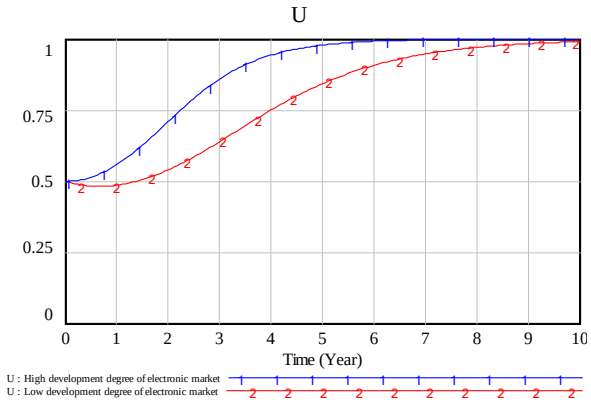
$$EC_3 = G_{21} \times EG - G_{22} \times EG + G_{22}$$

$$EC_4 = EG_{12} \times G + EG_{22} \times (1-G)$$

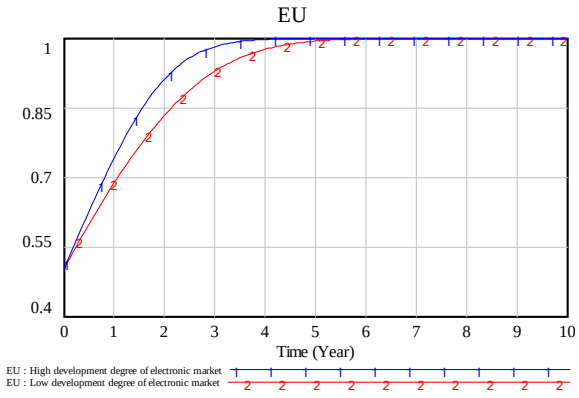
$$ED_3 = ER_3 - G \times ER_3 - (1-G) \times EC_3$$

$$ED_4 = ER_4 - EG \times ER_4 - (1-EG) \times EC_4$$

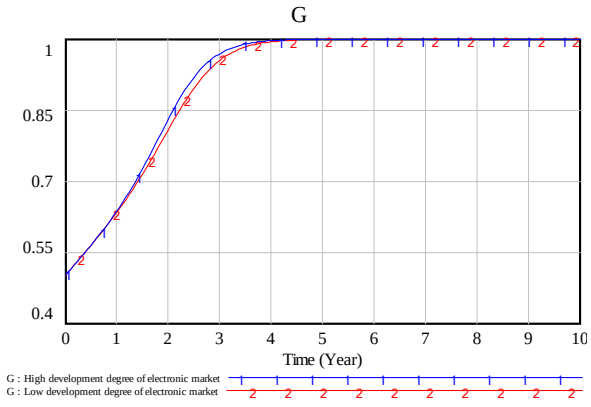
Vensim software is used to simulate the system dynamics model as shown in **Figure 1**. Theoretically, in equation (1), when , $[(U_{11} - U_{12} - U_{21} + U_{22})EU + (U_{12} - U_{22})] = 0$, any point in U ∈ [0,1] is equilibrium point. When $[(U_{11} - U_{12} - U_{21} + U_{22})EU + (U_{12} - U_{22})] \neq 0$, the equilibrium point is U = 0 and U = 1. In the same way, equation (2), (3), (4) have similar properties. As for equation (1), when $[(U_{11} - U_{12} - U_{21} + U_{22})EU + (U_{12} - U_{22})] > 0$, U = 0 is stable equilibrium point. When $[(U_{11} - U_{12} - U_{21} + U_{22})EU + (U_{12} - U_{22})] < 0$, U=1 is stable equilibrium point. Here, we only consider when equilibrium point is 1. In general, at this time, U starts from arbitrary initial conditions will eventually come to the equilibrium point U = 1. We consider the configuration parameters in the following conditions:



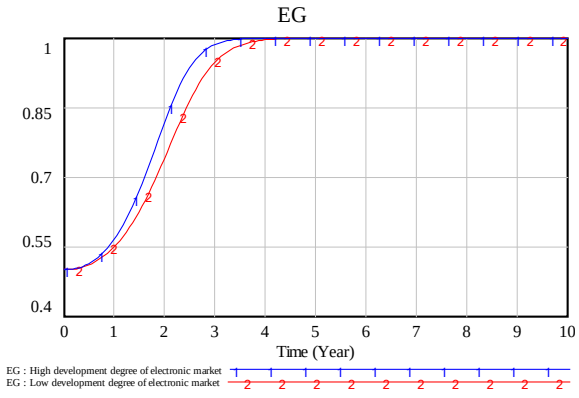
Changes in the decision-making process of user involvement in company's innovation



Changes in the companies' decision-making in user involvement in innovation



Changes in the decision-making process of government incentives for company's green innovation



Changes in the companies' decision-making process in green innovation

Figure 2. Decision-making simulation results of Industry-University-Research-User in user involvement in green innovation and electronic market: A typical case when the stable equilibrium point is 1

$$[(U_{11} - U_{12} - U_{21} + U_{22})EU + (U_{12} - U_{22})] < 0$$

$$EU(1 - EU)[(EU_{11} - EU_{12} - EU_{21} + EU_{22})U + (EU_{21} - EU_{22})] < 0$$

$$dG/dt = G(1 - G)[(G_{11} - G_{12} - G_{21} + G_{22})EG + (G_{12} - G_{22})] < 0$$

$$EG(1 - EG)[(EG_{11} - EG_{12} - EG_{21} + EG_{22})G + (EG_{21} - EG_{22})] < 0$$

$$N_{11} > N_{12} > N_{22}, N_{11} > N_{21} > N_{22}, K_1, K_2 > 0$$

Using various combinations of parameters satisfying the above conditions, and assuming that the parties in the initial phase of the game do not have any decision-making preferences, that is, U = 0.5; EU = 0.5; G = 0.5; EG = 0.5, we find the trends of simulated U, EU, G, EG are similar under different parameter combinations. Wherein **Figure 2** is a typical case. As we can see, in the stable equilibrium point U = 1, EU = 1, G = case 1, EG = 1, the company is more positive and fast in supporting user involvement in green innovation. And once the company

gains performance in supporting users involved in innovation, there tends to be more companies to follow suit rapidly, so that user innovation is promoted in companies. Government's attitude towards company's green innovation is relatively positive and firm. However, in contrast, the initiative of users' involvement in company innovation is lagging behind, presenting an S curve. It reflects that there are pending phenomenon in user involvement in innovation in the early stage. But once users participate in innovation through a certain period of time, it exhibits rapid growth. Whereas, the company is relatively slow in developing green innovation, the pending period is longer, and the time to reach the peak is longer too. Additionally, we compare the two situations in which the development degree of electronic market is high or low by setting the parameters L, M, N, P as 1 or o.5 respectively. The result shows that the intension of the users' involvement in company's innovation and the support of user involvement in innovation by companies represent a positive relationship with the development degree of electronic market. Moreover, the government is more willing to implement incentive policy, while the companies are more likely to active in green innovation in high development degree of electronic market.

ANALYTICAL RESULTS

In the development of open innovation, the Chinese government's guidance is very important. The Chinese government's support for industry-university-research can be divided into three stages. The first stage is to support industry-university-research cooperation, including the support in the system, policy and funding, to assist universities, research institutes and enterprises in doing joint scientific researches and personnel training, building research centers, research institutes and laboratories, establishing science and technology parks, implementing scientific research and achievements hatching, setting up a special fund for "industry-university-research" cooperation, establishing high-tech enterprises.

China has its particular situation, in which the government has a major advantage in terms of strength and speed of innovation resource scheduling. In the enterprise's green innovation activities, the enterprise is absolutely a main body and even a dominant body in green innovation activities. Because China's science and technology human resources mainly distributed in universities and research institutes, therefore, they should be regarded as the main body of the green innovation. Green innovation requires user involvement, therefore, in the near future, it needs to actively promote the user to become the main body of green innovation with using electronic platform. Here, the basic paradigm of green innovation in the Chinese green education context is proposed as "4 Fundamental & 3 Supported Bodies" paradigm, as demonstrated in **Figure 3**. That is, the collaborative industry-university-research-user green innovation through electronic platform is simplified as four fundamental bodies

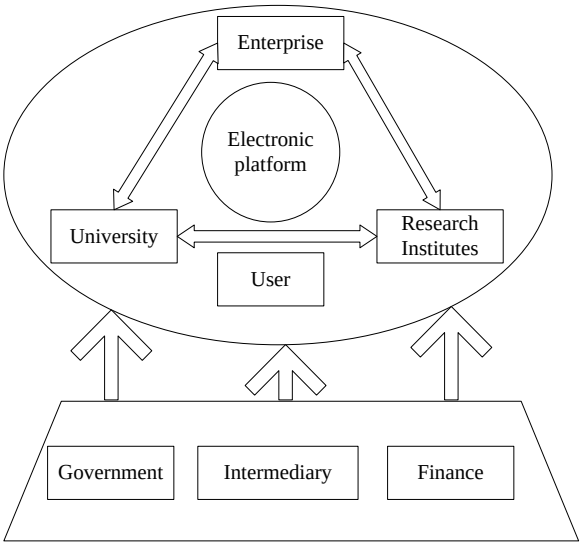


Figure 3. The mode of green innovation by collaborative electronic platform

and three supported bodies, in concrete, the four fundamental bodies refer to the organizations, like industries, universities, research institutes and users, who take the risks and returns, participate substantively in the process of collaborative green innovation through electronic platform, and take part in operation activities, such as participation in the creative development, research and development, production, marketing and other activities. And the supported bodies refer to the organizations, like governments or government service providers, financial institutions or financial services providers, and intermediaries or intermediary services providers, who participate un-substantively in the process of collaborative green innovation, but provide elements and services for green Technological innovation.

In China, the role of government played in user involvement electronic platform in the process of green innovation is very significant. The government acts in three areas: (1) the role of guidance, namely to guide users to participate in green innovation activities through the government publicity and demonstration, or to guide enterprises to attract users to participate in green innovation activities; (2) the role of support for constructing enterprise-oriented and user-involved green innovation electronic platform; (3) the role of risk protection, that is, the government supports and give subsidies for enterprises to buy science and technology insurance for green innovation projects, and the government provides the guarantee for the user to participate in the green innovation activities. For example, Wuhan and Shenzhen municipal governments give science and technology insurance subsidies to enterprises to participate in green innovation, and Zhejiang province gives compensations to failure green innovation projects according to 20 percent risk of losses in subsidies. Universities and research institutes provide the elements, outcomes, and knowledge support for the users involved in enterprises' green innovation projects, then users are deeply involved into green innovation activities of enterprises, through the user experience, DIY, user proposals, user innovation community, users involved in R&D or marketing and other ways, to achieve the users' personalization preferences and green demand for products and services. In the four-helix model, the real main bodies involved in the helix movement are enterprises, users, universities, research institutes and users, to achieve helix development under the supporting and protecting of governments in the base, and the feeding and nurturing of intermediaries and financial institutes. Intermediaries and financial institutions' main functions are: (1) the patent agency, provide advisory services intellectual property rights and interests divisions for users involved in green innovation; (2) enterprise incubator and maker space. When users involved in the enterprise green innovation with the strong willingness to innovate and start an undertaking, they can be supported by the enterprise incubators or maker spaces; (3) crowd funding and angel capital service platform, to attract investors for companies and to provide information and financial services for innovation participants.

IMPLICATIONS

In the context of China, the operational modes of user involvement electronic platform in green innovation can be roughly classified into three types: the operational mode of user proposal, the operational mode of user experience and the operational mode of user R&D. These three operational modes can also be combined to form new operational modes.

The operational mode of user proposal, which is to seek the views and suggestions of users dynamically in the entire process of green innovation decision-making phase, and the good ideas are adopted into the optimization process of innovation decision-making and innovative products manufacturing for enterprises. Enterprises can also take the views of consumers' solicitation way, giving prize or rewards for users raising good ideas and valuable suggestions in different ways and different grades, such as, bonuses, a reward after the successful development of green innovation products. Because most of the enterprises green innovation projects can get a grant from the government and recognition from the environmental protection department, there still exist the need to consulate from the government finance sectors, the environmental protection sectors, and experts in other fields, as shown in **Figure 4**.

The operational mode of user experience, refers to the enterprises invite users to experience the green innovation activities and achievements. In addition, green innovation experience is to invite users to the R&D and production sites of green innovation, experience the idea and technology of green innovation, the process and

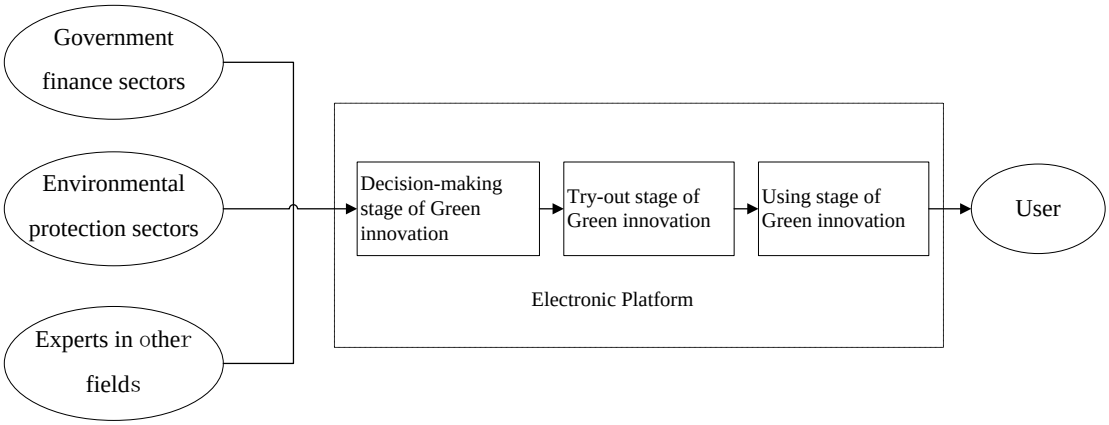


Figure 4. The operational mode of user proposal for user involvement electronic platform in green innovation

environment of green production. Furthermore, green innovation fruits experience means to invite customers' try-out before putting the green innovation products in batches to the market. This try-out can be divided into two types, one is a separate try-out, and the other is a group try-out. The group try-out is usually a specialized experience center set up by the enterprise or its agents, consumers can interact with the manufacturers of technology, production and marketing personnel, moreover, they can also exchange experience with each other. Through the operational mode of user experience, enterprises can, on one hand, collect the views of users to further improve their products, on the other hand, launch an experience marketing for green innovation products. These experiences can be achieved through the electronic platform, more convenient and economical.

The operational mode of user R&D refers to the user directly participate in the research and development activities, which includes two kinds of circumstances, one situation is the enterprise users is not the end product user, but the intermediate product user or subsistence users, that is, the downstream enterprises participate in the upstream enterprises' R&D activities, in concrete, downstream enterprises may choose the way of supervision or participation in manage R&D activities of upstream suppliers, joint research projects are carried out among upstream and downstream enterprises, and R&D companies or supply chain alliances are established among upstream and downstream enterprises to conduct collaborative green innovation activities. The second situation is the user is the end user, that is, subsistence users, at this time, the users can participate in the product design, or join into the enterprises' R&D projects directly. For example, many enterprises provide users with electronic platform for R & D design through the development of mobile phone APP.

A few Chinese enterprises start to explore the various operational modes of user involvement electronic platform in green innovation, for example, Hubei Provincial Huang mailing Phosphate Chemical Co., Ltd. invites farmers to do experiments in their rice fields, in order to develop green phosphate fertilizer, letting farmers to participate in collecting data after using the green phosphate fertilizer, which help the company to get useful result from the experiment and improve the product. Chinese Academy of Agricultural Sciences establishes joint company with farmers to develop the application of new varieties of green agriculture. Chengdu Blu-ray group is a real estate development enterprise, in the development of ecological, healthy, environmental protection, energy saving green villa project, the company undertakes energy-saving design tasks, and hand ecological and out-looking design tasks to the user, the user presents various design styles based on local climate, natural resources and cultural characteristics of the region, moreover, the user can also make recommendations on localization of building materials, and participate in research and development of materials localization. Among these user involvement practices, some are the operational modes of user proposal, some are the operational modes of user R&D, and some are the combination.

A typical example of Chinese enterprise's user involvement electronic platform in green innovation is China NIU electric vehicle company. China NIU electric vehicle company (NIU) is a new start-up company, the

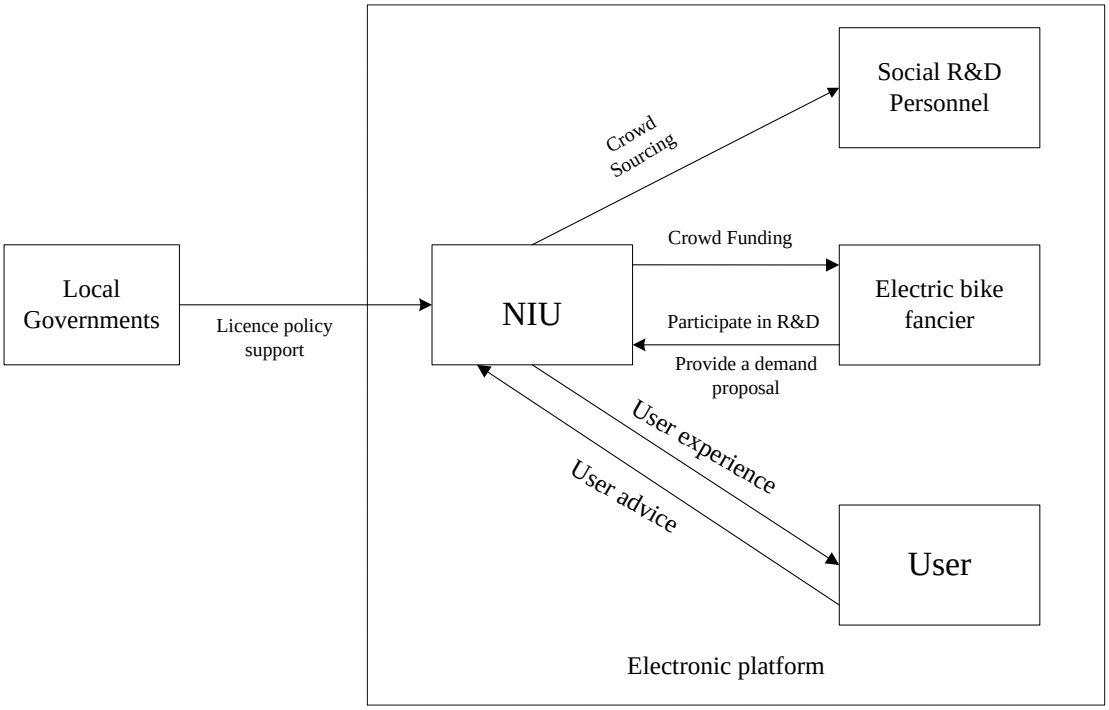


Figure 5. The integrated operational mode of user involvement electric platform in green innovation at China NIU electric vehicle company

main products of which is electric bicycles, and its target of 2014-2015 green products are: (1) lightweight, low-pollution batteries, no transfer and recyclable interior design for electric core, that is, the batteries can only be used for NIU electric vehicles, cannot removable to other brands of electric vehicles. The purpose is to guard against theft and avoid battery drain, and it is easy to trace the whereabouts of the battery, but the batteries can be recycled and secondary manufactured internally within NIU electric vehicles. (2) shortened frame arm, aimed at saving materials. (3) LED design for the whole car, aimed at increasing life span of lamps, such as, the LED headlights, for example, less heat and power saving.

The main characteristics of user involvement electronic platform in green innovation at China NIU electric vehicle company can be concluded as shown in **Figure 5**: (1) adopting crowd sourcing to attract R&D personnel including the user to participate in R&D activities of electric bicycles. (2) emphasizing on user experience, such as inviting users to take a test drive and to put forward opinions and suggestions. (3) collecting users' modifications, many users can modify their new electric bicycles according to their individual needs after the purchase. When NIU collects comments and ideas from the users, there are questions to be asked what are the potential aspects of new products to be improved. Finally, NIU's future products can meet users' satisfaction without any modification. (4) financing by crowd funding, in the first half of 2014-2015, NIU raised 76 million Chinese Yuan by Jingdong crowd funding platform to be input to produce 16,000 sets of electric bicycles, not only absorbing the suggests from the crowd, but also return a part of products to the funders, while another part of products be put on sale. (5) getting government support. China NIU electric vehicle company takes the lead to communicate with some city government to solving successfully on the licensing issue of electric bicycles for new users. Visibly, NIU has integrated user three operational modes of user involvement in green innovation, adopted crowd funding, and obtained government support. (6) establishing NIU mall, through the electronic platform, NIU starts from the understanding of products, service and support network, such as search, NIU arrived, NIU CARE, NIU APP and other customer service policies, to provide users with a better experience.

CONCLUSIONS

Green innovation mainly reflects the open innovation of user innovation, which is the trends in the field of innovation, and the integration of green innovation user innovation is a much bigger trend. User involvement electronic platform in green innovation can enhance the production of green innovation, while green innovation can attract more users to participate in the innovation activities. Since China launched the strategy of invigorating the country through science, technology and education, green innovation has been attached great importance to, and the implementation of current innovation-driven strategy that supplemented by carrying out the public entrepreneurship and innovation strategy, can greatly promote China's future green innovation involved by users. In this paper, based on the practice of China's green innovation, user innovation, the development of electronic platform and relevant cases, the paradigm and operational modes of user involvement electronic platform in green innovation are discussed.

As a consequence, during the process of green education, the explanation of green innovation should include the user involvement and electronic platform. But there are still many issues need to be further in-depth studied, such as the statistics analysis of user innovation's positive effect on promoting green innovation, and government policies designed to encourage users to be involved electronic platform in green innovation.

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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The Effectiveness of Using Stereoscopic 3D for Proportion Estimation in Product Design Education

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ABSTRACT

In product design education, identifying proportion and manipulating proportional relationships are important practices in form-giving training. However, using conventional 2D displays with monocular depth cues to train students with different spatial abilities remains a great challenge. Although, some literature has indicated that stereoscopic 3D (S3D) displays were helpful for depth-related tasks, whether S3D is helpful for proportion estimation is an open question. Therefore, the objective of this research was to study whether using S3D for design department students could assist them in improving their ability to interpret the proportions of products. The independent variables of the experiment included spatial ability, task complexity, and display mode. Spatial ability was a between-subject variable. Students aged 20–25 years were recruited as participants and were categorized into high-, moderate-, and low-performance groups depending on their score on a spatial ability scale. Task complexity and display mode were within-subject variables. In the experiment, three chair styles were used as samples. Digital models of three chairs with distinct proportions were displayed in two conditions: 2D mode with monocular depth cues and S3D mode. Participants were asked to compare the proportions of a physical chair and three digital chairs and then select the digital chair with the correct proportions in the 2D and S3D modes. The dependent variable were the score of selecting the 3D digital models with correct proportions compared to the physical objects. The result indicated that students could perceive proportions more accurately in the S3D mode than in the 2D mode. In particular, when using S3D, participants with low spatial ability demonstrated overall performance that was equal to that of participants with high spatial ability.

Keywords: product design education, proportion estimation, spatial ability, stereoscopic 3D (S3D)

INTRODUCTION

Product Design Education and Spatial Ability

The primary goal of design education is to improve designers' proficiency. The curriculum content includes creative thinking, design methods, ergonomics, psychology, aesthetics, graphics, mechanics, material, manufacturing processes, and other professional knowledge and practical abilities that designers must acquire (Yang, You, & Chen, 2005; Phillips, De Miranda, & Jinseup, 2009).

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Contribution of this paper to the literature

- In product design education, identifying proportion and manipulating proportional relationships are important practices in form-giving training.
- This paper demonstrates that S3D, which has disparity depth cues, is helpful for the training of proportion estimation in product design education.
- When using S3D, participants with low spatial ability demonstrated performance equal to participants with high spatial ability.

In the curriculum of design and engineering education, teaching dimensions, proportions, and spatial composition through 2D images with monocular depth cues is a critical introductory course. In addition, teaching the perspective method of constructing 3D spaces is critical. During the learning process, students often encounter tasks that require 3D spatial visualization skill, and learning performance is dependent on the spatial ability of students (Marunić & Glažar, 2014). Therefore, spatial ability plays an important role.

Spatial ability, including spatial cognition and spatial intelligence, is the ability to comprehend image variations, and the concept was originally studied in the field of psychology. Thurstone (1938) defined spatial ability as the ability to mentally memorize, twist, and move an image before comparing the mentally changed image with the original image. Lohman (1984) argued that spatial ability is not a single ability but a structured combination of the ability to move, combine, analogize, preserve, and transform abstract visual images. McCormack (1988) divided spatial ability into four types: spatial perception, spatial memory, logical spatial thinking, and creative spatial thinking. Furthermore, the abilities of understanding spatial relations, spatial orientation, and spatial visualization were critical factors affecting designers' performance in 3D product design (Liao, 2017).

In an application study on spatial cognition involving 37 high school students, Donelson (1990) determined that the participants with high spatial ability significantly outperformed those with low spatial ability in aspects such as information encoding, spatial thinking, and reaction time. Sorby (2007) indicated that 3D spatial ability is a key factor to succeeding in engineering and other technical fields. In particular, the ability to imagine object rotation in space is most crucial. Poor 3D spatial ability affects designers' performance in engineering graphics. Therefore, spatial cognition refers to the ability of a person to accurately observe and identify objects, memorize visually received images in the brain, and mentally imagine the received image subsequently. As an indicator of intelligence, the level of spatial ability is positively correlated with learning, reasoning, and creativity. In addition, design training had positive effects on spatial ability performance (Lin, 2016). The students with design training tended to use the holistic strategy, however the students without design training tended to use the analytical strategy.

Roth (1993) claimed that the creative thinking, problem solving, and concept formation practiced in design concept development entail spatial ability. Lacking spatial ability hinders perceiving the 3D spatial concepts represented in 2D images, thereby decreasing learning effectiveness.

However, in the curriculum of product design or architecture design education, some teaching materials for demonstrating and discussing case studies have always been presented in 2D images with monocular depth cues such as motion parallax, occlusion, shadow (or shading), relative size, texture gradient, linear perspective, and accommodation. Identifying these depth cues relies on learners' individual experience and on their complex spatial cognition of relative object attributes in the image.

For novice students, their capabilities of graphic drawing, observation, and spatial imagination still undergo continual training. If the capabilities of observation and spatial imagination are not well developed, teaching professional knowledge with these 2D images would lead to communication gaps between instructors and students. The gap increases with the complexity of the image (Mukai, Yamagishi, Hirayama, Tsuruoka, & Yamamoto, 2011; Guedes, Guimarães, & Méxas, 2012).

Therefore, in order to reduce the gap, some research groups have tried to use virtual reality (VR) and augmented reality (AR) technologies (Kaufmann, Steinbügl, Dünser, & Glück, 2005). In order to improve the spatial ability (i.e., spatial relations, spatial visualization, and spatial orientation) of new engineering students, VR and AR were used in a training experiment (Roca-González, Martin-Gutierrez, García-Dominguez, & Carrodeguas, 2017). Recently, stereoscopic 3D (S3D) displays, which have binocular disparity, have been used to present teaching materials for product design education or architecture design education (Smith et al., 2005; Chen, Cheng, Chu, & Sandnes, 2015). However, given the contributions from many research groups, some literature has still reported that the existing VR systems were not suitable to support the learning process of industrial design students and it was necessary to develop a designer-oriented VR system (Liang et al., 2016).

Applications of S3D Displays

Unlike a traditional 2D display, an S3D display increases the composite of monocular and binocular depth cues.

For example, since both spatial thinking and spatial ability can be improved through training (Newcombe & Stieff, 2012), stereoscopic vision has been used in teaching descriptive geometry, which is relatively difficult in spatial geometry (Kaufmann et al., 2005; Kaufmann, 2009). With two lateral-shift images, one for the left eye and the other for the right eye, the students were able to perceive additional depth cues from the S3D teaching materials.

Regarding S3D applications, tour guide or interpretation systems in museums were pioneering S3D applications (Styliani, Fotis, Kostas, & Petros, 2009). Recently, applications for medical education have gradually increased (van Beurden, IJsselsteijn, & Juola, 2012). For example, 3D holographic displays have been used to demonstrate anatomy and infection scenarios at the single-cell level. S3D streaming of surgeries has been helpful for collaborative e-learning. S3D has fostered the ability to represent anatomical details for biological e-learning. For neuroanatomy lectures, students considered the S3D approach superior in spatial understanding, applicability in future anatomy classes, effectiveness, and enjoyableness (Kockro et al., 2015).

In addition to education, 3D displays have been used successfully for video conferencing. A research team developed an S3D system that enabled collaboration and telepresence among team members by allowing automobile models to be rotated through two-point touch (Edelmann, Gerjets, Mock, Schilling, & Strasser, 2012).

In addition, Lin, Cheng, & Wang (2015) reported that stereoscopic displays were helpful for the performance of depth-related tasks. These tasks included judging absolute and relative distances, finding and identifying objects, performing spatial manipulations of objects, and navigating. However, the accuracy of distance judgment was influenced by the angle of declination while estimating depth in a projection-based stereoscopic virtual display.

Most studies on S3D displays have verified that user perception of 3D scenes and objects was improved with such technologies. Furthermore, these technologies enhanced the users' ability to memorize and recall 3D scenes and objects and increased the effectiveness of learning spatial and environmental relationships (Patterson, Cristino, Hayward, & Leek, 2012). Regarding the completion time of spatial cognition tasks, stereoscopic presentation methods were more efficient and accurate than conventional 3D methods for estimating depths (Price & Lee, 2010).

For medical applications, some research has reported that S3D displays were beneficial over monoscopic 3D displays for relative position judgment tasks in a medical visualization setting (Escobar et al., 2015). However, some experiments have concluded that S3D viewings offer no significant advantages over monoscopic 3D viewings (McIntire & Liggett, 2014). If the presence of monocular depth cues was sufficient to complete the tasks, the binocular depth cue offered by S3D was not necessary.

In addition, some research has reported that the effects of S3D on science learning were related to the spatial ability of the viewer (Price, Lee, Plummer, SubbaRao, & Wyatt, 2015). Participants with different levels of spatial abilities perceived stereoscopic images differently. Recently, a study about virtual molecule manipulation

has demonstrated that S3D did not benefit participants with high spatial ability, while it did benefit those with low spatial ability (Barrett & Hegarty, 2014).

Given the potential advantages and limitations of S3D, determining if a stereoscopic viewing approach is effective for all students or if its efficacy depends on the characteristics of the tasks or the levels of spatial abilities of the students deserves in-depth study. Also, given that in product design education, identifying "proportion" and manipulating "proportional relationships" are important practices in form-giving training (Rampino & Gorno, 2011), determining whether S3D is helpful in form proportion training is another research issue addressed in this research.

METHOD

Research Design

The objective of the present study was to understand whether using an S3D as a teaching tool for design department students can assist them in improving their ability to interpret the dimensions and proportions of objects. The independent variables of the experiment included spatial ability, task complexity, and display mode. Spatial ability was a between-subject variable. Students aged 20–25 years were recruited as participants and were categorized into high-, moderate-, and low-performance groups depending on their score on a spatial ability scale. Task complexity and display mode were within-subject variables. The participants interacted with 3D digital models in 2D and S3D display modes before judging an object's proportions. In order to control the task complexity, the deformation of the digital models changed sequentially from differences of 20%, to 10% and then to 3%. The dependent variable were the score of selecting the 3D digital models with correct proportions compared to the physical objects.

Stimuli and Apparatus

In order to construct a system for experiment, Visual C++ 2013 and Direct3D 11.1 were employed as the development tools. The Direct3D S3D sample and Visual Studio 3D Starter Kit were modified and integrated to construct a platform for importing 3D models in FBX format and displaying these models in either S3D or 2D mode. The program ran on a Windows 8 operation system installed in an Acer desktop computer with a GT640 graphic card. The images were displayed on a 50-inch 3D TV and viewed through passive glasses. In addition, the experiment system allowed users to adjust the effect of disparity for S3D display mode. The investigator could switch between 2D display and S3D display modes. The pilot test of such a system was carried out previously with 30 participants (Chen et al., 2015). The system could help participants perform the tasks of identifying image differences and locating ergonomic or design problems.

To offer minimal interactivity, the users could change the mode of model rotation. At the beginning of program execution, the 3D models rotated in 1.0 rpm with respect to the vertical axis. The user could use the left button on the computer mouse to stop or start rotation.

The computer-based test displayed 2D and S3D images in a laboratory. Only the participant and the recorders stayed in the experimental site, thus minimizing external interference (**Figure 1**). The lighting of the experimental site was dimmed to minimize lighting interference on the testing results. The participants were video-recorded as they completed the computer-based test. The recorders used interviews to understand the participants' perceptions of 2D and S3D modes.

The computer-based test in this study referenced the triangulation cupping method adopted in the World Cup Tasters Championship to facilitate questionnaire responses. A cup taster must determine the correct cup of coffee among three similar samples. Similarly, three chair styles (i.e., Chair One, Emeco Kong, and Navy 1006 chairs) that the design department students were familiar with were used as the samples. For each chair style, two chairs with distinct length–width ratios in addition to a chair with the correct length–width ratio were prepared. The participants were asked to pick the correct one from the three chair examples. Similar to the triangulation

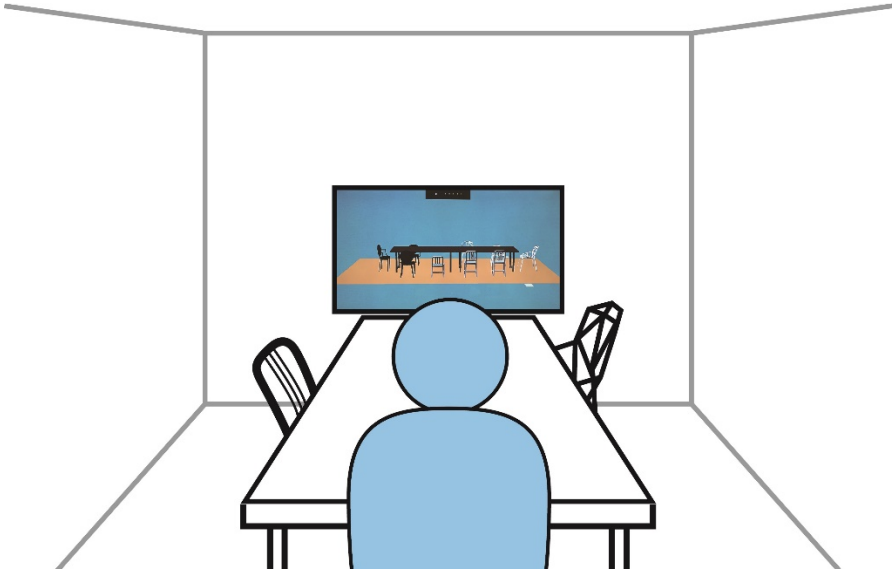

Figure 1. The equipment and the experimental site planning

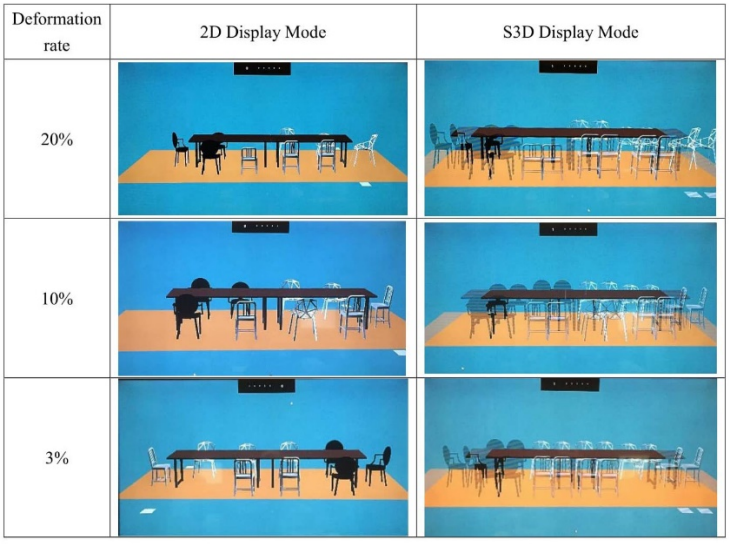

Figure 2. The 2D and S3D modes with different deformation rates from 20% to 3%

cupping method, in which the difference among the three cups of coffee diminishes and the difficulty increases gradually, the deformation of the chair dimensions in this study changed sequentially from differences of 20% to 10% and 3% to increase the difficulty.

The computer-based test comprised two stages: the 2D and S3D modes (**Figure 2**). In both tests, the three chair styles were used as the samples. For each style, three chair examples with distinct dimensions were displayed. For each chair style, the participants were asked to select the chair with the correct dimensions and proportions. Each correct answer received 1 point, and the full score for each test was 3 points. Each participant received three cycles of testing in completing the computer-based test.

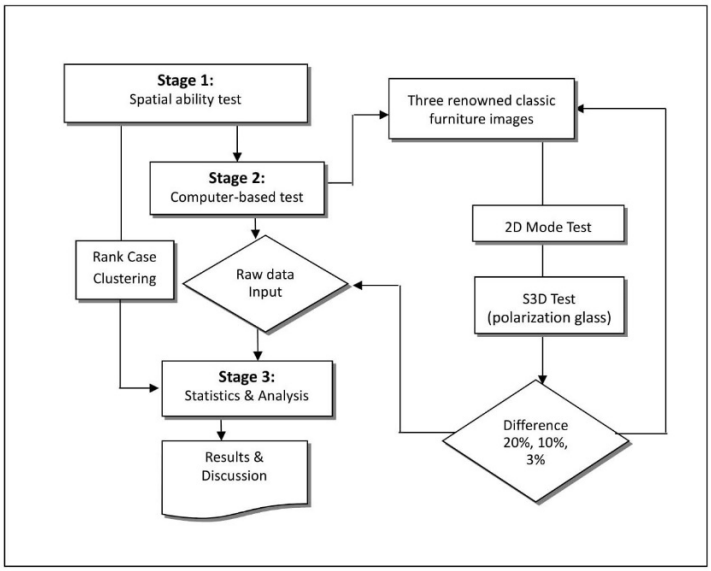

Figure 3. Research design and the experiment flowchart

Procedure

This study was carried out in two stages. In Stage 1, all participants completed a spatial ability test to determine their spatial ability. Stage 2 involved a computer-based test. The test objects were renowned classic furniture that the students were familiar with. The participants first observed interactive 3D furniture models displayed in a 2D mode and completed the questionnaire. Next, they wore S3D glasses to observe interactive 3D models and answered related test questions. Finally, analysis of the differences between 2D and S3D modes were conducted to determine the learning effectiveness from employing an S3D to identify proportions. A flow chart of the experiment is shown in **Figure 3**.

Spatial ability test

At Stage 1, all participants completed a spatial ability test. A total of 41 design department students aged 20–25 years participated in this study. The 30-item questionnaire for the spatial ability test was based on Revised Purdue Spatial Visualization test: Visualization of Rotations. The validity and reliability of this test in measuring spatial ability had been proved in the literature (Maeda et al., 2013). One point was received for each correct answer, i.e., the full score was 30 points. The participants were requested to complete the test in 20 minutes.

The purpose of this test was to identify the participants' spatial ability levels. The authors used the rank cases function in SPSS software to divide the 41 participants into three groups with low, moderate, and high spatial ability (Nlow = 13, Nmoderate = 13, and NHigh = 15, respectively). Descriptive statistics such as means and standard deviations of the scores of each group are shown in **Table 1**.

Table 1. The rank cases clustering for spatial ability test

Spatial Ability Groups	***N***	***Mean***	***Std. Deviation***
Low	13	17.62	0.96
Moderate	13	21.85	1.41
High	15	27.20	1.66
Total	41	22.46	4.24

Figure 4. The computer-based test

Computer-based tests

After the spatial ability test, the participants rested for a few days before taking the computer-based test in Stage 2. The participants were allowed to take the test whenever they wanted. In Stage 2, the participants were provided with actual chairs to enable them to perceive the correct chair dimensions and proportions, thus facilitating their responses and comparisons (**Figure 4**). The participants were permitted to note or sketch the chair dimensions and proportions that they perceived.

In the 2D test, the participants were asked to watch images on a television screen. The screen presented three chair styles that the participants could rotate, thus freely selecting a view angle. Three examples were provided for each chair style. Therefore, the screen showed nine chairs at the same time. For each style, only one chair had the correct dimensions and proportions; the other two had a ratios of difference compared with the actual chair. The difference was relatively large at the beginning (20%). The participants had to identify the chair with the correct dimensions and proportions. Since three chair styles were presented concurrently, the participants had to choose three chairs in each test. A correct answer for a style earned 1 point for each participant.

After the 2D test, the arrangement of the chairs was randomly altered before the participants performed the S3D test wearing polarized glasses. Similarly, the participants could rotate and customize the view angle freely while picking the correct three chairs from the nine chairs. For each style, 1 point was received for a correct answer. **Figure 4** shows the testing scenario, with the participant viewing 3D images while wearing polarization glasses.

After the first test, the participants relaxed their eyes for 10 minutes. The same cycle of 2D and S3D image viewing was repeated with the proportional difference decreased to 10%, which increased the difficulty of the spatial identification. Subsequently, the participants took another break before the last cycle, which had a proportional difference of 3%, further increasing the difficulty of the spatial identification. The entire computer-based test and the two breaks were completed in 40 minutes.

Table 2. Descriptive statistics for computer-based test with different deformation rates

			2D		S3D		Total	
Deformation rate	**Group**	***n***	***M***	***SD***	***M***	***SD***	***M***	***SD***
20%	L	13	1.385	0.506	3.000	0.000	2.192	.100
	M	13	1.692	0.480	2.923	0.277	2.308	.100
	H	15	2.000	0.655	2.867	0.352	2.433	.093
	Total	41	1.707	0.602	2.927	0.264	2.311	.057
10%	L	13	1.000	0.707	2.385	0.506	1.692	.118
	M	13	1.538	0.519	2.692	0.480	2.115	.118
	H	15	1.267	0.594	2.733	0.458	2.000	.110
	Total	41	1.268	0.633	2.610	0.494	1.936	.066
3%	L	13	0.231	0.439	1.769	0.832	1.000	.124
	M	13	0.615	0.506	2.231	0.439	1.423	.124
	H	15	0.800	0.561	2.133	0.640	1.467	.116
	Total	41	0.561	0.550	2.049	0.669	1.297	.070

M = mean, *SD* = Standard Deviation

Table 3. Analysis of variance (ANOVA) results

		SS	**df**	**MS**	**F**	**Sig.**
	Between	2.642	2	1.321	4.237*	.022
2D 20%	Within	11.846	38	.312		
	Total	14.488	40			
	Between	1.885	2	.942	2.528	.093
2D 10%	Within	14.164	38	.373		
	Total	16.049	40			
	Between	2.313	2	1.156	4.491*	.018
2D 3%	Within	9.785	38	.257		
	Total	12.098	40			
	Between	.124	2	.062	.887	.420
S3D 20%	Within	2.656	38	.070		
	Total	2.780	40			
	Between	.977	2	.488	2.114	.135
S3D 10%	Within	8.779	38	.231		
	Total	9.756	40			
	Between	1.554	2	.777	1.806	.178
S3D 3%	Within	16.349	38	.430		
	Total	17.902	40			

RESULTS AND DISCUSSION

Descriptive statistics for the computer-based test are shown in **Table 2**. The mean scores clearly show that the difficulty in selecting the correct chair increased as the deformation difference decreased. The overall mean decreased from 2.311 to 1.297 points. Regardless of the participants' spatial ability, they attained substantially higher average scores when in the S3D test than they did in the 2D test. This result confirmed that S3D is conducive to identifying proportions. This beneficial effect was increasingly significant as the difficulty increased.

Analysis of variance (ANOVA) results for these data are shown in **Table 3**. When the participants were in the 2D test, the level of spatial ability affected response accuracy. For instance, the participants exhibited a significant difference in means at the 20% deformation rate ($F(2,38) = 4.237$, $p = .022$) and the 3% deformation rate ($F(2,38) = 4.491$, $p = .018$). However, when the participants conducted the S3D test, no significant difference was observed in the mean scores of the three testing cycles, regardless of the participants' spatial ability. For instance,

at the 20% deformation rate, the groups with distinct levels of spatial ability showed no significant difference ($F(2,38) = .887$, $p = .420$). As the deformation rate decreased to 10% and 3%, the results still showed no significant difference. These preliminary results verified that the S3D mode assists in mitigating gaps between students' spatial abilities.

To determine the relationship among the experimental variables in the three testing cycles, two-way ANOVA of repeated measures was conducted. In the 20% deformation test, an analysis of the main effect of the two independent variables showed no significant differences among the total scores of groups with distinct levels of spatial ability ($F(2,38) = 1.553$, $p = .225 > .05$). However, the two within-subject sample means of 2D and S3D tests exhibited a significant difference with a between-group effect of $F(1,38) = 260.532$, $p = .000 < .05$. This result verifies that wearing polarization glasses significantly improved the participants' spatial cognition in selecting the correct chairs.

According to this result, although the group with high spatial ability exhibited a high total mean at the 20% deformation rate, no significant difference was observed between the groups. The authors inferred that the participants with low spatial ability experienced no difficulties during tests because the difference in deformation rate was considerable.

In the second cycle, the test difficulty increased by decreasing the deformation rate to 10%. Analysis of the main effect of the two independent variables showed that the total mean scores between the groups with distinct spatial ability levels reached a significant difference ($F(2,38) = 3.473$, $p = .041 < .05$). This result indicates that when the deformation rate reached 10%, the level of spatial ability generated a significant difference. The two within-subject sample means also demonstrated a significant difference with a between-group effect of $F(1,38) = 149.400$, $p = .000 < .05$. This result indicates that the S3D mode had a more significant effect on picking the correct chairs than the 2D mode did.

In the third cycle, the difference among chairs of the same style declined to 3%, considerably increasing the difficulty of picking the correct chair. Analysis of the main effect of the two independent variables revealed that the groups with distinct spatial ability levels showed a significant difference in total mean scores ($F(2,38) = 4.424$, $p = .019 < .05$). This result indicates that when the deformation rate decreased to 3%, the mean scores of participants with distinct spatial ability levels still showed a significant difference. In addition, the between-group effect of the two sample means for whether the participant in the S3D mode reached significance ($F(1,38) = 160.331$, $p = .000 < .05$), validating that the S3D mode was significantly conducive to spatial cognition.

Finally, a post hoc comparison was conducted, and line charts were plotted for analysis. The y- and x-axes represent mean score and spatial ability, respectively. The 2D and S3D use are expressed in individual lines. **Figures 5–7** show the relationship of the three testing cycles involving deformation rates of 20%, 10%, and 3%, respectively. Clearly, the three line charts demonstrate nonparallel lines, indicating that an interactive effect existed between spatial ability and the S3D mode. In other words, the mean scores of the three spatial ability groups were moderated by S3D use, exhibiting a significant difference.

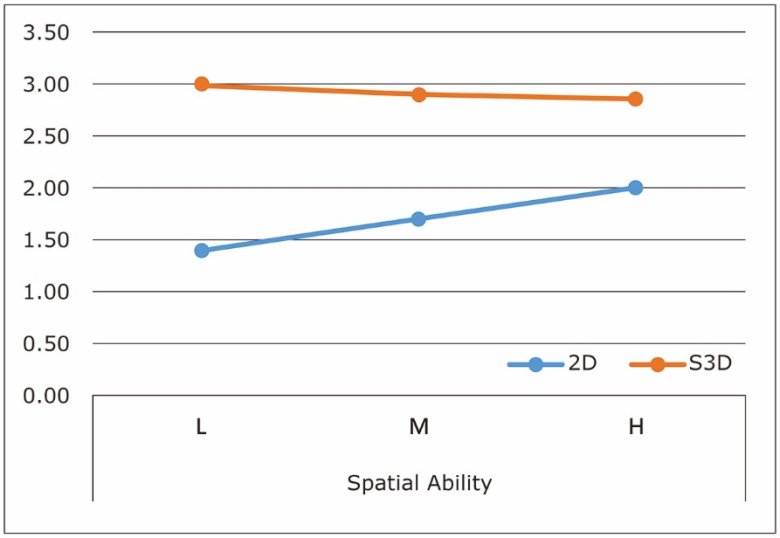

Figure 5. The performance line chart for the 20% deformation rate

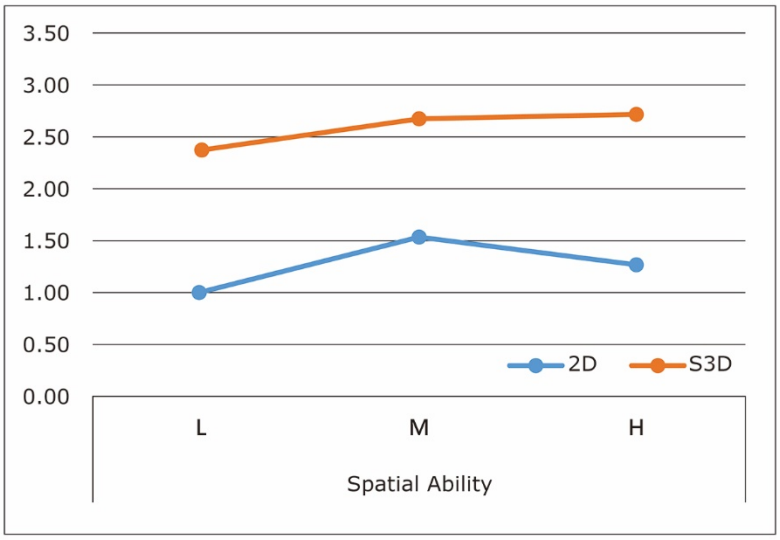

Figure 6. The performance line chart for the 10% deformation rate

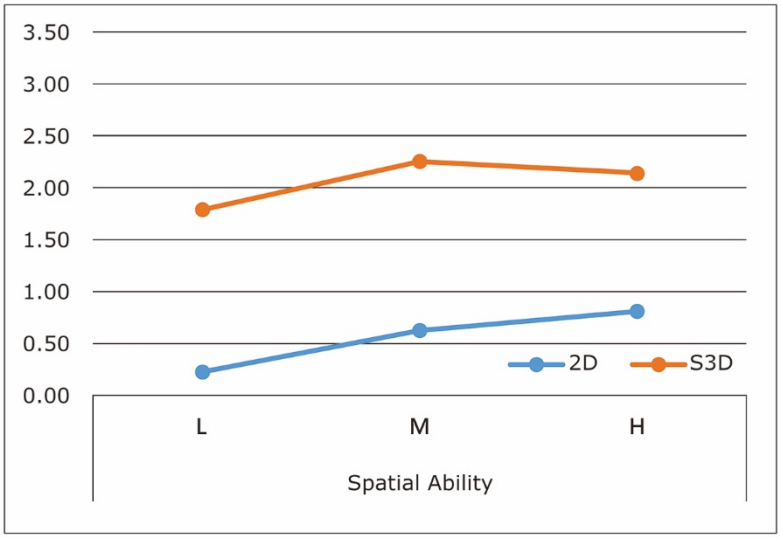

Figure 7. The performance line chart for the 3% deformation rate

The effect of S3D use on the scores of the three groups differed. For example, the participants with low spatial ability occasionally exhibited scores higher than those of the participants with high ability. A fixed order could not be determined from the three cycles of experimental data. This result was possibly caused by approximating the spatial ability of the three groups after they conducted the S3D test, thereby mitigating the gap between the spatial ability levels of the participants in the 2D test. In other words, the group that originally scored highest in spatial ability on the 2D test did not necessarily score highest on the S3D test. This result again proved that the S3D mode effectively assists students in design education.

While most literature focused on the techniques and tools for improving the abilities of spatial relations, spatial visualization, or spatial orientation (Alqahtani et al., 2017; Nagy-Kondor, 2017; Roca-González et al., 2017), the present study focused on training the synthesis ability of proportion estimation. Furthermore, the experimental S3D system provided users with binocular depth cue, overcoming the limitation of traditional Virtual Reality or Augmented Reality systems that offered only monocular depth cues. The binocular depth cue could stimulate self-regulated reflections while comparing the virtual models and physical objects in the training sessions.

CONCLUSION AND SUGGESTIONS

The ANOVA results of the experiment clearly indicate that the S3D system assists students in identifying the proportions of objects. This effect became particularly pronounced as the test difficulty increased. For example, in the testing cycle with a 20% deformation rate, the mean score of the 41 participants increased from 1.7 to 2.9 points (nearly a full score of 3 points), a 70% increase. In the most difficult cycle (3% deformation rate), the mean score for the 2D test was 0.56 points; however, the mean score reached 2.05, a 266% increase, when the participants conducted the S3D test. This result was unexpected and showed that, in contrast with the 2D mode, the S3D mode was more beneficial for design department students in interpreting the proportions of objects in spatial compositions.

As shown by the differences among the three groups of participants with low, moderate, and high spatial ability, S3D use was most beneficial to the participants with low spatial ability. In the 2D test, differences existed among the three groups in identifying proportions. The group with low spatial ability exhibited test data significantly different from those of the other groups in the three testing cycles. At a deformation rate of 3%, the group with low spatial ability attained an average score of only 0.23 points. However, the mean scores stratified by

spatial ability showed no significant difference in any of the three S3D testing cycles. Moreover, the participants who scored lowest on the 2D test scored the highest on the S3D cycle with a deformation rate of 20%. In the most difficult cycle (3% deformation rate), the participants who had moderate mean scores on the 2D test achieved the highest mean scores on the S3D test. Thus, the S3D mode maximized the spatial ability of participants with low spatial ability and benefitted them the most.

The aforementioned results indicate if S3D were introduced in design teaching activities, students could more accurately perceive proportions. Regardless of the spatial ability of the students, they could achieve significant progress. In particular, participants with low spatial ability demonstrated excellent overall performance when using S3D that was equal to the participants with high spatial ability. Hence, students with low spatial ability require similar equipment to improve their ability to identify proportions.

The test results indicate that technological advancement has provided a novel solution to a conventional design education problem. The S3D system enables students to perceive the third axial direction (i.e., depth), whereas the conventional 2D teaching model relies only on monocular depth cues. The S3D system enables students to easily discern the relationship between object proportions during the learning process, in addition to strengthening their self-reflection and self-regulation in training, compensating for gaps in spatial cognition. Thus, their learning effectiveness can be substantially improved.

Although the proposed test achieved satisfactory outcomes, whether the S3D can be introduced into design practice with designers operating 3D digital contents over long periods was not investigated in the present study. For example, some literature has indicated that participants might experience eyestrain and fatigue, due to long-term exposure to S3D (McIntire & Liggett, 2014). Future studies should consider including such a topic in their experimental planning.

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Symbiotic Relationship between Higher Engineering Education and Manufacturing Industry in China

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ABSTRACT
According to the requirements of the current "knowledge economy era" background, to explore the harmonious symbiosis between higher engineering education and manufacturing industry with the state space model, the results show that: the investment of higher engineering education has obvious influence on the factor of "higher engineering teachers' input", and the intermediary effect of "higher engineering teachers' input" is obvious.

Keywords: higher engineering education, manufacturing industry, coordination relationship, causal relationship

INTRODUCTION

At present, in the context of economic growth, which is relying more and more on the production, diffusion and application of knowledge in the world, "knowledge economy" emerges as the times require, for knowledge economy, it is a knowledge-based economy, and it is based on the production, distribution and use(consumption) of knowledge, and it is seen as "the knowledge-based economy" that regards the accumulation of knowledge as an endogenous independent factor of economic growth, it believes that: the knowledge can improve the benefit of investment, the accumulation of knowledge is the source of modern economic growth, and human capital is playing an important role of the technological progress and knowledge accumulation, and considers that special and specialized human capital is the real source of economic growth. Now, with the developing of information and network technology, the updating of knowledge is very fast, to get an education and learning has become one of the most important activities in life.

Higher engineering education aims at training advanced engineering and technical personnel with high professional knowledge and operation skills, and it is the basic force to improve the manufacturing knowledge and technology level. In recent years, China's higher engineering education has achieved rapid development in line with the requirements of the era of "knowledge economy", as of 2016, the number of engineering students in colleges and universities in China has reached 5.12 million, accounting for 40% of the total number of engineering students in the world, and it is the largest scale of higher engineering education in the world. Under the influence of global strategy of "industry 4.0 and manufacturing return", in order to effectively identify the development efficiency of higher engineering education in China, it is necessary to study the coordination and symbiosis between higher engineering education and manufacturing industry, and this study is of great practical significance for

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Contribution of this paper to the literature

- Foresight this paper, taking full account of the intermediary variable factors, to study the harmonious symbiosis relationship between higher engineering education and manufacturing industry, compared with the traditional research, it has important innovative and practical significance in the selection of variable factors.
- This paper, to adopt the state space model, which can be more practically reflected the time-varying effect of educational input on economic growth in different periods, it has important contribution to the existing literature to explore the symbiotic relationship between higher engineering education and manufacturing industry more accurately.

improving the quality and efficiency of higher engineering education, and improving the knowledge and technology content of China's manufacturing industry.

LITERATURE REVIEW

Recently, the relationship between education investment and industrial economic growth has been a hot issue in academic research, and more and more achievements have been made, which include that:

The Contribution Rate of Educational Input to Industrial Economic Growth

Denison. E. F first set the education as an input to human capital (Denison, 1983; Gao and Wang, 2017), and made a research to calculate "the return of educational capital" to measure "the contribution of education investment to the economy", and in China, many scholars have made great achievement in the quantitative measurement of the contribution rate of higher education investment to regional economic growth (Hui Min Qian, 2013; Lin, 2017; Song et al., 2017).

The Relationship between Educational Input and Industrial Economic Growth

In this field, R. Blundell, L. Dearden and B. Sianesi believed that education development is the driving force of economic growth (Blundell et al., 2015; Park and Kim, 2017), and M.E. Menon believed that the reason for the education development is economic growth (Menon, 1997), and education is the result of economic development, and the education investment promotes economic development, and later, Bing. G and King. X. Lee divided the investment of higher education into broad definitions of human and financial factors (Bing, 2010; King and Wang, 2009), and made a quantitative measurement on the "grainger causality" among educational investment and human input and GDP growth.

The Impact of Specific Factors of Education Investment on the Industrial Economic Growth

Many studies have been made to explore the impact of specific factors of education investment on the industrial economic growth (Lolas and Olatun bosun, 2008), and have achieved rich results, but the existing statistical literature has not given a clear scope of the specific indicators-selection of education input, at present, the research on the impact of education investment on economic growth is mostly from the perspective of the total amount of education input, lacking segmentation of the specific content of education input, and it has blurred the actual influence degree of "teacher's personnel input" index, and neglected the importance of human capital in the context of "knowledge economy era".

Research Review

Seen from the current literature, on the whole, in the study of the relationship between education input and economic growth at home and abroad, most studies limit the content of education input into the category of "educational investment", and other factors such as the number of teachers etc are not considered, and the targeted

research on higher engineering education is relatively few (Yin and Qing, 2007; Chen and Han, 2008), and for the study results, the actual degree of influence between engineering education and economic growth is blurred.

Then, seen from the point of view of research methods, the traditional regression model is often used in the measurement of the relationship between educational input and economic growth, and it is assumed that the estimation parameters are unchanged, then it is failed to consider the time-varying effect of educational input on economic growth in different periods (Tang, 2013).

This paper, taking full account of the intermediary variable factors, to study the harmonious symbiosis relationship between higher engineering education and manufacturing industry with the state space model, compared with the traditional research, it has important innovative and practical significance in the selection of variables and the choice of research methods, and it has important contribution to the existing literature to explore the symbiotic relationship between higher engineering education and manufacturing industry more accurately.

STAGE CHARACTERISTICS OF HIGHER ENGINEERING EDUCATION IN CHINA

Since 1990s, the higher engineering education in our country has undergone great changes, mainly in the school scale, number of engineering teachers and educational funds:

The Scale of Engineering College Students

In 1995 China's engineering college students was 1.23 million, as to 2016, the number of engineering college students has reached 5.12 million (Wang and Li, 2009), and from the development characteristics of each period, it can be roughly divided into three stages:

1995-1998 is the steady growth stage of engineering students scale, at this stage, although the scale of engineering students has expanded year by year, the growth trend is relatively mild.

1999-2006 is the rapid expansion stage, the first reason is the increase in population base（That is, the peak birth rate started in early 1980s, which resulted in an increase in the number of school-age candidates）, and the popularization of higher education in China has also led to the rapid expansion of engineering college students.

And 2007 so far is transformation and adjustment stage of engineering students scale, at this time, because of the one-child policy, resulting in a decline in population, the number of school-age students decreased, the higher engineering education has entered a stage of transformation and adjustment from denotative quantity expansion to connotation quality upgrading.

Number of Employed Teachers in Engineering Education

1998-2001 is gentle development stage, the total number of employed teachers in engineering has little changes, the number of professional teachers has increased by about 83.1 thousand, compared with the growth rate of students, the growth rate of teachers is relatively slow.

2002-2009 is the expand and ascending stage, since 2002, the enrollment expansion in colleges and universities leaded to the marked increase of internal students, in order to complete the task of education and teaching, large-scale recruitment of teachers has been carried out, among which the total number of full-time engineering teachers has increased by 508.9 thousand.

2009 so far is steady growth stage, since 2009, China's Ministry of education has begun to carry out teaching quality inspection, along with the stability of the number of students enrollment, the colleges and universities began to focus on improving the teachers' overall quality, the number of engineering teachers gradually slowed down and entered a steady growth period.

Table 1. Stationary Test Results of Residual Sequence

Variable	Lagged rank	P	Test results (0.05%)
lnA1	2	0.0110	Stationary
lnA2	1	0.0106	Stationary
lnA3	2	0.0061	Stationary

Educational Funds Input

Since 1995, the total amount of funds input in engineering education in China has shown a continuous upward trend, in 1995, China's higher engineering educational funds invested 10.21 billion, in 2016, it is up to 682.69 billion, from the development characteristics of stage, 2003 can be seen the dividing line, showing inverted "V" shape of "first rose and then fell", the growth rate of investment was higher before 2003 and then began to decline.

From the above analysis, it can be seen that, on the whole, China's higher engineering education has achieved rapid development in the past decade and more years, teacher input and educational investment have provided strong support for the development of higher engineering education (Lang, 2004; Ming., 2012), but compared with the scale growth of higher engineering education, the investment of full-time engineering teachers and educational funds is still insufficient (Wei and Guo, 2011), in some extent, it also affected the quality of China's manufacturing industry growth (now, China's manufacturing industry is still in the stage of high investment, high emission and low production, the quality of products is unstable, and there are not many star enterprises and star products in the manufacturing field).

RESEARCH DESIGN

Variable Selection and Data Resources

In order to highlight the importance of human capital under the background of knowledge economy, to select the number of engineering teachers (A1) as the input factors of manpower, and the total amount of engineering education expenditure (A2) is regarded as the input factor of resources, and the gross domestic product (A3) is used as the indicator of the manufacturing industrial economic output, the sample data can be obtained from the 2000-2016 years of "China Statistical Yearbook", "China Education Funding Statistics Yearbook" and "China Education Statistics Yearbook", in order to eliminate the heteroscedasticity of the time series, in this case, the relevant data is processed by the logarithm method (which does not change the relationship between the original variables), as lnA1,lnA2 and lnA3.

Analysis of Symbiotic Relationship between Higher Engineering Education and Manufacturing Industry

In order to study the impact of engineering education investment (A2) and the investment of full-time engineering teachers(A1) on the economic growth of manufacturing industry(A3), this study, "grainger causality test" is applied to test and analyze the linkage of lnA1, lnA2 and lnA3.

Analysis of co-integration test

To avoid pseudo-regression which may be caused by the instability of economic variables, it is needed to test the stationarity of the sample data, that is, unit root test is conducted before the grainger causality test.

With SPSS 19.0 software, to make ADF test for the unit roots of lnA1, lnA2 and lnA3, the results are shown in **Table 1**, and it can be seen that at the significant level of 5%, lnA1, lnA2 and lnA3 are stationary variables, and no spurious regression exists.

Table 2. Results of Granger Test between Variables

Null hypothesis	F-test	Adjoint Probability	Test results
Hypothesis 1: lnA3 is not lnA2's granger cause	1.4504	0.1481	Accept
Hypothesis 2: lnA2 is not lnA3's granger cause	7.6835	0.0099	Refuse
Hypothesis 3: lnA1 is not lnA2's granger cause	0.9661	0.1210	Accept
Hypothesis 4: lnA2 is not lnA1's granger cause	10.9876	0.0081	Refuse
Hypothesis 5: lnA1 is not lnA3's granger cause	8.6311	0.0033	Refuse
Hypothesis 6: lnA3 is not lnA1's granger cause	0.8766	0.1379	Accept

Table 3. State Space Models

	1	**2**	**3**
measurement equation	$lnA3= c_1+sv_1*lnA2+sv_2*lnA1 + \mu_1$	$lnA3=c_2+sv_3*lnA2 +\mu_2$	$lnA2=c_3+sv_3*lnA1+\mu_3$
state equation	$sv_1=sv_1(-1)$, $sv_2=sv_2(-1)$	$sv_3=sv_3(-1)$	$sv_4=sv_4(-1)$

Granger causality test analysis

In order to see the dependence causality of A1, A2 and A3, Granger causality method should be adopted for further test analysis, now to use the statistical software of Eviews 8.0, to choose minimum principle, perform significant judgment by log-likelihood estimated value, and adopt AIC and SC methods, the calculation results are shown in **Table 2**.

As shown in **Table 2**, at a significant level of 5%, lnA1 and lnA2 is the Grainger reason for lnA3, and lnA2 is lnA1's Grainger reason, lnA2 influences lnA3 through direct effect and mediating effect, and the other causal relationships are not valid.

TIME-VARYING EFFECT ANALYSIS

Concerning the larger span of 2000-2016 years, to build state space models to calculate the direct influence of A2 on A3 and the indirect effects brought by the mediating effect of A1, it can accurately estimate the time-varying effects and vary trends of variables.

Taking into account the mediation effect, it is needed to use the three measurement equations, as: the measured equations of the explanatory variable A3 and mediator variable A1 to the explanatory variable A2, the measured equations of the explanatory variable A3 to the explanatory variable A2, the measurement equation of the mediator variable A1 to the explanatory variable A2, the three state space models are shown in **Table 3**:

Among them, c_1, c_2, c_3 are constant terms, μ_1, μ_2, μ_3 are random interference terms, and sv_1 is the variable coefficient of A2 to A3, sv_2 is the variable coefficient of A1 to A3, sv_3 is the variable coefficient of A2 to A3 when A2 is the only independent variable, sv_4 is the variable coefficient of A2 for A1.

Analysis of the State Space Models Results

To estimate the state space model with SPSS 19.0 software, the temporal variation of the four state variables results are shown in **Figure 1** to **Figure 4**, and it can be seen that A2 and A1 have a continuing positive effect on A3.

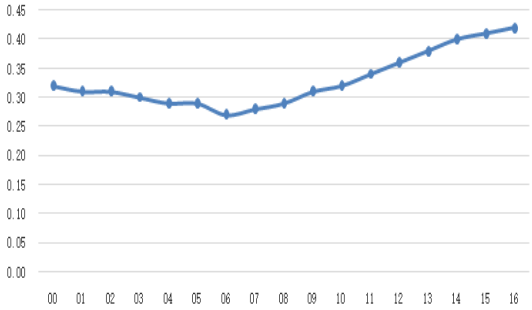

Figure 1. The result of sv_1

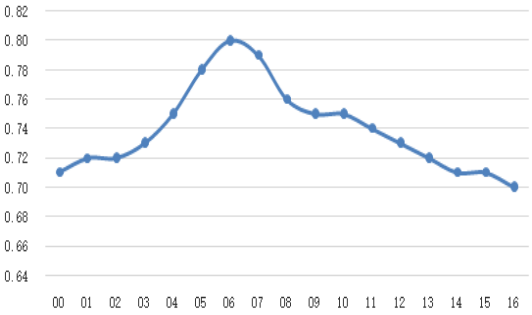

Figure 2. The result of sv_2

As shown in **Figure 1**, the impact of A2 on A3 (sv_1) shows the characteristics of "slow decline in the early stage and slow increase in the later stage" taking 2006 as the dividing line, and it is closely related to the development of higher engineering education in China, during the 2002-2006 years, higher engineering education has been expanding rapidly with the expansion of the national higher education enrollment policy in China, and the huge scale of engineering education has aggravated the shortage of educational funds, which has made the input of engineering educational funds fail to achieve the maximum effectiveness. From 2006, China began to reduce the enrollment rate of engineering education, and gradually increased the input of financial educational funds, and the pulling effect of A2 on A3 gradually increased.

Seen from **Figure 2**, the impact of A1 on A3 (sv_2) shows the characteristics of "slow decline in 2000-2005 and slow increase in2006-2016", and mainly due to the expansion of engineering education scale and the increase of scientific research funds and engineering science and technology resources, the positive impact of A1 on A3 is increasing in 2000-2005, but in recent years, because of the transformation and upgrading of the industrial structure in China, the demand for engineering talents has changed, and the engineering education has lagged behind the transformation and development of the manufacturing industry, and there are many problems such as the shortage of teachers with engineering experience, and the separation of teaching activities from engineering practice, which have caused the impact of A1 on A3 is weakening.

Sv_3 stands for the full effect of A2 on A3（shown in **Figure 3**）containing direct effects and mediating effects, its changing trend is consistent with that of sv_1, showing a dynamic change trajectory of "slight rise - fall - rise". And sv_4 stands for the full effect of A2 on A1 (shown in **Figure 4**), it is of the dynamic trajectory of "fall – slight rise", and the effect is always slight rise from 2002, which shows the positive pulling effect of A2 on A1.

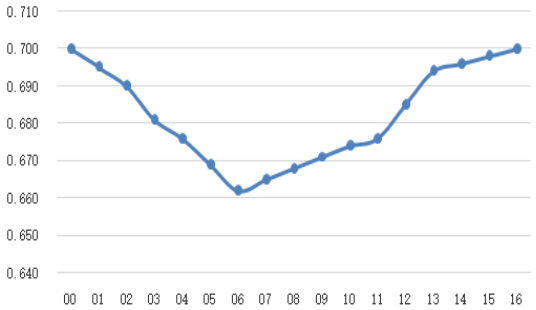

Figure 3. The result of sv_3

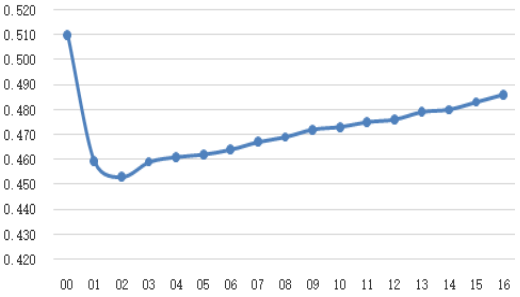

Figure 4. The result of sv_4

Mediator Effect Calculation

Mediating effects are used to measure the effects of independent variables acting on non-independent variables through mediation variables, seen from above, it can be seen that the effect of A2 on A3 is mediated by A1 as a mediator, and A1 has mediating effect as mediator variable, and using the method proposed by Mackinnon, as:

$$m = sv_2 sv_3 / (sv_2 sv_4 + sv_1) \quad (1)$$

In Equation (1), m is the value of the proportion of intermediary utility, the calculation results are shown in **Figure 5**.

Seen from **Figure 5**, an average of 51.6% of the effect of A2 on A3 comes from the mediating effect of A1, in the whole period of 2000-2016, the intermediary effect of A1 generally shows the dynamic track of "rise - fall - rise", and there are two dividing lines in 2006 and 2012, firstly in 2000-2006, the mediating effect of A1 showed a "rising" trend, and in 2006-2012, it showed a "falling" trend, then in 2012-2016, showed the trend of "rising" again, it is mainly because the ministry of education has put forward the requirement of "renewing the educational paradigm and further promoting the educational system reform", and the human capital investment of engineering teachers was increased, so the mediator effect of A1 began to rise again.

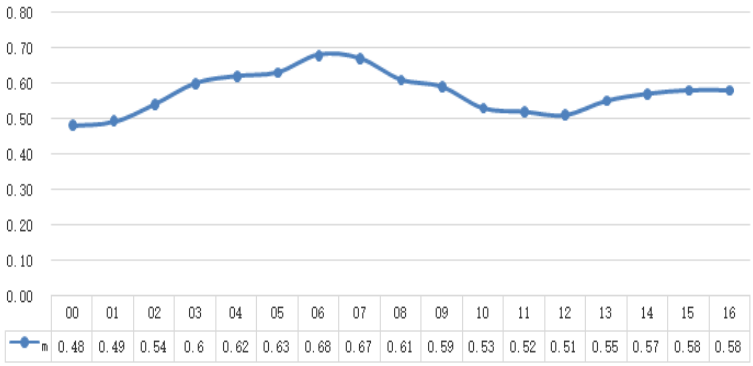

Figure 5. Proportion of intermediary utility

RESEARCH CONCLUSIONS

This paper is to research the symbiotic relationship between higher engineering education and the manufacturing industry in China from 2000 to 2016, and to explore the impact of the investment in higher engineering education and full-time engineering teachers on the manufacturing industry using state space model, and further analyze the intermediary role of full-time teachers in engineering, the following conclusions can be drawn:

Firstly, based on the scale of engineering education and the educational investment in China in 2000-2016, it can be seen that the scale of higher engineering education in China is in the changing stage from the denotative expansion to connotative quality upgrading, and educational funds input is still insufficient relative to the scale of growth of higher engineering education development, the contribution of education to the economic growth of manufacturing industry is relatively low, and it is still in the stage of transition from industrial input-driven economy to knowledge economy.

Secondly, in the view of the impact of higher engineering educational funds and engineering teachers' input on economic growth, the influence of investment in higher engineering education and input of engineering teachers on manufacturing industry growth showing a positive time-varying effect.

Thirdly, as for the intermediary effect of the full-time engineering teachers, in the effect of the input of higher engineering education on economic growth, 51.6% of the average proportion comes from the intermediary effect of the factor of full-time engineering teachers.

In addition, due to limited space, the suggestions on the coordinated development between higher engineering education and manufacturing industry in the context of the "knowledge economy era" will be further studied in another manuscript.

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Development, Validation, and Application for a Bilingual Education Curriculum in Turkey

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ABSTRACT
The right to education is one of the most essential rights ensured by international agreements. The right of mother tongue education is vital for a child to have equal access to education and derive benefits from that education as do other children. The literature has claimed that receiving bilingual education offers many benefits, such as preserving cultural and ethnic identity and the linguistic knowledge of minority groups, and helps in socialization so that minority group members are involved in the community. Therefore, a need exists to develop a bilingual education program for the benefit of the academic development and social life of minority communities. The purpose of this study is to investigate a bilingual education curriculum scale including certain parameters such as the views and attitudes towards bilingual education and curriculum development that may affect the development of a bilingual education curriculum in Turkey. The results indicated that "The Attitude Scale towards the Development of a Bilingual Education Curriculum (DBEC)" is a valid and reliable tool. The DBEC is a valid and reliable data collection tool for future studies on attitudes towards a bilingual education curriculum.

Keywords: DBEC, bilingual education, ethnic identity, curriculum

INTRODUCTION

The literature has claimed that receiving bilingual education offers many benefits, such as preserving cultural and ethnic identity and the linguistic knowledge of minority groups, and helps in socialization so that minority group members are involved in the community (Cummins, 2000). Therefore, a need exists to develop a bilingual education program for the benefit of the academic development and social life of minority communities. Thus, this study investigated certain parameters such as the views and attitudes towards bilingual education and curriculum development that may affect the development of a bilingual education curriculum. Implementing a bilingual education program may allow all individuals who speak minority languages to prosper in their education and in their opportunities for job employment (Ozfidan, 2014). It will also allow for minority groups to continue strengthening their culture while participating in the greater culture.

This study is significant in its attempt to pave the way for the development of a bilingual education program in Turkey. When a bilingual education begins in Turkey, this education can contribute to the integration of minority people in the society in general (Ozfidan, Burlbaw, & Kuo, 2016). Such an education model will enable minorities to have better job opportunities, preserve their cultural identities, to be equal in front of the law, and to

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Contribution of this paper to the literature

- The study contributes to a deepening of the current debates about mother tongues based on an understanding and development of bilingual education, involving the use of minority languages in educational settings in Turkey.
- This study is significant in its attempt to pave the way for the development of a bilingual education program in Turkey.

express themselves more effectively (Ozfidan, & Burlbaw, 2016). Moreover, being bilingual means that students can understand the lesson content more effectively, leading to success in their education. When students receive education in their mother tongue, they can express their thoughts, ideas and feelings better in their classes. This, in turn, will give them the self-confidence they need to be successful in their courses. If students see that their mother tongue and culture are valued and vital, they will seek to retain their fluency in their mother tongue. When they become good writers and readers in their native language they can apply the same methods to reading and writing in the target language (Krashen, 2000).

Another significance of the study is that, if more information can be collected about how to develop a bilingual education program in Turkey, the results may help educators in Turkey gain a broader perspective on the establishment of a language education system as they address these questions in Turkey. Finally, the study will contribute to a deepening of the current debates about mother tongues based on an understanding and development of bilingual education, involving the use of minority languages in educational settings in Turkey.

The purpose of this study is to investigate a bilingual education curriculum scale including certain parameters such as the views and attitudes towards bilingual education and curriculum development that may affect the development of a bilingual education curriculum in Turkey.

The following questions are addressed:

1- What are the exploratory factor analysis results of The Attitude Scale towards the Development of a Bilingual Education Curriculum (DBEC)?
2- What are the confirmatory factor analysis results of the DBEC?

METHODS

The DBEC was aimed at identifying what the participants believed to be the main reasons for the development of a bilingual education program in Turkey. A snowball sample procedure was used to collect data for the DBEC. Summative scale scores were calculated, and Exploratory Factor Analysis was used to analyze the scales. Data were gathered through administering a survey by snowball sampling. The DBEC included 5 demographic questions and 57 questions that were ranked on a 5-point Likert-like scale. All data gathered through this scale (Appendix A) were quantified and placed into tables.

The purpose of the factor analysis was to examine the structure of the DBEC underlying the perception of a bilingual education curriculum in Turkey. Because the study contained many variables that were grouped into to a smaller number of factors, factor analysis was used to group variables with similar characteristics. According to Isaac and Michael (1997), factor analysis "is a statistical procedure that affords an explanation of how the variance common to several inter-correlated measures can be accounted for in terms of a smaller number of dimensions with which the variables are correlated" (p. 212). Clusters and outliers were used to identify the factors. This analysis, according to Borg and Gall (1989), contributes

> *An empirical basis for reducing the many variables to a few factors by combining variables that are moderately or highly correlated with each other. Each set of variables that is combined forms a factor, which is a mathematical expression to the common element that cuts across the combined variables (p. 621).*

The first step for factor analysis in this study was a correlation matrix generated for all variables. To select the factors from the variable data, the maximum likelihood estimation procedure was used. Kaiser's rule, which requires that a given factor can explain at least the equivalent of one variable's variance, was used to decide which factors were most appropriate for interpretation. According to Isaac and Michael, "Kaiser's rule is not unreasonable given that factor analysis has as its objective reducing several variables into fewer factors" (p. 215).

Participants

The DBEC were prepared based on quantitative measures. A survey link was sent to more than 1000 people and 140 participants responded. Participants included 96 males and 44 females. In accordance with the IRB (Institutional Review Board) guidelines of Texas A&M University (reference #043138) (Appendix B), the participations were voluntary, and they could drop out at any phase of the study if they did not want to continue.

Reliability and Validity

Cronbach's alpha was used to analyze "The Attitude Scale towards the Development of a Bilingual Education Curriculum" (DBEC) for reliability. Because factor analysis was used, Cronbach's alpha scores were created while running the data on SPSS. **Table 1** indicates that the Cronbach's alpha internal consistency measure was found to be high across all 57 items (α = .98). For Cronbach's alpha, a minimum value of .70 is considered acceptable (Nunnally, 1978). Hence, the DBEC scale was reliable.

Table 1. Reliability statistics

Cronbach's alpha	N of Items
.984	57

Likewise, academicians who are experts in the field of bilingual education in Turkey and the United States reviewed the questionnaires for content/face validity. The results for validity in the DBEC scale indicated a statistically significant correlation. The correlation (rs = .520, p = .000) can be considered to be a moderate/medium correlation (.40 -.60). (See Laerd Statistics, n.d.) Therefore, the DBEC was found to have content validity.

FINDINGS

Factor analysis examined variables that were studied measure the same underlying construct. This analysis determined which variables were associated with each other and then sorts them mathematically into groups called factors. There are two types of factor analysis normally used in this type of exploratory research: Principal Axis Factoring and Principal Component Analysis (Browne, & Cudeck, 1989). The method of factor analysis that was used in this study was called Principal Component Analysis; Principal Component Analysis lets a researcher create or simply a measurement scale into various components. That is because principal components analysis finds optimal ways of combining variables into a small number of subsets (Factor Analysis versus PCA, n.d.). Additionally, PCA is designed to account for all the variance including those found in the correlation coefficients and error variance.

However, before data was analyzed using factor analysis, five assumptions were met. These include: multiple variables that were measured at a continuous level, a linear relationship between the variables, sampling adequacy, suitability for data reduction, and no significant outliers. With respect to this data set, the assumptions that need to be tested for include suitability for data reduction, which is measured by correlation, and sampling adequacy, which is measured by the Kaiser-Meyer-Olkin Test (KMO) and Bartlett's Test (Laerd Statistics, n.d.).

Preliminary Analysis

A correlation matrix was used to check the relationships for patterns. First, the significant values were determined, and the results found that virtually all values were less than 0.05. Second, correlation coefficients were determined, and all of them were less than 0.9. The determinant value of these data was 0.0003010, which was

higher than the required cutoff value of 0.00001. Thus, multicollinearity was not an issue for this study. None of the correlation coefficients were predominantly large, and all items in the DBEC correlated fairly well; therefore, no need existed to remove any items/questions from the analysis.

KMO and Bartlett's Test

The Kaiser-Meyer-Olkin (KMO) test is used to indicate sampling adequacy, which is an assumption that must be met in determining the appropriateness of using factor analysis, and values can range between 0 and 1 (Ballesteros, 2003). The KMO test can be used to determine the overall sampling adequacy of the sample or to measure each individual variable (Anderson, & Gerbing, 1984). In this study, the overall sampling adequacy was tested for factor analysis.

Several guidelines exist for interpreting the results. Jolliffe's (2002) guideline for interpreting the test said that a "value of 0 shows the sum of partial correlations is large relative to the sum of correlations, which indicate diffusion in the correlations pattern; therefore, factor analysis is probably inappropriate" (p. 213). He also stated that "if the value is close to 1, patterns of correlations are quite compact and factor analysis indicates different and reliable factors" (p. 213). Kaiser (1974) created more precise guidelines for interpretation. He asserted that if the values were higher than 0.5 they were acceptable. Furthermore, he said that values between 0.5 and 0.7 should be considered mediocre, values between 0.7 and 0.8 should be considered good, values between 0.8 and 0.9 should be considered great, and values of more than 0.9 should be considered superb (Hutcheson & Sofroniou, 1999, p. 226-227). This study used Kaiser's interpretation; the value for this study was 0.93, which falls into the range of superb. Thus, these data are appropriate for factor analysis.

Additionally, Bartlett's test is used to test if a sample comes from populations with equal variances and if the variables have enough variation to be separated into components. This variation is called homoscedasticity, which is a necessary condition for factor analysis. According to Hutcheson and Sofroniou (1999), "a significant test tells us that the *R*-matrix is not an identity matrix; therefore, there are some relationships between the variables we hope to include in the analysis" (p. 228). For this study, **Table 2** indicates that Bartlett's test was significant at $p < 0.001$); hence, factor analysis was appropriate for this study.

Table 2. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.926
Bartlett's Test of Sphericity	df	7044.687
	Sig.	.000

Factor Extraction

Typically, four approaches are used. These include: 1) select the factors with eigenvalues of 1.00 or higher, 2) examining the scree plot of eigenvalues plotted against the factor numbers, 3) increasing the numbers of factors and stopping when all non-trivial variance is accounted for, 4) and using the number of factors that the theory being used would predict (Gorsuch, 1983).

In factor analysis, eigenvalues are used to condense the variance in a correlation matrix. "The factor with the largest eigenvalue has the most variance and so on, down to factors with small or negative eigenvalues that are usually omitted from solutions" (Tabachnick & Fidell, 1996, p. 646). Traditionally, only variables with eigenvalues of 1.00 or higher are considered worth analyzing (see Gorsuch, 1983, pp. 164-171).

All eigenvalues that were related with every liner factor were determined before extraction, after extraction, and after rotation in this study. SPSS has found 57 linear factors in the data set before extraction. The eigenvalues related with each factor signify the variance explained by that particular liner component. "The factor with the largest eigenvalue has the most variance and so on, down to factors with small or negative eigenvalues that are usually omitted from solutions" (Tabachnick & Fidell, 1996, p. 646). See **Table 3** below.

Table 3. Communalities

Question	Initial	Extraction	Question	Initial	Extraction
1	1.000	.743	30	1.000	.604
2	1.000	.746	31	1.000	.600
3	1.000	.760	32	1.000	.610
4	1.000	.614	33	1.000	.675
5	1.000	.600	34	1.000	.677
6	1.000	.588	35	1.000	.622
7	1.000	.655	36	1.000	.603
8	1.000	.593	37	1.000	.744
9	1.000	.659	38	1.000	.565
10	1.000	.598	39	1.000	.515
11	1.000	.680	40	1.000	.617
12	1.000	.665	41	1.000	.632
13	1.000	.638	42	1.000	.534
14	1.000	.536	43	1.000	.632
15	1.000	.608	44	1.000	.591
16	1.000	.622	45	1.000	.684
17	1.000	.621	46	1.000	.648
18	1.000	.627	47	1.000	.703
19	1.000	.659	48	1.000	.679
20	1.000	.577	49	1.000	.721
21	1.000	.579	50	1.000	.720
22	1.000	.660	51	1.000	.698
23	1.000	.583	52	1.000	.640
24	1.000	.593	53	1.000	.625
25	1.000	.715	54	1.000	.686
26	1.000	.604	55	1.000	.716
27	1.000	.599	56	1.000	.766
28	1.000	.614	57	1.000	.550
29	1.000	.583			

Because one assumption was this study was that the factors might be correlated, oblique rotation was used. The result of this rotation was that factor 1 was found to explain about 52.01% of total variance. The first few factors indicated a large amount of variance (particularly the first factor). SPSS extracted all factors with eigenvalues that were larger than 1, and five factors resulted.

Rotation influences the structure of the factors, and one consequence for these data is that relative importance of the five factors is matched. Before performing factor rotation, factor 1 explained considerable more variance than the remaining four (52.01%) compared to 4.06%, 2.92%, 2.49%, and 2.25%; however, after extraction, factor 1 explained 14.756 % of the variance compared to 12.77 %, 12,69 %, 12,56 %, 11.04 % for the other four factors.

Before and after extraction of communalities were run in SPSS. Principal component analysis was used, and all variance on the initial assumption was common; therefore, the communalities were all 1 before extraction. The communalities on the extraction assumption reflected the common variance in the structure of the data. The variance associated with item 1, which was 74.3 % was common variance.

Five factors were extracted using Kaiser's criterion. This criterion is accurate because the average of the communalities was greater than 0.6, and communalities were also greater than 0.7 after extractions. The average of the communities, after added them all of them up, was 0.65.

Figure 1 indicates that a scree plot was also used that indicated the point of inflexion on the curve, and the curve started to tail off after four factors; a drop after four factors before a stable plateau was reached. All factors with eigenvalues above 1 because communalities were also greater than 0.7 after extraction, and the average of the communalities was greater than 0.6. See **Table 4**.

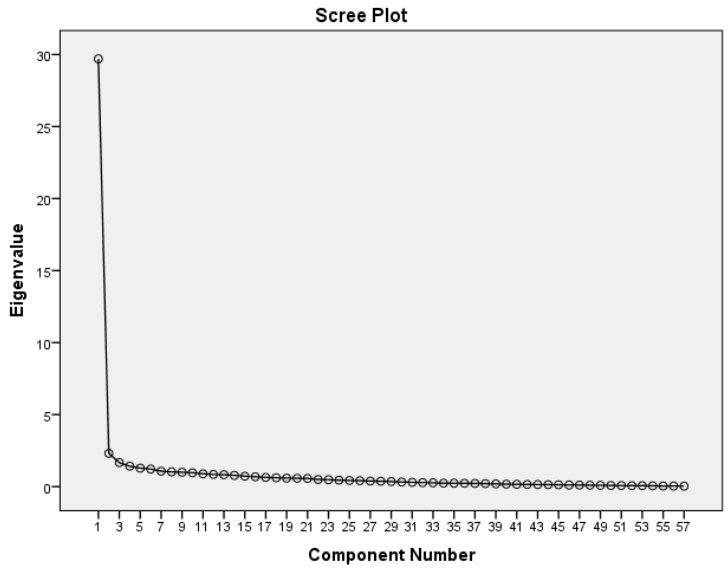

Figure 1. Scree plot for data that underlying factors

Oblique rotation was used because factors were related to each other. To identify common themes, the content of the questions, which loaded onto the same factor, were examined. This analysis revealed that common themes existed among highly loading questions, which helped in recognizing content. The first highly loaded factor concerned a perspective on bilingual education. Therefore, this factor was labeled "beliefs about bilingual education in Turkey." The second highly loaded factor was related to the benefits of using a bilingual education program; therefore, this factor was labeled "benefits of bilingual education." The third highly loaded factor was related to how bilingual education is useful in an academic environment; therefore, this factor was labeled "academic value of bilingual education." The fourth highly loaded factor was about the relationship of the mother tongue to bilingual education; therefore, this factor was labeled the "right of knowing and using mother tongue." The fifth highly loaded factor was about curricular issues; therefore, this factor was labeled "curriculum related issues." Thus, this analysis indicated that the questionnaire included five sub-scales: 1) beliefs about the value of bilingual education in Turkey, 2) the benefits of bilingual education, 3) the academic value of bilingual education, 4) the right of knowing and using mother tongue, and 5) curriculum-related issues. Taken as a whole, the sub-scales indicated that respondents believed that a bilingual education program would conserve the cultural heritage, linguistic knowledge, religious, and ethnic identity of minority peoples in Turkey. They strongly believed that such a program would increase the educational success of minority students, promote peace between different ethnic groups, and provide equality in education. A bilingual education program would build strong relationship between different ethnic groups. A mother language is an inseparable element of someone's culture, and everyone has the right to learn his or her mother tongue according to the respondents.

Table 4. Rotated Component Matrix

Question	1	2	3	4	5
1	.755				
2	.761				
3	.618				
4	.491				
5	.641				
6	.604				
7	.639				
8	.565				
9	.524		.504		
10	.478				
11	.511				
12	.529				
13	.510				
14		.480			
15		.487			
16		.532			
17		.459			
18		.506			
19		.601			
20		.450			.434
21		.374			
22		.454			
23		.467			
24		.602			
25		.568			
26		.493			
27			.613		
28			.588		
29			.466		
30			.465		
31			.539		
32			.517		
33			.623		
34			.500		
35			.477		
36			.426		
37			.620		.520
38			.465		
39			.473		
40				.664	
41				.647	
42				.474	
43				.496	
44				.557	
45		.464		.474	
46				.462	
47					.601
48					.560
49					.609
50					.722
51					.631
52					.545
53					.643
54					.633
55					.669
56					.632
57					.422

DISCUSSION AND CONCLUSION

Five factors were extracted according to Kaiser's criterion. Each factor represented a different sub-topic related to the development of a bilingual education program in Turkey. The first factor was related to the thoughts of the respondents about the development of a bilingual education program in Turkey. The second factor was concerned with the benefits of using a bilingual education program for minority populations. The third factor was related to how bilingual education would be useful in an academic environment, which is important for the future careers of minority children. The fourth factor was concerned with mother tongue and bilingual education. This factor was related to the rights of learning a mother tongue, which many believe is a human right (UNESCO, 2003). The last factor was about curricular issues. This factor represented what should be involved in a bilingual education curriculum. Overall, this factor analysis represented each subscale and related topics in these subscales, and how the instrument is relevant to this study.

Each factor extracted from the analysis was also discussed in terms of a descriptive analysis. The first factor was labelled "beliefs of bilingual education in Turkey." This factor showed that respondents believed that minority students who are taught by means of a bilingual education program could protect their linguistic knowledge, cultural heritage, ethnic, and religious identity; additionally, other benefits that would be seek include an increased understanding of language and cultural variety, and school attendance at the primary school level. If minority

people are educated under a bilingual education program, respondents believed that such as program might also bring balance among the ethnic structures by preserving linguistic and cultural diversity and helping to reduce ethnic conflicts and integrating people into society at large. The respondents perceived that a bilingual education program in Turkey would have an affirmative influence on minority groups and might increase intergroup understanding.

The second factor was labelled "benefits of bilingual education." This factor reflected that respondents believed that a bilingual program for minority students could provide language skills and improve employment skills for minority groups. This program, according to the respondents, could increase the educational success of minority students, bring peace into the society, and provide equality in education. Via a bilingual education program, minority students could have equal access to education. Respondents believed that, if these students were allowed to be educated in their mother tongue, the result would be helping to solve social conflicts between different ethnic groups, and these students would psychologically feel more comfortable. Therefore, according to the respondents, the government should support bilingual education programs. Children who have a good knowledge of their mother tongue have been seen to improve their literacy skills in the majority language (Baker, 2000; Skutnabb-Kangas, 2000). Developing bilingual education has been seen to improve not only the mother tongue in the school, but also student aptitudes in the language that the majorities speak (Aydin, & Ozfidan, 2014; Cummins, 2000).

The third factor was labelled "academic value of bilingual education." Respondents believed that minority students whose Turkish language is not good usually do not continue their education. Integrating the language courses of these students into their education might help them be successful in their education and reinforce their ethnic identity. Respondents also believed that minority students were losing their mother tongue because they are only being taught in a language other than their mother tongue. Respondents believed that students who are taught in a bilingual education program would become more fluent and confident in their second language for their academic purposes. Respondents also felt that bilingual education would help build stronger relationships between different ethnic groups and have a positive effect on all the academic achievement of minority students. Bilingual education also brings socio-economic equalities and opportunities for equal access to education. In academic content courses, students should be taught in their mother tongue while they study their second language (dominant language) (Krashen, 2000). This process would enable these students to learn such subjects as math, science, and history while developing their language capabilities.

The fourth factor was "right of knowing and using mother tongue." Respondents believed that someone's mother language was an inseparable element of his or her culture and that everyone has the right to learn his or her mother tongue. In this study, respondents said that speaking or learning a mother tongue should not be prohibited; on the contrary, learning a mother should be encouraged. Speaking the mother tongue in school was also seen as a way to increase self-confidence and thinking skills and provide speech freedom. This is vital. According to UNESCO's (1974) reports, the most realistic way to eliminate discrimination between majority and minority students when they begin school is to use their mother tongue in education within a bilingual education model.

The fifth factor was labelled "curriculum-related issues." Respondents believed that a bilingual education curriculum was necessary for the education system in Turkey because the population of minority peoples is quite large (approximately 30 %). Respondents also believed that a bilingual education program in Turkey should focus on speaking, listening, writing, reading, and on the development of vocabulary. Universities should open language teacher training departments for teachers who are going to teach in two languages. Teachers who are going to teach in two languages should demonstrate their proficiency in both languages before they can teach in bilingual classrooms, and materials used in schools should be available in both languages. Respondents also believed that bilingual education programs developed in other countries should be examined for possible use in Turkey. In doing so, the challenges that other countries faced could be examined, and, therefore, a Turkish bilingual program could develop solutions to potential stumbling blocks beforehand. In this way, Turkey might avoid time-taking false

starts and errors and move forward more quickly. Perhaps bilingual educational systems like the Basque program in Spain and French immersion program in Canada could provide useful elements upon which Turkey could draw.

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APPENDIX A

IRB Outcome Letter

DIVISION OF RESEARCH

TEXAS A&M UNIVERSITY

DATE: September 21, 2016

MEMORANDUM

TO: Lynn M Burlbaw
TAMU - College Of Education & Human Dev - Teaching, Learning And Culture

FROM: Dr. David Martin
Chair, TAMU IRB

SUBJECT: Expedited Approval – Reference #043138

Study Number: IRB2016-0601

Title: Investigation of Parameters Affecting the Development of a Bilingual Education Curriculum in Turkey

Date of Determination:

Approval Date: 09/21/2016

Continuing Review Due: 08/15/2017

Expiration Date: 09/15/2017

Documents Reviewed and Approved: Only IRB-stamped approved versions of study materials (e.g., consent forms, recruitment materials, and questionnaires) can be distributed to human participants. Please log into iRIS to download the stamped, approved version of all study materials. If you are unable to locate the stamped version in iRIS, please contact the iRIS Support Team at 979.845.4969 or the IRB liaison assigned to your area.

Submission Components			
Study Document			
Title	Version Number	Version Date	Outcome
Survey Questions	Version 1.1	08/17/2016	Approved
Interview Questions	Version 1.1	08/17/2016	Approved
Study Consent Form			
Title	Version Number	Version Date	Outcome
consent form for interview	Version 1.2	08/17/2016	Approved
consent form for survey instrument	Version 1.3	08/17/2016	Approved

Document of Consent: Written consent in accordance with 45 CF 46.116/ 21 CFR 50.27
Waiver of Consent: Waiver approved under 45 CFR 46.117 (c) 1 or 2/ 21 CFR 56.109 (c)1

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Comments:

- This study has been approved for 200 participants.
- This IRB study application has been reviewed and approved by the IRB. Research may begin on the approval date stated above.
- Research is to be conducted according to the study application approved by the IRB prior to implementation.
- Any future correspondence should include the IRB study number and the study title.

Investigators assume the following responsibilities:

1. **Continuing Review:** The study must be renewed by the expiration date in order to continue with the research. A Continuing Review application along with required documents must be submitted by the continuing review deadline. Failure to do so may result in processing delays, study expiration, and/or loss of funding.
2. **Completion Report:** Upon completion of the research study (including data collection and analysis), a Completion Report must be submitted to the IRB.
3. **Unanticipated Problems and Adverse Events:** Unanticipated problems and adverse events must be reported to the IRB immediately.
4. **Reports of Potential Non-compliance:** Potential non-compliance, including deviations from protocol and violations, must be reported to the IRB office immediately.
5. **Amendments:** Changes to the protocol and/or study documents must be requested by submitting an Amendment to the IRB for review. The Amendment must be approved by the IRB before being implemented.
6. **Consent Forms:** When using a consent form or information sheet, the IRB stamped approved version must be used. Please log into iRIS to download the stamped approved version of the consenting instruments. If you are unable to locate the stamped version in iRIS, please contact the iRIS Support Team at 979.845.4969 or the IRB liaison assigned to your area. Human participants are to receive a copy of the consent document, if appropriate.
7. **Post Approval Monitoring:** Expedited and full board studies may be subject to post approval monitoring. During the life of the study, please review and document study progress using the PI self-assessment found on the RCB website as a method of preparation for the potential review. Investigators are responsible for maintaining complete and accurate study records and making them available for post approval monitoring. Investigators are encouraged to request a pre-initiation site visit with the Post Approval Monitor. These visits are designed to help ensure that all necessary documents are approved and in order prior to initiating the study and to help investigators maintain compliance.
8. **Recruitment**: All approved recruitment materials will be stamped electronically by the HRPP staff and available for download from iRIS. These IRB-stamped approved documents from iRIS must be used for recruitment. For materials that are distributed to potential participants electronically and for which you can only feasibly use the approved text rather than the stamped document, the study's IRB Study Number, approval date, and expiration dates must be included in the following format: TAMU IRB#20XX-XXXX Approved: XX/XX/XXXX Expiration Date: XX/XX/XXXX.
9. **FERPA and PPRA:** Investigators conducting research with students must have appropriate approvals from the FERPA administrator at the institution where the research will be conducted in accordance with the Family Education Rights and Privacy Act (FERPA). The Protection of Pupil Rights Amendment (PPRA) protects the rights of parents in students ensuring that written parental consent is required for participation in surveys, analysis, or evaluation that ask questions falling into categories of protected information.
10. **Food:** Any use of food in the conduct of human research must follow Texas A&M University Standard Administrative Procedure 24.01.01.M4.02.
11. **Payments:** Any use of payments to human research participants must follow Texas A&M University Standard Administrative Procedure 21.01.99.M0.03.
12. **Records Retention**: Federal Regulations require records be retained for at least 3 years. Records of a study that collects protected health information are required to be retained for at least 6 years. Some sponsors require extended records retention. Texas A&M University rule 15.99.03.M1.03 Responsible Stewardship of Research Data requires that research records be retained on Texas A&M property.


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Further Discussion about Nature of Physical Education

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ABSTRACT
With the deepening of the research on nature of physical education, academic circle has formed many different even opposing physical education concept of nature, we should reflect further criticism in order to promote to the deepening of research. In this paper, use the relationship between "people and physical education" as the starting point of reflection, cast off the yoke of the traditional way of thinking, from "productiveness", "sensibility" and "multiple nature" perspective to explore the nature of physical education.

Keywords: nature of physical education, productiveness, sensibility, multiple nature

INTRODUCTION

Since the 80s, with the deepening of theoretical research, physical education scientific research was established and obtained significant progress, the nature of physical education has been arising constant reflection and discussion, and this is the inevitable requirement of social development. In this process, people not only gradually formed a lot of valuable knowledge, but also some misunderstandings and one-sided opinions, which requires us to inherit the fine traditions of thought liber Eason, to strengthen the existing achievements continuously, on the basis of promoting to further develop the theory research (Yang, 2016; Xu & Fan, 2017; Gao et al., 2017).

The nature of physical education is as a branch of philosophy which explores a special practice in human life–sports. The goal of physical education nature is to discover the unique form of human intellect in sports (Yang, 2013; Lee et al., 2017). This endeavor, on the one hand, reveals some of the general characteristics of human intellect through examples in the practice of sports, and on the other hand, examines the existing principles of physical practice in specific historical conditions based on the basic criterion of sensible actions and thoughts (Wang & LI, 2010; Kaymakamoglu, 2017). That is to say, the nature of physical education is a special form of research on the rational interaction of human reason in the creation of a unique interaction between human and the perceptual existence, and is a kind of general feature that reproduces the general characteristics of human reason that can be identified in sports practice, and also try to find principles and premise in a specific historical period of sports practice which is the real embodiment or distortion of human reason.

This article attempts to put forward some viewpoints and ideas about the nature of physical education dialectically, elucidates the relationship between man and physical education as the core of some understanding about the nature of physical education.

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Contribution of this paper to the literature

- On the basis of promoting to further develop the theory research to inherit the fine traditions of thought liber Eason and strengthen the existing achievements continuously.
- People's physique and social progress are not in direct proportion as some people imagined, but on the contrary. If we cannot understand correctly, then we will involve in the wrong region in which the more progress of society, the more failure of our physical education.
- Understanding people have a lot of perspective, in order to better reveal the inner link between physical education and people, we mainly from three perspectives of "productive", "sensibility" and "multiple substance" to clarify the nature of human.
- From the purpose of physical education, physical education is a way of making and improving people. Physical education is the existence of perceptual activities first, it is unfavorable for the binary opposition of sensibility and reason in this activity. Physical education activities have the double characteristics of sensibility and reason, through the whole process of physical activity, sensibility is marked deeply by reason, reason sublimates by sensibility.

LITERATURE REVIEW

As for the nature research, the purpose is to deepen understanding of things and people, so is the research on the nature of physical education. Physical education as an important part of human civilization, is a historical phenomenon, its content, nature and function change with the development of human society. Physical education at the same time also has its personality, physical education of all ethnic groups, national and regional has similarity, also have its own diverse characteristics. But in the concrete research process, due to the influence of a particular way of thinking, people tend to get a "Confucianism-only ideology "type of conclusion which effectively guides the physical education practice. As a result, the research on the nature of physical education became the battle of concepts and definitions, in which the process, some characteristics of physical education have been praised to the height of "nature", and other characteristics are excluded to the "non-essential" status, which as if the dynamic discussion has been put forward, but actually the discussion is not beyond the existing research results, far from the nature of physical education research.

For physical education, it is not difficult to reach a consensus: it is a uniquely human practical activity which involves people's physical activity, takes certain physical activity and skills as the carrier, exists as education inheritance; entertains body and mind, enhances physique; also loads cultural functions to adjust social relations and so on. Controversy concerns that only in the rich content, which one is more fundamental, more natural. Once some concept of nature is established, then a clear place can be drawn for physical education which can distinguish between physical education and non-physical education activity to focus on strengthening concrete physical education practice. Because in some view of point, nature can be the only one, more nature is admitted to be anti-nature.

We believe that such a mode of thinking is the current core and origin of some debate. This way of thinking can be divided according to philosophy as formal logic way of thinking or "metaphysics" way of thinking which its main methodology representatives is to give physical education a definition under "genera and differentia". In order to understand and grasp the cognitive object, taking this way is the inevitable result, because of its strong clarity, as long as we make an accurate and complete positioning to "genera" and "differentia", so there is no doubt to make specific cognitive object reflects in people's mind.http://fanyi.youdao.com/translate

However, this approach has its limitations, because the world itself is changing, since human being is born and practice is constantly kept on, constantly generate a people's world. Then abstractions which solids in people's mind will opposite or even departure from living reality. And together with some people in pursuit of homogeneity and clarity, continuously reduce the "differentia", finally can only make understanding of the nature of physical education as a dry "mummy" without vigour and vitality.

This kind of "achievement" in some universal readings can be no more than a temporary briefly introduces, and must not be the core idea to guide physical education practice, content with this understanding cannot be considered as physical education science research. Very easy to find an obvious paradox is that in many theorist's opinions mentioned that in recent years' youth fitness is in a declining trend, and on this basis to discuss serious misunderstanding on the nature and function of physical education which conduces wrong practices. And at the same time people admit that along with the social civilization progress, physical education content gets more rich, the development of physical education more popular, time can be used for physical education more abundant, people's nutrition and health better than ever before and these advantages might naturally promote the improvement of physical fitness.

So what exactly is causing the physical falling instead? Someone sum up to the problems of measure and evaluation in the process, someone thought that it was particular stress on intellectual education and ignored physical education in the exam-oriented education. Such interpretation has a point, and the most fundamental reason has yet to be elucidated. For human social history, the most fundamental determinants are people's mode of production, a certain mode of production determines the way of people activity and content, and correspondingly determines the people's physical condition. Since the industrial revolution, manual labour had been gradually replaced by machine production, people did not need to rely on the strength of human organisms to direct effects on the natural objects in the agrarian age, and so inevitable consequence of people's physique presents a trend of decline gradually. In this sense absolutely people's physique and social progress are not in direct proportion as some people imagined, but on the contrary. If we cannot understand correctly, then we will involve in the wrong region in which the more progress of society, the more failure of our physical education.

DISCUSSION

The above shows that if we do not take the nature of physical education to cross-examine, only do the research from the nature of physical education to obtain a formal logic definition, rather than reality research, then the conclusions are difficult to stand up to close scrutiny. Maybe we should set free temporarily from the mode of nature of physical education to ask what kind of way of thinking more can appropriate to understand and grasp the nature of physical education.

Physical education is a component part of human civilization, it is a kind of the way of human culture, only relate physical education and people to study, and can we reveal the mysteries of the nature of physical education. In a word, only do we properly understand people, can we properly understand physical education. Understanding people have a lot of perspective, in order to better reveal the inner link between physical education and people, we mainly from three perspectives of "productive", "sensibility" and "multiple substance" to clarify the nature of human.http://fanyi.youdao.com/

Firstly, people are a kind of productive existence. The relationship between human and the outside world is not natural, but through the production practice for mediation. People make production for living materials on the one hand, on the other hand, for human oneself. Human oneself production is not only for breeding, but also improving lives. This is shown as once the low-level needs are met, the need of more advanced will naturally form, in this sense the production of human is a never-ending process. This is a process from simple to complex, is a process from low level to high level, the achievements and cognition of previous stage are the prep reasons and conditions for the following stage.

Secondly, people are emotional life existence. No matter in the traditional sense to conclude human as a "thinking, speaking can making and using tools" animal, or define people's nature from practicality, sociality and historicity, all based on the life existence of people. Human cannot be non-sentimental being. On the one hand, people need perceptual materials as necessities to diet and to keep warm, on the other hand, the perceptual activity has created the entire contents of social history. People needs reason and spirit, but on the significance of attribute can only be in the subordinate and the tool position, only to obey and serve the perceptual life has positive significance. Although the process is unidirectional, but it is in the contradiction differentiation between sensibility

and reason, then unification as the basic form, or reason differentiates from sensibility, then unify again. This is a perfect course of human life, also a road of human to freedom.

Finally, people are an existence of multiple nature. Under the vision of traditional philosophy, the nature of people is ascribed to either animal nature or divine nature, either natural nature or social nature, and even dual nature of "half angel and half beast" all of these are the understanding consequences of materialization machinery. In fact, the nature of people is based on practical activity as mediation of multiple natures of the unity of opposites. From the point of intuitive, people have both physical existence and spiritual phenomenon, have both natural and supernatural characteristics, both finite life and infinite living style. The world of people is reflected both external material foundation and human spirit, both comply with the principle of freedom and meet the requirements of people's will and requirement, everywhere is a unified entirety and is difficult to completely binary.

So it seems that physical education is a peculiarly cultural way of people, the study of its nature can also from three aspects as productive, sensibility and multiple nature. From physical education productive perspective, people's own production is the production of various integrity on the basis of breeding, although we can roughly divide it into moral education, intellectual education, physical education, aesthetic education, and so on several aspects, but its ultimate point is to complete the human individuality. This requires aspects of beauty, intelligence and physique in a dialectical relationship of distinguishing and fusion with each other, and only so can be production of people, and also can produce a real people. So we can say that physical education is both the moral education, intellectual education and aesthetic education, regardless of the rigid mind can understand, reality has made answer to us. No matter what time, only those good aspects join together, can people consider physical education for real development? On the basis of the emphasis on this point, we will never cancel the characteristics of physical education. The relationship of physical education and other aspects is "unify but different", in this sense, only through physical education play its own characteristics, can be better combined with other aspects. The same, only better combined with other aspects of physical education, can truly play its own characteristics. Some people complained that physical education is required to do this and to do that, which will delay physical education its own thing. The fact is just on the contrary, if let physical education do so-called its own things, like the pursuit of sharp knife, but grind knife out, both unnecessary and unrealistic.

From the purpose of physical education, physical education is a way of making and improving people. Physical education is the existence of perceptual activities first, it is unfavourable for the binary opposition of sensibility and reason in this activity. Physical education activities have the double characteristics of sensibility and reason, through the whole process of physical activity, sensibility is marked deeply by reason, reason sublimates by sensibility. In physical education activities, the nature of human is confirmed and improved, human senses are tempered doubly with sensibility and reason to have social attribute and become a real human sense which is not only natural sense but also social sense with all sorts of perceptual ability corresponding external conditions, also give birth to "human's inorganic body" into the nature of people.

Since modern times, due to the rising of reason leads to repression of sensibility to cause criticism from theorists, people try to find some natural relationship between "duality of body and mind" to give meaning to sensibility properly which is impossible to achieve. Sensibility and reason concrete only through people's realistic and specific practice, the reconstruction and development of modern physical education is an indispensable path. Yet it is still difficult to get rid of the old thinking in theory, such as "barbaric the body", "return to nature" seem to make effort, but limit to the corner without noticing. Physical education with its outstanding physical practice leaves people with visual perceptual form, but we must go further to perceptual life activity levels to grasp the nature to return to physical education real characteristics with "developed limbs with not simple mind ".

From the multiple natures of physical education, as some theorists summarized: physical education is the activity of body to develop people's "nature"; physical education is to strengthen body; physical education is one kind of education through body; physical education is a social cultural activity, and so on. These induction condenses scholars' strong reality concern to achieve a more thorough understanding from a specific perspective into physical education phenomena which cannot be simply denounced. The problem relies that these essential

understanding cannot effectively integrate under the existing way of thinking, thus involves in opposition and contradiction. Distinguish between phenomenon and nature to seek the nature of things which often combined with determinism of traditional thinking path together. Western traditional philosophy thought that phenomenon is unreal because of the contradiction, only through the nature of the same level to eliminate contradictions deep into the thing itself to get the understanding and knowledge, also can control things that dominates the object. This path leads to the ultimate pursuit of thinking, through going back infinitely to find the function of the premise, and the prerequisite for its intimacy and can only be one rather than more. So even if we put the existing judgments of nature of physical education together, we still have to face the intimacy of questioning. So is this way the only one to close to the truth? The answer is obviously negative.

CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

As mentioned above, ever since the dawn of human world, constantly experiencing human practice activity of differentiation and integration, its prominent feature is the contradictory unity. This is a two-dimensional world, in this world, the original natural direct unity is broken, and nature of things presents multiple characteristics. We want to emphasize here is that multiple nature is different from many natures, admitting that one thing has many natures is essentially the paradox of same level, and thinks that one thing has multiple nature and multiple nature unifies with the overall which is the reasonable expression to the human nature of things, also multidimensional solid. MAO zedong once said that within things there are primary and secondary contradictions, and contradictions are divided into main aspects and secondary aspects, the relation of primary and secondary changes with the specific situation which is the theoretical expression of multiple nature. We previously thought that those aspects of nature of physical education is always concomitant with other temporary non-essential nature, but shows up because of the limitation of actual situation, so when situation changes with the relation of primary and secondary, it is not surprising about the changes of nature of physical education. So we don't have to trouble with whether chess and electronic physical educations, even cockfighting and dog walking are counted into physical education activities, because multiple nature means openness and containment, history has proved that Stuck in the past and restrict in designated area will only lead to limitation and retrogression.

As a self-education activities of sports, through physical education sublimates the will of person to form a perfect personality and equip sports with a culture quality. The philosophical thinking of physical education can not only focus on the relationship between physical education and human, especially from the perspective of human nature to understand the meaning and value of physical education. Therefore, the study on the nature of physical education can not only describe the role of physical education on body and soul, cannot just as an argument and summary of sports science, but also to seek for the overall development of the role of physical education Consequently, the principle of "cultivating a perfect person" as the ultimate sense seems to be reasonable, can be used as the core concept of physical education essence. The existing ideas for "cultivating a perfect person" is as the ultimate value of the sense to understand, and is still based on the traditional philosophy of physical and mental epistemology of dualism, is the essence of human nature.

http://fanyi.youdao.com/Questioning the nature of physical educations is never-ending. Such thought-provoking questions can give us a particular angle of view under the understanding of physical educations, also can give us a different guidance to transform thinking. Theories will be clearer under the debate, and the practice will be changed constantly. As long as we won't be limited by rules, face reality to do sincere thinking, the truth of physical educations will show up to us which is the real value we kept asking.

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Collaborative Problem-Solving Behavior of 15-Year-Old Taiwanese Students in Science Education

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ABSTRACT
Collaborative problem solving (CPS) is a crucial skill for students and people entering the workforce. Hence, an online CPS assessment system was developed for the Programme for International Student Assessment to test 12 CPS skills. This study compared the CPS skills of students on the basis of a CPS assessment developed for science scenarios in Taiwan. Moreover, a sequential analysis was applied to explore the behavioral patterns of students with CPS skills. The results demonstrated that most Taiwanese students are proficient in the 11 CPS skills (except for D3: "Monitoring, providing feedback and adapting the team organisation and roles"), and that female students are significantly more proficient than male students. The results also indicated that most students can successfully transition between CPS skills. However, the students in a given class may demonstrate a lack of behavioral patterns. Teachers can design activities and develop strategies to address this lack of behavioral patterns and thus increase students' CPS skills and behavioral patterns.

Keywords: assessment, behavior pattern, collaboration problem solving, science education

INTRODUCTION

In the 21st century, noncollaborative work by a single person may be insufficient for solving complex problems, and it is generally preferable for people to solve problems together through collaboration and communication with other team members (Griffin et al., 2011; National Research Council, 2011). Hence, the teaching and assessment of students' collaborative problem solving (CPS) skills is crucial to their preparation for future careers (Brannick & Prince, 1997; Griffin et al., 2011; National Research Council, 2011; Rosen & Rimor, 2012). Various human-to-human CPS tasks were developed to assess multidimensional skills, including social skills (participation, perspective-taking, and social regulation skills) and cognitive skills (planning, executing and monitoring, flexibility, and learning skills) for the Assessment & Teaching of 21st Century Skills (ATC21S) project. A person can collaborate with a partner to solve common problems online. Moreover, an assessment system can record corresponding conversations and actions in a log file (Griffin et al., 2011). Nevertheless, the level of individual skill should be graded by experts through rubrics. In addition, individual skill level may be influenced through collaboration with partners.

Therefore, the Organisation for Economic Co-operation and Development (OECD) designed a human-to-agent, computer-based standardization CPS assessment system for evaluating the CPS proficiency of 15-year-old students in the Programme for International Student Assessment (PISA) 2015 (OECD, 2013). The CPS skills were

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Contribution of this paper to the literature

- In this study, the levels of mastering of Taiwanese's students for the 11 CPS skills, four problem-solving processes, and three major CPS competencies were analyzed according to two simulated CPS assessments in science problem scenarios.
- A coding scheme was proposed for conversation-dialog tasks that were assessed using predefined multiple choice test items. In addition, sequence analysis was applied to students CPS behavior in the science problem scenarios.
- The main contribution of the current study was to propose an analysis of students' CPS behavioral patterns. Teachers can understand students' CPS behavior patterns through the proposed coding scheme with other CPS assessment units.

based on other CPS frameworks, such as the Center for Research on Evaluation, Standards and Student Testing teamwork processing model (O'Neil et al., 2003, 2010), the teamwork model of Salas et al. (Fiore et al., 2008, 2010; Salas et al., 1992, 2008), and the ATC21S (Griffin et al., 2011), and it incorporated four cognitive processes into the individual problem-solving skills proposed in the PISA 2012 with three major CPS competencies (OECD, 2010; OECD, 2013).

Table 1 provides a matrix of CPS skills for the PISA 2015. The first column indicates the four major individual problem-solving processes: exploring and understanding, representing and formulating, planning and executing, and monitoring and reflecting (OECD, 2010, pp. 20–21). The first row displays the three major CPS competencies: establishing and maintaining a shared understanding, engaging in the appropriate action to solve a problem, and establishing and maintaining team organization (OECD, 2013). Each entry shows the interaction between the individual problem-solving process and CPS competency. Moreover, two sample units, the Aquarium (a test taker and a computer agent) and Class Logo (a test taker and two computer agents), were provided to assist readers in understanding the concepts of the assessment framework (OECD, 2013).

During a collaboration, an individual must communicate with and react to other participants to perform actions to achieve common goals. Moreover, individuals must sense and adapt to change their environment, and learn from each other (Franklin & Graesser, 1996; OECD, 2013). Because interactions between two or more participants are required for the CPS units, at least one other (computer) agent is required to collaborate with the test taker. In complex social interactions, some individuals support and praise other team members, whereas other individuals disagree with team members and provide negative feedback on the basis of false evidence. Furthermore, participants may have a different statuses, perspectives, abilities, and understandings when attempting to solve the problem (Millis et al., 2011; Wiley & Jensen, 2007). Therefore, single and multiple computer

Table 1. Matrix of Collaborative Problem Solving Skills for the PISA 2015

	(1) Establishing and maintaining shared understanding	**(2) Taking appropriate action to solve the problem**	**(3) Establishing and maintaining team organisation**
(A) Exploring and Understanding	(A1) Discovering perspectives and abilities of team members	(A2) Discovering the type of collaborative interaction to solve the problem, along with goals	(A3) Understanding roles to solve problem
(B) Representing and Formulating	(B1) Building a shared representation and negotiating the meaning of the problem (common ground)	(B2) Identifying and describing tasks to be completed	(B3) Describe roles and team organisation (communication protocol/rules of engagement)
(C) Planning and Executing	(C1) Communicating with team members about the actions to be/ being performed	(C2) Enacting plans	(C3) Following rules of engagement, (e.g., prompting other team members to perform their tasks.)
(D) Monitoring and Reflecting	(D1) Monitoring and repairing the shared understanding	(D2) Monitoring results of actions and evaluating success in solving the problem	(D3) Monitoring, providing feedback and adapting the team organisation and roles

agent units were designed for the PISA 2015; the CPS skills shown in **Table 1** were assessed on the basis of interactions between an individual and computer agent(s) (OECD, 2013). In addition, units with a single computer agent and those with two computer agents were considered in this study.

Because students' domain knowledge influences collaboration and problem-solving processes, CPS is typically taught separately domains such as science, mathematics, and history (Funke & Frensch, 2007; Healy et al., 2002; Lee & Pennington, 1993; Mayer, 1992; Mayer & Wittrock, 1996; OECD, 2013). The PISA 2015 CPS assessment included domains such as mathematics, science, reading, environmental studies, community studies, and politics (OECD, 2013). In addition, science education is a crucial for young learners and is an obligatory element of the school curriculum. Furthermore, scientific literacy is a major domain in the PISA (OECD, 2003, 2013). During the communication and knowledge sharing that constitute CPS, students can explain the problem or their understanding of it to other team members and synthesize their understanding with knowledge from other subject areas (Luckin, Baines, Cukurova, & Holmes, 2017). Hence, they have opportunities for scientific argumentation including proposing, supporting, criticizing, evaluating, and refining ideas, and, thus, advance their beliefs about scientific phenomena. This emphasizes the usefulness of explanation and concept-mapping techniques as evaluative measures of student knowledge (Coleman, 1998; Duschl & Osborne, 2002). Some studies have revealed that students can work more collaboratively in science than in mathematics and humanities (Baines, Blatchford, & Kutnick, 2003; Kutnick & Blatchford, 2013; Webb & Palincsar, 1996; Luckin et al., 2017). Hence, this paper only discusses student CPS skill proficiency and behavioral patterns in the context of science.

On the basis of the PISA 2015 draft CPS framework and the corresponding 15 CPS skills, a CPS assessment system was developed for Taiwanese students in Grades 9 and 10 (aged approximately 15 years; Kuo, 2014; Li, Pai, Kuo, Lin, & Liu, 2015). The assessment included six units, two of which involved science-based scenarios (i.e., the Slurpee and Water Purification). The design concept of the Slurpee scenario was similar to that of the Aquarium sample unit (a test taker and a computer agent) in the draft CPS framework. In this case, the test taker and a computer agent collaborated to determine the optimal proportions of a cryogen. The design concept of the Water Purification scenario was similar to that of the Class Logo sample unit (a test taker and two computer agents) in the draft. The test taker and two computer agents collaborated to design an optimal purification bottle filter using five provided tools. The test taker was able to interact with one or more computer agents (simulated team members) through a chatbox to obtain the solution to a given problem from multiple choice items (OECD, 2013, 2016). Each item reflected one of the target skills in **Table 1**. The alternatives for an item were a set of chat options designed by experts; the test taker was instructed to select the most appropriate alternative. This study determined the skill level in Taiwanese students and compared skill differences with respect to the background variable of gender.

These two units were designed according to the PISA 2015 draft CPS framework (Kuo, 2014; OECD, 2013). Every task item corresponded to a target CPS skill with possible scores of 0, 1, and 2, which were predetermined according to chatting paths of the item. That is, the levels of mastery of the 12 CPS skills were scored automatically by the system. Hence, for each unit, the target CPS skills formed a fixed sequence and indicated possible skill changes among the 12 CPS skills. For example, if an item corresponded to matrix component C1 ("Communicating with team members about the actions to be/being performed"), and the next item corresponded to C2 ("Enacting plans"), then according to the graded skill levels, the item would determine whether students can enact plans after communicating with team members. Progressive sequential analysis can be used to infer potential behavioral patterns in CPS assessment (Hou, 2010). Furthermore, sequential analysis can indicate whether a certain behavior is followed by another through a statistical dependence index, which illustrates the difference between the observed behavioral pattern frequency and expected independent behavioral pattern frequency (Bakeman & Quera, 1995; Cheng & Hou, 2015; Hou, Chang, & Sung, 2007, 2008, 2009). However, during the assessment, the target CPS skill corresponding to an item had three levels, namely 0, 1, and 2. The combinations of these levels indicated variation among skill components. For example, scores of 2 on C1 and C2 indicates that the test taker can enact plans after communicating effectively; scores of 2 on C1 and 0 on C2 demonstrate that the test taker cannot enact plans efficiently. Therefore, a coding scheme for the CPS assessment was proposed in this study, and the differences between student behaviors were explored by applying sequential analysis to the CPS skill sequence on the basis of the proposed coding scheme.

In an academic achievement, educational researchers pay attention to gender gaps, especially in reading, mathematics, and science literacy (Ma, 2008). In science, boys have outperformed girls in the past, and gender differences have been observed in their interests and expectations from an early age, which have been attributed to the differences in their thinking, learning, and working styles (Browne & Ross, 1991; Murphy, 1997; Ziegler & Heller, 1997; Kimbell, Stables, Wheeler, Wosniak, & Kelly, 1991). Moreover, girls tend to work through communication and collaboration, whereas boys tend to work independently (Kimbell et al., 1991). However, studies on the gender gaps in science education have raised concerns about the issue of equity in science education; thus, gender differences in science have exhibited a general decrease since the 1980s. Furthermore, they have the same positive attitudes and interests in science. (Ziegler & Heller, 1997; Yip, Chiu, & Ho, 2004; Ma, 2008; Sjøberg & Schreiner, 2005). Nevertheless, collaborative style also affects science achievement among students (Schroeder, Scott, Tolson, Huang, & Lee, 2007). Therefore, this study also investigated the gender gaps in the participants' CPS skill proficiency and their behavioral patterns on the basis of the science scenarios.

This study explored CPS skill proficiency according to the responses to the CPS assessment developed by Kuo (2014; Li et al. 2015). Additionally, the sequential behavioral patterns of students with various CPS skill levels were compared. The research questions explored in this study were as follows:

1. What are the 12 CPS skill proficiencies for Taiwanese students in science scenarios?
2. Do the CPS skill proficiencies of male and female students differ significantly?
3. Which behavioral patterns do Taiwanese students lack in science scenarios?
4. Which behavioral patterns do the students in a particular class lack?
5. Do the substantial behavioral patterns of male and female students differ?

METHOD

Participants

The participants in this study were 52,110 students (29,273 Grade 9 students and 22,837 Grade 10 students) with an average age of approximately 15 years. They were enrolled through purposive sampling from approximately 320 junior and senior high schools in Taiwan. They included 27,062 boys and 25,048 girls. All of the students had taken basic science courses, which were designed according to the Taiwanese Grade 1–9 Curriculum Guidelines for Science and Technology, including courses covering water and soil conservation and temperature and heat. Because they had not previously participated in the CPS assessment used in this study, their teachers instructed them on the basic CPS concepts before they participated; the students also participated in an exercise unit called the Wellness Program.

CPS Assessments in Science Scenarios

Two science scenario units for CPS assessment were considered in this study (Kuo, 2014). The first was the Slurpee (**Figure 1**), which included a test taker and a computer agent. In this unit, the test taker collaborated with the computer agent to implement cryogens using various constituents, such as salt, sugar, and monosodium glutamate, and ice. In addition, they were instructed to consider the proportion of cryogen to ice and attempt to determine the optimal proportions. The unit contained 17 multiple choice items, and each item corresponded to a target CPS skill (**Table 1**). The left panel of **Figure 1** illustrates the chatbox. The test taker was able to communicate with a simulated agent and collaborate to determine the optimal proportions of a cryogen. The left-down block included three alternatives, which were designed according to one of the CPS skills in **Table 1**. After the test taker selected an alternative, the choice was displayed in the history area of the chatbox. Responses from the computer agent, which were designed by experts, were displayed on the basis of the selected alternative. The right side of the screen (**Figure 1**) presented related materials such as figures, tables and notes. For example, the right screen in **Figure 1** shows three cryogen candidates and ice. In general, for each item, two dialog layers were used to create convergence or rescue points based on the responses of the computer agent. The first item of the Slurpee scenario is described as follows. The corresponding CPS skill was "(A1) Discovering perspectives and abilities of team members." Hence, the most appropriate solution was to ask the computer agent about the method of making ice.

Figure 1. Screenshot of the Slurpee unit (Kuo, 2014)
Note: From Teachers' Collaborative Problem-Solving Teaching Competency Project, by B. C. Kuo, 2014

After the directions for the task, a message from computer agent reading "Let's start to make Slurpee" was displayed. Then, three options were available for the test taker.

Item 1
Computer agent: Let's start to make a Slurpee.
◯ I1M1 Let's discuss the principles and methods of ice making.
◯ I1M2 I have never done it.
◯ I1M3 Everything is followed by you.

The credited response was I1M1. If the test take selected I1M1, then they were able to discover the perspectives and abilities of the computer agent. Hence, they received 2 points for Item 1. Moreover, the response of the computer agent was "I1M1(R) I have found some information on the cooling, you can use the refrigerant method." However, if the test taker did not select the credited response, the computer agent rescues and the test taker is presented with additional alternatives to consider. For example, a test taker selecting "I1M2 I have never done it" is insufficient evidence to determine that they lack CPS skill A1. Hence, the test takers were presented with additional options. The responses for I1M2(R) and I1M3(R) were identical: "I1M2(R) Computer agent: I would like to know our understanding of the ice making method." Then, the following additional alternatives were presented.

◯ I1M21 I have no idea about ice making.
◯ I1M22 What do you know about the ice making method?
◯ I1M23 It will be difficult without a refrigerator.

If test taker selects I1M22, then they have demonstrated the A1 ability through the additional options. Hence, the test taker receives 1 point for Item 1. However, if they select I1M21, then they receive 0 points and the conversation of Item 1 is converged by the computer agent response, "I1M21(R) I have checked some information on the ice making. We can try the refrigerant method." Because the task instructions stated that a refrigerator cannot be used, the test taker also receives 0 points and the response is the same. The additional alternatives may differ with respective to the options at the first stage. Thus, the following are the seven paths in Item 1.

1. Item 1→I1M1→I1M1(R)→Item 2;
2. Item 1→I1M2→I1M2(R)→I1M21→I1M21(R)→Item 2;
3. Item 1→I1M2→I1M2(R)→I1M22→I1M21(R)→Item 2;
4. Item 1→I1M2→I1M2(R)→I1M23→I1M21(R)→Item 2;

5. Item 1→I1M3→I1M2(R)→I1M21→I1M21(R)→Item 2;
6. Item 1→I1M3→I1M2(R)→I1M22→I1M21(R)→Item 2;
7. Item 1→I1M3→I1M2(R)→I1M23→I1M21(R)→Item 2.

This design was employed to ensure that the test taker can progress through the tasks with the computer agent despite selecting incorrect or nonoptimal alternatives. The student responses for this unit yielded a Cronbach's α of 0.82, which was between 0.80 and 0.90 and thus indicated excellent interrater reliability (De Vellis, 1991).

The Water Purification unit (**Figure 2**) involved a test taker, a highly collaboratively oriented computer agent and a less collaboratively oriented computer agent. In this 13-item unit, the test taker's role was to lead a group (two computer agents) to design an effective water purifier using the provided tools and thus win a competition. Cronbach's α was 0.74 for this unit, which was between 0.7 and 0.8 and thus indicated reasonable interrater reliability (De Vellis, 1991).

According to the PISA 2015 draft CPS framework (OECD, 2013) and the PISA 2015 Released Field Trial Cognitive Items (OECD, 2016), a single unit could not cover all 12 CPS skills because of the content of the corresponding science scenario. Hence, this study employed two units to test all the 12 CPS skills in science scenarios. However, if the items involved matrix component D3 ("Monitoring, providing feedback, and adapting the team organization and roles"), then the alternatives of the item were designed to encourage students to reflect on the process and to affirm the importance of attending to provided criteria to solve the problem efficiently (OECD, 2016). For example, test takers can provide reflective feedback on the work or suggests a collaborative method to improve their CPS performance (OECD, 2013). Because the CPS units contained multiple paths, three scores of 0, 1, and 2 were difficult to predetermine on the basis of chatting paths for D3. The corresponding scores depended on previous conversations (chatting paths) with the agents and the feedback options for the item. Because the scores should be determined according to the chatting paths through the CPS unit, the analysis of these items with respect to D3 was omitted in this study. Cronbach's α was 0.86 for the two units combined, which was between 0.80 and 0.90 and thus indicated excellent interrater reliability (De Vellis, 1991).

Coding Scheme

To observe behavioral changes over the testing period, the CPS target skills corresponding to the items were viewed as a CPS behavioral sequence. Moreover, a sequential analysis was applied to explore the significance

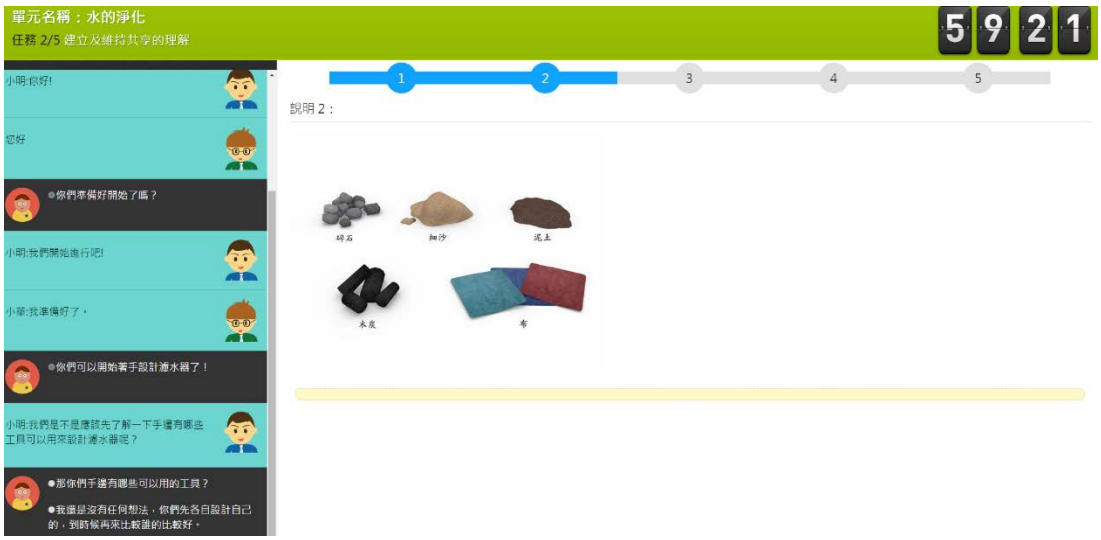

Figure 2. Screenshot of the Water Purification unit (Kuo, 2014)
Note. From Teachers' Collaborative Problem-Solving Teaching Competency Project, by B. C. Kuo, 2014

Table 2. Target CPS Skills of the Items

The Slurpee unit		Water Purification unit	
Item	**Target CPS skill**	**Item**	**Target CPS skill**
1	A1	1	A2
2	C1	2	A1
3	C2	3	B1
4	B2	4	C1
5	C1	5	C3
6	A3	6	D1
7	B3	7	C2
8	B1	8	D2
9	C2	9	D1
10	C3	10	C2
11	D2	11	D3
12	D1	12	D3
13	C1	13	D3
14	B1		
15	C2		
16	D2		
17	D3		

of the interactions among the CPS skills within the CPS test (Bakeman & Quera, 1995; Cheng & Hou, 2015). Because each item corresponded to a target CPS skill (**Table 2**), the order of the CPS behavioral sequence was fixed as follows:

A1C1C2B2C1A3B3B1C2C3D2D1C1B1C2D2 A2A1B1C1C3D1C2D2D1C2

A space was added between D2 and A2 because the former sequence is of the Slurpee unit and the latter is of the Water Purification unit. Hence, the behavioral pattern D2A2 cannot be included in the sequential analysis. Individual student CPS behavioral sequences could be distinguished by considering students' CPS skill proficiencies, which varied according to their response paths. The coding scheme depended on each student's CPS skill proficiency, as proposed in this section.

Suppose X and Y are two CPS skills in **Table 1** that correspond to two adjacent items, i and j. For example, X = B1 and Y = C2 are respectively the CPS target skills of two adjacent items, namely items 8 and 9, in the Slurpee unit. In the two science scenarios in the CPS assessment, student CPS skill proficiency for X and Y were scored on a discrete scale, with possible values of 0, 1, and 2 (Kuo, 2014; Li et al., 2015). Hence, there are nine different paths based on received scores (**Table 3**). We divided these nine paths into three distinct categories (i.e., codes). If X and Y result in scores of 2, then the student has a high CPS skill proficiency with respect to the two adjacent items. In addition, this indicates that the student is highly efficient in CPS skill Y after effectively performing CPS skill X. Hence, the path of $X \rightarrow Y$ yields a score of 2. In other words, in sequential analysis, the frequency of XY should be higher than the frequency with respect to the other paths in **Table 3**. Therefore, we computedXY twice as shown in the third column in **Table 3**. A space was added between these two XY codes because they should be counted twice in the sequence. In the second category, the level of $X \rightarrow Y$ was 1, indicating that at least one instance of X and Y resulted in a score of 1 and that none of scores for X and Y were 0. In this case, the level of $X \rightarrow Y$ should be lower than that of the previous category, that is, the level of $X \rightarrow Y$ should be 2. Moreover, students can still obtain the score of the CPS skill even if the score is lower than that of the previous category. Hence, the level of $X \rightarrow Y$ was set to 1. Finally, if one of the skill proficiency values of X and Y was 0, then no convincing evidence indicated that the student can smoothly progress from X to Y. Therefore, the level of $X \rightarrow Y$ was scored as 0.

Table 3. Coding Scheme for the Nine Paths from *X* to *Y* Based on Scores

X	Y	The level of $X \rightarrow Y$	Code
2	2	2	$XY\ XY$
2	1	1	XY
2	0	0	N/A
1	2	1	XY
1	1	1	XY
1	0	0	N/A
0	2	0	N/A
0	1	0	N/A
0	0	0	N/A

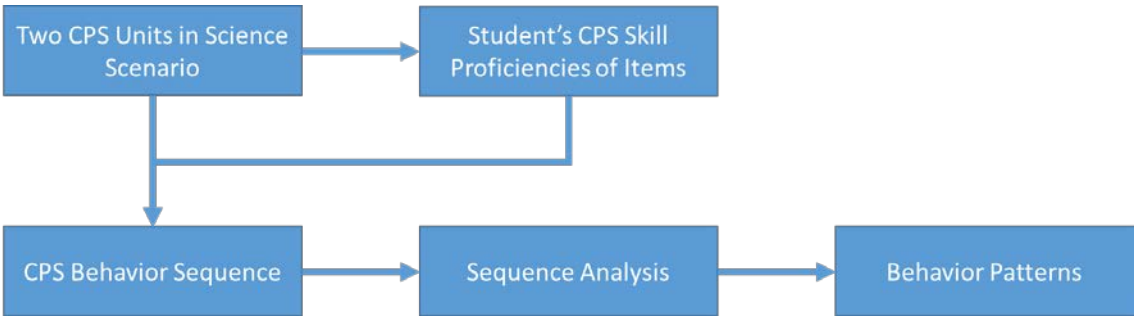

Figure 3. Research flowchart

Sequence analysis can indicate the level of dependence (significance level) between X and Y (Bakeman & Quera, 1995). If X and Y are dependent, then $P(XY) \neq P(X)P(Y)$. The transition frequencies of XY were calculated, and a variation between observed and expected frequencies (z score) of >1.96 indicated that the given sequential pattern was statistically significant (i.e., $X \rightarrow Y$) (Cheng & Hou, 2015). In this study, the p value of the z score was also computed. Y featured a connection from X (i.e., $X \rightarrow Y$) if the corresponding p value reached a significance level of .001.

Figure 3 exhibits the research flowchart for this study. First, student CPS skill proficiencies and target CPS skills for the items were employed to define the CPS behavioral sequence. Then, sequence analysis was then implemented to examine the significant behavioral patterns of students.

Table 4 provides an example student response for the Slurpee unit. Items i and j indicate two adjacent items corresponding to the target CPS skills X and Y. The fifth column in **Table 4** lists the proposed coding scheme. Spaces were added in the sequences to ensure that the behavioral pattern was counted twice. Therefore, the corresponding coded behavioral sequences for this student and unit were as follows:

A1C1C2 C1C2B2 C2B2C1 B2C1A3B3 C3D2C3D2 C2D2

Table 4. Example Student Response and Corresponding Codes for Two Adjacent Items

Item *i*	Item *j*	*X*	*Y*	Code
1	2	A1	C1	A1C1
		1	2	
2	3	C1	C2	C1C2 C1C2
		2	2	
3	4	C2	B2	C2B2 C2B2
		2	2	
4	5	B2	C1	B2C1 B2C1
		2	2	
5	6	C1	A3	C1A3
		2	1	
6	7	A3	B3	A3B3
		1	2	
7	8	B3	B1	N/A
		2	0	
8	9	B1	C2	N/A
		0	0	
9	10	C2	C3	N/A
		0	2	
10	11	C3	D2	C3D2 C3D2
		2	2	
11	12	D2	D1	N/A
		2	0	
12	13	D1	C1	N/A
		0	2	
13	14	C1	B1	N/A
		2	0	
14	15	B1	C2	N/A
		0	1	
15	16	C2	D2	C2D2
		1	1	

RESULTS AND DISCUSSION

CPS Skill Proficiency Analysis

In this section, we compare the student proficiency measures for the 11 CPS skills excluding D3; moreover, we compare collaborative competency and problem-solving competency. **Figure 4** presents the average proficiency scores for the Taiwanese students for the 11 CPS skills in the science scenarios. The average scores for the 11 CPS skills were all higher than 1. Each item was scored 0, 1, or 2, corresponding to three respective levels for the target CPS skills. Hence, on average, the Taiwanese students were at least proficient in these 11 skills. The two highest average scores were received for B3 and C1, indicating that the Taiwanese students were efficient in describing the roles of team members (B3) and communicating with team members (C1) about actions. However, the skill of building a shared representation or negotiating the meaning of a problem with other team members (B1) was lacking in Taiwanese students.

Furthermore, the collaborative competencies, (1), (2), and (3), and the problem-solving competencies, (A), (B), (C), and (D), could be computed by averaging the CPS scores for related items (**Figure 5**). All of them had scores higher than 1. The highest score (1.69) was obtained for problem-solving competency (A). Thus, students could effectively discuss with team members how to solve the given problem (OECD, 2013). Although the score for problem-solving competency (B) was the lowest, it was similar to the scores for competencies (C), (D), and (2). **Table 5** lists the correlations between the collaborative and problem-solving competencies, most of which had

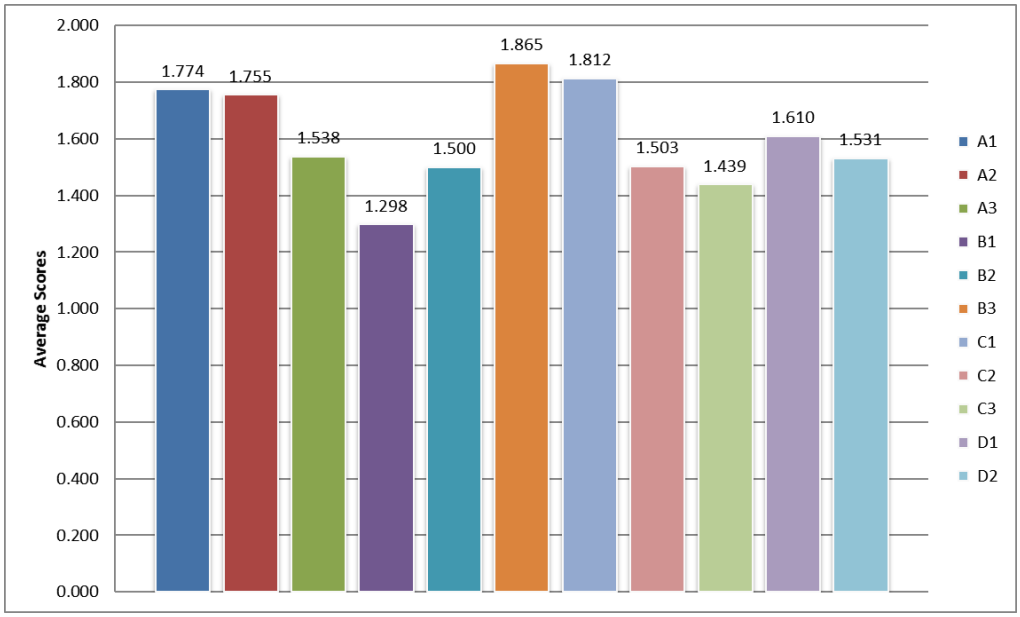

Figure 4. Average proficiency scores for the Taiwanese students for the 11 CPS skills in science scenarios

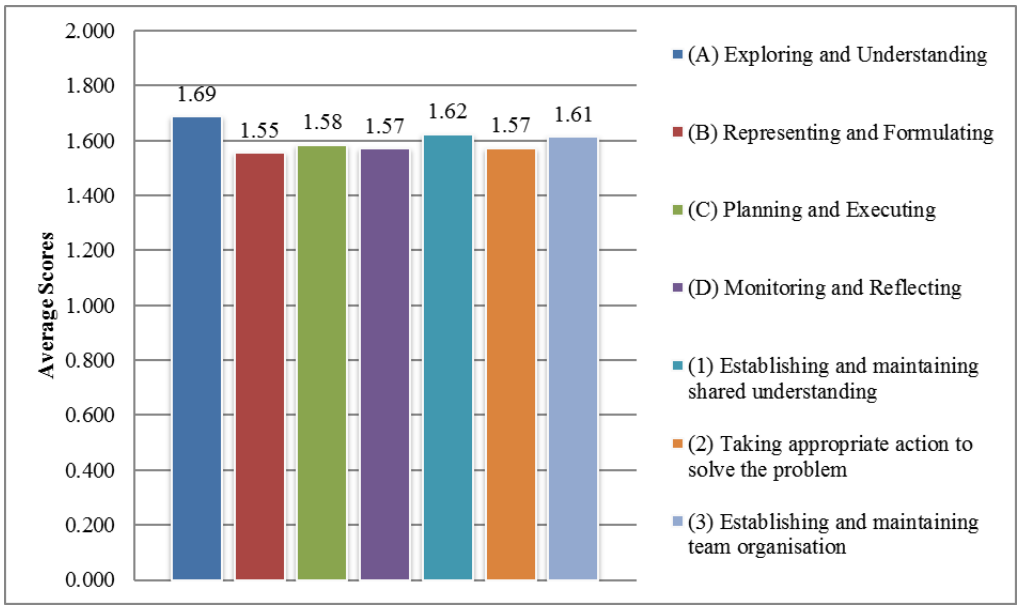

Figure 5. Average scores for collaborative competencies, (1), (2), and (3), and problem-solving competencies, (A), (B), (C), and (D)

scores higher than 0.7; therefore, most collaborative and problem-solving competencies were highly correlated, except for (B) and (3), which were moderately correlated.

The independent sample test results for the male and female students' 11 CPS skill proficiencies are provided in **Table 6**. The variances between the male and female students for the 11 CPS skill proficiencies were unequal because the significance levels corresponding to the test for equality of variance were less than .001. Hence, all *t* test statistics in **Table 6** assume unequal variance. Moreover, because the *p* values were less than .001, female student CPS skill proficiencies were significantly higher than those of male students.

Table 5. Correlation between Collaborative Competencies and Problem-Solving Competencies

Correlation	(1) Establishing and maintaining shared understanding	(2) Taking appropriate action to solve the problem	(3) Establishing and maintaining team organisation
(A) Exploring and Understanding	0.724	0.734	0.763
(B) Representing and Formulating	0.711	0.709	0.612
(C) Planning and Executing	0.734	0.714	0.797
(D) Monitoring and Reflecting	0.781	0.724	N/A

Table 6. Independent Sample Test Results for the 11 CPS Skill Proficiencies of Male and Female Students

CPS Skill	Sex	Average Score	Test for Equality of Variances			*t*-test for Equality of Means	
			F	*p*-value	Equality	*t*	*p*-value
A1	M	1.73	778.90	0.00	No	-28.170	0.00
	F	1.82					
A2	M	1.69	750.784	0.00	No	-28.17	0.00
	F	1.83					
A3	M	1.45	750.79	0.00	No	-34.80	0.00
	F	1.63					
B1	M	1.27	165.02	0.00	No	-12.88	0.00
	F	1.33					
B2	M	1.46	299.7	0.00	No	-17.36	0.00
	F	1.55					
B3	M	1.81	728.55	0.00	No	-27.41	0.00
	F	1.92					
C1	M	1.76	1147.22	0.00	No	-34.33	0.00
	F	1.86					
C2	M	1.45	1238.29	0.00	No	-35.36	0.00
	F	1.56					
C3	M	1.40	313.75	0.00	No	-17.78	0.00
	F	1.48					
D1	M	1.57	593.63	0.00	No	-24.5	0.00
	F	1.65					
D2	M	1.47	1099.39	0.00	No	-33.4	0.00
	F	1.60					

Note. *p < .05, **p < .01, ***p < .001

Sequence Analysis

For an improved understanding of the transit between the target CPS skills for two adjacent items, a series of sequence analyses were applied to explore the behavioral patterns for (a) all students, (b) all male students, (c) all female students, (d) all students in a given class, (e) all male students in a given class, and (f) all female students in a given class. Because the sequence of target CPS skills corresponding to items was fixed, only 20 behavioral patterns were observed (**Figure 6**) for the two science scenario units.

Table 7 lists the adjusted residuals for the sequence analysis of all students. Each *z* score (*p* value) indicates whether a path between two related CPS skills was dependent. The row categories represent the starting behavior, and the column categories indicate the subsequent behavior. For example, in the second row and first column of **Table 7**, A2 is the starting behavior and A1 is the subsequent behavior. The corresponding *z* value is 1183.933, and the *p* value is .000, which is less than .001. Thus, the sequence A2 → A1 was significant. Hence, in the corresponding behavioral transition diagram, a black arrow points from A2 to A1. "N/A" in **Table 7** indicates that the corresponding CPS skill behavioral pattern was not detected in the two units. In the CPS skill sequences combining

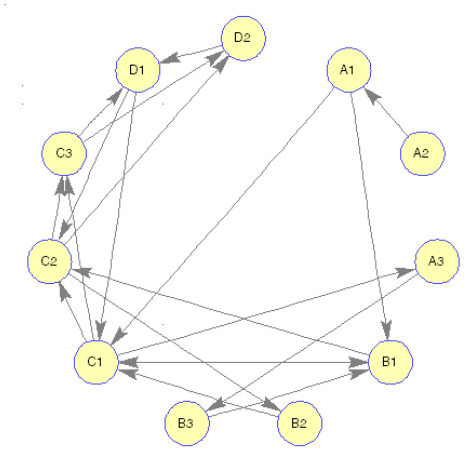

Figure 6. The 20 observed behavioral patterns in the two science scenario units

Table 7. Adjusted Residuals Table for Sequence Analysis of All Students (*p* value shown in brackets)

z (*p*-value)	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2
A1	N/A	N/A	N/A	416.499 (0.000)	N/A	N/A	456.458 (0.000)	N/A	N/A	N/A	N/A
A2	1183.933 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A3	N/A	N/A	N/A	N/A	N/A	1337.748 (0.000)	N/A	N/A	N/A	N/A	N/A
B1	N/A	N/A	N/A	N/A	N/A	N/A	193.429 (0.000)	378.544 (0.000)	N/A	N/A	N/A
B2	N/A	N/A	N/A	N/A	N/A	N/A	602.615 (0.000)	N/A	N/A	N/A	N/A
B3	N/A	N/A	N/A	751.493 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C1	N/A	N/A	582.536 (0.000)	220.608 (0.000)	N/A	N/A	N/A	138.620 (0.000)	248.619 (0.000)	N/A	N/A
C2	N/A	N/A	N/A	N/A	519.449 (0.000)	N/A	N/A	N/A	224.773 (0.000)	N/A	528.117 (0.000)
C3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	326.232 (0.000)	599.859 (0.000)
D1	N/A	N/A	N/A	N/A	N/A	N/A	167.994 (0.000)	644.189 (0.000)	N/A	N/A	N/A
D2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	805.409 (0.000)	N/A

Note. *p < .05, **p < .01, ***p < .001

all students' behavioral sequences, all 20 paths were connected and significant. This was because, on average, the Taiwanese students were at least proficient in the 11 CPS skills (**Figure 4**). Thus, the CPS behavioral ransition diagram for all students corresponded to the results provided in **Figure 6**. To examine the differences in the CPS behavioral patterns of the male and female students, the adjusted residuals tables for their sequence analyses are shown in **Tables 8** and **9**, respectively. The results were similar to those for all the students. All 20 behavioral patterns were significant.

Table 8. Adjusted Residuals Table for Sequence Analysis of Male Students (*p* value shown in brackets)

z **(*p*-value)**	**A1**	**A2**	**A3**	**B1**	**B2**	**B3**	**C1**	**C2**	**C3**	**D1**	**D2**
A1	N/A	N/A	N/A	284.646 (0.000)	N/A	N/A	324.462 (0.000)	N/A	N/A	N/A	N/A
A2	825.367 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A3	N/A	N/A	N/A	N/A	N/A	932.164 (0.000)	N/A	N/A	N/A	N/A	N/A
B1	N/A	N/A	N/A	N/A	N/A	N/A	132.837 (0.000)	250.753 (0.000)	N/A	N/A	N/A
B2	N/A	N/A	N/A	N/A	N/A	N/A	424.741 (0.000)	N/A	N/A	N/A	N/A
B3	N/A	N/A	N/A	543.478 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C1	N/A	N/A	407.632 (0.000)	158.176 (0.000)	N/A	N/A	N/A	97.744 (0.000)	182.964 (0.000)	N/A	N/A
C2	N/A	N/A	N/A	N/A	364.779 (0.000)	N/A	N/A	N/A	140.248 (0.000)	N/A	373.362 (0.000)
C3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	236.433 (0.000)	417.932 (0.000)
D1	N/A	N/A	N/A	N/A	N/A	N/A	110.797 (0.000)	468.500 (0.000)	N/A	N/A	N/A
D2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	559.549 (0.000)	N/A

Note. *p < .05, **p < .01, ***p < .001

Table 9. Adjusted Residuals Table for Sequence Analysis of Female Students (*p* value shown in brackets)

z **(*p*-value)**	**A1**	**A2**	**A3**	**B1**	**B2**	**B3**	**C1**	**C2**	**C3**	**D1**	**D2**
A1	N/A	N/A	N/A	304.290 (0.000)	N/A	N/A	321.097 (0.000)	N/A	N/A	N/A	N/A
A2	848.834 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A3	N/A	N/A	N/A	N/A	N/A	959.764 (0.000)	N/A	N/A	N/A	N/A	N/A
B1	N/A	N/A	N/A	N/A	N/A	N/A	140.675 (0.000)	284.417 (0.000)	N/A	N/A	N/A
B2	N/A	N/A	N/A	N/A	N/A	N/A	427.482 (0.000)	N/A	N/A	N/A	N/A
B3	N/A	N/A	N/A	519.333 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C1	N/A	N/A	416.269 (0.000)	153.831 (0.000)	N/A	N/A	N/A	98.295 (0.000)	168.790 (0.000)	N/A	N/A
C2	N/A	N/A	N/A	N/A	369.815 (0.000)	N/A	N/A	N/A	177.270 (0.000)	N/A	373.564 (0.000)
C3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	225.006 (0.000)	430.291 (0.000)
D1	N/A	N/A	N/A	N/A	N/A	N/A	126.740 (0.000)	442.590 (0.000)	N/A	N/A	N/A
D2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	579.433 (0.000)	N/A

Note. *p < .05, **p < .01, ***p < .001

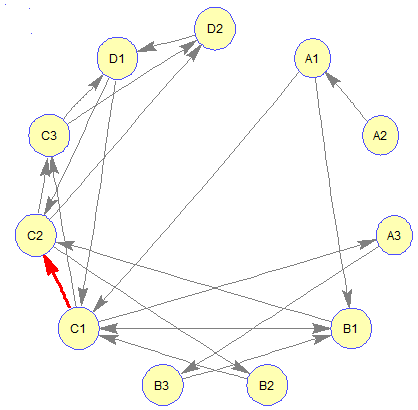

Figure 7. CPS behavioral transition diagram for 22 students in a class from northern Taiwan

Table 10. Adjusted Residuals Table for Sequence Analysis of 22 Students in a Class from Northern Taiwan (*p* value shown in brackets)

z **(*p*-value)**	**A1**	**A2**	**A3**	**B1**	**B2**	**B3**	**C1**	**C2**	**C3**	**D1**	**D2**
A1	N/A	N/A	N/A	8.023 (0.000)	N/A	N/A	10.018 (0.000)	N/A	N/A	N/A	N/A
A2	26.814 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A3	N/A	N/A	N/A	N/A	N/A	27.503 (0.000)	N/A	N/A	N/A	N/A	N/A
B1	N/A	N/A	N/A	N/A	N/A	N/A	3.144 (0.000)	9.390 (0.000)	N/A	N/A	N/A
B2	N/A	N/A	N/A	N/A	N/A	N/A	13.391 (0.000)	N/A	N/A	N/A	N/A
B3	N/A	N/A	N/A	17.373 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C1	N/A	N/A	13.421 (0.000)	4.880 (0.000)	N/A	N/A	N/A	2.578 (0.005)	6.803 (0.000)	N/A	N/A
C2	N/A	N/A	N/A	N/A	11.282 (0.000)	N/A	N/A	N/A	4.417 (0.000)	N/A	12.665 (0.000)
C3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.916 (0.000)	11.277 (0.000)
D1	N/A	N/A	N/A	N/A	N/A	N/A	4.425 (0.000)	12.246 (0.000)	N/A	N/A	N/A
D2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16.070 (0.000)	N/A

Note. *p < .05, **p < .01, ***p < .001

Sequence analysis can be applied not only to all participating students but also to the students in a given class. This type of report can provide their teachers with constructive feedback on their learning activities and enable them to train students that lack sufficient CPS behavioral transition patterns in science courses. **Table 10** shows the adjusted residuals table for the sequence analysis of 22 students (13 female and 9 male students) in a class from northern Taiwan; the corresponding CPS behavioral transition diagram for the class is presented in **Figure 7**. In the seventh row and eighth column of **Table 10** (gray cell), the *p* value is .005. Thus, the sequence C1 → C2 was nonsignificant in this study. Hence, a red arrow pointing from C1 to C2 is used to highlight the behavioral pattern in **Figure 7**. Overall, students in this class were not proficient in enacting plans (C2) after communicating with team members about the actions (C1). Therefore, the science teacher can design further related collaborative activities in science class to train students.

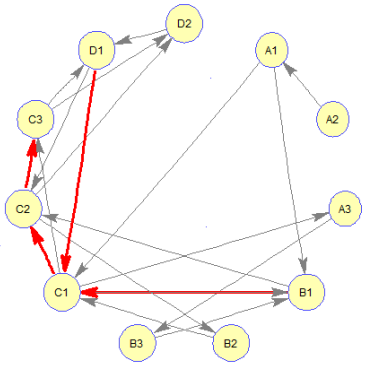

Figure 8. CPS behavioral transition diagram for male students in the class

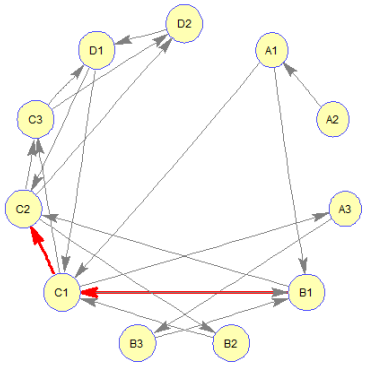

Figure 9. CPS behavioral transition diagram for female students in the class

The CPS behavioral patterns of the male and female students in the class are illustrated in **Figures 8** and **9**, respectively. **Tables 11** and **12** respectively comprise the corresponding adjusted residuals tables for sequence analysis. **Figure 8** and **Table 11** demonstrate that the male students in the class were not proficient in behavioral patterns C1 → C2, C2 → C3, D1 → C1, and B1 → C1. Moreover, **Figure 9** and **Table 12** indicate that the female students in the class were not proficient in behavioral patterns C1 → C2 and B1 → C1. Thus, the male students lacked more behavioral patterns than the female students in the class did. Additionally, comparing **Figures 8** and **9** with **Figure 7** indicates that some students, regardless of gender, were not proficient in communicating with team members about actions after building a shared representation and negotiating the meaning of the problem.

CONCLUSION

In this study, we analyzed the CPS skill proficiencies of Taiwanese students (aged approximately 15 years) in science scenarios, and we explored their behavioral patterns through sequential analysis. The results demonstrated that the Taiwanese students were at least proficient in the 11 CPS skills. They exhibited particularly strong proficiency in B3 and C1 and low proficiency in B1. Studies have demonstrated that, on average, male students exhibit higher learning achievement than female students in science and that the gender differences have decreased (Browne & Ross, 1991; Murphy, 1997; Ziegler & Heller, 1997; Kimbell, Stables, Wheeler, Wosniak, & Kelly, 1991). However, female students tend to work collaboratively with others, whereas male students tend to work independently (Kimbell et al., 1991). **Table 6** indicates that the CPS skill proficiencies for the female students were significantly superior to those of the male students for all 11 CPS skills. The finding is in agreement with those of Kimbel et al. (1991).

Table 11. Adjusted Residuals Table for Sequence Analysis of Male Students in the Class (*p* value shown in brackets)

z **(*p*-value)**	**A1**	**A2**	**A3**	**B1**	**B2**	**B3**	**C1**	**C2**	**C3**	**D1**	**D2**
A1	N/A	N/A	N/A	5.197 (0.000)	N/A	N/A	6.311 (0.000)	N/A	N/A	N/A	N/A
A2	16.889 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A3	N/A	N/A	N/A	N/A	N/A	16.947 (0.000)	N/A	N/A	N/A	N/A	N/A
B1	N/A	N/A	N/A	N/A	N/A	N/A	1.506 (0.066)	5.961 (0.000)	N/A	N/A	N/A
B2	N/A	N/A	N/A	N/A	N/A	N/A	8.859 (0.000)	N/A	N/A	N/A	N/A
B3	N/A	N/A	N/A	11.326 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C1	N/A	N/A	8.631 (0.000)	3.656 (0.000)	N/A	N/A	N/A	1.778 (0.038)	5.112 (0.000)	N/A	N/A
C2	N/A	N/A	N/A	N/A	7.048 (0.000)	N/A	N/A	N/A	2.191 (0.014)	N/A	7.809 (0.000)
C3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.621 (0.000)	7.562 (0.000)
D1	N/A	N/A	N/A	N/A	N/A	N/A	1.969 (0.024)	8.141 (0.000)	N/A	N/A	N/A
D2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.702 (0.000)	N/A

Note. *p < .05, **p < .01, ***p < .001

Table 12. Adjusted Residuals Table for Sequence Analysis of Female Students in the Class (*p* value shown in brackets)

z **(*p*-value)**	**A1**	**A2**	**A3**	**B1**	**B2**	**B3**	**C1**	**C2**	**C3**	**D1**	**D2**
A1	N/A	N/A	N/A	6.162 (0.000)	N/A	N/A	7.782 (0.000)	N/A	N/A	N/A	N/A
A2	20.772 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A3	N/A	N/A	N/A	N/A	N/A	21.747 (0.000)	N/A	N/A	N/A	N/A	N/A
B1	N/A	N/A	N/A	N/A	N/A	N/A	2.882 (0.002)	7.291 (0.000)	N/A	N/A	N/A
B2	N/A	N/A	N/A	N/A	N/A	N/A	10.066 (0.000)	N/A	N/A	N/A	N/A
B3	N/A	N/A	N/A	13.143 (0.000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C1	N/A	N/A	10.278 (0.000	3.273 (0.000)	N/A	N/A	N/A	1.877 (0.030)	4.520 (0.000)	N/A	N/A
C2	N/A	N/A	N/A	N/A	8.796 (0.000)	N/A	N/A	N/A	4.054 (0.000)	N/A	9.954 (0.000)
C3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.075 (0.000)	8.458 (0.000)
D1	N/A	N/A	N/A	N/A	N/A	N/A	4.095 (0.000)	9.165 (0.000)	N/A	N/A	N/A
D2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.785 (0.000)	N/A

Note. *p < .05, **p < .01, ***p < .001

Overall, regardless of gender, among the Taiwanese students, all 20 of the detected sequential patterns in science scenarios were significant. However, if a single class is considered, some behavioral patterns may be lacking. In the case of a class from northern Taiwan, most of the students were not proficient in enacting plans after communicating with team members. Moreover, some students in the class could not effectively communicate with team members regarding the actions (**Figure 7**). In addition, we compared the significant behavioral patterns of male and female students in the class and revealed that the male students exhibited low performance in $C2 \rightarrow C3$ and $D1 \rightarrow C1$. We hope that the findings regarding CPS skill proficiencies and CPS behavioral transition patterns in this study can serve as a reference for teachers, researchers, and governmental departments for designing future training courses or government policies.

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A Study on the Visual Images of Lotus Ink-Painting

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ABSTRACT

The purpose of this study is to explore the visual images of lotus ink-painting of visitors and to investigate the gender, age difference. The participant who attended 2016 Hsieh, Yi-E Lotus Ink-painting exhibition. The sample consisted 199 (male: 68, female: 131; age between 18~24 undergraduate student) valid questionnaires had been collected. Results indicate that: A Lotus Ink-painting of "Zen Sit "has the most Phlegmatic (t=-17.380, p=.000), Sorrowful (t=-9.999, p=.000) Meditation (t=-18.783, p=.000), Lonely (t=-10.803, p=.000) Plain (t=-18.747, p=.000) feeling. A Lotus Ink-painting of "Red Lotus" has the most Passionate (t=30.259, p=.000), Abundant (t=24.438, p=.000), Untrammeled (t=24.235, p=.000), Liberated (t=18.187, p=.000), Foison (t=21.306, p=.000) feeling. Gender and age difference do interaction significantly influence the visual images of lotus ink-painting. An artist can adopt the visual images of lotus ink-painting concluded form this study to understand the feelings of visitors on the lotus ink-painting.

Keywords: visual images, lotus ink-painting, symbolic images

INTRODUCTION

Chinese flower and bird painting has a history of more than 1,400 years (Chen 2006; Sung 1992; Luppino 2000). They are used to express certain meanings. The common means are homophony and pun, that convey meaning whilst reflect people's yearning for happiness. For example, the "Four Gentlemen" are plum blossom, orchid, bamboo, and chrysanthemum and given the corresponding symbolic meanings like nobleness, modesty, and integrity (Liu 2000). Ink painting "Hé huā": Lotus is also popular with Chinese people, also known as lotus, Fu Qú, water hibiscus, water Chi, Han Dàn, etc., is the family of Water Lily. Lotus is very important to cultures across Asia. The lotus is a representative of purity and perfect beauty in many Asian cultures and faiths. This plant is the national flower of both India and Vietnam. It is also a symbol in many religions including Hinduism, Jainism, and Buddhism. Many interesting literatures about lotus have been proposed by many researchers. Kubisch and Heyne (2016) conducted practical lessons on bionics, focused on the lotus effect, with 260 students at the botanical garden of the University of Wurzburg. Tarnai and Miyazaki (2003) studied the connection between the conjectural solutions of the discrete geometrical problem and the fruit arrangements in the receptacles of lotuses, and then they put forward a proposition about the contribution of the geometric configurations of lotus receptacles to the

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Contribution of this paper to the literature

- This study is to explore the visual images of lotus ink-painting of visitors and to investigate the gender, age difference.
- Gender and age difference do interaction significantly influence the visual images of lotus ink-painting.
- An artist can adopt the visual images of lotus ink-painting concluded form this study to understand the feelings of visitors on the lotus ink-painting.

conception of certain shapes seen in Japanese culture. Peach (2002) examined the gendered imagery in the lotus satra in order to assess its messages regarding normative gender relations and the implications of these messages for gender justice in the contemporary world.

Creation is to reflect the fountain of their own touches, all the real creative power in the depths of the artist's exudation. But what is the feeling, perception or emotion of the visitors in the gallery of Exhibition hall? Many researchers in the visual arts use social science methodology to design studies that describe and interpret responses to objects of art (Hardiman & Zernich, 1984). However, to the best of our knowledge, there have been no reports on the feeling of visitors after the lotus Ink-painting exhibition.

RELATED RESEARCH

Hardiman and Zernich (1984) examined three groups of untrained subjects' responses to paintings done in two different styles (representational or semiabstract) presented in three different modes (as original objects, colored slides, and colored photographic prints). Response profiles generated by eighteen semantic differential (SD) scales revealed no significant response differences due to mode of presentation. This study provides support for the proposition that mode of presentation has little systematic effect on untrained subjects' evaluations of paintings.

Chen and Hong (2009) used SD method to explore the lifestyles, and product form image preferences of craft-furniture visitors. A sum of 232 respondents were surveyed after they had visited the exhibition. Based on visitor's lifestyles, four significant lifestyle groupings have been found: conservative and common group, fashion and rationality group, quality driven group, as well as ordinary and moderate group.

Huang and Li (2015) reported the similarities and differentials of personal characteristics between expert and novice designers within four product design stages utilizing the SD method. Ikei *et al*. (2016) evaluated the psychological effect of the smell using the modified SD method. Three pairs of adjectives were assessed on 13 scales as "comfortable-uncomfortable", "relaxed-awakening", and "natural-artificial".

Wang (2001) employed qualitative and quantitative analysis to describe the shape of bicycles, inducing product design principles of various feeling images. Zhai *et al*. (2009) used SD method to convert complex feeling factors into quantitative design rules for improved user satisfaction of specific products.

This method has also been applied in the assessment and analysis of product-feeling images, to research the relationship among product design factors and feelings, to conduct further design.

PURPOSES

Given the limit of these relate research about visual images on ink-painting. Hence, the question remains: what is the visitors' feeling or perception of lotus ink-painting. The objective of the following study was to extend the knowledge about the visual images that undergraduate students, who attended the exhibition have on lotus ink-paintings. It was also an objective to analysis the gender, age difference in the perceptions of visual images of lotus ink-painting. Furtherly, to test the interaction between gender and age (freshman: below 19 & senior: upper 20).

Table 1. Title, Figure, Artists, and Size of Ink Paintings

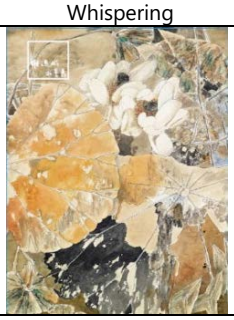
Title	Westerly Wind Whispering	Rounded	Zen Sit	Carved	Red Lotus
Figure					
Size	79.5 x 82 cm	79 x 80 cm	70 x 96.5 cm	110 x 71 cm	53 x 100cm
Artist	Hsieh, Yi-E	Hsieh, Yi-E	Hsieh, Yi-E	Hsieh, Yi-E	Hsieh, Yi-E
Year	2011	2011	2011	2012	2010

Table 2. Seven -point scale of each paired adjectives of semantic differential method in questionnaire

	3	2	1	0	1	2	3	
Phlegmatic								**Passionate**
Sorrowful								**Abundant**
Meditation								**Untrammeled**
Lonely								**Liberated**
Plain								**Foison**

METHOD

Participants

The participants consisted of visitors who attended 2016 Hsieh, Yi-E Lotus Ink-painting exhibition. Respondents were surveyed after they had visited the exhibition. The participants in this study are including 68 men and 131 women, total 199 valid questionnaires had been collected. The age of the visitors was between 18~24 undergraduate student. The average age of the participants was 20.08.

Stimuli

Five original ink paintings were selected from the collection of the exhibition of 2016 Hsieh, Yi-E Lotus Ink-painting for use as stimuli in this study (see **Table 1**). The paintings represented two general stylistic classifications (black and white, color).

Procedure

The original ink paintings were exhibited in a gallery in a museum. All visitors were individually finished the scale by themselves. Visitors were recorded their immediate impressions of each ink painting on a semantic differential (SD) instrument. This particular form of the semantic differential consisted of 5 adjective scales that represented emotive, dynamism factors (see **Table 2**). Visitors must score on a 7-point scale table of corresponding adjective groups to select the better adjective for record his or her impressions of the ink painting of lotus.

Semantic Differential (SD) Instrument

Subjects using this method receive various levels of external stimuli or feelings regarding a product, and compile various adjective groups to use the SD method on questionnaire tests (Osgood and Tzeng, 1990). The instrument comprised a series of pairs of adjectives generated from specialized literature, which permit assessing

	3	2	1	0	1	2	3	
Phlegmatic	□	□	□	□	□	□	□	**Passionate**
	⇩	⇩	⇩	⇩	⇩	⇩	⇩	
	1	2	3	4	5	6	7	

Figure 1. The process of recoding the value of score

assumptions on ink painting. In order to select the adjectives that finally shaped the instrument, a trial test was previously applied to a sample of 30 university students and later assessed by experts. The following pairs of adjectives were selected from this process: Phlegmatic/Passionate; Sorrowful/Abundant; Meditation/Untrammeled; Lonely/Liberated; Plain/Foison.

The pairs of adjectives of the "positive" and "negative" aspects of each pair were displayed by Questionnaire. A distance of seven points between the extremes was assigned so that those surveyed could mark where they placed each of the reactive for each of the 5pairs of adjectives (see **Table 2**).

Statistics

The average number of the study is to determine the image of the indicators, first consider the statistical presentation, to recode the value of score (see **Figure 1**). The average of the operations will correspond to the degree of sensitivity of each conversion value. When the average (M) is less than 4 that means the feeling of the visual images tends to the left and the smaller the value, the greater the degree of perception on adjective. For e.g.: when the average is 2.58 (M<4), showed more feeling about **Phlegmatic.**

The goal of this study were analyze the whole feeling of the visual images of lotus ink-painting and to analyze the gender and age diffidence in the visual images of lotus ink-painting. The analysis methods were used in this paper with the statistics software of SPSS 20.0: the one-sample t test and two-way ANOVA.

RESULTS

The Perception of Visual Images of Lotus Ink-Painting

The whole feeling of "01Westerly Wind Whispering" has Phlegmatic (t=-2.880, p=.004), Meditation (t=-3.501, p=.000) and Lonely (t=-2.468, p=.014). The whole feeling of "02Rounded" has Meditation (t=-3.015, p=.003). The whole feeling of "03Zen Sit" has Phlegmatic (t=-17.380, p=.000), Sorrowful (t=-9.999, p=.000), Meditation (t=-18.783, p=.000), Lonely (t=-10.803, p=.000) and Plain (t=-18.747, p=.000). The whole feeling of "04Carved" has Abundant (t=2.678, p=.008). The whole feeling of "05Red Lotus" Passionate (t=30.259, p=.000), Abundant (t=24.438, p=.000), Untrammeled (t=24.235, p=.000), Liberated (t=18.187, p=.000) and Foison (t=21.306, p=.000) (see **Figure 2**).

The Composition of Visual Images and Lotus Ink-Painting

A one-sample t test for repeated measures design was used to analyze the data in this study (see **Table 3**). The "01 Westerly Wind Whispering" (t=-2.880, p=.004) and "03 Zen Sit" (t=-17.380, p=.000) of lotus ink-painting, brought out the "Phlegmatic" feeling from the perception of visual images are statistically significant.

Only the "05 Red Lotus" (t=30.259, p=.000) of lotus ink-painting, brought out the "Passionate" feeling from the perception of visual images are statistically significant.

The "03 Zen Sit" (t=-9.999, p=.000) of lotus ink-painting, brought out the "Sorrowful" feeling from the perception of visual images are statistically significant.

The "04 Carved" (t=2.678, p=.008) and "05 Red Lotus" (t=24.438, p=.000) of lotus ink-painting, brought out the "Abundant" feeling from the perception of visual images are statistically significant.

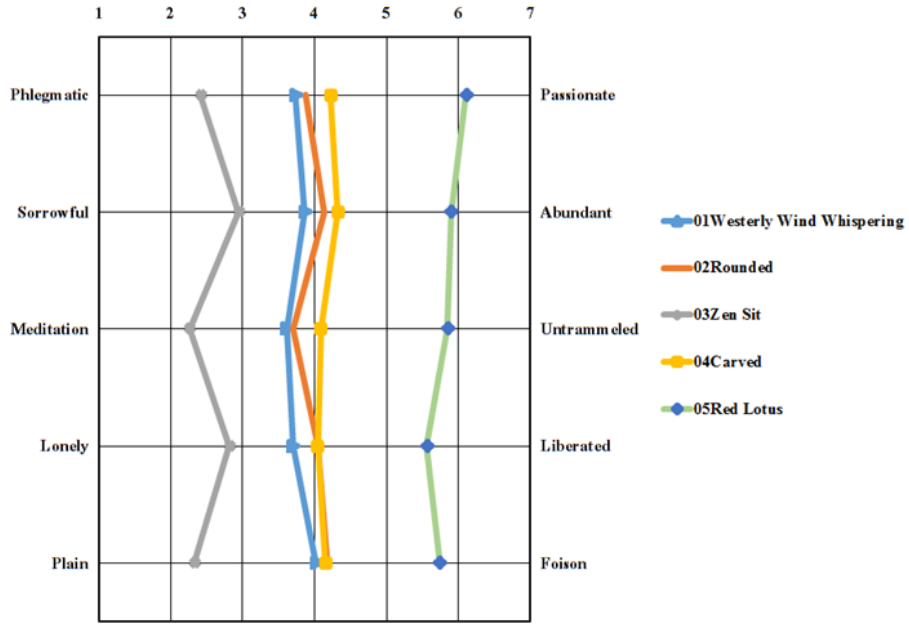


Figure 2. The line chart of visual images of lotus ink-painting

Table 3. Visitors' visual images of lotus ink-painting (n=199)

Adjective	Ink-painting	Mean	t	Sig.(2-tail)
Phlegmatic	01 Westerly Wind Whispering	3.73	-2.880	.004**
	03 Zen Sit	2.43	-17.380	.000***
Passionate	05 Red Lotus	6.11	30.259	.000***
Sorrowful	03 Zen Sit	2.95	-9.999	.000***
Abundant	04 Carved	4.31	2.678	.008**
	05Red Lotus	5.89	24.438	.000***
Meditation	01 Westerly Wind Whispering	3.62	-3.501	.001***
	02 Rounded	3.70	-3.015	.003**
	03 Zen Sit	2.28	-18.783	.000***
Untrammeled	05 Red Lotus	5.84	24.235	.000***
Lonely	01 Westerly Wind Whispering	3.72	-2.468	.014*
	03 Zen Sit	2.82	-10.803	.000***
Liberated	05 Red Lotus	5.56	18.187	.000***
Plain	03 Zen Sit	2.33	-18.747	.000***
Foison	05 Red Lotus	5.73	21.306	.000***

*p<.05, **p<.01, ***p<.001

The "01 Westerly Wind Whispering" (t=-3.501, p=.000), "02 Rounded" (t=-3.015, p=.003) and "03 Zen Sit" (t=-18.783, p=.000) of lotus ink-painting, brought out the "Meditation" feeling from the perception of visual images are statistically significant.

The "05 Red Lotus" (t=24.235, p=.000) of lotus ink-painting, brought out the "Untrammeled" feeling from the perception of visual images are statistically significant.

The "01 Westerly Wind Whispering" (t=-2.468, p=.014) and "03 Zen Sit" (t=-10.803, p=.000) of lotus ink-painting, brought out the "Lonely" feeling from the perception of visual images are statistically significant.

The "05 Red Lotus" (t=18.187, p=.000) of lotus ink-painting, brought out the "Liberated" feeling from the perception of visual images are statistically significant.

Only the "03 Zen Sit" (t=-18.747, p=.000) of lotus ink-painting, brought out the "Plain" feeling from the perception of visual images are statistically significant.

The "05 Red Lotus" (t=21.306, p=.000) of lotus ink-painting, brought out the "Foison" feeling from the perception of visual images are statistically significant.

A Lotus Ink-painting of "03Zen Sit "has the most Phlegmatic, Sorrowful, Meditation, Lonely and Plain feeling. A Lotus Ink-painting of "05Red Lotus" has the most Passionate, Abundant, Untrammeled, Liberated, Foison feeling.

Comparison between Gender and Age

To statistically compare the perceptions of visual images of lotus ink-painting of gender. The independent sample t test was conducted to determine. This procedure revealed no significant gender differences (n=199).

A two-way analysis of variance for repeated measures diffidence ink-paintings was used to analyze the data in this study. Results indicated that the main effect for gender was not significant for any of the semantic differential scales, but the main effect for age was significant (F (1, 197) =6.169, p= .01) for the feeling of "Lonely" of the lotus ink-painting "03 Zen Sit". In addition, first order interaction for the gender and age was significant (F (1, 197) =5.166, p= .02) for the feeling of "Phlegmatic" of the lotus ink-painting "04Carved". Comparing with the average of four groups, the pattern of responses across age was significant for men. The students of below 19 years old (M= 4.591) expressed the feeling of "04Carved" were more "Passionate" On the contrary, senior student (upper 20 years old) (M=3.689) expressed the feeling of "04Carved" were more "Phlegmatic".

DISCUSSION

This is considerable evidence that artistic style of ink-painting (black and white, color) is an important variable in preference. "03 Zen Sit" is the classical style just used black ink for painting was significant for Phlegmatic, Sorrowful, Meditation, Lonely and Plain feeling. On the contrary, using the color of RED for printing operated important role of impact on the perception of visual images, a Lotus Ink-painting of "05Red Lotus" was a typical example has the most Passionate, Abundant, Untrammeled, Liberated, and Foison feeling. Lower saturation of painting as "01 Westerly Wind Whispering" and "02 Rounded" did not cause a strong feeling.

Iinterestingly, the feeling of ink-printing "04Carved" caused the age diffidence within men. The growing up of undergraduate students may be the special experience to change the perception of visual images.

Visual images such as red, can be said to be our nation's favorite color. For thousands of years, whether it is the temple of the high, or rivers and lakes far away, whether it is ceremony, or civilian customs, whether it is the girl's dressing, or literati drama, have been or is still widely used. In many cultures around the world, red seems to be regarded as the exclusive color of women, on behalf of the beautiful, gentle, charming and auspicious meaning. The results of the study further show that the use of color in the creation of art, the visitors ' sense of appreciation, the proportion of the use of red, the visitors have more positive feelings.

The semantic differential method used in this study is traditionally used by artists, critics, historians, and teachers of art to qualify, evaluate, and characterize works of art (Hardiman and Zernich, 1984). But that is not common on Chinese ink-printing. This study provides support for proposition the using of color has effect on visitors the perception of visual images.

Through the traditional aesthetic expression of visual imagery and the spiritual traits of contemporary art creation, it will reach the deeper and foresightedness artistic conception and innovation, and it can be applied to the teaching of ink and ink through the study of visual image.

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Mobile Interactive Translation Teaching Model Based on "Internet +"

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ABSTRACT
Nowadays, we have entered a new era of globalization and information. The new information technology featured by Internet and computer has permeated every sphere of our lives and affected our viewpoint of consuming and life-style. As for translation teaching, the traditional translation-teaching model cannot satisfy the needs of modern education. In China, the translation teaching based on Internet has become the norm. And more and more people have accepted the mobile learning model. Under such background, this study analyzes the features of mobile teaching and constructs a new model of mobile interactive translation teaching from the perspective of constructivism. The paper also preliminarily testified the new model by taking three different social interactive tools that are most popular in China as example, that is, WeChat, QQ, and Micro-blog. The result shows that this new model based on "Internet +" can improve translation teaching and learning.

Keywords: translation teaching, M-learning, Internet+, interaction

INTRODUCTION

Ma Huateng, the CEO of Tencent, first put forward the concept of the "Internet +" publicly in his article which published in the "People's Daily" on April 21, 2014. He believed that "Internet +" is a trend, and "+" stands for connecting the Internet with the traditional all walks of life (Wang, 2016; Liu, 2017). Premier Li Keqiang first proposed "Internet + Plan" in the "Government Work Report" at the beginning of 2015, which means that the "Internet +" has been raised to the national strategic level. At the two sessions in 2015, Ma proposed to accelerate the "Internet +". In this proposal, he explains the "Internet +" as "making use of the Internet platform, information and communication technology to join the Internet and the industries, including the traditional ones together so as to create a new ecology in the new field."

THE EFFECTS OF "INTERNET +" ON EDUCATION

As with many other industries, education has been greatly influenced by the Internet, and the concept of "Internet +" has brought revolutionary shocks and challenges to traditional educational ideas. The widespread use of the Internet, especially the development of big data, cloud computing and mobile internet technology is profoundly changing the face of education, to promote it to the digital, network and intelligent direction. (Agrawal, 2011) How to confront the education with the "internet+" and then adapt to it? How to promote the level of public education service and elevate the quality of education through the exploration of scientific model of "Internet +

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Contribution of this paper to the literature

- This paper tries to construct a new model which emphasizes students' feedbacks and the interaction between teacher and students, which makes up the deficiency of previous model that neglects student's feedbacks.
- This paper makes an empirical research on the new model which proves the feasibility of the model.
- The mobile tools are diversified in the experiment and comparison is made between those mobile tools, which helps teacher to choose a more suitable way.
- This paper applies the model interaction model based on "Internet+" to the translation teaching, which fills the gap in translation teaching.
- This paper discusses the impact of Internet on translation teaching and tries to construct a new model of mobile interactive translation teaching.
- Experiments have been done to testify this new model by comparing WeChat, QQ and Microblog and the results turn out that the model is positive for translation teaching.

education"? These are not only the unavoidable problems in the process of deepening the reform of education, but also the realistic tasks placed in front of the educators.

To understand the "Internet +" from the perspective of education, we should see that this trend not only innovates the educational technology, but changes the learning and teaching model and has a deep impact on the educational philosophy and system. The effects of "Internet +" thinking on education can be summarized into the following points according to Duță (2015). (1) The closed education resources have become open. Traditional mode of educational resources has been centralized in a relatively closed physical space — the campus, confined to the classroom, libraries, laboratories and other places to meet the needs of a fixed population. The Internet, with its powerful storage and interactive technical advantages, quickly absorbs knowledge and information in a short time, becoming an unprecedented repository of information in human history, and the repository can be expanded constantly. (2) The multiple education institutions have become more diversified. In the traditional education, the school is the main carrier (institute). However, educational resources are re-collocated and integrated with the help of the Internet +, and the school education has been deeply influenced by social education institutions, new educational organizations due to their flexibility, free of charge and other advantages. (3) The passive learning changed into active. In the traditional teaching model, students are placed in the classroom to do their learning according to the school curriculum. However, they can learn anywhere and anytime, getting rid of full dependence on the classroom and books, under the environment of Internet as long as the network can be linked. During learning, people can choose their own courses and share lessons, and the learning process and outcomes can be assessed by themselves and others. (4) The teaching mode has been changed from indoctrination to interaction. The Internet has changed the traditional teacher-centered mode of teaching and students' dependencies on teachers are significantly reduced as teachers are no longer the only source of knowledge. Teachers are now more focused on communication and feedback.

MOBILE LEARNING

With the popularity of wireless coverage and smart phones, the Internet is developed from the "computer era" to "mobile Internet era". According to statistics (2015) the 39th "China Internet Development Statistics Report", released by the China Internet Network Information Center (CNNIC), China's mobile Internet users increased progressively year by year, as shown in **Figure 1**.

Until December 2016, Chinese Internet users has reached 731 million, occupying 53.2 percent of the total population, equivalent to the total population of Europe. Among the 95.1 percent netizen who used the mobile phones to access the Internet, the students have accounted for 46.4 percent. The rate of students' ownership of smart phone is much higher than the computer. Compared to the computer-based registration MOOC (Massive Online Open Course) platform, learning with wireless mobile devices is clearly more portable and extensive, that is also the reason of Mobile learning's appearance.

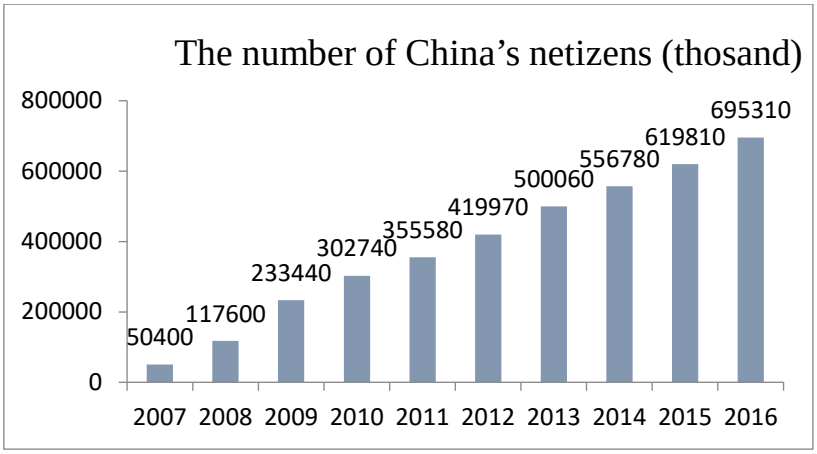

Figure 1. The number of China's netizens

Mobile learning, written as M-Learning, was introduced to China in 2000 by Boticario (2000), an Irish distance education expert. In Boticario's opinion, the next generation of learning will shift from distance learning and e-learning to mobile learning (Ally, 2016; Lim, 2016; Huang, 2015). As the name implies, mobile learning is different from traditional learning lies in its focus on "mobile", terminal equipment, learning environment, the realization of technology is mobile. Learners are not limited to follow the schedule time to stay the designated classroom with the computer (Boticki, 2015; Yang et al., 2017). Moldovan (2014) and other scholars suggested that the terminal equipment of mobile learning should be portability, wireless and mobility. Smart phones are the most widely used tool for mobile interaction with their vast presence and superior performance. Dye et al. (2001) argue that "mobile learning is a learning that happens at anytime and anywhere with the help of a kind of mobile computing device, which must be able to effectively present learning content and provide a two - way communication between teachers and learners in the process of learning." The New Media Consortium Horizon Report (Johnson et al., 2013) in 2013 predicts that mobile learning will be the mainstream in the near future. It can be seen that mobile learning will become a new trend of conforming to the times. The way of how the mobile interactive teaching and learning model works is showed as follows (see **Figure 2**).

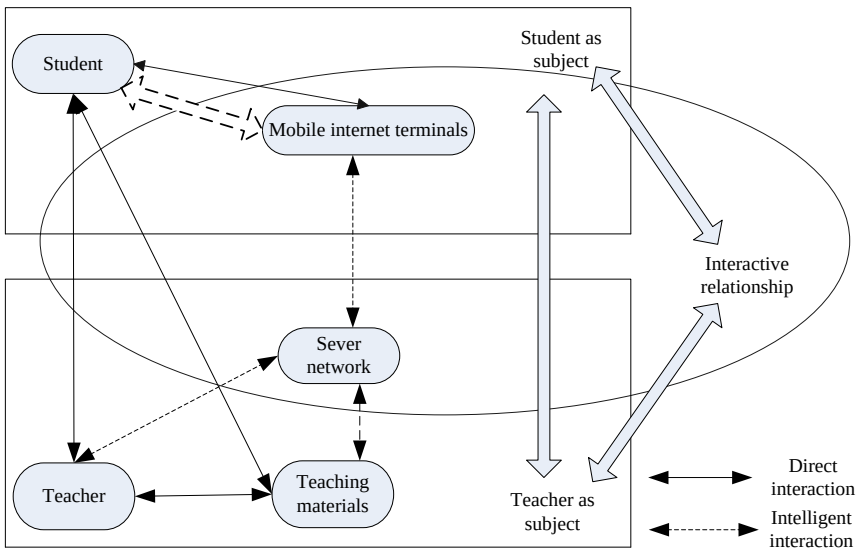

Figure 2. The network structure of mobile interactive teaching and learning

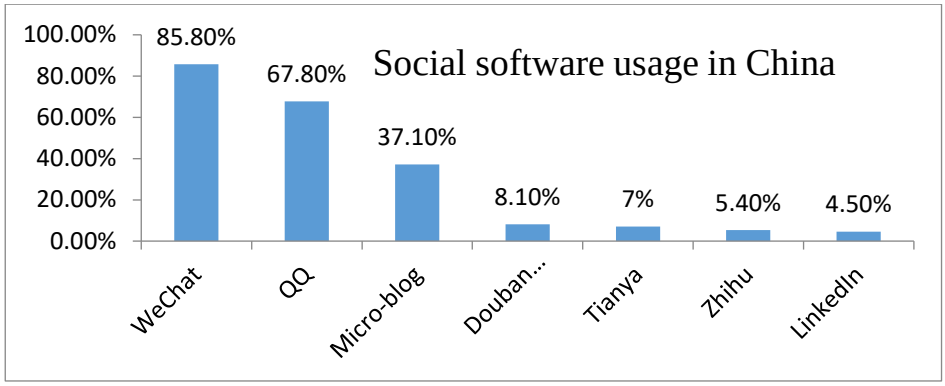

Figure 3. The social software usage in China

Currently, the main M-learning model in China has following types: (1), M-learning through SMS; (2), M-learning through multimedia mail; (3), M-learning through learning software; (4), M-learning through online browsing; (5), M-learning through interactive software. The first four types are less real-time, single-form, and relative expensive. Compared with the first four types, the last type has more advantages, such as powerful interaction, low cost, easy operation and real-time. Thus, the last type is a comparatively ideal for mobile teaching. However, the effect of interactive depends greatly on specific interactive software. In China, the most popular social software are WeChat, QQ and Micro-blog (see **Figure 3**).

In the past decade, the trend of Chinese translation teaching revolution is "student-centered" and "taking advantage of Information network technology". Thus, this study aims to construct a new translation teaching model based on "Internet +" and M-learning.

THE CONSTRUCTION OF MOBILE INTERACTIVE TRANSLATION MODEL BASED ON "INTERNET +"

Theoretical Basis

Constructivism is a branch of cognitive psychology, which was first proposed by the Swiss psychologist Piaget. Constructivism learning theory holds that "collaborative learning" plays a key role in the construction of knowledge meaning. It emphasizes the interaction between students, teachers and students, and the interaction between students and teaching content and teaching media.

Constructivism holds that students are the main body of cognitive activities, not the passive recipients of external stimuli and knowledge (Al-Huneidi, 2012; Luneeva & Zakirova, 2017). The learning and development of learners occur in the interaction with others, and the important role of interaction in foreign language teaching is supported by a lot of empirical researches(Gopnik,2012;Gilakjani,2013).Constructivism emphasizes the design of learning environment that in the process of learning, teachers should provide learners with a variety of resources including various types of teaching media and teaching materials and encourage learners to explore and complete the meaning construction so as to achieve learning goals(Denton,2012; Ertmer,2013). The importance of this interactive teaching concept used in translation teaching, both domestic and foreign scholars have expounded. The importance of interaction for teaching in translation has been paid more and more attention by experts and scholars in translation field. Kiraly (2000) believes that the essence of teaching of translation is interaction, which is a dynamic interactive process to enhance learners' autonomous ability. However, in traditional translation teaching, the interaction between teachers and students is limited by the classroom and limited by the number of teaching hours that the chances of interaction are seriously insufficient. Although the traditional E-education of teaching can extend the teaching mode from the classroom into extra-curricular, due to the dependence on wired network and constraints of computers, the teaching effect is greatly reduced.

Table 1. Main functions of interactive tools

Module	Main functions
(1) Private chat	Chatting one-to-one. It supports voice input, text input, file-sending, Video Call and audio call.
(2) Group chat	Chatting in-group. Other functions are as same as (1).
(3) Moments/Qzone	Sharing related materials and experiment.
(4) Official Accounts	Posting related material on certain subjects regularly.
(5) E-mail	Sending and receiving e-mail which can be one-to-one and one-to-many.
(6) Group-sharing	Used in QQ. Saving files for sharing in group

Main Functions of Interactive Tools

At present, some interactive tools that are widely used for M-learning have some common functions listed as follows (see **Table 1**).

From the main functions of social platform showed above, we can see that interactive M-learning is no longer limited to specific time and space. Students can learn, share and communicate as long as they have mobile phone.

The Construction of Mobile Interactive Translation Teaching Platform Based on "Internet +"

The paper tries to construct an Internet plus mobile interactive translation-teaching platform based on main functions of interactive tools, which forms a new teaching model showed in **Figure 4**. Teacher can design different interactive steps under the guidance of Constructivism Theory.

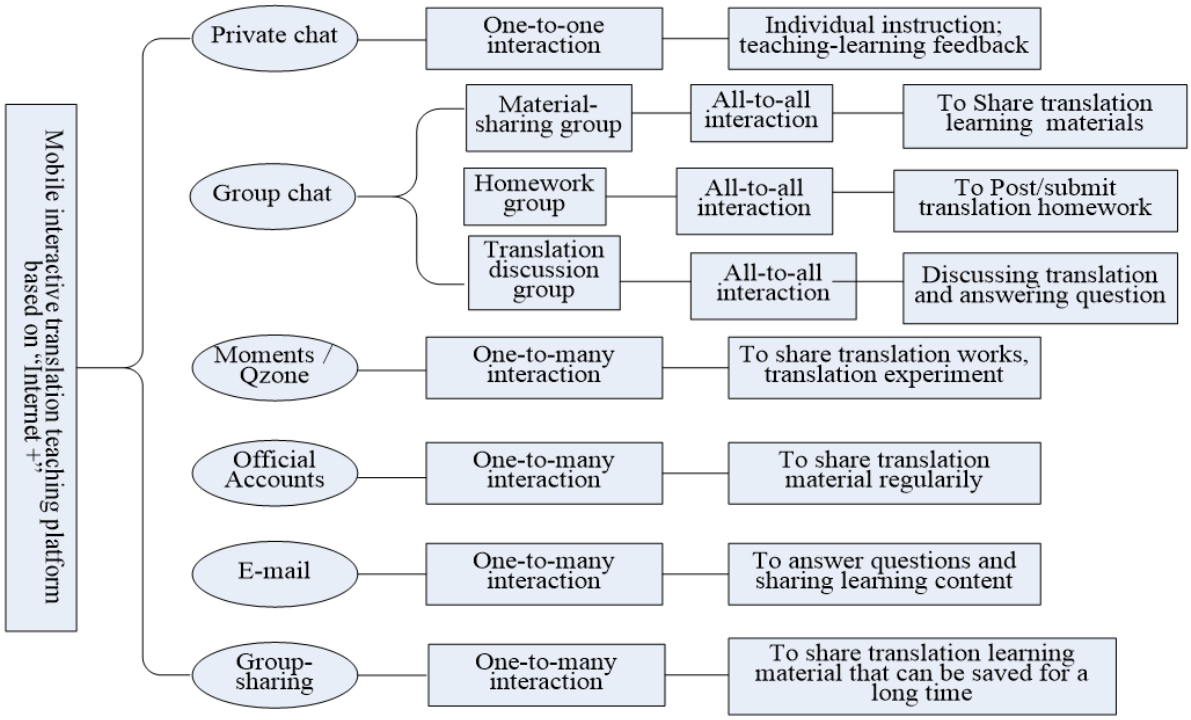

Figure 4. New teaching model based on "Internet+"

The private chat module is one-to-one interaction. Teacher can instruction individually and get teaching-learning feedback. The group chap module is all-to-all interaction. According to the needs of teaching, teacher can build different groups, such as translation material-sharing group, homework group and translation discussion group. Moments (in WeChat)/Qzone (in QQ) module is a one-to-many interaction. Teacher and student can share what they learned, such as translation theories, translation works and translation experience. Official Accounts is mainly used by teacher to share translation materials on different topics regularly. It is also one-to-many interaction. Teacher can use E-mail to share material, answer questions, and collect homework. Compare with private chat, E-mail seems less convenient and less effective in terms of answer students' questions. Group-sharing is mainly used to share files that can be saved for a long time so that students can check the files anytime.

Those functions applied by the platform aim to improve the efficacy of interactive teaching and make translation teaching more convenient. Moore proposed three different interaction types, that is, interaction between teacher and student, interaction between student and student, and interaction between student and learning material (Michael, 1989). The three types of interaction run through the whole model.

EMPIRICAL RESEARCH ON MOBILE INTERACTIVE TRANSLATION TEACHING MODEL BASED ON THE "INTERNET +"

In order to test whether the new mode can promote the interaction in teaching of translation and effectively improve the students' translation ability and can be accepted by the students, we applied the new mode to the translation course, and conducted the applied experimental research for one semester. As WeChat, QQ and Microlog are most frequently used by Chinese, they are taken as typical mobile learning tools here. Through the experimental treatment, excluding the interference of experimental factors, we explore the distinctiveness of the actual effect on experimental factors for the different academic levels of students in aspects such as mathematics achievement and autonomous learning ability.

Experimental Subject

This teaching experiment is based on the third-year students of undergraduate university in five parallel classes who taking the public course of English-Chinese translation taught by me, 160 students as a total to be the object. My school is an ordinary university located in Xi'an with multimedia classrooms and campus network. Among the five classes, Class 1 is the control class and classes from 2 to 5 are the experiment classes, and there are 32 people in each class and the sex ratio is basically the same. And after the initial placement test, there is no significant difference in the overall translation ability of students in each class. For all the junior students who participated in the experiment translation classes, it was their first time to attend translation class and they had never experienced internet-assisted teaching before.

Experiment Preparation

Before the teaching experiment, I created the "translation teaching Micro-blog" and asked the students of the experiment to create their own "translation learning Micro-blog", and I added "translation teaching Micro-blog" being my follower, based on which I created a "translation learning space". At the same time, for different experiment classes, we take different communication tools, such as sharing of WeChat groups and QQ groups, which are mainly managed by the teacher and in the groups, there are sufficient link resources, including the classic translation works study links, English interpreting audio and video links, translation corpus links etc., ensuring that all the information received by different communication tools is the same.

Experiment Parameters

a. Objective Hypothesis: Implementing the teaching based on the autonomous interactive teaching model, aiming to achieve the objectives as follows, 1) to enhance students' autonomous learning ability, 2) to improve the students' translation achievements, 3) to improve students' learning motivation, 4) to promote students' flexibility of the use of learning methods and 5) to ensure the learning hours of each student the courses are the same in this semester.
b. Control Variables: Independent Variable: an interactive teaching model based on autonomous learning; Dependent Variable: primary dependent variable-students' autonomous learning ability and their translation achievements.

To control the interference of the teachers, teaching materials, and other unrelated variables on the experiment to the greatest extent, the task of English translation teaching in the experiment class and the control class is still handled by the teacher, and five classes are required to be consistent with the teaching content, teaching progress and the teaching hours in class, including 16 teaching weeks, and class hours per week are 2 hours. The only difference is that the control class is taught with the traditional teaching mode and Experiment class 2 is taught with the new teaching mode. Class 2 uses Micro-blog as the communication tool, Class 3 uses WeChat as the communication tool, Class 4 uses QQ as the communication tool and Class 5 uses all the three communication tools.

Experiment Process

The experiment began in September 2016, ending in January 2017 for one semester. The teaching content of one semester is divided into 16 units, and each unit is strictly conducted as the above four steps. In order to urge the students to continuously and actively participate in all aspects, the teacher has set strict examination standards. And in order to compare the experiment results, before and after the experiment, the Chinese-English translation ability tests were conducted relatively. In order to ensure the reliability of the test results, both the pretest and the post-test were conducted by the same senior translation teacher who does not participate in the study. The test items were both Chinese-English translation, and the two sets of questions were in the same difficulty. In order to ensure the fairness and reliability of the score, after the examination, the three external translation teachers who do not participate in the study are strictly graded according to the score, and the score is not written directly on the test paper, so as not to cause interference to other raters, and the average score of the three teachers is the final score. The result data is analyzed and processed by the social science statistical software SPSS 16.0 to test whether the new mode can effectively improve the students' translation ability. The interaction between the experiment class on the Internet platform and the interaction between English and Chinese translation class in the first semester of the class is compared vertically, and the interaction between the class and the control class is compared horizontally to know whether the new mode can promote the interaction in teaching of translation.

RESULTS ANALYSIS AND DISCUSSION

Analysis of Results

The teaching experiment of interactive teaching model based on autonomous learning is based on the students' learning model and teacher's teaching model as the independent variable and the students' translation performance as the dependent variable. After the teaching experimental study of one semester, the results of the pre-test and post-test comparison of the experiment class and the control class are as the table below.

From **Table 2**, we can see that the average pre-test scores of the experiment class and the control class are slightly different, but with the independent sample t test, there is no significant difference (value of t is about -0.019, value of p is about 0.98 and more than 0.05), that is to say, the level of Chinese-English translation ability of the students in the first five classes is almost the same. While the average scores of the control class and the experiment class were significantly different, the average grade of the control class improved by about 2.06, while the improved scores of the experiment classes are between 7.93 and 10.96. After the independent sample t test, the results show

Table 2. Comparison pretest and protest average scores between experiment class and control class

Class (number)	Application	Pre-test Average grade	Post-test Average grade	Variation
Control class 1 (N = 32)	Traditional teaching	73.61	75.67	+2.06
Experiment class 2 (N = 32)	Micro-blog	73.52	81.45	+7.93
Experiment class 3 (N = 32)	WeChat	73.64	83.37	+9.73
Experiment class 4 (N = 32)	QQ	73.39	82.60	+9.21
Experiment class 5 (N = 32)	Combination of the three	73.59	84.55	+10.96

that there are significant differences between the two classes. The results show that the Chinese-English translation ability of the experiment classes is significantly higher than that of the control class. In addition, after the pre-test and post-test scores of the students in the experiment classes were tested with paired samples t test, the results showed that the scores of the experiment classes were significantly different, that is, after one semester's teaching experiment, the translation scores of the experiment classes improved significantly. The improvement of teaching with Micro-blog was 7.93, compared with 9.73 and 9.21 of which teaching with WeChat and QQ, improved in small amount, but the increase of the Experiment class 5 used combination tools was 10.96. This shows that the new model is more effective than the traditional model in the cultivation of students' translation ability. And different communication tools can play a complementary role among each other.

Discussion of the Subjects

The new model can effectively promote the interaction of teaching of translation and the traditional translation-teaching mode is more conducive to improve students' translation ability, and can be accepted by the students. The main reasons are as follows.

Firstly, interactive teaching can effectively promote the construction and cultivation of students' translation knowledge. The new model emphasizes the interactions between students and teachers, students and learning resources in teaching of translation, which will penetrate in the whole process of teaching of translation, no matter it is in-class or extracurricular, and it is translation practice, question answering, information resource sharing or translation review, interaction can be carried out at any time. Interaction makes the relationship between teachers and among students become more harmonious, which is conducive to improve the effect of teaching of translation. Secondly, the mobile teaching based on the Internet can really break the restriction of time and space, and realize the ubiquitous teaching of translation. The teaching space extends from the classroom to any place outdoors, the teaching time changes from fixed to anytime and it really gets rid of the shackles of space and time on interaction under the traditional teaching mode. In addition, through the comparison of different communication tools, it is found that QQ which is with group-sharing is better than Micro-blog which is with only one-one and one-more that can be more conducive to teaching interaction. The use of the complementary function between the communication tools can better solve the traditional mode of teaching interaction under the lack of a single problem, the interactive opportunities greatly increased, and the efficiency greatly improved, thus it promotes the development of students' translation ability.

CONCLUSION

The mobile interactive translation teaching based on the mobile Internet can solve effectively such problems as deficiency of interaction that exists in traditional translation-teaching model and limitation of classroom. Teacher and students can use mobile phone or other mobile communication equipment to communicate at any time and any place. The interaction between teacher and students, student and student, students and learning material become more diversified, personalized, flexible and dynamic. Under the guidance of the teacher, students can construct translation knowledge to improve translation ability through communication with others. Meanwhile, it helps to cultivate critical thinking, creative ability, teamwork spirit, and awareness of sharing. The

new model based on internet and mobile learning is complementary to the traditional class and computer and network assisted instruction. It facilitates the effect and efficiency of translation teaching.

Though this new model has great effect, some limitations cannot be ignored. In this research, due to limited conditions, the experimental samples are relative small. Then the experimental subjects major in other disciplines rather than translation. The experimental subjects can be studied in a more full-scale way. Besides, the participation of teacher, including the degree of the participation and the way teacher participate, can influence the effect in a way. Therefore, the study needs further work on it.

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A Study on the Impact of Environmental Education on Individuals' Behaviors Concerning Recycled Water Reuse

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ABSTRACT

In order to verify whether environmental education can play guiding role among the individuals in terms of the reuse of recycled water, and to further confirm its mechanism of action, a structural equation model was established in this study regarding to the influence of knowledge about recycled water on acceptability of recycled water. Besides, a survey was made among 714 individuals. The structural equation model revealed that high levels of knowledge about recycled water stimulate individuals' trust in water authorities, and reduce their perceived risk of recycled water. More specially, knowledge about recycled water was reported to be a significant predictor of individuals' acceptability of recycled water. Individuals' high levels knowledge about recycled water can affect their acceptability of recycled water indirectly through two different ways, while high levels knowledge about recycled water can reduce the individuals' perceived risk of recycled water, so it could increase their acceptability of recycled water indirectly. Another influence path is that high levels knowledge about recycled water could reduce individuals' perceived risk of recycled water by improving their trust in the water authorities, and ultimately improve their acceptability of recycled water. In this paper, it has proved that environmental education has significance guiding effect on individuals in terms of the use of recycled water, and provided a clue as how does environmental education affects individuals' behavior to use recycled water.

Keywords: environmental education, recycled water reuse, structural equation modeling

INTRODUCTION

With the socio-economic development, the growth of population and the improvement of people's demand for quality of life, human activities are sharply deteriorating the consumption of natural resources and environmental pollution (Bogardi 2012, Chen 2017.). Thus, human behaviors have become the most important factor affecting natural environment (Pahl-Wostl 2013). The damage and the impact exceed the earth's ecological carrying capacity, which results in irreversible damage to the ecological environment. At the same time, due to climate change and the sustainable development of human society, this contradiction is getting fiercer so the issue that the deterioration of the ecological environment restricts social and economic development has become a major problem that all mankind must face in the 21st century.

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Contribution of this paper to the literature

- This research has proved that environmental education has significance guiding role on individuals in terms of the use of recycled water.
- This research has provided a clue as how does environmental education affects individuals' behavior to use recycled water.

Environmental education enables people to understand the knowledge of environmental protection and to develop pro-environmental behaviors, which is significant for mitigating the current global environmental problems (Teksoz 2012). The term "environmental education" originates from a meeting held by the International Union for Conservation of Nature in Paris, France, in 1948. During the decades when the concept of environmental education was first introduced, environmental education is generally seen as a synonym for environmental education. Until the 1970s, with the deterioration of environmental pollution problems and human concern for environmental issues, environmental education was formally identified as an independent branch of the discipline. The Stockholm Conference on the Human Environment and the Tbilisi Intergovernmental Conference on Environmental Education, which were held in 1972 and 1977 respectively, culminated international environmental education. People have gradually formed a consensus on the purpose of environmental education, that is, some citizens who understand and care about the ecological environment and its related issues are cultivated so that they have the ability to solve current ecological problems and prevent new ones (Roczen 2016). However, since different specific industries have their own characteristics, what effects environmental education will produce and how it produces these effects are still questions to be studied in these different areas.

Water shortage is undoubtedly one of the common problems faced by mankind in the 21st century. The development of recycled water reuse has become an effective means to deal with this problem because recycled water can be used as a substitute for natural water resources. The production and use of recycled water, however, involves a number of complex links, such as sewage collection, sewage disposal and recycled water transport, which are unfamiliar to the majority of the population. Nonetheless, due to the limited cognition of resources, it is of great difficulty for individuals to fully understand recycled water reuse in most cases. Therefore, it is easy for some folks to be caught in a negative or wrong understanding concerning the perception for recycled water (Chen 2015), or even they preconceive that recycled water is unsafe (Rozin 2015). It is probably the most effective way of overcoming this problem to strengthen the environmental education for residents and to popularize knowledge of recycled water reuse (Liefländer 2015). Therefore, the potential impact of environmental education on residents' behaviors about recycled water reuse is taken as the research object, the effect is verified and the path is explored.

RESEARCH METHODS AND HYPOTHESES

Research Methods

To obtain the data needed, this research takes the authoritative data of the population distribution in the administrative regions of Xi'an in the sixth national census as the basis for the layered random sampling survey. The survey is made in ten distracts and 3 counties in Xi'an. In the early period, the 10 surveyors were trained to know about relevant fundamental knowledge on survey. And from September 16 to October 16, 2016, the survey was conducted in the streets, central squares, shopping malls and parks randomly selected from all the districts and counties. And after, each participant was presented a beautiful gift for souvenir.

This research, based on the authoritative data of the population distribution in the administrative regions of Xi'an in the sixth national census, makes random layered survey in 10 districts and 3 counties. Altogether 714 questionnaires were distributed and 584 valid questionnaires were retrieved, with a validity of 82%. The percentage of questionnaire distribution of different districts roughly equals to that of the population. See specific questionnaire data in **Table 1**.

Table 1. Questionnaire data

District/county	Questionnaire validity	Valid Questionnaires	Invalid questionnaires	The percentage of valid questionnaires	District population (persons)	The percentage of the district population
Yanta District	0.82	86	19	0.15	1178529	0.14
Xincheng District	0.89	64	8	0.11	589739	0.07
Zhouzhi County	0.84	41	8	0.07	562768	0.07
Yanliang District	0.89	24	3	0.04	278604	0.03
Baqiao District	0.88	42	6	0.07	595124	0.07
Chang'an District	0.84	53	10	0.09	1083285	0.13
Weiyang District	0.82	59	13	0.10	806811	0.10
Gaoling District	0.68	17	8	0.03	333477	0.04
Lantian County	0.84	37	7	0.06	514026	0.06
Hu County	0.78	42	12	0.07	556377	0.07
Lintong District	0.85	45	8	0.08	655874	0.08
Lianhu District	0.69	41	18	0.07	698513	0.08
Beilin District	0.77	33	10	0.06	614710	0.07
Total	0.82	584	130	1	8467837	1
		Total questionnaires：714				

Note: The population data is from the sixth national census o State Council census in 2010

Table 2. The basic information of the participants

Variables	Variable description	Total
Age	43 and above	120
	Under 43	454
Gender	Male	127
	Female	447
Educational background	Bachelor degree or above	301
	Others	280

The basic information of the participants is shown in **Table 2**.

The red dot in the map is the survey location of the questionnaire, as shown in **Figure 1**.

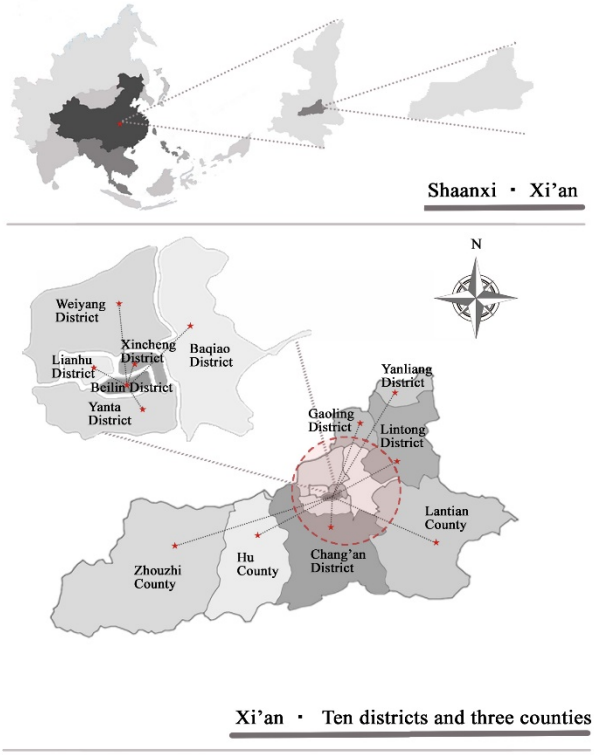

Figure 1. The survey location distribution map

Variables Definition

In the process of questionnaire design, in order to improve the validity and reliability of the questionnaire as much as possible, some classic relevant questionnaires or others successfully applied in related studies were referred and this questionnaire adopted in this study was modified in line with the characteristics of this research field, with The Likert 7 metric for the measurement of variables.

(1) Acceptability (ACC) of Recycled Water. In selecting the measurement indicators of residents' ACC, the classification of urban recycled water is referred and finally five kinds of urban miscellaneous uses of recycled water, such as residential flushing, urban road sprinkling, firefighting, residential community greening, and car washing are selected as the measurement indicator for it is closely related to the urban residents' daily lives and easy to be understood by them.

(2) Perceived Risk of Recycled Water (PR, Perceived Risk of Recycled Water). According to Sara's summary of residents' anxiety type about recycled water reuse, it can be seen that residents' concerns about recycled water reuse are mainly about not only the health risks that recycled water reuse may bring to themselves and their family members but also the impact on the local environment. Thus, this section focuses on investigating residents' risk perception for recycled water reuse from these two aspects (Ross, 2014; Lin, 2017). In order to simplify the calculation of the directness of each potential variable, the data x'= 8-x is adjusted after the risk-perception facet data of recycled water reuse is substituted into the forward data direction of the model, if the original data is x.

(3) Trust in Water Authorities (TIWA, Trust in Water Authorities). The trust in the water authorities represents the trust in water sectors from three aspects, providing residents with reliable renewable water capacity, the original intention, and offering residents' safety information on recycled water

(Jeffrey 2003; Hurlimann 2007). Therefore, this part of the research questionnaire mainly aims to measure residents' trust degree in water authorities from the above three aspects.

(4) Knowledge about Recycled Water（KARW，Knowledge about Recycled Water). This section aims at understanding residents' knowledge about recycled water reuse by measuring residents' knowledge about sources, processes and quality of recycled water (Ross 2014).

Research Hypotheses

A related study in the field of social psychology has found that these factors whether risk is visible, whether participants in risk are voluntary, and whether they are familiar with risk exert significant influences on residents' risk perception (Otway 1982). Residents are likely to fear something less familiar. At present, the recycled water reuse in China is in the early stage of promotion so residents' knowledge of recycled water reuse is very limited and participants are passive or even involuntary. Therefore, residents' knowledge may be an important factor influencing their risk perception at this phase. In addition, among many studies on government trust, the degree of government information disclosure has been taken seriously as another key factor. The consensus is that improving the degree of government information disclosure in operation enables residents to effectively enhance their confidence in the government. As for recycled water reuse industry, the current promotion in China to a large extent depends on government power, and an index, residents' knowledge of recycled water reuse is also dependent on the extent of relevant government information disclosure. Therefore, this index can reflect the water authorities' information disclosure degree in terms of recycled water reuse and residents' knowledge about recycled water reuse will exert a positive impact on their trust degree in water authorities. A large number of related research literature suggest that residents' risk perception degree for recycled water reuse and their trust degree in water authorities are seen as important factors influencing public willingness to accept recycled water reuse (Siegrist 2010). On this basis, the research hypotheses are put forward in this paper.

Hypothesis 1: Residents' knowledge about recycled water reuse will indirectly produce a positive effect on their willingness to receive it by influencing their trust degree in the water authorities.

Hypothesis 2: Residents' knowledge about recycled water reuse will indirectly exert a positive effect on their willingness to receive it via influencing their risk perception for recycled water reuse.

Hypothesis 3: Residents' knowledge about recycled water reuse will indirectly affect their willingness to receive it in an active way by means of influencing their trust degree in the water authorities and their risk perception for recycled water reuse.

DATA ANALYSIS

On the advice of Bentler, in order to ensure the credibility of the structural equation model, the samples should be randomly divided into two parts, one for the development of the model and the other for the repeated validation of the model (Bentler 1980). Therefore, in this part, the 584 samples gotten through stratified random sampling are randomly divided into two samples in each layer to ensure that the samples are randomly equalized in the case of keeping stratification ratio unchanged and meanwhile to avoid regional samples or regional factors' interfering in research results. Finally, 292 samples are used to develop the model, and 292 samples are used for model repeated verification.

According to the proposal of Hair and others, the ratio between the sample and the observed variable should be between 1: 10 and 1: 15, and the number of samples is from 200 to 400 (Hair 1998; Ting, 2017), in the research adopting the structural equation model as the means of analysis. And a total of 4 facets with 14 questions are included in this study, so 292 samples are used for the development model to meet the number of samples in this study.

Table 3. The Reliability and Convergence Validity

Latent variable	Questions	Estimation of parameter significance				Factor loading	Question reliability	Combined reliability	Convergence validity	Cronbach's α
		Unstd	S.E.	t-value	P	Std.	SMC	CR	AVE	α
Acceptability of Recycled Water	ACC1	1.000				.907	.823	.957	.816	.956
	ACC2	1.085	.042	25.745	***	.917	.841			
	ACC3	1.012	.041	24.407	***	.899	.808			
	ACC4	1.010	.041	24.526	***	.900	.810			
	ACC5	.989	.041	23.992	***	.893	.797			
Perceived Risk of Recycled Water	PR1	1.000				.829	.687	.860	.672	.808
	PR2	.987	.071	13.961	***	.795	.632			
	PR3	1.034	.072	14.340	***	.834	.696			
Knowledge About Recycled Water	KARW 1	1.000				.758	.575	.874	.699	.881
	KARW 2	1.210	.083	14.497	***	.874	.764			
	KARW 3	1.216	.084	14.483	***	.870	.757			
Trust in Water Authorities	TIWA 1	1.000				.710	.504	.838	.634	.849
	TIWA 2	1.188	.099	11.980	***	.852	.726			
	TIWA 3	1.112	.093	11.975	***	.819	.671			

Table 4. Discriminate Validity of Policy Mechanism Model about Knowledge Popularization

	AVE	KARW	TIWA	PR	ACC
KARW	.699	.836			
TIWA	.634	.575	.796		
PR	.672	.513	.551	.820	
ACC	.816	.322	.391	.581	.903

Note: The bold number is the square root of the AVE between the corresponding facets, and the remaining values are the Pearson correlation values between the facets.

Reliability and Validity Analysis

To judge whether the reliability of the questionnaire is up to relevant standards, this part first measures Cronbach's α, which represents the reliability, and the results are shown in **Table 3**. All the values of Cronbach's α are beyond the standard of 0.7, demonstrating that the questionnaire is of sound reliability. The most widespread testing items in this field, namely, convergence validity and discrimination validity are adopted. In convergence validity test, Fornell and Larcker's recommendations are followed. Therefore, the standardized factor loading, combined reliability (CR) and average variance extraction (AVE) are noticed (Fornell 1981). The standardized factor loading is greater than 0.6, and non-standardized tests were all significant. CR values are greater than 0.7, in line with the recommended standard of Fornell and Larcker. At the same time, the AVE values are greater than or close to 0.5, also in line with Fornell and Larcker' recommended standard. It can be concluded that the convergence validity of each area is good.

In terms of distinguishing loudness test, according to the proposal of Fornell and Larcker, it is only necessary to determine whether the square root of the AVE value corresponding to the latent variable is greater than its Pearson correlation coefficient with all other latent variables. Therefore, from **Table 4**, it can be seen that the dimensions of the questionnaire have better discriminant validity.

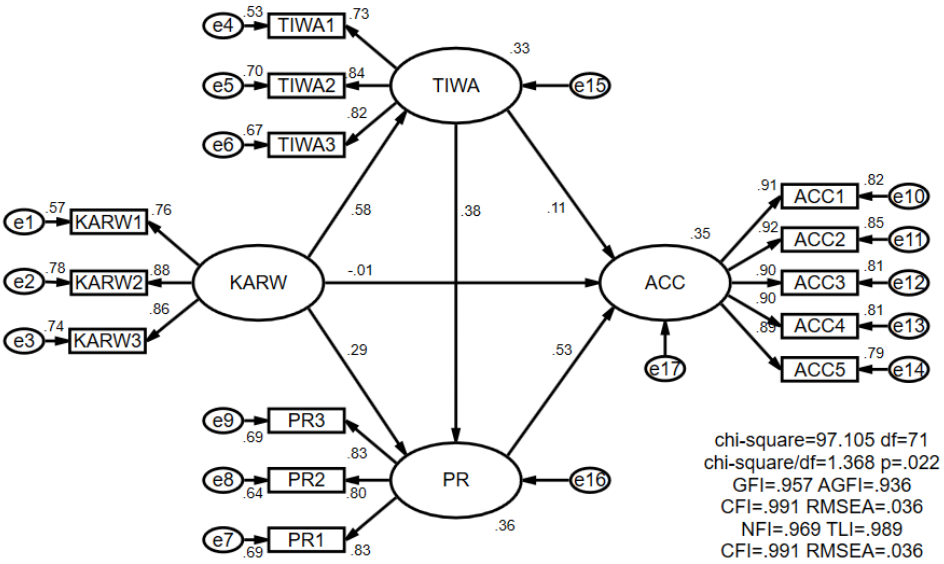

Figure 2. The standard estimation of structural equation model

Table 5. Model Fit

Fitting indexes	Chi-square	Df	Chi-square/df	RMSEA	SRMR	GFI	AGFI	NFI	TLI	CFI
Measured value	97.105	71	1.368	.036	.033	.957	.936	.969	.989	.991

Model Fit Analysis

Model fit

After the verification of the reliability and validity of the data as well as the number of samples, in this section, with the help of AMOS21.0 software, 292 samples randomly distributed are used to develop model (see **Figure 2**). And then the fitting of the model is also tested. At last, another 292 samples are used to retest the developed model.

Fitting indexes are shown in **Table 5**.

According to **Table 5**, the structural equation model has good fitting indexes, indicating that the model and the data fit well.

Cross-validity test

To verify whether the structural equation model has a good cross-validity, the group comparison method is applied in this part to bring the previously randomly distributed group (292 samples) into model and compare it with the present model so as to determine whether the structural equation model has cross-group consistency(Cheung 1999). In the process, Kline's recommendation is followed and the Tight Replication Strategy is adopted to test the group consistency. The various indexes of the model are all consistent with each other, so that the structural model has cross-group consistence between the two groups. That is, the structural equation model passes the cross-validity test, and the settings of the model are correct.

Model Path Coefficient Test

Based on the verification of the structural equation model by fitting degree and cross validity, the path coefficients of the model are reported and the corresponding research hypotheses are tested.

Table 6. Standardized Path Coefficient Test for Structural Equation Model

Path name	Standardized estimated value	Non-standardized estimated value	Standard deviation	t-value	P
PR→ACC	0.528	0.688	0.101	6.831	***
TIWA→PR	0.382	0.431	0.089	4.84	***
TIWA→ACC	0.107	0.157	0.115	1.362	0.173
KARW→PR	0.293	0.242	0.063	3.867	***
KARW→TIWA	0.575	0.422	0.049	8.693	***
KARW→ACC	-0.011	-0.012	0.079	-0.15	0.881

Table 7. The Mediational effect Test for Knowledge about Recycled Water Reuse on Acceptance of Recycled Water Reuse

Indirect Effect	Point Estimate	Product of Coefficients		Bootstrapping			
				BC 95% CI		Percentile 95% CI	
		SE	Z	Lower	Upper	Lower	Upper
Indirect effects							
PR	.167	.053	3.151	.080	.294	.075	.284
TIWA	.066	.059	1.119	-.052	.182	-.052	.182
TIWA &PR	.125	.037	3.378	.068	.221	.063	.209
TOTAL	.358	.069	5.188	.232	.509	.230	.505

Note: BC is short for being Bias-corrected; CI stands for Confidence Interval; PR refers to path KARW →PR→ ACC; TIWA refers to path KARW →TIWA →ACC; TIWA & PR refers to path KARW →TIWA →PR →ACC; samples are obtained after 5000 times by Bootstrap.

From **Table 6**, the path coefficients in the structural equation model are significant except for the TIWA→ACC and KARW→ACC paths. That is, in addition to that the trust degree in the water authorities and knowledge of the recycled water reuse do not sharply affect the acceptance of recycled water, significant influences exist among other dimensions.

Mediational Effect Test for Structural Equation Model

According to the hypothesis, the consequences awareness of water pollution may affect acceptance of recycled water reuse by these three paths, namely: KARW→PR→ACC, KARW →TIWA →ACC and KARW→ TIWA→ PR →ACC. Whether mediational effects exist on the three paths will be tested with the Bootstrap method as follows.

From **Table 7**, the Z values of the paths KARW→ PR→ ACC and KARW→ TIWA→ PR →ACC are both greater than 1.96, which shows that the mediational effect of the two paths is significant with the coefficient product method. At the same time, in the Bootstrap method the minimum and maximum interval of Bias-corrected method and Percentile method does not contain 0. It is known that in the paths of the KARW→ PR→ ACC and KARW →TIWA →PR →ACC mediational effects are significant. Meanwhile, the path KARW→ TIWA →ACC fails in the coefficient product method (Z value is less than 1.96), Bias-corrected method and Percentile method (the minimum and maximum interval contains 0), indicating that the path of the mediational effect does not exist. It can be proved that hypothesis 2 and hypothesis 3 are established, and hypothesis 1 is invalid.

CONCLUSION

Residents' trust degree in water authorities can be improved and their risk perception for recycled water reuse can be reduced through knowledge popularization about recycled water reuse As a result, residents'

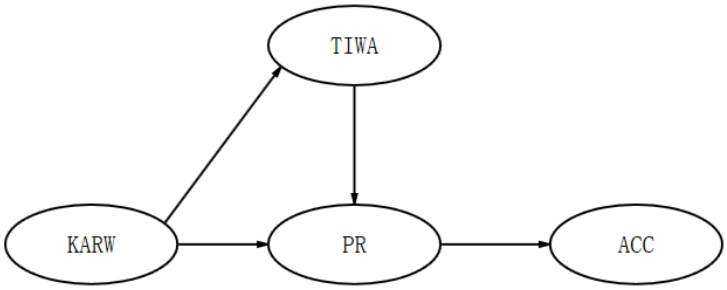

Figure 3. The Effect Path of Environmental Education on Residents' Willingness to Accept Recycled Water Reuse

behaviors about recycled water reuse can be guided. Through the examination of the path coefficient in the model and the mediational effect test, it is found that improving residents' knowledge about recycled water reuse can positively affect their willingness to accept recycled water reuse through these two influence paths. That is, reducing residents' risk perception for recycled water reuse contributes to improving the willingness to accept it; and increasing the trust degree in the water authorities is indirectly beneficial for reducing their risk perception for recycled water reuse and then enhancing their willingness to accept it. Thus the guidance of environmental education on the residents' behaviors concerning recycled water reuse and its acting path are verified, as shown in **Figure 3**.

On the basis of the research, the following specific suggestions are put forward in order to effectively guide residents' participating behaviors in recycled water reuse.

The first point is that environmental education is strengthened and urban residents should be stimulated to protect water environment. It has been verified that environmental motivation is conducive to guiding residents behaviors in regard to recycled water reuse in this paper. The mechanism of environmental motivation is also refined in the fifth chapter, including responsibility attribution for human activities and for water environment pollution, as well as consequences awareness of water environment pollution. In the conclusion part, it is found that residents can be effectively guided to participate in recycled water reuse by means of strengthening environmental education and raising their sense of responsibility and consequences awareness of water shortage and water pollution caused by human activities.

Moreover, relevant knowledge popularization about recycled water reuse is reinforced and public knowledge of recycled water reuse is improved. In this era of information explosion when flow means money, it is not easy to make the message about recycled water reuse to get on the ground floor in the battle for people's cognitive resources. Therefore, the author believes that related knowledge about recycled water reuse should be considered into pre-school education in order to improve residents' related knowledge. Children are supposed to be steered into building up scientific and correct understanding of recycled water reuse through proper education before their prejudices against it are not formed.

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Psychometric Properties of Spence Children's Anxiety Scale (SCAS)

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ABSTRACT

The aim of this study is to explain the validity and reliability of the SCAS translated into Turkish language, as well as testing the validity of the 6-factor model among the Turkish Republic of Northern Cyprus (TRNC) population. The sampling group consists of 461 students studying in the 4th and 5th grade of 11 primary schools selected randomly among 112 primary schools in Northern Cyprus under the Ministry of National Education. 48.80% of these students were female (N = 225) and 51.20% were male (N = 236). The age of the children ranged from 9 to 12 (X = 9.89, S = 0.69). Exploratory factor analysis was used in order to assess the validity produced by the six-factor model. The confirmatory factor analysis results with six-factor model resulted in a good fit to the data. The Cronbach's Alpha value of the scale was .83 and the split half value was .80. The correlation between the social phobia scores, which is a sub-scale of SCAS, and Social Anxiety Scale for Children was studied and it was observed that the correlation coefficient was found as .523 ($p < .001$). The MANOVA revealed a significant multivariate main effect of the gender. These results suggested that girls had significantly higher levels of anxiety, social phobia and physical injury fear symptoms compared to boys. The results obtained in the study have demonstrated that SCAS has strong psychometric properties. The study on the Turkish version of the scale has provided psychometric information about the fact that the scale can be used in our country.

Keywords: anxiety disorders, confirmatory factor analysis, psychometric properties, reliability, validity

INTRODUCTION

Education is regarded as dispensable factor to obtained a better future. Academic failure has been linked to negative substantial outcomes in childhood (Elmelid, Stickley, Lindblad, Schwab-Stone, Henrich & Ruchkin, 2015). Academic performance and motivation in school may be affected by symptoms of anxiety (American Psychiatric Association & DSM-IV Task Force, 2013). According to Malinauskiene, Vosylis and Zakauskiene (2011) anxiety negative related to academic achievement. In this context, understanding the factors of academic perform in school has potentially important implications for the prevention of educational, health and occupational outcomes (Elmelid et al., 2015). Resents years, school-based counselling programs become important in educational system. School-based anxiety programs directly inside the child's environment and trained school staff may play supportive role for children (Manassis, Wilansky-Traynor, Farzan, Kleiman, Parker & Sanford, 2010). Teachers,

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Contribution of this paper to the literature

- The aim of this study is to test the validity and reliability of an anxiety scale that children would fill it. It is observed that the Turkish version of the scale provides strong psychometric properties.
- The anxiety scales used in the Turkish language measure cannot provide any information for the younger age group, however gives a measure for general anxiety. Another contribution of this study is that different types of an anxiety can be measured with this scale.
- It is also determined that there is a significant difference between boys and girls in terms of anxiety types.

counsellors and school psychologists were trained to the programs implement as part of the standard school curriculum. Measurements which can examine the anxiety were needed from researchers and teachers.

In the other hand, psychological problems have been widely investigated within the framework of cross-cultural studies. In this case, common assessment measurements have to been used. Anxiety disorders are accepted by inter-culturally perspective. In the other hand, there are many cultural differences and cultural differences in responses to survey measurements should be paid attention for anxiety disorders (Baxter, Scott, Vos & Whiteford, 2013). Anxiety is related to the academic achievement (Lepp, Barkley & Kaprinski, 2014). Developing countries such as Northern Cyprus, Turkey, Brazil, South Africa and Hong Kong carry out many reforms in order to play a role in the global world (Yüksel, 2014). Educational system is one of the most important factors determining the socio-economic development, so studies on anxiety would be addressed in education and cross-cultural researches in the developing countries.

Anxiety is defined as a tense situation that arises when an event cannot be predicted or it is unsure whether the results will be as desired (Chamsky, 2009). As anxiety is a part of the natural development process, it causes anxiety disorders to be ignored. Researchers often support that anxiety is frequently related to depression, school performance and social life (Gullone, King & Ollendick, 2001). As can be seen together with other disorders, it also generates significant disadvantages in the field of education (Kendall, 2010). In addition, anxiety is associated with other anxiety disorders. Clinical anxiety is often associated with separation anxiety and social phobia (Weems, Silverman & La Grece, 2000). Anxiety disorders observed in childhood and adolescence also increase the risk of the incidence of anxiety in adulthood (Pine, Chone, Gurley, Brook & Ma, 1998). Anxiety disorders are in the first place in Eastern countries as in Western countries (Merikangas, He, Burstein, Swanson, Avenevoli, Cui, Benjet, Georgiades & Swendsen, 2010).

Anxiety is described as an important feeling experienced as a protective and adaptive function in terms of development experienced throughout life. Anxiety disorders have a structure that disturbs the person, affects his life negatively and disrupts the functionality of life (Karakaya & Oztop, 2013). In a study on the prevalence of anxiety, it has been found out that 26.6% of the patients were found to be at risk; 15.8% had specific phobia, 6.6% had post-traumatic stress disorder, and 5.6% had separation anxiety symptoms (Abbo, Kinyanda, Kizza, Levin, Ndyanabangi & Stein, 2013). The solution to this problem, which is common in children and affects many areas of life, started to gain importance. The anxiety symptoms observed in children and adults differ. Somatic complaints in children (excessive sweating, abdominal pain, irregularities in bowel movements, etc.) are observed more often than those in adults (Karakaya & Oztop, 2013). It is also unlikely that children will have this awareness when they accept that obsessions or compulsions are excessive or meaningless in relation to the obsessive-compulsive disorder (OCD) (Koroglu, 2007). Anxiety disorders are known to be a major problem beginning in childhood and continuing in adulthood. For example, the annual prevalence of the social phobia varies between 5% and 10%, and the lifetime prevalence varies between 10% and 15% (Ohayon & Shatzberg, 2010). In a study conducted on school-aged children aged between 4-12 years, it has been reported that 67.4% of these children experienced anxiety. In the same study, it has been found that anxiety prevalence increased in line with age (Muris & Merckelbach, 2000). Conducted studies have shown that anxiety disorders start at an early age and social phobia is the earliest type of anxiety disorder (McEvoy, Grove & Slade, 2011). It has also been found that social anxiety in children is associated with the lack of desire to go to school and the fall in the academic achievement (Stein & Kean, 2000). Having analysed the literature, the significance of measuring anxiety disorders increases. While measurement tools that measure anxiety

are available in research, no scales considering the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria, evaluating anxiety disorders together, and taking into consideration different age groups and gender variables were encountered. In the studies conducted on anxiety disorders, it has been stated that the incidence of anxiety (Gultekin & Dereboy, 2011) and the symptoms change according to gender. Therefore, the validity and reliability of a scale, distinguishing between normal anxiety and anxiety in childhood, susceptible to gender and age, and evaluating many anxiety problems together, suggest that it will fill an important gap in the field. When the research was examined, it has been observed that the scales regarding anxiety, which were translated into Turkish, measure either a certain characteristic of anxiety or have a parental form. It is believed that the case most frequently seen in children and adolescent psychiatric services is anxiety but the self-report scales are limited, which limits the research to be conducted and it is considered that Spence Child Anxiety Scale will contribute to future work. Although State-Trait Anxiety Inventory (STAI) 1-2 is the most commonly used anxiety scale, this scale is designed for adults and developmental differences are not taken into account. In addition, the sub-dimensions of anxiety are not measured.

The Spence Children's Anxiety Scale (SCAS) was developed by Spence (1998) with the aim of assessing different dimensions of anxiety disorders based on the DSM-IV criteria, taking into account the child development. Separate forms are used for 8-11 years-old children and 12-15 years-old children as well as the child and parental forms. The scale is a 4-point Likert type and consists of 44 items and one open-ended question. Panic attack and agora phobia, separation anxiety, fear of physical injury, social phobia, generalized anxiety and obsessive-compulsive disorder are available as sub-dimensions. It has been found out that the scale was translated into various languages and adapted to different cultures (Essau, Muris & Ederer, 2002; Essau, Sakano, Ishikawa & Sasagawa, 2004; Spence, Barrett & Turner, 2003).

The Australian Cronbach's Alpha value of the SCAS-Child Form was found to be 0.92 (Spence, 1998). In a validity and reliability study conducted on 556 primary school students in Germany, it was found that the scale reliability was 0.92 and the two half reliability was 0.90. High internal consistency and validity of the scale were supported by various findings. The reliability of the sub-scales varies between 0.57 and 0.82 (Essa et al., 2002). German child form was conducted on 556 primary school students and the consistency was found as .92 while two half reliability was found to be .90. Internal consistency, test-retest reliability, child-parent relationship, validity, and descriptive qualities were observed to be stronger when SCAS adaptation studies conducted in many different countries were investigated. Whiteside and Brown (2008) indicate that the scale has the character to distinguish between anxious children and non-anxious children. In addition, anxiety is considered to be affected by cultural factors. Erol and Sahin (1995) talk about the widespread fears of death, separation and God in Turkey. In a study looking at the differences in the anxiety scores between China and Germany, it has been stated that Chinese people have significantly higher anxiety scores than Germans (Essau, Leung, Conradt, Cheng & Wong, 2008).

Orbay and Ayvasik (2006) conducted a preliminary study to translate the parental form of the scale into Turkish, but Cyprus has a bicommunal structure, where two different languages (Turkish and Greek) are used. In addition, there are cultural differences between the Turks in Turkey and in Cyprus. Cyprus was found to be the country with the second highest OCD score among the European countries (Essau, Olaya, Pasha, O'Callaghan & Bray, 2011; Essau, Sasagawa, Anastassiou-Hadjicharalambous, Guzmán & Ollendick, 2012).

The factor structure of the SCAS's Brazilian sample for the child form was constructed for both the clinical and the normal group (Desousa Petersen, Behs, Manfro & Koller, 2012), and the factor structure was examined in Iran. Spence et al. (2003) state that the scale was collected under 6 factors. It has been observed that Essau et al. (2011) obtained a 4-factor structure in their study as social phobia is gathered under one factor with general anxiety. In this context, the aim of this study is to explain the validity and reliability of the SCAS translated into the Turkish language, as well as to test the validity of the 6-factor model in the Turkish Republic of Northern Cyprus (TRNC) population. We translated the SCAS into Turkish with the permission of the original author. Through to use of exploratory and confirmatory factor analysis, the factor structure of the scale in the Turkish culture was assessed. Moreover, another aim of the study is to examine the age and gender patterns of the SCAS and its subscales.

METHODOLOGY

Sample

The sample consists of 461 students studying in the 4th and 5th grade of 11 primary schools selected randomly among 112 primary schools in Nicosia, Morphou, Kyrenia, Famagusta and Iskele districts of the Turkish Republic of Northern Cyprus under the Ministry of National Education. The study was conducted on the 4th and 5th grades of the primary schools during the course hours of the students. Inform consent form which explains the background of the study and the contact information of the researcher were used to determine the participants. Volunteer participants filled out the inform consent form. All the data were checked before the statistical procedures were performed, and the analysis was performed with 461 data as no missing data were found. 48.80% of these students were female (N = 225) and 51.20% were male (N = 236). The age of the children ranged from 9 to 12 (X = 9.89, S = 0.69).

Data Collection Tools

Spence Children's Anxiety Scale (SCAS)

The Spence Children's Anxiety Scale (SCAS) was developed by Spence (1998) with the aim of assessing different dimensions of anxiety disorders based on the DSM-IV criteria, taking into account the child development. Separate forms are used for 8-11 years-old children and 12-15 years-old children as well as the child and parental forms. SCAS is a 4-point scale and consists of 44 items and one open-ended question. Panic disorder and agoraphobia, separation anxiety, fear of physical injury, social phobia, generalized anxiety and obsessive-compulsive disorder are available as sub-dimensions. Six questions are positive filler items and planned to prevent orientation towards the anxiety problem ones. This measure rates from 0 (never)-3 (always). The maximum score of 114 represents the highest anxiety scale score. A total SCAS score is obtained by summing scores of the 38 anxiety symptom items. Item 45 contains an open-ended question and an additional four-point Likert scale item has been placed to item 45 (Spence, 1998). It has been found out that the scale was translated into various languages and adapted to different cultures (Essau et al., 2002; Essau et al., 2004; Spence et al., 2003).

Cronbach's alpha value of the original form of the scale is reported to be .92 (Spence, 1998). The value of Cronbach's alpha in the adaptation of the adult form of the scale into Spanish was .89 (Orgiles, Mendez, Spence, Medina & Espada, 2012); the adaptation into Iranian was .92 (Essau, Olaya, Pasha, O'Challaga & Bray, 2012); the adaptation into German was .92 (Essau, Muris & Ederer, 2002); the adaptation into Greek was.90 (Mellon & Moutavelis, 2007); the adaptation into Japanese was .88 (Ishikawa, Oota, & Sakano, 2001) and the adaptation into South African was .92 (Muris, Schmidt, Engelbrecht, & Perold, 2002). The Guttman split-half value was reported to be .90 in the German adaptation study (Essau, Muris & Ederer, 2002).

It has been observed that the effects of the age and gender variables are examined in the studies, in which the psychometric tests related to the scale are made. In the study of Orgiles, Méndez, Spence, Huedo-Medina and Espada (2012), it has been reported that the anxiety scores decreased in line with the age, girls had higher anxiety scores than boys and the relationship between STAI and the total scale score was moderate and significant (r = .41).

State-trait anxiety inventory

The original form was developed by Spielberger (1973) in order to determine the State and Trait Anxiety levels separately. The scale was adapted into Turkish and reliability and validity studies were conducted by Oner and Le Compte. It consists of two separate scales consisting of 40 items. The first scale measures the state anxiety and the second scale measures the trait anxiety. The total score for each scale ranges from 20 to 80. Higher scores indicate higher levels of anxiety and lower scores indicate lower levels of anxiety. The Kuder-Richardson (Alpha) reliability of the scale ranged from .83 to .87, the test-retest reliability ranged from .71 to .86, and the Item Remainder reliability ranged from .34 to .72. Structural or experimental concept validity and criterion validity analyses were conducted and satisfactory results were obtained (Oner & Le Compte 1985)

Table 1. Language equivalence of the Turkish-English form

	N	X	SS	T	df	P
Turkish	50	70.00	11.875	0.821	49	.415
English	50	69.28	12.349			

p>.05

Social anxiety scale for children

It was developed by La Greca, Dandes Wick, Shaw and Stone in 1988. The scale consisting of 10 questions were finalized into the final form of 18 items. The fear of negative evaluation of social anxiety and discomfort in the social environment was evaluated. The scores obtained from the scale ranged from 18 to 90. The adaptation work into Turkish was performed by Demir, Eralp-Demir, Turksoy, Ozmen and Uysal (1998). The internal consistency of the scale was found to be 0.81 according to the Cronbach's Alpha method. Test-retest correlation was found high (r = 0.81). The validity study was conducted on the social phobia patients admitted to the clinic and it was seen that the scales could be distinguished from the normal controls.

Rosenberg self-esteem scale

It was developed by Morris Rosenberg in 1963. The validity and reliability study, especially developed for the adolescent age group, was conducted by Cuhadaroglu in 1985 (validity coefficient was 0.71, reliability coefficient was 0.75). It consists of 11 sub-scales, which are self-esteem, continuity of the concept of self, trust in people, sensitivity to criticism, depressive affect, imagination, threatening interpersonal relationships, level of participation in discussions, psychological isolation, psychosomatic symptoms and parental interest. The self-esteem sub-scale consists of ten items that have a positive and a negative meaning. According to the evaluation system of this sub-scale, 0-1 points are evaluated as high, 2-4 points are evaluated as moderate and 5 and higher points are evaluated as high. Accordingly, the high scores achieved by individuals showed that their self-esteem was low.

Process

The permission for the adaptation of the scale into Turkish was taken. The scale was translated into Turkish by three faculty members at the faculty of the university and by an instructor who taught at the Faculty of English Language Teaching.

An independent evaluation was made by a psychologist, a clinical psychologist and a child and adolescent psychiatrist for the compliance of the Turkish form of the scale. The evaluation of the items in terms of the Turkish language was performed by a scholar from the Turkish Language Department. Five children at different ages were consulted about the clarity of the scale items. In order to look at the conformity of the scale items with their original form, the study was conducted on academicians from different parts of the university, who are native speakers of English, with an interval of three weeks. The academicians were divided into two groups: 25 were firstly given the Turkish form and they were given the English form three weeks later, while the other 25 were firstly given the English form followed by the Turkish form. The relationship between the two scales was found to be .87. The meaning equivalence between English and Turkish forms has been evaluated on the basis of the total scores.

Having the dependent sample t-test results presented in **Table 1** examined, it has been determined that there was no significant difference between the two scales when the mean value of Turkish form (70.00 + 11.875) and the mean value of English form (69.28 + 12.349) were compared (t = 0.821, p> .05).

Following the adaptation of the scale to Turkish, study was conducted on voluntary students at schools during their lessons with the permission of their teachers in accordance with the permission from the Ministry of National Education. In the beginning of the study, the children were given some short information about the scale and then they were asked to fill it in. It was observed that it took 15-20 minutes to fill in.

RESULTS

Factor Analysis

An analysis of the basic components was conducted in order to determine the factor structure of SCAS. The Kaiser Meyer Olkin (KMO) value for assessing the suitability of the sample analysis was determined as .80 (Barlett's; $x^2 = 4.716$, $p<.001$). Accordingly, it was decided that the data were appropriate for the factor analysis. According to the basic component analysis, eleven factors with an eigenvalue greater than 1 were obtained. The eigenvalues of the factors describing 59.45% of the total variance are 5.67, 3.47, 2.47, 1.81, 1.69, 1.61, 1.32, 1.23, 1.18, 1.08 and 1.04, respectively. When the scree plot was examined, it was decided that it was appropriate to examine 6 factors. When varimax rotation was performed, it was found that 6 factors explained the 44.07% of the total variance. The first factor explaining 14.94% of the total variance (Items 36, 34, 21, 37, 32, 30, 13, 28, 39) was called

Table 2. The factor scores of the Turkish version of SCAS by six-factor model

		F1	F2	F3	F4	F5	F6
Item	39	.75					
Item	34	.75					
Item	21	.73					
Item	37	.69					
Item	32	.68					
Item	30	.66					
Item	13	.65					
Item	28	.63					
Item	39	.38				.37	
Item	9		.69				
Item	10		.65				
Item	6		.62				
Item	29		.54				
Item	7		.47				
Item	35		.46				
Item	15			.75			
Item	16			.68			
Item	5			.38			
Item	44			.60			
Item	8		.34	.49			
Item	12		.33	.46			
Item	14				.65		
Item	42				.65		
Item	41				.59		
Item	40				.55		
Item	27				.49		
Item	19				.39		
Item	2					.64	
Item	18					.64	
Item	23					.57	
Item	33					.57	
Item	25					.46	
Item	1						.72
Item	4						.61
Item	24						.54
Item	3						.53
Item	22						.49
Item	20						.37

Extraction Method: Principal Component Analysis

panic disorder-agoraphobia; the second factor explaining 9.15% (Items 9, 10, 6, 29, 7, 35) was called social phobia; the third factor explaining 6.50% (Items 15, 16, 5, 44, 8, 12) was called separation anxiety; the fourth factor explaining 4.77% (Items 14, 42, 41, 40, 27, 19) was called obsessive-compulsive disorder; the fifth factor explaining 4.45% (Items 2, 8, 23, 33, 25) was called general anxiety and the sixth factor (Items 1, 4, 24, 3, 22, 20) explaining 4.26% was called fear of physical injury. **Table 2** presented that items 39, 8 and 12 were related to multiple factors when the basic component analysis results were investigated. In order to determine whether an item had a simple structure, the difference between the highest factor load of that item and its load on other factors was studied and it was found below 0.20 (Nunnally and Bernstein, 1994). In this regard, it has been decided that all items had a simple structure.

Reliability of Scale

The reliability of the scale was tested by both Cronbach's Alpha method and two half-test reliability methods.

Table 3. The reliability values of the items in the Turkish version of SCAS

	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Item 1	.33	.38	.83
Item 2	.27	.37	.83
Item 3	.23	.23	.83
Item 4	.41	.45	.83
Item 5	.32	.43	.83
Item 6	.37	.32	.83
Item 7	.30	.23	.83
Item 8	.38	.41	.83
Item 9	.38	.41	.83
Item 10	.37	.38	.83
Item 12	.34	.40	.83
Item 13	.35	.40	.83
Item 14	.21	.28	.83
Item 15	.32	.52	.83
Item 16	.21	.39	.83
Item 18	.21	.24	.83
Item 19	.25	.22	.83
Item 20	.21	.22	.83
Item 21	.40	.48	.83
Item 22	.45	.36	.83
Item 23	.27	.24	.83
Item 24	.32	.30	.83
Item 25	.23	.24	.83
Item 27	.21	.26	.83
Item 28	.34	.43	.83
Item 29	.40	.38	.83
Item 30	.33	.43	.83
Item 32	.42	.51	.83
Item 33	.27	.30	.83
Item 34	.23	.54	.83
Item 35	.27	.26	.83
Item 36	.42	.55	.83
Item 37	.40	.47	.83
Item 39	.47	.38	.83
Item 40	.21	.28	.83
Item 41	.33	.34	.83
Item 42	.21	.31	.83
Item 44	.39	.39	.83

The Cronbach's Alpha value of the scale was .83 and the split half value was .80. For the reliability of each item, the total item correlation was tested with a square of multiple correlations, and then, the item was subtracted, the reliability was tested by alpha value. Having studied the **Table 3**, it has been seen that total item correlation values of 14th, 16th, 18th, 40th and 42th items were lower than 0.20. When the multiple correlation values of the items and their alpha values measured after the item exits were examined, it was decided that the items should have been included in the scale.

Having analysed the reliability scores of the sub-scales (**Table 4**), the panic disorder-agoraphobia sub-scale was determined to be .85, the social phobia sub-scale was .70, the separation anxiety sub-scale was .72, the obsessive-compulsive disorder sub-scale was .62, the physical injury fear sub-scale was .52 and the general anxiety sub-scale was 63.

Table 4. The correlations among the Turkish version of SCAS and subscale scores

	1	2	3	4	5	6
Total sc.	-					
GA	.63**	-				
PI	.49**	.16**	-			
PA	.63**	.32**	.18**	-		
OCD	.47**	.23**	.15**	.17**	-	
SP	.65**	.32**	.21**	.24**	.23**	-
SA	.60**	.26**	.25**	.14**	.15**	.29**

p***<.001; p**<.01; p*<.05

GA: General Anxiety, **PI**: Physical Injury Fear, **PA**: Panic Disorder and Agoraphobia, **OCD**: Obsessive-Compulsive Disorder, **SP**: Social Phobia, **SA**: Separation anxiety, **Total sc.**: Total scores of SCAS

Validity of Scale

The correlation of the test scores with the results of another scale that measures the characteristic to be measured has been defined as the criterion validity (Tanrıgen, 2009). In this context, the State-Trait Anxiety Scale was used in order to assess the scale validity, the Spence Children's Anxiety Scale was used in order to test the validity of the sub-scales and the Rosenberg Self-Esteem Scale was used in order to collect information on the correlation between anxiety and self-esteem, which was shown to have negative correlation in the research.

The correlation between the social phobia scores, which is a sub-scale of SCAS, and Social Children's Anxiety Scale were studied and it has observed that the correlation coefficient was found as .523 ($p < .001$). It has been determined that there was a slightly low but significant relationship ($r = -.243$, $p < .001$) between the total anxiety score and the Rosenberg self-esteem scale scores. Similarly, having studied the relationship between the total anxiety scores and the state trait anxiety scale scores, it has been noted that there was a moderate and significant relationship ($r = .139$, $p < .001$) between the trait anxiety scale and the Spence Children's Anxiety Scale scores ($r = .404$, $p < .001$).

Confirmatory Factor Analysis (CFI)

The results indicated that the measurement model demonstrated an acceptable fit to the data for the sample (**Table 5**). The chi square of the measurement model was significant ($X^2(203)=438.74$, $p<.001$). According to Steiger (1990), the root mean square error of assessing (RMSEA) of the amount of model misfit and it was found to be .069. The standardized root mean square residual (SRMR) is the average discrepancy between the hypothesized and observed variances and covariance. SRMR was .054 in this model. SRMR values should be .08 or less for a good fitting model (Hu & Bentler, 1999). The results showed that it was a good fitting model. The CFI of .94 was satisfactory. Additionally, the ratio between chi square and degree of freedom was 2.16 in the study. According to Klein (1998), the ratio between chi square and degree of freedom should be 1 and 3 or less than 3 for a good fitting model.

Table 5. Summary of the fit indices from measurement model of the Turkish version of SCAS

	X^2	Df	X^2/df	RMSEA	SRMR	CFI	NNFI	GFI
CFA	458.74	203	2.16	.069	.054	.94	.93	.88

The results supported the measurement model of Turkish version of SCAS with six factors in North Cyprus. The results showed that all the path coefficients were significant and had a good fitting to the data.

Gender and Age Effect

It has been stated that there was a significant difference between girls and boys in terms of the anxiety scores in the original form of the scale and adaptation studies made afterwards (**Table 6**). **Table 6** shows the means and standard deviations of the total SCAS scores and its subscales for the total sample and for gender. The MANOVA revealed a significant multivariate main effect of the gender F(1,459)= 9.903, p<.001. The Wilds' Lamb values were found for the following scales: the total scores of SCAS= .957, separation anxiety= .988, social phobia= .971, obsessive-compulsive disorder= .999, physical injury fear= .896, panic disorder and agoraphobia= .997 and general anxiety= .993. Significant univariate main effects for gender were obtained for the total scores of SCAS F(1,459)= 20.462, p<.001, separation anxiety F(1,459)= 5.718, p<.05, social phobia F(1,459)= 13.887, p<.001, physical injury fear F(1,459)= 53.050, p<.001; no significant gender differences were found for obsessive-compulsive disorder F(1,459)=0.406, p>.05, panic disorder-agoraphobia F(1,459)= 1.389, p>.05 and general anxiety F(1.459)= 3.250, p>.05. These results suggested that girls had significantly higher levels of anxiety, social phobia and physical injury fear symptoms compared to boys. No significant age differences were found for the total scores and its subscales.

Table 6. The multivariate main effect of gender among the Turkish version of SCAS and subscale scores

Variables	Girls		Boys		Total	
	Mean	SD	Mean	SD	Mean	SD
GA	12.89	3.28	12.36	3.17	12.60	3.23
PI	10.66	3.22	8.62	2.80	9.61	3.17
PA	14.65	4.97	14.08	5.51	14.35	5.25
OCD	15.05	3.44	14.83	3.89	14.93	3.67
SP	13.66	3.64	12.36	3.87	12.99	3.81
SA	13.19	3.97	12.28	4.13	12.72	4.07
Total sc.	80.11	13.49	74.52	13.04	77.24	13.54

p^{***}<.001; p^{**}<.01; p^{*}<.05

GA: General Anxiety, **PI**: Physical Injury Fear, **PA**: Panic Disorder and Agoraphobia, **OCD**: Obsessive-Compulsive Disorder, **SP**: Social Phobia, **SA**: Separation anxiety, **Total sc**.: Total scores of SCAS

Having investigated the age variable, it was concluded that the participants, whose age average was X = 9.89, did not make a meaningful difference in terms of the anxiety scores.

DISCUSSION & CONCLUSION

Although the Spence Children's Anxiety Scale, created by Spence (1998) taking into consideration the DSM-IV diagnostic criteria, provided models for the formation of different factor structures, a model consisting of 6 factors was taken into account. It has been reported that the general structure of the scale, which was translated into many different languages and adapted culturally, is composed of 6 factors. It has been stated that separation anxiety and fear of physical injury are combined in a single factor in the Turkish preliminary study of the Parental Form (Orbay & Ayasik, 2006). In the Cypriot sample, it has been seen that the 6-factor structure defined by Spence (1998) is preserved. In the first factor analysis, screen factor was determined by dividing the factor into 11 factors. The factor structures and the distribution of items into factors found in the study are in compliance with the original of the scale. In the German and Japanese adaptations, it has been indicated that 5 factors were obtained and obsessive-compulsive disorder did not distinguish from general anxiety (Essau et al., 2004). In the adaptation made in the Southern Cyprus, 6 factors were reported (Greek). Having evaluated the criterion validity of the scale, it has been found that there was a significant positive correlation between the social phobia scores, which is a sub-scale

of the SCAS, and the Social Anxiety Scale scores for children. It has been observed that similar results were found in the literature (Orgiles et al., 2012). It has been concluded that there was a negative significant correlation with the Rosenberg Self-Esteem scale and a positive significant correlation with the Continuous Anxiety Scale, which were used for the criterion validity.

The reliability of the scale has been evaluated as quite high in many studies. In the adaptation study, the Cronbach's Alpha value was found as .83 and the Split Half value was found as .80. The reliability coefficient was considered to be lower than the original scale. It has been seen that the closest value among the adaptation studies is the score of children of this age in Japan, which is similar to the reliability coefficient of the parental form in Turkey. In the German adaptation, the split half value was reported as .90. Having analysed the reliability scores of the sub-scales, the panic disorder-agoraphobia sub-scale was determined to be .85, the social phobia sub-scale was .70, the separation anxiety sub-scale was .72, the obsessive-compulsive disorder sub-scale was .62, the physical injury fear sub-scale was .52 and the general anxiety sub-scale was. 63. Having analysed the German adaptation, it has been observed that the reliability coefficient of panic disorder-agoraphobia was .82, that of social phobia was .72, that of separation anxiety was .70, that of obsessive compulsive was .71, that of fear of physical injury was.57 and that of general anxiety was .74 (Essau et al., 2002). It has been identified that sub-scale reliability coefficients were of similar quality.

Having the study analysed in terms of the gender difference, this study revealed similar results with the literature. The original form of the scale (Spence, 1998) and subsequent adaptations indicate that girls have higher anxiety scores than boys (Essau et al., 2004). Similarly, in the Greek adaptation study, it has been stated that girls have higher anxiety points than boys (Mellon & Moutavelis, 2007). It has been observed that the Social Anxiety, Social Phobia and Physical Injury Fear scores of girls and boys were found to be significantly different but there was no significant difference in the Obsessive-Compulsive Disorder, Panic Disorder and Agoraphobia and General Anxiety sub-scales. Anxiety types are thought to be influenced by cultural values. When the literature is investigated, it has been observed that similar results were obtained. There are many cultural differences for anxiety disorders (Baxter, Scott, Vos & Whiteford, 2013). In the future researches, it would be better to address the investigation within the framework of cross-cultural studies about children anxiety in developing countries such as Northern Cyprus, Turkey, Brazil, South Africa and Hong Kong.

In the studies conducted with both the child and parental form of the scale, it has been stated that younger children had higher scores than adults (Essau et al., 2004, Nauma et al., 2004). However, no significant difference was found between the groups according to age in this study. This difference can be explained by the fact that the age groups for the study were close to each other.

The results obtained in the study demonstrate that SCAS has strong psychometric properties. The study on the Turkish version of the scale provides psychometric information about the fact that the scale can be used in our country. Due to the fact that the sample is composed of only the normal group, attention should be paid to use it in terms of the informative qualities rather than diagnosing in the clinical use. SCAS is proposed as a scale that can be used in prevalence studies on anxiety disorders, especially for children with anxiety disorders or in studies to be conducted on variables associated with anxiety disorder types. The fact that the scale was formed as a self-report scale taking into account the developmental characteristics of children with DSM-IV criteria broadens the scope of use of the scale. While professionals in the fields of Psychology, Psychiatry, Education and Child Development are encouraged to take advantage of multiple sources of information, the use of an inventory that the child will answer personally has a major appeal. The scale is suitable to be used by researchers and interested people in line with the indicated recommendations.

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Using Information Retrieval to Construct an Intelligent E-book with Keyword Concept Map

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ABSTRACT
More and more people enjoy the brand new experience an e-book brings to them, but the traditional e-book is plenty of room for improvement. One of the reasons is that the book has to be read page by page; thus, it is not easy to grasp the overall structure of such a book. As such, we propose a novel system based on the information retrieval technologies to automatically create the keyword concept map for each section of the book. Moreover, in addition to showing the context where each keyword in the concept map is located, with each keyword in the concept map is associated a hyperlink, to make it easy for a reader to move to the context associated with the keyword. Equipped with the keyword concept map and the hyperlink associated with each keyword, it can be expected that the learning achievement of the reader can be raised. Our experimental results show that the proposed e-book system with the keyword concept map can provide a better learning result than a tradition e-book does in terms of both the scores received after learning and practicing and the results of satisfaction questionnaire on learning, practicing, and system satisfaction.

Keywords: information retrieval, e-book, keyword concept map

INTRODUCTION

The e-book (Woody et al., 2010) typically can be regarded as a product of book after digitization which means that e-book is composed of any kinds of digitized content. A precisely definition (PC magazine encyclopedia) is that a book can be read by the interactive digital devices, such as These devices might be desktop computer, cell phone, tablet. The basic concept of interactive for e-book means that is not only the digital contents for the audience, but also a smart device. From the way to display the images and audios, interactive multimedia, to smart aids, these works usually are impossible missions for paper-book. That is why with the advance of e-book, a digitized book now is become to a variety of multimedia products (Siegenthaler et al., 2010). However, the reading styles and strategies for traditional e-book usually need to read page by page which will make the reader can not easy to grasp the overall structure of such a book. Since the number of words is not too many we can easy to understand the

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Contribution of this paper to the literature

- In this paper, we propose a novel system by using a keyword concept map to provide an integrated viewpoint of book to make the reader understand its overall structure.
- The basic idea of proposed system is to try to let the reader easily understand the important concepts in the book very quickly by using the keywords of contents of the book when the reader reads the book at the first time.
- The proposed system automatically creates the keyword concept map for each section of the book using the frequency of words. With this kind of e-book system at hand, clicking a keyword can help the readers to move the particular page they want. Thus, reader then can easily understand overall structure of the e-book.

meaning of contents when we start with read the e-book from the first half; but most people may not be able to handle the contents of other half if contents of this book is too many (Squire, L. R., 1987). It is because our brain cannot remember everything we see and change the focus to the last part, the reader usually can not easy to comprehend the relationships of different concepts (or contents) of e-book. If the reader can not realize all the relationships of concepts, it will let him/her get some concepts like the fragments after read an e-book. Most of them will probably understand some ideas from this book, but they cannot get a big picture of this book and they also will not able to integrate these concepts. But the good news is that the contents display of e-book is not like the traditional paper-book cannot be changed, it can be added much more interactive functions to solving the problems that we cannot easy to realize all the relationships of concepts for a book.

Because the most important characteristic of e-book is it can provide the interactive using to the reader and book, it can be used to improve the learning performance of reader if concepts from different contents cannot easy be integrated to a simple concept. This paper will present a novel system by using the keyword concept map to provide an integrated viewpoint of book to make the reader can understand its overall structure. The basic idea of proposed system is try to let us can easy to understand the most things of the book very quickly by using the keywords of contents of the book when we read this book at the first time. However, the find out the keywords is difficult work if the reader is the first time to read this book. That is why the proposed system employed the term frequency-inverse document frequency (TF-IDF) (Aizawa, 2003) to calculate the frequency of word in different sections. Based on these information, the proposed then can be dynamic adjust define the frequency threshold of words to determine which words will be extracted. The proposed system then will automatically create the keyword concept map for each section of the book with the frequency of words. With this kind of e-book system at hand, the behavior that click different keyword can help the readers move the particular page they want, thus, reader then can easy to understand overall structure of such a book. The main contribution of the paper is that the proposed system will automatically create keyword concept to enhance the learning performance of reader.

LITERATURE REVIEW

Concept Maps

Since how to enhance the learning performance is a critical problem, several tools and systems have been presented in recent years. Among them, mindtools is a computer application which can be used to show learners are in which kind of situations for learning and thinking to support them organize the knowledge they have and integrate these knowledge with other knowledge (Jonassen et al., 1998; Jonassen, 1999; Jonassen & Carr, 2000). The approaches of mindtools for education typically can be divided into five categories, which are: (1) database mindtools, (2) graph mindtools, (3) concept mapping, (4) search Internet mindtools, and (5) visualization mindtools (Averill et al., 2005). The concept mapping of them is one of well-known approaches because it an effectively knowledge visualization tool to support learner to identify and understand the structure of knowledge while it can also be widely applied to several fields (Cañas, Alberto J., et al., 2005). From the 1980s presented by Novak and Gowin until now, the applications of concept map have undergone several changes and now it is become to one of useful tools for education (Erdogan, 2009). The roles of concept map for education can be the a to organize and construct the knowledge (Erdogan, 2009; Hwang, Shi, & Chu, 2011; Li, Chen, & Yang, 2013), computer assisted

instruction (Price, 2008), directed learning tool (Panjaburee et al., 2010; Chu, Hwang, & Liang, 2014), or a tool to induce the learner study interest and initiative (Hwang, Yang, & Wang, 2013).

Not only the traditional way by using the pen and paper to construct the concept map, but also the modern way by using the computer technologies to develop the digital concept map, much more studies shown that the concept map can be used to enhance the learning performance for the learner (Asan 2007; Hwang et al. 2011, 2013; Yang et al. 2013). For example, Asan attempted applied the concept map to the course of natural science for the 5th grade and the results also shown that the learning performance of learner can be improved significantly when they used the concept map (Asan 2007). Another example is that Yang et al. tried to apply the concept to cell phone by scanning the QR code of paper-book to get the concept to support student to learning (Yang et al. 2013). The final results of the study (Yang et al. 2013) also shown that this idea really can improve the student to reduce the number of content they cannot fully understand on the course. Due to one of characteristics of concept map is that it can be used to show the knowledge in our mind via the image display, compare to one the only simplest text, visualizing concepts is a better way to easy understand the content. That is why most of the logos and trademarks contain the text and images at the same time (Anna, C. 2000 & Asan, A. 2007). Moreover, the concept map can also help us to understand the concepts and relationships from different subjects, catch up the key points quickly, and then understand the most of things of e-book (White and Gunstone, 1992).

From the perspective on the advance of information technologies to see the changes of teaching and learning ways as well as changes the learning tool, the concept map on paper become to the digital concept map is one of representative example. The advantages of digital concept map are the main reason why the several recent studies used the digital concept map to design the relevant experimentations to replace the way to drilled via paperwork. In the study of "The effects of a concept map-based information display in an electronic portfolio system on information processing and retention in a fifth-grade science class covering the Earth's atmosphere.", Kim et al given a discussion about the difference for performance of information processing and retention by using the concept map between traditional folder-based information display and concept map-based information display. Wu et al. (2012) also presented a novel learning strategy which integrated the digital concept map and real-time assessment and feedback to improve the learning performance of students when they are use concept map on paper but the teacher cannot quick evaluate concept maps of students to further providing the applicable feedback to students. Chu et al. (2014) in the study of "A cooperative computerized concept-mapping approach to improving students' learning performance in web-based information-seeking activities" presented another solution to digitize the concept map to further improving the learning performance of student for web-based information-seeking activities.

Based on these perspectives, this study try to add the keyword to each section by the proposed system to support learner can easy to preview, learn, and review and then enhance the learning performance to reduce the number of unknown or unclearly concept of course.

Electronic Book

In the previous stage of e-book development, the most well-known understanding is that display the contents of paper-book by digital formats (Ismail & Zainab, 2005) while it need to be displayed on computer or e-book reader (Rao, 2003). Most of studies were focused on challenges and opportunities (Cox, 2004), discussion on the electronic textbook and paper textbook (Shepperd et al., 2008 & Slater, 2009 & Christianson et al., 2005), and discussion on the paper-book will be disappeared or not (Van der Velde et al., 2009) at that time. Even though the e-book has several useful distinguishing features (e.g., flexibility, reusability, and creativity) to attracted a large number of advocates, however, it still has some studies pointed out that the students would like to learn by textbook (i.e., paper-book) not the e-book (Woody et al., 2010). Another study (Gregory, 2008) also argued that although student will use the e-book, but they are much like to use the traditional textbook to learn the knowledge.

But the advocates of e-book and paper-book now are beginning to see these argues will be endless if we discuss them by using different perspectives. No one can be beat the other one is become to a common consensus

and consequently the research focuses have been shifted from the argues of e-book and paper-book to how to applied the e-book to which field, especially in education and learning. The changes can be easy found in recent studies. The study of Korat and Shamir (2008) presented an idea by using the e-book to support the preschoolers to emergent literacy as well as Yang et al. (2013) attempted use the smart phone to scan the QR code to get the auxiliary materials and concept map to make the user use the smart phone to be the e-book reader to read the relevant information.

In fact, Coyle (2008) has been mentioned that the key point to increase the value of e-book is how to develop the innovative technologies to make the e-book has a variety of learning methods not just only digitizing the text books. This kind of viewpoints has become to a promising research trend gradually in recent studies. Le et al. (2013) presented a visual cue map to solve the reading problem on e-book and the experimental results also shown their solution can be used to solve the problems of e-book on reading, reviewing, and navigational performance. Yi et al. (2014) also presented an integrated solution to combine reading guidance module and annotation map on e-book to discussion the impacts of that kind of systems for college students. Moreover, the research focus of Lim and Hew (2014) is on the feeling of students when they use NG-eBook which has the ability to make the annotation and information sharing. In addition to the innovation, some of studies attempted make the discussion on humanity for e-book, such as the study of "Investigating E-book Reading Patterns: A Human Factors Perspective." was focused on the different cognition styles (e.g., browsing patterns, navigation facilities, and annotation patterns) to observe the learning behavior of human (Hwang et al., 2014).

With the advance of e-book (e.g., increase the value of e-book by innovation or using different analyses for cognition of human to make it more suitable for humanity), one of critical issues is how to improve the learning performance, therefore, the focus of this paper is that attempted presented a novel key concept map method to make the learner can easy and simply to understand the content of e-book within an reasonable time or reduce the learning curve.

Data Mining, Machine Learning and Information Retrieval

The document analysis technologies typically play a key role in finding the important information for the textbook, material, examination paper and even the learning behavior of students on an e-Learning system. The well-known technologies for e-book are data mining (Fayyad et al., 1996), machine learning (Dillenbourg, 1999), and information extraction and information retrieval (Baeze-Yates & Ribeiro-Neto, 1999). More precisely, the data mining and machine learning technologies can be used to find the hidden information from the textbook and learning behavior to provide the teacher additional information can easy to understand how to help the students improve the learning performance as well as can help the students know which part of contents need to review again to fully understand all the concepts of textbook. The information extraction technologies for e-book are usually used to be the data preprocess, such extract the most important contents of textbook and learning behavior of students. Generally speaking, the information extraction plays the role to reduce and filter the number of contents for information retrieval tool to avoid the redundant loading on the system. Since the main work of information retrieval for e-book is that understand the relationship between the contents on different sections or parts, vector space model (VSM) (Baeze-Yates & Ribeiro-Neto, 1999) would be one of important technologies for computing the similarity between contents or concepts. In addition to VSM, the other document similarity method can also be combined with other data mining techniques to give a complete analysis for text-book and e-book.

THE PROPOSED SYSTEM

The Basic Idea

As mentioned in previous, the basic idea of this study is attempt design an intelligent system to build the keyword concept map for e-book. The contents of the e-book will be loaded to our proposed system. By using the preprocessing methods (e.g., remove the irrelevant terms) and TF-IDF, the proposed system can compute the similarities of contents of each section. These information will useful to recognize the structure of the e-book. The

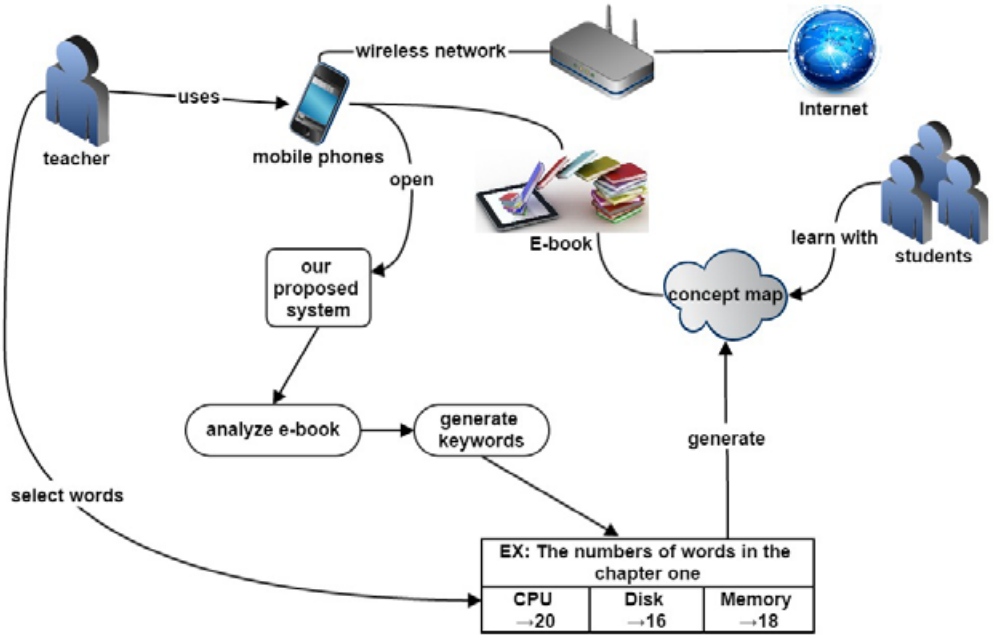

Figure 1. The design of the proposed system

proposed system then can used these similarities and relationships to know which section will relevant to another section. Of course, it can also find out the most important keyword from these sections by using the TF-IDF. With these information (relationship and important keyword) at hand, the proposed system then can construct the keyword concept map like as a knowledge integration map (http://en.wikipedia.org/wiki/Knowledge_integration_map). The reader on our proposed system then can easy to understand which parts are relevant. Thus, the reader will much easy to plan their reading strategy or learning path.

As shown in the **Figure 1**, we develop an Android APP to be the e-book reader which will load the contents of the e-book. Based on relationship and important keyword, the proposed system will able to construct the keyword concept map to improve the learning performance of reader for traditional e-book. After the proposed system (Android APP) find out the keyword from the contents of e-book, it will analyze the keyword frequency for each section and find out applicable keywords by the given threshold from teacher or expert.1 In other words, the high frequency or low frequency keywords must filter out. For example, if we set the range of frequency threshold is 30 to 50, the proposed system will select the keyword on this section which at the least need to be appeared more than 30 times and not to be exceed more than 50 times. The proposed system will use frequency of these keywords to construct the keyword concept map. To make the user can easy to understand this concept map, each node of the concept map will add the keywords to explain the meaning or important concept of this node (e.g., paragraph or section). Moreover, readers can jump to the section they want to go after they click the keyword near the node.

A Simple Example

A simple example is used to explain how to use the proposed system. In this example, the contents of e-book of operating system will be uses to document analysis which contains the preprocessing (i.e., information extraction) and similarity computing (i.e, information retrieval). If we set the frequency threshold between 15 to 25 times, the propose system will construct the concept map by this setting. As shown in **Figure 2**, the keywords are CPU、LRU、FIFO、Memory and Disk, the relationships between keywords and section provide the information to their relevance. For example, if the keywords CPU is appeared in chapter 1.1 twenty times, this information will

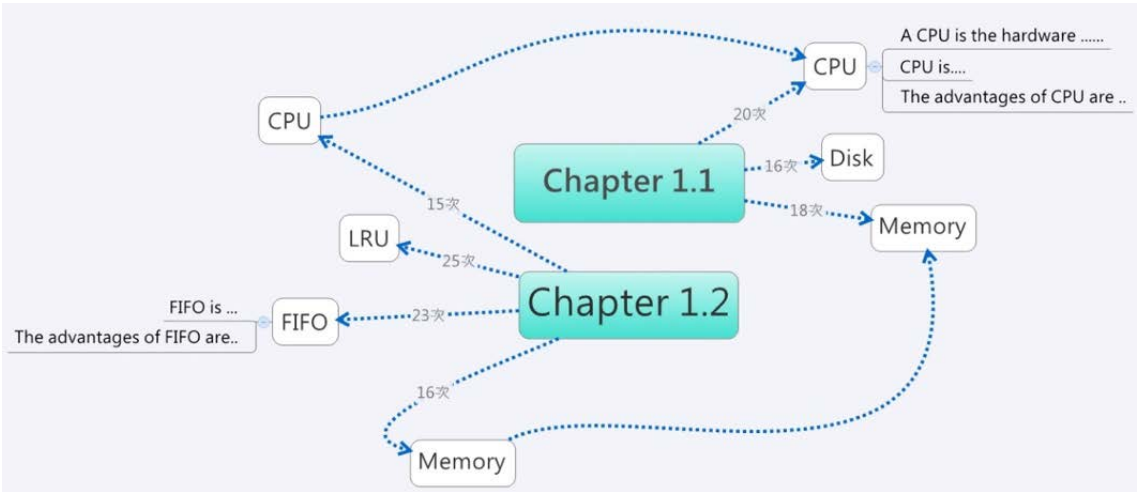

Figure 2. A simple example of the proposed system

be displayed on this connection edge (i.e., relationship). The descriptions will also be displayed near the keyword to explain where the keyword appeared in this section. It can be easy to found that the FIFO has been appeared in chapter 1.2, after click this node, the reader then can move the page of chapter 1.2. As a result, the reader can easy and quickly to find out the contents they need on the e-book and keyword concept map.

EXPERIMENT RESULTS

Participants and Experimental Procedure

The subjects are 61 students from one class of sixth grade students and then we divide them into two groups. All of these students have not been learning these materials before. One group as the students use the e-book with keyword concept map (G1) and the other group as the students use the e-book without the concept map (G2). The G1 group contains 31 students as the experimental group while G2 group contains 30 students as the control group. More precisely, the design of experimental was referred to the book of Campbell et al. [Campbell et al., 1963], the students are divided into control group and experimental group, and then use the pre-test, post-test, and test after review to understand the learning performance of students. As shown in **Figure 3**, it can easy to recognize that seven steps will be used for the experiment in this paper which are: (1) pre-test, (2) introduction to experiment and operator procedures, e.g., questions from students and answers for these questions, (3) use the proposed system to construct the keyword concept map for e-book, (4) all the students, G1 and G2, learning by their e-books, (5) post-test, (6) review after fourteen days, and (7) the survey and test after review.

As shown in **Figure 3**, at the first steps, the students will divided into G1 group as the experimental group and G2 group as the control group, where the students in G1 group will use the e-book with the keyword concept map and the students in G2 group will use the e-book without the keyword concept map. Also, these two groups will conduct test at the same time. At the second step, teacher will guide all the students in this experimental how to operate the e-book they will be used to learning and answer the questions from the students. At the third step, the proposed system will analyze the contents of each section and counts the frequency (i.e., the number of times that each word in this section). The teacher will use this information to dynamic adjust the scope of frequency for sampling and use the keywords provided by the proposed system to selected applicable word to be the keyword. Finally, the proposed system will use these keywords to construct the keyword concept map of each section for e-book. At the fourth step, the students of G1group will use the e-book with keyword concept map to learn the knowledge while the students of G2 group will use another kind of e-books (i.e., traditional e-book) to learn the knowledge. The time for learning is limited to 60 minutes. At the fifth step, the students of these two groups will be tested to evaluate their learning performance. At the sixth step, the students of these two groups have to review

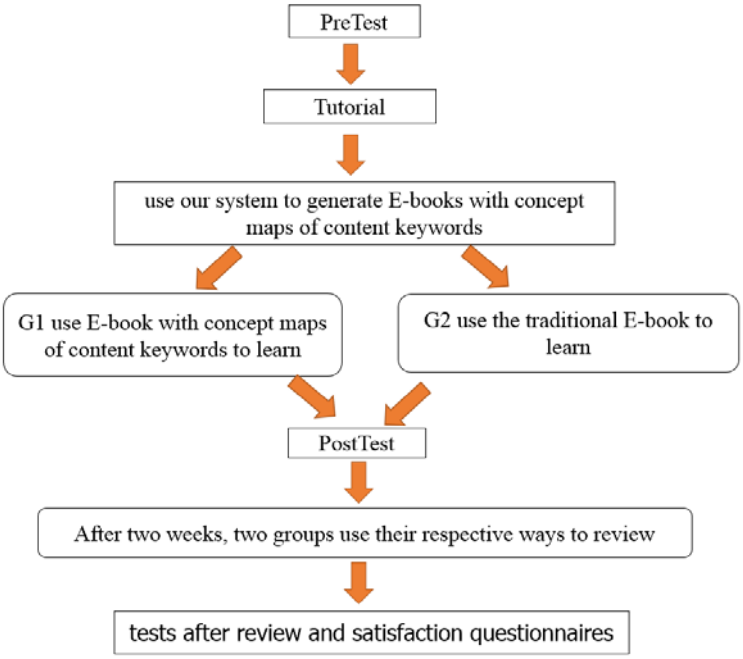

Figure 3. The design of experimental

procedure via the e-book for twenty minutes after fourteen days. At the final step, all the students of these two groups need to be tested after the review procedure, and then we can evaluate the learning performance of them. In addition, all students need to complete a satisfaction questionnaire.

The Tools

Four tools are used in this paper that are: questions for pre-test, questions for G1 and G2 after use the e-book to learn the knowledge, the questions after using the e-book to review, and a satisfaction questionnaire which based on Likert 5 point to design. The exams of pre-test, test after review, and pro-test have twenty-five questions, respectively and the perfect score is one hundred. Moreover, these question is developed by the expert in this field and e-book.

The Satisfaction Questionnaire

The satisfaction questionnaire for concept map of material is attempt to know can the keyword concept map able to support the students handle the content structure when they see the new materials at the first time and also yield twice the result with half the effort for review the materials. That is why we design a satisfaction questionnaire for concept map of material to observe the learning situation of students. This questionnaire contains fourteen items and these items can be divided into two groups: one is availability and the other one is usability which from item 1 to item 11, and item 12 to item 14, respectively. The Likert 5 point is also used to evaluate the result of this questionnaire from 1 (very disagree) to 5 (very disagree). Among them, the items of availability are used to observe the students to understand is it useful for their learning while the items of usability are used to know can the students easy to operate the proposed system.

Rating Items	Strongly Agree	Agree	Normal	Disagree	Strongly Disagree
(1) By using this system, I can have a better understanding of computer science.					
(2) The system can help me to find my learning problems.					
(3) The system can help me to understand knowledge of computer science I learn.					
(4) Through this system, I can think more extensible subjects of computer science.					
(5) Functions provided by the system are favorable for my learning.					
(6) Through feedbacks of the system, I can understand more knowledge about computer science.					
(7) Through feedbacks of the system, I can systematize my learning to knowledge about computer science.					
(8) Through feedbacks of the system, I can focus on my learning					
(9) Feedbacks provided by the system can help me to revise the wrong idea.					
(10) Through feedbacks of the system, I can have a better understanding of concepts I didn't understand completely before.					
(11) Information provided by the system can help me to have a better learning performance.					
(12) I can easily receive information through this system on mobile devices.					
(13) The interface of system can be operated easily.					
(14) I can quickly learn to operate this system.					

Results of Learning Performance

Tables 1 and **2** show the pre-test and post-test results of the experimental control and experimental groups. In the average score of pre-test we can understand the prior knowledge of control group G2 is better than experimental group G1. But the post-test results after the experimental shown a different situation that is the average score of experimental group G1 is better than control group G2. More precisely, the average score of experimental groups G1 is 81.68 which is better than the average score of control group G2 72.93 with p-value 0.027. These results shown that by using the keyword concept map will able to improve the learning performance significantly. In the other side, after fourteen days of the post-test, the students of these two groups will use their e-book to review and complete the test after the review, respectively. The results also shown that the students (G1) used the keyword concept map for the review can get better average score than the student of G2 group who do not use the keyword concept map, i.e., the average scores of G1 is 83.13 and G2 is 75.33 with p-value 0.014. It means that if the e-book provide keyword concept map to support the student to review can significant to enhance the learning performance of students. In summary, the students can get better performance for learning and review when the traditional e-book adopts the keyword concept map.

Table 1. The pre-test results of the experimental control and experimental groups

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Pretest	1	31	66.84	12.461	2.238
	2	30	69.80	6.980	1.274
Posttest	1	31	81.68	10.849	1.948
	2	30	72.93	7.114	1.299
ReviewTest	1	31	83.13	10.874	1.953
	2	30	75.33	7.284	1.330

Table 2. The post-test results of the experimental control and experimental groups

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
PreTest	Equal variances assumed	16.932	.000	-1.140	59	.259	-2.961	2.598	-8.160	2.237
	Equal variances not assumed			-1.150	47.447	.256	-2.961	2.575	-8.141	2.218
PostTest	Equal variances assumed	5.145	.027	3.709	59	.000	8.744	2.357	4.027	13.461
	Equal variances not assumed			3.734	51.971	.000	8.744	2.342	4.045	13.443
ReviewTest	Equal variances assumed	6.430	.014	3.278	59	.002	7.796	2.378	3.038	12.554
	Equal variances not assumed			3.299	52.576	.002	7.796	2.363	3.056	12.536

Table 3. The results of the satisfaction questionnaire

Group		Availability	Usability
1	Mean	4.0155	4.19
	Standard Dev.	0.33916	0.46941
	Variance	0.115	0.220
2	Mean	3.5680	4.0050
	Standard Dev.	0.28445	0.41706
	Variance	0.081	0.174

Results of the Satisfaction Questionnaire

Table 3 shows the results of the satisfaction questionnaire after the experimental that the user experience of all students for the proposed system is positive. First for the availability, it can easy to understand that this study integrated the keyword concept map to traditional e-book can enhance the availability of e-book while can make the user feel the proposed system can improve the learning performance much more than traditional e-book. Thus, the experimental group can get the average score 4.0155 which is better than the average score of control group 3.568.

In the other side for the usability, we recognized that the average score of experimental group G1 4.19 is similar to the average of control group 4.005. It means that the e-book is very mature today, the interface and using of e-book today are much better than early e-books. The e-book nowadays is much friendly than before. As a result,

the difference on usability for the experimental and control groups is not significantly. In summary, the goal of the keyword concept map is used to support the student for traditional e-book on availability. The results also matched the assumption of this study.

CONCLUSIONS AND DISCUSSIONS

This study proposed a way by using keyword concept map to improve the learning performance of traditional e-book. The experimental subject is the students of sixth grade students by using the paper and pen to know the performance of proposed system for learn and review. These result response the Coyle (Coyle, 2008) that the vital value of e-book is depends on how to find out the applications that we have not to pay close attention for them. That is why the relevant issues of e-book still attracted the attention of researcher form different disciplines. It also because that when the traditional paper-book or traditional e-book matured, the innovation idea for e-book still can improve the e-book and become a popular research domain. For these reasons, this study tried to provide a novel system to create the keyword concept map to strengthen the traditional e-book to further making it can easy to understand. The results of learning performance with no doubt shown that not only the learning but also the review can be significant improved by using the proposed system to learn. The findings indicated that the students by using the e-book with keyword concept map as the experimental group can get better average score of test than the students used the traditional e-book without keyword concept which as the control group. Moreover, the results of satisfaction questionnaire also show that the experimental group is better than control group for the availability. An interesting result is that results of usability for these two different groups are very similar. According our observation, it means that because the e-book today is matured, thus, even though the traditional e-book the user experience will not be terrible. It means that only take into account the interface of e-book or using behavior would not get the significant result for user feeling. But if we only consider the result of experimental, the usability of experimental group still better than control group which means that it still has the chance to improve it and match our expected. In the future work, we will try to improve the flexibility of the propose system, i.e., user can choice multiple section to create the concept map not just only can choice one section each time, and try to find or develop better methods to accurate choice the keyword automatically to avoid the loading of teacher to further make the proposed system can create the concept map fully automatically on overall process.

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A Brief View of the Evolution of Technology and Engineering Education

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ABSTRACT
The purpose of this study is to review and investigate the evolutionary course of technological education together with engineering before and after the industrial revolution. A brief history of technology and engineering is provided in this study with regards to Daniel Bell's documents who believed that mankind has so far experienced three technological revolutions. The first one is the invention of heat pumps, the second a result of advancements in chemistry and electricity, and the third revolution, which occurred after world war 2, is when new information technology and communication and thought technology entered the era of post-industrialism. This period was divided into 5 segments including before the industrial revolution, the emergence of the industrial revolution until 1913, from 1913 to the launching of the Sputnik satellite, from 1950-1980, and from 1980 to now. Considering the developments taken place, it can be concluded that educational approaches for engineering have changed following the changes in technological education.

Keywords: history-technological education, engineering education

INTRODUCTION

According to the documents of Baskette and Fantz (2013), Hampshire Technology Education (2012), ITEA/ITEEA (2007), T. Kelley and Kellam (2009), American Society for Engineering Education (2008), Dearing and Daugherty (2004), Cajas (2000), Cheek (1997); Project (1997) with regards to the author, historical periods of technological and engineering education can be divided into 5 periods:

1. Before the industrial revolution
2. Industrial revolution to 1913
3. 1913 to launching of the Sputnik satellite in 1950
4. 1980-recent

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Contribution of this paper to the literature

- The current Engineering Education requires to be updated toward current technology-entrepreneurship-oriented needs.
- In order to improve human capacities including people learning ability and the provision of the required means toward discovering new scientific areas, engineerings are.

HISTORICAL TREND OF TECHNOLOGICAL AND ENGINEERING EDUCATION

Before the Industrial Revolution

Engineering education: historically speaking, the invention of the training system dates back 4000 years before Christ in the lands of Egypt. Even now, Alexandria is considered Egypt's center for engineering, where many aspects of Egyptian technical culture can be seen. When this became the Greek scientists and philosopher's base, this merging lead to a new branch of science called engineering. Archimedes is sometimes called the founder of the science and art of engineering because he was a complete form of science and practice. Heron was the chief and engineer of Alexandria's school of engineers. It's true that throughout history the figure of an engineer was found in individuals such as Heron Alexandria, Archimedes, Artakhaleps, and Imhotep; however, engineering, as a coherent system for human activities, was established in the 19th century. (Hejazi et al., 2011)

Technology education: technology is considered one of mankind's primary activities, which, historically speaking, was performed with a purpose towards advancing and evolving human beings. However, most human beings were forced towards a coalition of common interests in order to satisfy their primary needs and resolve their physical deficiencies. This called for interaction of technical skills through training systems gaining an irrefutable position and for technology education. Scandinavian farmers were in need of a constructive profession to fill out their long winter nights, thus they started working on inlaying furniture and carving tools. This had become a major component of the Sweden and Finnish culture, which became part of the formal system after the industrial revolution and the emergence of machines. Anna Signiss and Oto Salomon from Swedin were the educational leaders of this educational system. In other words, technology education in many countries is the result of arts and crafts and technical skills. Technology education was long considered a component in both public and professional education. In the primary system, it was the master's responsibility to both teach the trainee how to perform the task and how to live a successful life within cultural aspects. With the gradual advancement of formal schools and educational systems, often one professional goal would be combined with academic goals. During early 1700, Bennet Anderson and Postalogy and Herber and Fenelberg Schools were established along with the Scandinavian Movement (Hampshire Technology Education, 2012).

Industrial Revolution – 1913

Engineering education: 19th century and first half of the 20th century - Since engineering is considered a specific and different profession, fundamental programmers for engineering education have focused on preparing students by means of practical training. However, the role of science and mathematical models were rarely accepted and didn't have a chance to improve much (Motoahari Nezhad, 2011). Russian engineers from the Tamperial School of Moscow were the first to replace traditional internship methods with a simple educational programming consisting of easy to hard practical classes separate from workshops. Traditionally, imitation was considered one of the main methods for gaining skills and information for a limited number of individuals all taught by a master. (Hampshire Technology Education, 2012)

Technology education

The need Viktor Dalavus and his coaches felt for an educational program that could shorten the time needed for learning industrial arts in Russia, 1876, led to the launching of an exhibition for industrial arts including products made by students for honoring the hundredth anniversary of the establishment of Philadelphia

Exhibition. This exhibition had great influence on the American Manual Training System. Calvin Woodward from Washington University in St. Louis and John Ranklin from the Massachusetts Institute of Technology determined that engineers from the corresponding institutes lacked educational preparedness, which was a result of lack of experience for working with machines and materials. They announced that most graduates needed to pass a long-term internship course before becoming formally known as engineers. Many ideas and inspirations were given at the industrial arts exhibition in Russia ultimately leading to a relatively novel system for manual training in higher education.

The establishment of St. Louis and Boston School of Arts and Crafts was a result of their endeavors. In 1890, John Raskin and William Morris started the Arts and Crafts movement in response to the anti-humanitarian aspects of the industrial revolution. The Arts and Crafts movement made its way to the United States where Charles Benet had established modern aspects in industry and arts. This included graphical arts such as geometrical shaping and visualization of industrial marketing of wood and metal as well as the arts of clay fabrics, spinning & weaving, wickerwork and binding, cooking, and printing. Benet's philosophy was concerned with preparing students for life. He believed that all learning experiences should be focused on this purpose. (Hampshire Technology Education, 2012)

From 1913 to Launching the First Sputnik Satellite in 1950

Engineering Education: during this period, engineering education entered into scientific and statistical fields in order to improve engineering and industry, which, for example, can be seen in the works of Henry Ford and Dr. Shuart for controlling the Six Sigma process. However, the major leap in quality of engineering occurred after the World War. (Akbarpoor Shirazi, 2005)

Technology education

In 1913, Fredric Bouncer and Louis Mosmen established an individual framework for industrial arts in Columbia University. Their main work was concerned with elementary teachers. They believed that before becoming mature consumers, students had to think productively, which led to a new fundamental definition for educational programs. Industrial arts applied new changes in the form of materials used by humans to satisfy their needs including 7 fields of carpentry, industrial design, metalworking, graphical arts, handicrafts, mechanics, and power (electricity) (Board of Technology Education, New Hampshire Engineering, 2012). In the course of time, changes were made in modern large-scale literacy focusing on cognitive and executive qualification in vocational training for some educational programs. (Ernst & Haynie, 2010)

From 1950 to 1980

Engineering education

The "Engineering Science Approach" starting in Europe was later developed and empowered in the United States after World War II. The main reason that this approach was proposed is that previously, scientists were more prepared in facing new and modern technology than were engineers.

Thus, the scientific and mathematical context of education engineering programs increased, whereas the amount of time spent by students in workshops and for technical and professional engineering activities decreased. (Grimson, 2002) After World War II (1945), General Electric Company realized that it's expenditures during the war had increased; thus, Lawrence Miles, the senior engineer at General Electric Company was sent to investigate this issue. After necessary investigations, he found that during the war, due to pressures and difficulties of war as well as operational and time requirements, some materials and projects had been replaced coincidentally with better performance and lower costs. Considering this, he established the fundamentals and principles of Value Engineering in 1947 taking major steps in decreasing General Electric Company's expenditures and costs.

After Miles had recognized the innovative ways of Value Engineering, in 1950, the U.S Navy considered employing Value Engineering in its contracts for building warships. In 1962, Mack Namara, the former Secretary of Defense of America, gave the order to include Value Engineering in the ministry's activities. Later, in the 1980s, the application of Value Engineering in reducing government expenditures had become quite common throughout America. American Ministries were able to avoid millions of dollars in their costs and expenditures.

In 1969, along with enhancements in Value Engineering in America, the Society of American Value Engineering (SAVE) formally began operating making value engineering known to other countries. Currently, the society has become known on a global level as an international value engineering society (SAVE International) with a purpose to improve and develop value engineering by publishing articles, training evaluators, VE teachers, recruiting real and legal individuals and value engineering societies of other countries, and providing them with academic support.

In spite of the fact that with the help of advanced methods, many countries have been able to optimize their activities, the importance of value engineering in re-optimization is very clear such that it ensures a 20-dollar return on investment for every 1 dollar of investment. It is worth noting that for more than 50 years, value engineering has been employed on global level to promote productivity and reduce worldwide costs, even in Arab countries of the Persian Gulf. However, value engineering was not that common in Iran except for a few recent cases (Saghafi, Ameli, & Mohammadsadeghi, 2004)

Technology Education: coincidently, at the same time that the Sputnik Satellite was launched (1950), the era of technological experiments and modern fields of transportation, plastics, and electronics began expanding (Board of Technology Education, New Hampshire Engineering, 2012). In other words, the latest educational programs come from these practical training methods which first began developing in the 18th and 19th centuries. The John Dewey Experimental School used similar educational activities with a focus on practicality. The three important factors in creating technology educational programs included the "industrial arts" movement in the U.S in 1950; combination of public and professional education in leading programs; and merging industrial and aesthetics components (arts and handicrafts). Two of the most effective projects for stabilizing technology educational programs included the industrial arts program and the Maryland project.

Generally speaking, these cases were based on research and introduced new subjects in the educational program which changed the frequent method of "teaching through practice" and were even applied widely by all schools or states. In addition, both of these projects still effect modern technology education of the 21st century. The industrial arts project was one of the biggest professional education programs funded by the United States departments of Education, Health, and Welfare. The first project officials were Donald G. Lux, Willis A. Ray, and Edward Towers.

This project led to the advancement of two new courses related to industrial arts programs for elementary levels, namely the World of Construction (Lux and Ray, 1970) and World of Manufacturing (Ray and Lux, 1971). Advancements in these courses were mainly inspired by the project leaders. Subjects were theoretically organized on the works of Warner (1948) and Olson (1963) limiting the element's names, different processes, and the curricula to two organizers: Construction and Manufacturing. Back then, this was considered an important step in the curricula.(Ernst & Haynie, 2010) The late Donald Molly, a professor at the Maryland University, was also a great influence on the technology education programs of today. His work reached its peak in the "Maryland Project" (Maryland, 1973). The Percy Jackson industrial arts educational program summit was held for planning a single route for ordering the clear definition of themes, qualifications, and comprehensive results. This summit led to a foundation for "reconstruction of industrial arts as a building block for technological literacy" (Cinder and Hals 1981 quoted from Hejazi (2016).

From 1980 to Recently

Engineering education

Technological advancements of the 21st century including successful containment of nuclear energy and also geo-political realities such as satellites led to mastering engineers in science and mathematics and consistency of engineering education programs with the changed requirements. This structural change continued to a great extent until recent times, although the design context gradually increased. During early 90s, it was found that something more than science is needed, and many engineering colleges emphasized on non-technical skills such as group work and communication. Engineering is in fact somewhere between science and society and is concerned with systematic principles of science and mathematics in order to conclude scientific results for improving real life (Grismon J, 2002).

Therefore, in engineering education, we must emphasize on both science and practice (John V, 2002) so that students majoring in engineering fields could achieve the necessary qualifications for working in the industry and working environments of the 21st century. During the last few decades, engineering education has been criticized in some countries.

In France, during the 90s, industry owners complained about the engineer's practical disabilities while in Britain, these similar complaints were raised a decade earlier. During the 90s, in the United States, members of academic boards of many engineering colleges discussed the best method for engineering education reform for undergraduates. The main discussion of many colleges was about corresponding engineering education with the requirements of the industry. Other colleges were seriously focused on low design skills of engineering students. In all cases, the critics complained about the fact that engineering education has taken some distance from practical orientations, and real requirements have become even more unbalanced (Harwood, 2006; Motahhari, Hossein, & Davami, 2011)

During the 21st century, rapid changes occurred throughout the world, which along with the changes made in engineering education in 1990s, led to the expansion of engineering education. Despite the fact that the new structure was based on high scientific and mathematical preparedness, there will probably be a great emphasis on the professional role of engineers, and then, new qualifications will be mentioned regarding new world order. National investments for producing wealth are increasingly dependent on empowering the "Triangle of Knowledge" comprising of education, research, and innovation (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010; Motahhari, et al., 2011)

This approach is based on training "soft" skills of individuals through practical innovations in engineering education in order to ensure that the first year of undergraduate education becomes an entertaining and fun period, instead of a dull and boring one. This approach provides an overview of engineering education, introduces its supporting skills and creates interesting ways for attracting talent for STEM-based professions. It configures the curricula in way that different fields of learning are ensured. (Apelian, 2013)

It seems that engineering education of today requires a rebirth based on entrepreneurship and technology meeting recent requirements. In addition to technical knowledge, an engineer must be equipped with group, problem solving, and human power promotion skills such as improving learning capability of people and providing necessary tools for researching modern scientific fields. Physical power along with intellectual power are considered by engineers in economics fundamental global knowledge. Motahhari's classification, quoted from Apelian (2013) includes complementary engineering education courses. On the other hand, analysis of engineering education quality made by numerous national institutes and international councils have shown a great increase of changes in engineering education emphasizing the importance of engineering education during the last decades as well as the consistency with the surrounding world. Technology education during this period also faced great changes. It seems that different approaches for technology education and changes in engineering have become synchronized.

Technology education

The 1978 Standards Project was initiated with another major investigation based on determining the state and design for change. After this investigation, a team of professional gathered in order to improve standards related to educational, equivalency, and special needs organization. A collection of workshops were built for obtaining more occupational data including representatives from all 50 states. This project reached its peak in 1981 when it reached a collection of publications such as standards for industrial arts programs, American Society for Industrial Arts Education, Guideline for industrial arts programs, gender equality guideline for industrial arts programs, and the special needs guideline for industrial arts programs. (Reed & LaPorte, 2015)

Amongst other projects is the "human created world" project conducted by Josep Pell et al., in New York State University located in Stoney Brooke. This was the first high risk activity in the 19th century with a goal of merging science with technology (Dennis W Cheek, 1997).

The American Association for Industrial Arts changed its name to the International Technology Education Association in 1984, and guidelines were updated in order to formally include "technology". Traditional programs were taught in "workshops"; however, it did not involve modern computer technology and cognitive concepts of technology and its effects not operating well under standard reviews.

The technology project for all Americans was initiated in 1994 by the International Technology Education Association (ITEA) in order to provide educational program standards for supporting students in a technology research (ITEA, 2008). In 1996, the International Association for Technology Education and Training published a document containing reasons and structures for studying technology later used for standardizing technology literacy in 2000. The evolution of technology education led trainers towards teaching technology in the engineering design process, and engineers were provided with trainings for inventing test models for evaluation and building and were also provided with easy to hard solutions. In this engineering course, the individuals were exposed to different professions (Board of Technology Education, New Hampshire Engineering, 2012).

At the same time, the initial design for the national science education movement resulting from the AAAS movement and the scientific society of academic teachers was mentioned in 1996. Several significant discussions were made regarding how to face technology in the form of the mentioned standards and by considering it as an independent field of science and as an element in teaching sciences and independent technology education. Ultimately, the actual position of technology regarding social concerns of the modern world and sciences were mentioned. (Cheek, 1997)

Central issues regarding the literature of researching the history of technology are resulted from the efforts of individuals working in the field of society and technology published in technology journals. Historically speaking, technology education has accepted numerous options for training learners regarding technology. In the course of history, technology education has focused on educational programs including arts and crafts, handicrafts education, industrial arts, industrial technologies, preparing technology, and projects resulting in solutions, though it is worth noting that focus on skill-based and industrial-based approaches has changed towards design- and problem solving-based approaches. Additionally, the range of technology education expands very widely. For example, it includes construction, communication, transportation, biotechnology, etc. (T. R. Kelley, 2008) Results of a study conducted by Newberry (2000-2001) also indicate a huge movement in the course of introducing technology to educational programs in American schools. National surveys conducted in 1991 also indicated a transitional trend from industrial arts to technology education. Oaks et al. (1991) conducted a national survey in 1991 indicating a transition from industrial arts to technology education. They also performed a national census in Canada.

It is worth noting that during the course of history some have tried to stop the trend of changes in technology such as the 18th century Britain luddites who wanted to stop the significant technological advancements in knitting and leather industry by building knitting machines.

The luddites impact was; however, insignificant, and the knitting machines greatly helped the industrial revolution in England. On the other hand, the kind of thinking that anything can be solved using technology must also be reconsidered (New Jersey Curricula Framework, 1998). A study conducted by Sanders, which compared common technology education programs with the results of studies conducted by Pelley & Schmitt using research tools applied in the studies of Sanders and Dugger, Miller , Bame, Pinder, Gales, Yong, and Dixon, indicated that changes in the thinking process regarding technology education goals have started since 1980. Results of this study indicated high response rates for developing problem solving skills as a major goal in technology education. (Baskette & Fantz, 2013; Sanders, 2009). Amongst global efforts regarding technology education are: revival of technical skills, manufacturing handicrafts, engineering and change, expanding science and technology, modeling, and problem solving. Block provides a summary of recent advancements and approaches in many countries.

In Finland, technical skills are measured apart from their traditional concept, in which students study and use the skills for systems and materials. Visual elements, redesign, and performance in research and program are combined. Many approaches to industrial arts in Sweden involve a combination of manual skills, aesthetic sensibility, and traditional design. In Eastern Europe, technical productions are applied with an emphasis on skills along with concurrent machine production, its control, and organization. The global engineering internship method prepares technicians and engineers through a complex educational system. A complex method which complements modern technologies focused on information technology and is applied in France. Denmark and other countries are dependent on the science and techniques of technology, highlighting a close correlation between different regions. In Britain, the main emphasis is on design as an essential concept of technology research and application. The increasing impact of designed-based approaches in Britain has greatly helped in balancing the pressures of engineering for educational programs. Problem solving approaches in the United States defines and answers questions regarding social requirements and makes use of a mutual order approach. Social and technical approaches employ students to study technological innovations along with social changes. Engineering clusters, design, research, and advancements were clearly organized in previous educational programs. (Reed, 2010)After educational reforms, the importance of understanding technology and technical skills identified as an important goal for all students.

Important examples include the scientific project, project 2061, American Association for the Advancement of Science (AAAS) (1993) and standard of Technology Literacy, International Technology Education Association (ITEA) (2000), United Nations Educational, Scientific, and Cultural Organization (UNESCO). (Cajas, 2000)

After industrial educations were driven towards technology education and technology education approaches changed from skill-based approaches to problem-solving approaches, since 2000, when ITEA published its Technology Literacy standards, engineering concepts found their way into technology education programs and different fields were created including the ProBase project, principles of engineering, engineering design, and addressing technological literacy standards.(Daugherty, 2005; Denson, Kelley, & Wicklein, 2009; Lewis, 2006)

Later, the National Center for Engineering and Technology Education made an emphasis on the importance of studying the current state of technology education. The center also stated in its report (2006) that the best way for technology to make its way into technical and engineering classes is to make production its main goal.(Householder & Hailey, 2012; Seymour, 2002)

After historical changes in the concept of technology, technology-related processes were transformed into elements for technology education programs or technology literacy. Engineering is related to the concepts taught in technology education. Many educated people talk about the need for practice in educational programs and the importance of renaming professions as well as the fact that technology education leans towards a deeper reflection of processes and the concept of engineering.(Ritz, 2011)

At the same time, different types of curricula were developed with a combination of technology and engineering, including the following programs.

Smith College curriculum in engineering education:

In Smith College, engineering has been defined as a liberal and professional art at the service of humankind. According to this definition the engineering education curriculum focuses on three aspects of knowledge unity, technological literacy, and entrepreneurship fostering.(Rose, Shumway, Carter, & Brown, 2015) This college supports research and activities that develop an exciting and learner-centered curriculum and challenge the students, develop a combinative curriculum that encourages mastering over engineering foundations in a social and human context, encourage social responsibility and sustainability-based thinking, and support and develop the language of technology. (Nejad, 2015)

Binaural approach to the design of technology education curriculum:

Keirl (2015) emphasizes combining different cases in technology education, such as human and technology, natural and artificial, and visible and invisible, in order to extract basic concepts in technology education curriculum. One of the binaries in the studies of Keirl is whether the universities and technology education seek to make changes or maintain the status quo and whether technology education is just about using tools and technical skills or technological behaviors (Keirl, 2015).

Apelian and Tryggvason model in the curriculum of engineering schools:

The curriculum of engineering schools also underwent changes to emphasize the creative nature of engineering. This model shows the dimensions of the four broad areas including humanities, arts, science, and engineering. Humanities is described through culture (such as literature, art, and history), art activists deal with culture-building, science involves the study of the physical world, and engineering is to make thing in this physical world. This curriculum has been developed to promote technology and information literacy and also critical thinking, problem solving, and decision-making skills required for economic competition in this ever-changing world. (Behzadi, Razavi, & Hosseini, 2015)This curriculum, which requires strengthening the multidisciplinary understanding of scientific and practical knowledge and skills, increases the conceptual understanding of students and procedural knowledge skills and helps to solve social problems using technology. In this approach, students actively participate in the learning process and learn how to efficiently take part in getting access to discoveries and combining the information in the future.(Sharkawy, Barlex, Welch, McDuff, & Craig, 2009 quoted from Petroski, H,2015)

Massachusetts Science andTechnology/Engineering Curriculum Framework:

All students must have an appreciation for the wonder of science, possess sufficient knowledge of science and engineering to engage in public discussions on related issues, and be careful consumers of scientific and technological information and products in their everyday lives. Students' STE experience should encourage and facilitate engagement in STE to prepare them for the reality that most careers require some scientific or technical preparation, and to increase their interest in and consideration of careers in science, technology, engineering, and mathematics (STEM). All students, regardless of their future education plan and career path, must have an engaging, relevant, rigorous, and coherent pre-K–12 STE education to be prepared for citizenship, continuing education, and careers. (Mitchell D. Chester) afterwards Philip Reed and James LaPorte (2015) state that an interesting approach for many in the process of technology education is three-dimensional development of activities for students. There are many examples for this approach such as design-construction-assessment (according to Australian Education Committee, 1994) and determination-design-construction-assessment and stating the problem-hypothesis-model-test (in the US, according to the International Technology Education Association, 1998). Problems of unlimited design have been improved through repeated challenges in the technology curriculum. In this method, students use the divergent thinking practices to identify the classification of potential results and then choose one of them for investigation and subsequent developments. However, challenges of unlimited design do not thoroughly reflect the expected nature of design. (Reed & LaPorte, 2015)

CDIO approach:

The authors write primarily to engineering educators, administrators, and curriculum developers to discuss the Conceive-Design-Implement-Operate (CDIO) approach as it has now been implemented in classrooms across the globe. In looking at the gap between engineering education expectations and form, Crawley et al. (2014) "identified an underlying critical need—to educate students who are able to Conceive-Design-Implement-Operate complex, value added engineering products, processes and systems in a modern, team-based environment" (p. 1). Their message seems to be aimed at a wider audience that includes all engineering and technology educators. "It is not a matter of fixing something that is broken, but of improving something that is vital to our future, namely technological education" (p. 183). Education that is focused on preparing students with elements of practical knowledge must employ applied instruction. This theme is consistent throughout the text and the authors provide valuable insight on how to bring the applied element to classroom instruction. Crawley et al. (2014) make the case for their method by describing the role of engineers as conceiving devices and systems, designing "products, processes and systems that incorporate technology," (Chuchalin, Malmqvist, & Tayurskaya, 2016)

The most important question here is whether the approach of engineering science alone can respond to the challenges of engineering education in the 21st century. Just as engineering education was previously changed to comply with social needs, this evolution and change is also necessary to represent the requirements of the 21st century. Social challenges of the 21st century are quite vast and deep. Essential needs like energy, food and water, housing, transportation, and health are even more critical considering the world population is exceeding 9 billion. The demand for stable improvement requires leadership, innovative engineering talent, and a new definition. Along these changes and challenges, engineering education has performed major changes with an impact as high as the invention of engineering in the 19th century and establishing scientific knowledge as the principle of engineering in the mid-20th century. These changes are formed with the appearance of global entrepreneurship, competition, and continuous economies, in which successful engineers are more than ever in need of technical skills different from what was previously considered beneficial. This period is considered a renaissance and evolution of engineering education. (NAE, 2013)

Education that is focused on preparing students with elements of practical knowledge must employ applied instruction. This theme is consistent throughout the text and the authors provide valuable insight on how to bring the applied element to classroom instruction. (Motahhari Nejad, 2015)

Many organizations comprising of universities and international experts have pursued standardization of the engineering curricula including the CDIO engineering education, American Accreditation Board of Engineering and Technology (ABET), European Network for Accreditation of Engineering Education (ENAEE), Engineers Australia, and Institute of Engineering Education Taiwan (IEET).

CONCLUSION

Results show that meaning of Engineering and Technology has undergone change over the course of history. In the first period of teaching engineering and technology, much attention was paid to apprenticeship. However, after the advent of the industrial revolution, engineering became a different career, the role of science and modeling increased in it, and diverse fields of engineering emerged. Therefore, in addition to practical measures, engineering with a problem-solving approach entered the cultural and educational fields in countries; for instance, universities trained primary teachers with a production approach. In the following years, engineering education sought reduction of costs in societies and new technologies in this field could pave the way for those activities, which were gradually directed toward technological knowledge. The difference was that in the first historical period, technological approach was flexible to apprenticeship and practical work. However, technology has a different meaning today. It makes an effort to solve problems, create science, remove needs, and reduce needs. Soft skills like teamwork and management are on the agenda of future engineers. In sum, having examined the history of technology and engineering education, we conclude that engineering has always been affected by technology. In addition, the meaning of technology has undergone significant changes. These changes have altered

engineering approach in different periods. However, technology is not specific to engineering fields; rather, it encompasses all human fields. Example, history Architectural schools in Iran after passing two courses; one convergent Bowhos) and the other divergent period (postmodernism and pluralism) are now suspended to And the release of this situation requires an overhaul of the previous methods and adopting new approaches to Pay attention to the requirements of the present age. The weakness of educational systems is often the pre-university education. It turns out that instead of the amazing use of the power of mind to store information in an unbelievable way Calling. This undesirable condition of our educational system is inevitable. It is on the road of creativity and utilization of the potential capabilities of the human brain, and as this ability for individuals is prone to being taught; consequently, the importance of creative thinking in learning becomes evident. (Akbari, Selebenei, Hoshmandzadeh, & Tahmasebi, 2017)

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Different organizations such as universities and experts pursued the standardization of engineering educational program including CDIO engineering education, Accreditation Board of Engineering and Technology (ABET), European Network for Accreditation of Engineering Education (ENAEE), Engineers Australia, Institute of Engineering Education Taiwan (IEET).

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Ability Training in Educational Model of Feasibility Study Studio

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ABSTRACT

This paper proposed a training system in the educational model of feasibility study studio considering feedback mechanism based on the learning process and knowledge bank. System dynamic theory was used to analyze information feedback between undergraduates and teachers as well as among undergraduates. Positive feedback stimulates and negative feedback inhibits practical ability improvement in the studio educational model. An initial function with dynamic features was established according to the feedback mechanism, the function's differential equation was solved to get the general solution. An "S" curve demonstrates the trend of practical ability training performance in educational model of feasibility study studio. The formation process of the "S" curve was explained. At last, some methods running the studio were proposed to elongate positive feedback and improve practical ability training performance in the educational model. This paper established the ability training pattern educational model of feasibility study studio and realized the integration of modules and platforms with theoretical knowledge as the inputs and practical abilities as the outputs.

Keywords: the educational model of feasibility study studio (EMFSS), ability training system, positive feedback, negative feedback, module, platform

INTRODUCTION

The practice teaching in university education gradually grows out of symbolic participation towards full participation. The educational model of studio changes the traditional method into a practice teaching mode, which is from teachers being the main component, teaching content being the core and practice activities being the carriers to undergraduates being the main component, materialization of knowledge and skills being the core content and studios being the carriers (Rodriguez et al., 2016). With undergraduates being the main component, building a platform for smart communication is a must (Rodriguez et al., 2016; O'Dwyer and Childs, 2017). With materialization of knowledge and skills being the core content, building a comprehensive studio knowledge bank is a must. With studios being the carriers, a feedback mechanism on the knowledge and information in studio training system is needed so that the undergraduates' learning processes are macro controllable and micro adjustable (Alizadeh et al., 2017; Tsai, 2017). The feedback mechanism share, integrate and correct the knowledge and information in studio. The educational model of studio is the incubator for practical ability of undergraduates (Fasli and Hassanpour, 2017). Undergraduates graduated from this studio should be equipped with good communication skills, team cooperation skills, solid basic theories, strong technical application abilities, broad

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Contribution of this paper to the literature

- This paper builds the guarantee system for the ability training of studio, which has surpassed the situation that much existing literature mainly discusses the process of capability improvement.
- Taking feedback mechanism as the core, this paper analyzes the mechanism of improving the competence in studio education model.

knowledge and good all-around knowledge ability to meet the market requirements. Therefore, appointing individuals to accomplish studio tasks within a group-based framework creates a combination of strategies that can achieve both individual-based and group-based objectives (Soliman AM, 2017).

The engineering education is changing towards educating critical thinkers who are equipped with risk-taking abilities (Fasli and Hassanpour, 2017; Lin et al., 2017; Hsiao, 2017). The ability of feasibility study is an important skill to be mastered for engineering undergraduates. These skills will be developed in educational model of feasibility study studio (EMFSS). The undergraduates learn to compile feasibility reports and obtain investing & finance skills. EMFSS transfers tasks of solving problem to undergraduates. The team members of studio discuss how to obtain information, how to assemble content and how to use technique (Greer K, 2016). The discussion is supported by a discussion platform based on relevant knowledge bank. EMFSS training system is made up of feasibility study communication platform and knowledge bank, which provides the workplace for the feedback mechanism. The system solves the connection problem between knowledge and skill during studio practice teaching, pushes innovation in practice teaching, and enables seamless connection between university teaching and market requirements. (Liao XM, 2017; Huang et al.,2016).

BUILD THE EMFSS TRAINING SYSTEM

Implementation Process of EMFSS

In EMFSS, the fact that undergraduates are encouraged to take their own value positions and to incorporate them in a feasibility study report to reflect this, meant that they rehearsed the abstraction and reinsertion of values into their own works of the specific project site and context. This introduces skills applicable in any site or social context, so that the disciplined expression of meaning, which is what value is, may be a feasibility study technique potentially applicable anywhere in the world. (Chiaradia et al., 2017)

EMFSS trains undergraduate calculation and analysis abilities on various parameters of the feasibility study. It also trains assessment ability and decision ability on a project as a whole and overall. The training process takes into account economic, social, natural and policy factors, which enable members to judge project feasibility from a long-term and objective perspective. Table 1 shows training process, illustrates the task and the task sequences in EMFSS.

Training System of EMFSS

The training system of EMFSS includes three platforms and three modules, as shown in Figure 1. The three platforms are knowledge bank platform to realize abilities in EMFSS, cases sharing platform for ability realization of EMFSS, and communication platform for problems during feasibility report making. Three platforms serve feedback site, feedback opportunity and feedback medium in the studio while three modules serve feedback purpose. The three modules of feasibility study include ability module, tasks module and business module. The training system of EMFSS shows the logical relationship between knowledge, ability, tasks and business from shallow to deep, from simple to complex, from low level to high level, from left to the right and from bottom to top. Every stage and every step in Table 1 can correspond to a node in Figure 1. Knowledge and skills can accumulate through node modules and platform, and expand to a higher level. (Wang et al.,2016; Yan et al.,2016)

ESTABLISH THE FEEDBACK MECHANISM FOR TRAINING SYSTEM OF EMFSS

The training system of EMFSS is composed of two components, namely the teachers and undergraduates, upon which either positive or negative feedback will emerge based on the interplay and influence each other. The studio education needs to create feedback platforms, it highlight the need to create opportunities for undergraduates to engage with project stakeholders, engage in dialogue with project demanders and appreciate the value of local knowledge and input in project report. The feedback platforms encourage undergraduates to explore creative problem-solving in practice through design proposals based on negotiation, resource allocation, hybridity, unconventional configurations and attention to small, often ignored, spaces. (Loukaitou-Sideris and Vinit Mukhija, 2016).

Peer Feedback and Teacher Feedback

Peer feedback based on the three platforms are carried out in team and inter-team to discuss on knowledge points in different banks, case details, and difficulties in making feasibility reports. Team members learn synchronously, they can learn from peers by avoiding others' mistakes, so peer feedback can improve undergraduates' ability to implement the knowledge. Repetitive peer feedback can also stimulate more feedback response of peer. This communication feedback process can motivate undergraduates to use textbook knowledge as flexible as possible and strengthen their practice abilities of the feasibility study, this effect rather than passively receiving teacher instructions. Peer feedback provides members with real clients, readers and judges, which increase undergraduates' awareness to check clients' needs and requirements during report making and helps them to develop from "do it to fulfil teachers' requirements" to "do it to fulfil clients' feasibility study needs." Establishing this counseling awareness can help undergraduates to seriously consider clients' theoretical and real needs, to stand in clients' shoes and build a rigorous analysis attitude which combines qualitative and quantitative analysis, make correct project decisions. As a kind of cooperation between undergraduates, peer feedback motivates undergraduates to make the feasibility study report through discussion and negotiation. It sharpens undergraduates' oral and written communication, writing, critical thinking and self-learning skills (Kilinc et al., 2017; Wu, 2012).

Teacher feedback bases also on three platforms. Such feedback dispels the difficulties of undergraduates encountering during making the report, by written and oral mode in class. Teacher also suggests that the feedback framework of scope, context, process and practice can help guide work of feasibility study responses to project environment. To eliminate undergraduates' fallacy that teacher feedback is more authoritative and comprehensive, teacher feedback serves as a complementary method to peer feedback in running the studio.

Peer feedback and teacher feedback are not interchangeable; each of them is a part of the feedback mechanism and should integrate effectively. Regarding feedback method and content, vague and excessive feedbacks can exist in peer feedback. Vague feedback means undergraduates give overly summarized feedbacks commenting on peer's feasibility report. They do not point the keys of problems or do not offer specific suggestions. On the contrary, some able undergraduates may give excessive feedbacks, means the feedbacks are so detailed that almost all revision has been done, thus depriving others of the opportunities to learn and improve. Excessive teacher feedback should also be avoided not to impair undergraduates' enthusiasm to learn by themselves.

Positive and Negative Dynamic Feedback Mechanism in EMFSS

The roles of feedback mechanism

The proper connection of modules and platform in the training system in EMFSS motivate and give confidence to members to cooperate with each other. Peer feedback stimulates interaction and communication between undergraduates; teacher feedback guides undergraduates to the accurate searching way of solving the problem. After multiple feedback stages, invisible as well as visible knowledge is shared and transmitted, learning performance explodes exponentially, and members' practical abilities increase gradually in EMFSS.

Positive feedback cannot infinitely expand; it is inhibited by negative feedback. Some members out of their reasons are not willing to share knowledge and information with others. Other undergraduates may waste each other's time by discussing and communicating excessively. Excessive teacher feedback can tire and bore undergraduates or make them unconfident about their abilities to practice feasibility study. All these can lower the growing speed of performance of practical ability in EMFSS and lead to negative feedback cycle.

The dynamic performance model for feedback mechanism of shaping practical ability in EMFSS

Here is a dynamic model based on system dynamic theory, it is proposed to analyze the feedback's influence process. The model takes feedback as function variable and studies the influence on feedback's performance of shaping practical ability in EMFSS as it changes. The initial performance of shaping practical ability in EMFSS is relatively stable, it doesn't change over time or the change is negligible. Moderate feedback increases knowledge and skill, while too much or too less feedback inhibits and slows down the increase in shaping practical ability performance.

Set the initial function as

Take KM as the initial performance value of shaping practical ability in EMFSS, CM as performance added value of feedback to problems in making feasibility study reports, O as performance reduction value due to improper feedback of shaping ability in EMFSS, PM as the performance of shaping practical ability in EMFSS. PM changes as CM or O changes. K1 and K2 are two influencing factors of time on the initial value of performance of shaping practical ability in EMFSS, both factors are larger than 0. The Equations are as follows:

According to Function 1, get Function 5:

Both sides of function 5 divided by d_t, then substitute the variables with Functions (2), (3) and (4), get Function 6:

Then get the following differential equations:

General solution to Function 7 is as follows:

In which C_1 is any constant.

Solve the differential equation and get the general solution, get the growth curve for the performance of shaping practical ability in EMFSS under the positive and negative influence of the feedback, illustrated in Figure 2. The initial value of performance of shaping practical ability in EMFSS is C_1+k_2. At this stage, an orderly structure of the practical ability in EMFSS is forming, but with low efficiency, the growth trend of practical ability efficiency is not obvious. After the positive and negative feedback's effect on EMFSS, PM's initial value is slightly higher than C_1+k_2. After a time span of [0, t], factors inhibiting practical ability shaping increase gradually, and the effect of negative feedback becomes larger than positive feedback. The change rate of PM decreases gradually until 0, and the PM value shows as a typical "S" curve.

According to the above analysis, teachers and undergraduates should pay attention to the method and extent of problem feedback during the process of making feasibility report. The people who provide feedback should provide more guidance, enlightenment, and paths but not help those having difficulties to accomplish directly. Thus the growth stage of [0, t] on the S-curve can be extended as long as possible and enter the next exponential growth cycle as soon as possible when the PM performance turns stable.

CONCLUSION

The research demonstrates the connection pattern between the three modules and three platforms in the training system of EMFSS. It uses system dynamic theory to explain the positive and negative feedback mechanism

between undergraduates and teachers and among undergraduates. The research discovered the feedbacks could stimulate as well as inhibit practical ability improvement in EMFSS. At the same time, this research establishes an initial function with dynamic features according to the feedback mechanism. By solving the function's differential equation and achieving the general solution, the performance of practical ability training in EMFSS demonstrates an "S" curve. The formation process of the "S" curve is explained by solving the equation as well. At last, specific strategies to elongate positive feedback thus improves the performance of practical ability training in the studio were proposed. This paper established the ability training pattern in EMFSS and realized the integration of modules and platforms in which theoretical knowledge are the inputs, and practical abilities are the outputs.

This paper has suggested that EMFSS is both defined by the necessity of project construction and helps define it, and should be an active focus for engineering major pedagogy. It establishes the educational idea to take undergraduates as the protagonist based on the feedback mechanism of three modules and three platforms. The idea absorbs various elements such as interactive study and practical teaching in a flexibly way, takes project needs and social needs as the core content seriously, hands out tasks such as solving project construction scale, financing, finance structure, finance efficiency to undergraduates to analyze and proof. The undergraduates in EMFSS improve their feasibility study skills by professional instructions and feedback mechanism.

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Integrated Education Model of Information Technology and Financial Accounting

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ABSTRACT
In this paper, the research status at home and abroad as the background, from the perspective of constructivism learning theory and teaching model, a preliminary analysis based on Constructivism curriculum integration of information technology and accounting process should be discussed, the definition of core concepts, information technology and accounting curriculum integration research value, research objectives, contents and research the ideas and methods, finally, summarizes the connotation, goals and ways of the integration of information technology and accounting course.

Keywords: constructivism, information technology accounting, curriculum integration, integrated education, accounting education model

INTRODUCTION

Human beings have entered the information society represented by the information technology revolution, and the information technology environment is changing people's living environment, production, life style and their thinking habits. Accounting environment is also faced with the great influence of information technology. For example, information technology has changed the traditional accounting treatment and the use of information technology, and with a high degree of integration of financial and business information processing, provides a broad prospect for the accounting business accounting to traditional management and decision-making, to create favorable conditions for the development and innovation of accounting theory.

This contrasts sharply with the pattern of accounting education as a kind of education people handling and use of accounting education system of financial information and participate in the management activities is relatively backward, accounting education is still in accordance with the traditional accounting business process and system structure, make each other the inevitable connection or dependent on the relationship between information technology and accounting education between the two free and alone. With "two hot", "two skins" can be figuratively information technology and accounting education two completely separate status, for example, in the low grade "Computer Culture Foundation", "computer application foundation" and "Database Principle" courses, set up "information technology and financial accounting or accounting the information system" Curriculum in high grade, thus forming the teaching of information technology and the teaching of accounting major separation of "two skins" phenomenon, and not into the accounting information technology from first to last the doors of professional basic courses and specialized courses teaching. This situation makes the traditional accounting education model face challenges, that is, the scope, objectives and functions of the traditional accounting education model cannot meet the diversified needs of the growing accounting information.

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Contribution of this paper to the literature

- The future of information technology and accounting education model proposed ways and development.
- Comparison of Chinese and foreign accounting education system.

As far as the United States is concerned, the reform of accounting education mode is being carried out with greater strength and far-reaching influence. For example, the accounting department of Brigham Young University will ever set up independently of the intermediate accounting, cost accounting, management accounting, auditing, accounting information system integration into the core curriculum of a comprehensive 24 credits, in order to cultivate highly comprehensive ability of accounting personnel (Beed, 1998; Elena Escalera-Chavez, et al., 2017; Gercek, 2017; Chen, 2017). The accounting department of Illinois university designs a new model of accounting education according to the generation, utilization and control of accounting information. The reform of accounting teaching mode in these two universities provides a new idea for us, is not to the existing accounting education mode of tinkering as the goal, but more information on operation of accounting rules, and information technology integration, business process to design a new education mode of accounting, information technology and accounting professional course of internal consistency and logic to facilitate integrated financial, business and information technology integration, complete financial responsibility and accounting for the entrusted responsibility management measure and report to the new mode of accounting education scientific and systematic point of view, this is the development trend of information technology and accounting education, has practical significance and theoretical significance to study the relationship between.

In our country, an accountant who accepted accounting as an early information system was professor She Xuying. In 1980, he began to put forward the point of view in the article "from the point of view of development, which is the subject attribute of accounting". At present, the representative view in our country was put forward by Professor Ge Jiashu and Tang Yuhua in 1983. They think: "accounting is to improve the economic interests of enterprises and units, to strengthen economic management and establish a financial information to provide the economic information system."

From the angle of integration of information technology and financial accounting education model, this paper explores ways to solve these problems.

REVIEW OF RESEARCH STATUS AT HOME AND ABROAD

Today, mankind has entered the information technology revolution as the representative of the information society, information technology (including information technology, network technology, computer technology and communication technology) environment is changing the living environment, production and life style and thinking habits. Although the integration of information technology and curriculum has been carried out both at home and abroad for many years, so far, many teachers (and even the whole educational circle) still have a one-sided or even wrong understanding of the integration of information technology and curriculum. For example, a few teachers still put the integration of information technology and curriculum is regarded as a kind of fashion, not clear the implementation of information technology and curriculum integration is to what purpose, just because we are in the application of information technology, or is the call of the government information technology application to application. Many teachers only integrate information technology and curriculum as a tool for modern teaching, a means or a way to learn information technology more effectively.

To sum up, these mistakes or one-sided understanding involve the following three aspects: 1, the goal of the integration of information technology and curriculum is not clear - - why is it not necessary to integrate? 2, the connotation (essence) of the integration of information technology and curriculum is not clear - - what is integration is not known. 3, the ways and means of integrating information technology and curriculum are not mastered - not knowing how to integrate. Any theory about the integration of information technology and curriculum must be able to make a scientific analysis and answer to these three basic questions, and this answer should be tested by

Table 1. Modern information technology environment accounting research teaching mode based

1	The shortage of bilingual high-end accounting personnel.
2	Lack of advanced composite accounting talents.
3	The teaching mode of accounting in Colleges and universities is unitary, and the training of accounting talents is homogeneous.

Table 2. The status quo of international advanced accounting talents education system

America	The United States began to implement from 2004 CPA (Certified Public Accountant) computerized examination, the content and form of the examination of the corresponding change with the new mode of examination to assess the level of access to CPA's judgment analysis ability and professional technical knowledge. 2002 - Sarbanes Oxley act, requires a lot of CPA to all levels of staff training act meaning and to speak in the audit committee meeting that, in the United States personnel training in accounting education, not only pay attention to the cultivation of high-end business accounting skills, but also pay attention to the training of the occupation ability of Eq.
Japan	Accounting education in Japan consists of two parts, including institution education and enterprise follow-up training. The former is composed of different levels of education system such as the high school, occupation colleges, universities and graduate schools. The purpose is to develop different levels of accounting personnel, to meet the different needs of enterprises; the latter is the cultivation of enterprise management and decision making of high-end accounting personnel comprehensive ability, and also make high-end accounting personnel of knowledge update and supplement of the updated accounting regulations, accounting concept, to promote its development, improve the level of. Visible, Japan with the times of accounting personnel training philosophy is worth learning.
Canada	In a comprehensive survey of the Canadian Institute of certified public accountants, the 147 competencies required by the CPA are sorted, the ability to rank in the top eight are: The application of continuous occupation moral standards; exercise a high level of professional judgment; the relevant information and data security of the organization and its customers; the protection of the public interest in the work; professional ability range; according to the occupation related guidelines and policies, expression, analysis and processing operations; ensure the reliability of financial information system in line with the requirements of customers; the financial statements (Herremans. 1992). Therefore, Canada attaches great importance to the ability of accounting personnel, in addition to the emphasis on ability, also requires high-end accounting personnel should have CPA expression of leadership and management ability, and the ability to communicate with people and other soft skills; to obtain qualification of accounting personnel are strictly controlled, CPA education is a combination of school education and professional education; the two is to emphasize the practical work and experience combined; three is the emphasis on work ability and professional technology combination. And will continue as the only way. In the follow-up education requirements, in order to enhance the professional competence, we must obtain the qualifications of Certified Financial Accountants and master of business administration, so as to achieve the continuous education of accounting training.

teaching practice at all levels of schools. It is thus clear that the research and the conclusion of these three basic questions are the core contents of the theory of information technology and curriculum integration.

At present, the domestic and the research status we called "two hot", "two skins", namely in the low grade "Computer Culture Foundation", "computer application foundation" and "database" course, set up "information technology and financial accounting" or "accounting information system" Curriculum in high grade, thus forming the accounting professional teaching and information technology the separation of "two skins" phenomenon, and not into the accounting information technology from first to last the doors of professional basic courses and specialized courses teaching.

China accounting personnel are widely distributed in various industries and fields, the total number of the country's human resources accounting personnel reached nearly 10%, under the background of economic globalization, enterprises want to join the world economy stage, must enhance the core competitiveness, cultivate high-end accounting personnel. Many developed countries in the world, such as the United States, Canada, Japan and other practices, are worth learning and learning. As shown in **Table 1**, these countries pay great attention to the education system of high-end accounting talents.

Table 3. Drawing on international experience to promote the training mode of China's high-end information technology accounting talents

1	Clear accounting training target, pay attention to the structure optimization of knowledge system.
2	Improve the curriculum and improve the quality of accounting personnel training
3	School enterprise cooperation and transnational training.
4	Personnel training should pay equal attention to both professional skills and professional ethics, and pay equal attention to both knowledge and ability.

In the environment of economic globalization, China's high-end accounting personnel gap is large, the overall strength is not strong, and the accounting personnel structure is unbalanced, the university accounting teaching model is single, accounting personnel training homogenization (Beed, 1998). The traditional accounting teaching China is on the blackboard and chalk as the main mode of transmission of knowledge, the teaching methods are single, students lack of initiative and creativity in the classroom; enterprises of the accounting personnel training process, also mainly focus on the accounting aspect, the potential demand for senior personnel ignore enterprises to carry out the international market; globalization competition is essential for senior accounting personnel with the vision of globalization, the globalization competition era is coming, the necessary requirement in the setting of financial courses, to have the vision of globalization, change passive teaching mode; at the same time also requires enterprises with international vision of the accounting personnel should follow up education.

The Ministry of Finance in September 2005 officially launched the project to cultivate senior accounting personnel and issued the "national accounting leading (reserve) personnel training ten year plan", planning from the six aspects of the Chinese senior accounting personnel training to the relevant provisions, one is the goal of the task, two is the organization leadership, three is the selection of students. Four is the training organization, training mode is five, six is the elimination mechanism etc. In December 10, 2005, the Ministry of Finance held the first stage for enterprise class high talent training class in Shanghai National Accounting Institute to time, officially opened the prelude to the project of national accounting leading high-end talent cultivation in talents. The accounting profession in the long-term talent development plan "issued by the Ministry of Finance (2010 - 2020) clearly pointed out that the Ministry of Finance issued, senior accounting personnel training of large enterprises, not only to be familiar with the rules of the market and business; to master the information technology and internal control, and to master the international trade and financial law; we should be able to participate in the management of operational and strategic decision making, but also to grasp the development trend of the industry; should not only be able to solve complex economic problems, but also has the ability of cross culture communication.

According to the present situation, in the comparison of domestic and international high-end accounting personnel training mode on the basis of the training mode of Chinese concise, selection and training with international vision, occupation moral, practical experience, knowledge structure, innovation ability of high level, complex high-end accounting personnel, plays a leading role in Chinese accounting industry. Make a contribution to the economic construction of Chinese.

THE DEFINITION OF THE CORE CONCEPT OF THE INTEGRATION FRAMEWORK OF INFORMATION TECHNOLOGY ACCOUNTING COURSE BASED ON CONSTRUCTIVISM

Constructivism

Constructivism is also translated as structuralism. It is a branch of cognitive psychology. Constructivism holds that knowledge is not taught by teachers, but learners in certain contexts that the social and cultural background, with the help of other people (including teachers and learning partners) help, use the necessary learning materials, through the construction of meaning and. Because cognitive development is closely related to the process of individual learning, therefore the use of Constructivism can better explain the cognitive rules of the learning process, which can be used to explain how the concept of how learning takes place, how meaning is

constructed, and the formation of the ideal learning environment should include what main factors. In a word, under the guidance of constructivism, a new and effective cognitive learning theory can be formed, and an ideal constructivist learning environment can be realized.

Information Technology Accounting

Information technology accounting is often misleading as accounting for the information technology industry. The actual meaning of it is the information technology and accounting science depth, tightly formed by fusion of accounting theory and method system, including system information technology, accounting theory and practice of accounting information technology education and learning system etc.. The information technology accounting is guided by the traditional accounting theory and follows the current accounting standards, but the influence of it on the traditional accounting is enormous. It can be considered as the innovation and promotion of the traditional accounting.

Integrated Education Model

Integration refers to the mutual dispersion but between elements or things are closely related, through the joint mechanism, mutual connection, mutual penetration, effective combination and connection, so as to form a coordinated development of the new organic whole process and state. The process and state of integration are characterized by: 1.The dispersion and correlation between factors; 2. Overall coordination and comprehensiveness; 3.Institutional and institutional. In a nutshell, integration refers to the process and state of the gradual integration of multiple independent elements or entities into an organic whole in some way. Pattern is a methodology to solve a certain kind of problem. It summarizes, abstracts and abstracts the methods for solving a problem. Model is a kind of guidance, any action under a good guidance, will help to produce a good design program, get the best way to solve the problem, produce twice the result with half the effort, achieve the goal of action.

The integrated education mode is the various elements or things in a certain kind of education behavior repeated, through the establishment of a common mechanism, summed up the formation of a coordinated development of the new organic whole process and the theory of the state. This theory will guide the efficient achievement of the ultimate goal of such educational behavior.

Information Technology Accounting Integration Education Model

In the constructivist education thought, teaching theory and learning theory, to achieve specific goals in accounting teaching, the teaching of information technology under the environment of information technology into accounting education from first to last, summarizes the teaching elements in combination of specific and common mechanism and behavior in the process of state formation teaching structure operable, the relative stability of the theory, so as to form a new pattern of accounting education new coordinated development -- known as information technology integration of accounting education mode.

The Integration of Information Technology and Accounting Courses

The integration of information technology and accounting course is the core of the establishment of information technology integration of accounting education mode, it refers to the theory of the integration of information technology and accounting courses, including the integration of information technology and accounting course objectives or meaning; the integration of information technology and accounting course connotation and essence; the integration of information technology and course of accounting way.

THE RESEARCH VALUE AND DEVELOPMENT TREND OF THE INTEGRATION OF INFORMATION TECHNOLOGY AND ACCOUNTING COURSES

To sum up, is the real significance of the integration of information technology and accounting courses: information technology into accounting education from first to last, in order to build the new accounting education

model with information technology as one of the new - called information technology integration of accounting education mode. The model's goal is to create new, can teachers play a leading role but also can fully reflect the students' subject status of "dominant main body teaching structure" (Willis, 2016), in accordance with the quality education and the requirement of cultivating innovative talents. As the model is highly integrated with information technology, and in the multimedia LAN classroom with student machines, students are organized as the main body, so that students' learning initiative is greatly enhanced. In the learning process, students will be deeply aware of the principle and practice of the integration of financial and business development, and accounting and information technology integration, thus, naturally understand the principle, practice and operation mode under the information technology environment of financial accounting, and greatly enhance the classroom teaching capacity and teaching efficiency. In order to create more value for the organization, the graduates of the accounting profession should actively and actively adapt themselves to the needs of the information society while moving out of the classroom to the society. At the same time, the integration of information technology education model will clearly show the characteristics of the times accounting information society of accounting education, the education mode under the guidance, in the information technology environment, accounting will be more proactive in planning and controlling the development of enterprises.

The Connotation of Information Technology

Information technology plays an increasingly important role in economic and social development. Therefore, it is of great significance to deeply understand and grasp the connotation and development trend of it.

Information technology refers to the technology that can expand the function of human information organs in the aspects of information generation, acquisition, storage, transmission, processing, display and use. It is gradually developing from low level to high level with the development of human's understanding and control of the outside world. In ancient times, humans used their physiological functions to communicate and exchange limited information with gestures, facial expressions and so on. The emergence of language, the invention of writing, the gongs and drums, the horn and the use of fire have enabled mankind to transmit and store information in the initial period in light, sound, text, graphics, images and so on. In modern times, information dissemination technology and storage technology have made breakthrough progress. Information and communication technology breakthrough in 1937, when the American scientist Morse invented the telegrams and code, the "power" into the field of information technology, the information of human activities has entered a new stage. With the telecommunications revolution, information communication cable communication, wireless communication, satellite communication, image communication and continuous emergence of new information transmission tools, such as the telegraph, telephone, radio, fax, television and other unique features. At the same time, the rapid development of recordings, music, videos, CDs and other visual and auditory information storage, information storage technology has also made a breakthrough, realize the information technology of the epoch-making progress. With the development of economy and the progress of science and technology, modern information technology has developed into a comprehensive and high technology. Based on communications, electronics, computers, automation and optoelectronics, it has become the general name for all modern high-tech technologies that generate, store, transform and process images, text, sound, and digital information. It contains a wide range of cell technology, such as optical fiber communication technology, laser communication technology, remote sensing, remote control and artificial intelligence, and other high-tech. This has made breakthroughs in the field of information processing technology in human society. During this period, the generation and application of microelectronic technology, computer technology, laser technology and communication satellite technology made fundamental changes in the process of information processing. Prior to this, although in the process of the development of information technology, information transmission and storage technology continues to change and progress, however, information processing has been directly involved in the people, rely on the human brain to complete. The invention and application of computer have made it possible for people to process and process information effectively from the human brain by means of computers. As the industrial revolution people use the machine instead of heavy manual labor, people's hands were freed, the information revolution instead of people complicated mental computer, part of the mental work implement technology, people's mental liberation.

The New Trend of Information Technology Development

With the rapid development of information technology, new developments in the following two areas require special attention.

Computer as the core technology of information technology, to advanced, diversified development. The special function of computer processing information makes computer technology become the core of modern information technology development, and is advanced and diversified. The trend of development is as follows: on the one hand, the development of electronic information technology to more advanced, the function of electronic computer will be more perfect; at the same time, laser information technology and biological information technology are also developing rapidly. Laser, computer and biological computers will be paid attention to because of their special excellent functions.

Since the mid-20th century until before the 1980s due to electronic technology especially the rapid development of microelectronics technology and improve the performance to price ratio to make electronic information technology become a period of information technology to realize the most important means of electronic computer shows the dominating trend. At present, the electronic information technology is being experienced by the technology of microwave and millimeter wave technology to change in order to make the electronic information technology has made a major breakthrough in the band capacity, signal processing speed and signal recording width etc. to move on to more advanced technology level.

Computer and communication two major information technology organic combination, network technology increasingly important role, computer technology belongs to information processing technology, communication technology belongs to information transmission technology. In their respective stages of independent development, it is difficult to make breakthroughs in information technology. Eric, the pioneer of the Internet industry and the chief technology officer of the Sun Micosys tems Inc in the US, said Schmidt, "We always feel that microcomputers are not valuable for isolating each other, and that they are most useful only when they are linked together."

Network technology is becoming more and more important after computer networking. First, the application of network technology makes the energy of the computer realize unlimited expansion, and the information resources have been the most fully utilized. Because a good design can make the network online cumulative strength of each single implant, a computer linked to the network is bigger, more use it, the stronger the power of Internet work is not in the use of personal computers, but in the use of an energy of unlimited expansion of the large computer. The emergence of the Internet has made the information resource the third important resource after material and energy. Second, the development of network technology is beginning to seize the electronic space as the core of information technology, a new round of fierce competition. Computer networking is made up of LAN, Wan and net. That is, the development of the Internet has made the Internet technology rise rapidly. Especially since the commercialization of Internet in the last 4 years, the impact of the Internet revolution has shocked the world. Americans use words to describe change as if the industrial revolution and the Christian Reformation had been added together within a generation. The theory called speed. The Internet makes electronic space is becoming the new frontier of the world after land, sea, sky rushed to seize the advantage, because of who in the electronic space will obtain substantial economic benefit in the development of the network economy, the United States in recent years, the economic development is a real example.

Throughout the development process of accounting information system, each enterprise's internal and external competitive environment, information environment changes will cause the accounting information system design ideas and forms of operation changes. With the advent of the era of Internet economy, the operating environment of enterprises has undergone drastic changes. It not only breaks the concepts and boundaries of the region, but also forms a global competitive market, which leads to the rise and development of e-commerce. E-commerce will be the enterprise's raw material supply, production, sale, and even with the end consumer closely integrated into a new business model, greatly expanding the scope of business transactions. The future accounting

information system is no longer a simple manual imitation, but to make full use of the advanced information technology, to the enterprise accounting principle, work flow and methods to build, to meet the requirements of enterprise management to adapt to rapidly changing, with the future of the enterprise, the social, economic and technological environment of the new system.

The application of computer technology in the field of accounting is started from wage accounting and management of the computer, for a range of financial and business level and continue to expand and deepen, at present, from the financial accounting, management accounting and decision support system for the expansion of the enterprise resource planning (ERP) and the whole supply chain to enterprise supplier management including upstream and downstream customer relationship management, management. The management information system based on computer is a software application platform, in this platform, integrates the modern advanced management thought and management mode, reflecting the practice and process of management efficiency, promote the enterprise internal business process reengineering.

Therefore, the theoretical value of the integration of information technology and accounting course is: will the software platform to integrate the management thought and management mode, combined with the actual situation of enterprises in China, from the height of the theory system and models, thus forming a theoretical framework of accounting information technology integrated education mode. It can not only provide a more mature teaching model for information technology integration of accounting education, improve the quality of teaching, and more accounting information management information of enterprises accounted for 70%, the mature model to be copied, can be applied to enterprise resource planning (ERP) integrated education system integration education, supply chain management information system the integration of education and logistics management information system (Scapens & Jazayeri, 2015).

INFORMATION TECHNOLOGY AND ACCOUNTING CURRICULUM INTEGRATION RESEARCH OBJECTIVES, CONTENT, METHODS AND APPROACHES

Research Objectives and Integration

Since the integration of information technology and accounting course is the core of the establishment of information technology integration of accounting education mode, we should be based on information technology and accounting professional course of internal consistency and logic to facilitate integrated financial, business and information technology integration, the information fusion operation rules, information technology and accounting and business process to design a new model of accounting education under the environment of information technology, information technology integration of accounting education mode. The essence of the integration of information technology and accounting course is through the teaching process of information technology to effectively integrate in the accounting discipline to build a teaching environment (the environment should be able to support the creation of context, inspired thinking, information acquisition, resource sharing, multi interaction, self-exploration, cooperative learning and other aspects of the teaching methods and learning way), this can play the leading role of teachers and can fully reflect the dominant position of students "autonomy inquiry cooperation" for the characteristics of the mode of teaching and learning, and the students' initiative, enthusiasm and creativity to fully play out, make the classroom teaching structure of traditional teacher centered change, change the teaching from teacher centered "teaching structure is the main subject of combining". Eventually to build innovative and practical ability training requirements of the information technology and accounting education deep integration, integration, can play a leading role of the teachers and students to reflect the dominant position of the "dominant main body teaching structure".

Research Contents

The integration of information technology and accounting courses will follow the constructivism theory, educational psychology and information technology and the teaching of accounting rules, according to the information technology and accounting professional course of internal consistency and logical starting point, to

Table 4. The research content of the combination of information technology and traditional accounting education

1	The theoretical basis of information technology and accounting curriculum integration, teaching objects and teaching teachers
2	Research on the design of information technology and accounting curriculum integration, teaching content, curriculum design and teaching material system reform
3	Research on the experiment teaching, teaching form and teaching method of the integration of information technology and Accounting Curriculum
4	The operation and maintenance mechanism of the integration of information technology and accounting courses (including the school mechanism, the school enterprise joint mechanism, the accounting profession and the internal education)
5	The link between the educational profession and the practitioner
6	Research on double practice base and practice environment construction of information technology and accounting course integration
7	Around the above research results of the assessment form, changes and content assessment research; part of the teaching software, examination software and examination questions library system analysis, design and development

explore the integration of information technology and accounting courses, combined with the information technology and the traditional accounting education includes the following research contents:

Research Methods and Approaches

The research is based on the assumption that the integration of information technology and information technology supporting environment accounting course is accounting integrated education mode can be met, including: hardware, software, teaching quality and knowledge structure training etc.. The general idea is to stimulate the institutional thinking of accounting education process reengineering, break the traditional accounting education model, and build a new information accounting education model. Specifically, it is the trend from the perspective of Accounting Business Process Reengineering under the environment of information technology, through the phenomenon, to excavate the essence, the nature and the integration of the results derived by information technology and accounting curriculum integration. In the course of the study, get rid of the past "two hot", "two skins" research ideas, and always adhere to the wide caliber, thick foundation, strengthening quality education reform policy and student-centered educational philosophy as the guiding ideology of the integration of information technology and accounting courses, to teach knowledge, ability, cultivation to improve the quality of education, and ultimately achieve the information technology and accounting education deep integration, integration of the target.

By using the method of the study should be the methods of induction, deduction and in-depth investigation combination, which starts from the basic accounting and intermediate financial accounting of the best starting 11 for information technology and integration, and gradually to the interpretation of other related courses. Throughout the research process, we should investigate and coordinate the views and supply and demand of the accounting, education, practitioners, enterprises and related software suppliers. Analysis from the perspective of information technology, to provide information on the value and use value of information for decision-making and value of information supervision (i.e. generation, use and control) of accounting information circulation operation rule, and to find the best starting point design of the accounting professional education and information technology integration, gradually formed the accounting, finance and audit in three directions with the information technology deep integration, the integration of organic integration (Feucht , 2011).

The implementation steps of the integration of information technology and accounting courses can be divided into five stages, namely, the investigation stage, the analysis stage, the design stage, the modeling stage and the implementation stage.

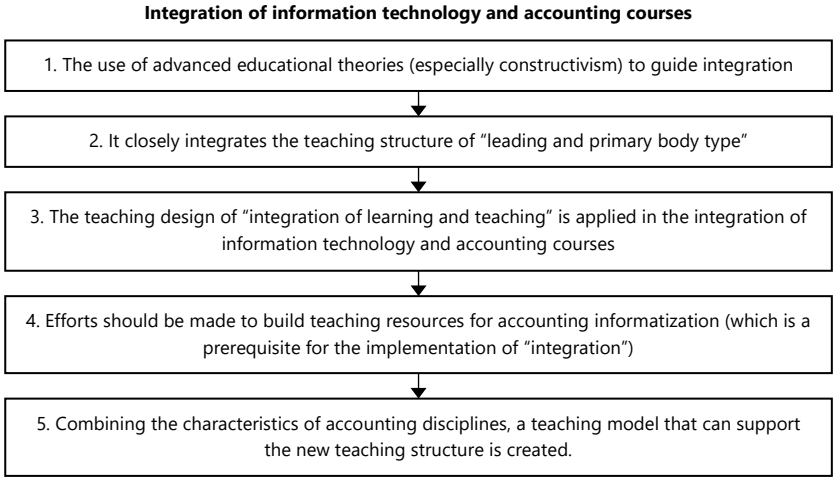

Figure 1. Integration of information technology and accounting courses

CONCLUSION

In summary, the integration of information technology and accounting course is quality education to cultivate students' innovative spirit and practical ability as the goal, to create a teaching environment of accounting information using information technology (rather than the information technology is only used as the auxiliary tool for teaching or learning, the environment should be able to support the creation of context, inspired thinking, information acquisition, resource sharing, multi interaction, self-exploration, cooperative learning and other aspects of the ways of teaching and learning), this can play the leading role of teachers and students can fully reflect the dominant position of the "autonomy inquiry cooperation" for the characteristics of the mode of teaching and learning, the students' initiative and the enthusiasm and creativity is fully displayed, so that the teaching structure of the traditional teacher centered change. Its connotation is that the information technology can be effectively integrated into the teaching course of accounting discipline, and the teaching structure from teacher centered to the teaching structure combining "leading and one subject".

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The Development of Model and Measuring Tool for Specialists Accreditation in Area of Public Health Services

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ABSTRACT

The main purpose of the paper is to present some theoretical approaches and some methods providing assessment optimization in specialists' accreditation in area of public health services. The results of research presented in this paper, include the model of multistage adaptive measurements and two methods for reliability and validity analysis, providing high justice decisions in accreditation and corresponding to requirements in High-Stakes Testing procedures. The assessment optimization intends for minimization time of assessment and for reliability and validity data increasing. For optimization the special model of measurements based on multistage adaptive testing is offered. The using of offered model in assessment design allows to realize the advantages of traditional adaptive testing and linear testing, while minimizing their disadvantages. So, this model is recommended as dominating for assessment in accreditation. For validity increasing in assessment in accreditation the approach based on Structural Equation Modeling is offered. This method allows to analyze the significance of relations between observed and latent variables that have any interpretation as causal effects, and to construct the model of their relations. The example of model of casual relations between disciplines, latent variables (competencies) and factors is offered. The model helps to increase construct and content validity of measuring tool using in public health services accreditation. The methods of reliability estimation in multistage measurements, offered in paper, has innovative character. It has branching structure as the value of reliability in multistage measurements depends not only on reliability of separate stages, but also from correlations between them. The presented approaches allow to increase validity and reliability of decisions in public health services specialists' assessment or in other spheres of assessment during accreditation.

Keywords: adaptive measurement, assessment, reliability, structural equation modeling, validity

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Contribution of this paper to the literature

- The model of multistage adaptive testing providing efficiency increasing of assessment in the conditions of high reliability and high validity measurements during assessment in accreditation is offered.
- The approach to construct validity increasing in measurements on the basis of Structural Equation Modeling is developed.
- The method of reliability estimation of multistage measurements adequate to the offered model is described.

INTRODUCTION

Relevance of the Problem

The first experience of specialists' accreditation in area of public health services in Russia on 2016 and 2017 has shown that assessment processes require optimization. Thousands of specialists of public health services as examinees, thousands of items and long time, necessary for multistage procedures of measurement, are involved in accreditation process. According to this problem of optimization some questions have defined the paper purposes in which the attempt to give the answers for these questions is presented. These questions are:

1. How to optimize the model of measurements for the purpose of assessment time minimization?
2. How to increase content and construct validity of measurements on the basis of optimum set variables choice?
3. How to estimate the reliability of multistage measurements results?

The decision of these questions was the objective of this research, and the hypothesis includes the assumption that the answer to questions will allow to optimize assessment procedures in accreditation.

Literature Review

In Russian theoretical educational researches, the topics in area of adaptive measurements are presented fragmentary. Except the fundamental monograph of M. Chelyshkova (2000), devoted to the theory of adaptive testing in education, and the dissertation of A.A. Malygin (2011), the publications are concentrated around separate applied problems (Dorozhkin et al., 2016; Ke, Borakova & Valiullina, 2017; Fu, Kayumova & Zakirova, 2017). Basically, its consider the possibilities of adaptive testing in dialogue computer testing which changes an order of test items administration depending on examinee performance of previous item (Oparina et al., 2007; Ushakov & Romanova, 2010; etc.).

The base ideas of adaptive testing confirm the possibility of standard scales construction for testing data interpretation if examinees were carrying out various on difficulty and length adaptive tests. The minimization of adaptive tests length is reached by optimization of item difficulty which is defined for each examinee individually, but in full conformity with the uniform content specification. By individual selection every examinee is not administrated too easy items which he can carry out correctly certain, or too difficult items in which it is waited for certain by failure. So, this base idea of adaptive testing helps to reduce the number of each adaptive test items without loss of reliability, validity and comparability data (Chelyshkova, 2000).

The level of development in international researches in area of educational measurements considerably differs from the level of science development to this problematic in Russia. Numerous scientists publish hundreds of articles and books on problems of substantiation of measurement results quality by estimation of their reliability and validity. The possibilities of Item Response Theory for increasing of objectivity in longitudinal study are considered (Baig & Violato, 2012). Some problems of formative and programmatic assessment and their influence on quality of medical students training are discussed (Heeneman, Oudkerk & Schuwirth, 2015; McKinley et al., 2000). The considerable attention in articles is given to questions of competence approach in medical training and scoring its results (Hawkins et al., 2015). The problems of scaling and aggregations of testing students are analyzed with reference to assessment of medical students (McLachlan & Whiten, 2000). On the beginning of the second

decade in XXI. Century the theory of multistage adaptive testing began to develop intensively at Educational Testing Service (Yan, von Davier & Lewis, 2014).

For the purpose of optimization some models of assessment for specialists' accreditation or certification in other countries, for example, in the Netherlands, Israel, the USA, are under construction in a mode of adaptive testing (Crocker & Algina, 2010; Hambleton, 2000; Yan, von Davier & Lewis, 2014).

But, completely there are no researches devoted to questions of reliability estimation in multistage adaptive measurements, and also there are no models with reference to multistage adaptive testing in accreditation. Despite the highest level of development in different Russian and international articles the problems validity increasing in educational measurements on the basis of Structural Equation Modeling are not considered in Russian and international publications. The decisions of these topics are offered in this paper.

MATERIALS AND METHODS

The Model of Multistage Adaptive Measurements

The simplified model of adaptive multistage testing technology assumes item selection optimization on difficulty not for separate examinees, but for subgroups into which all group of examinees is divided. The results of general test performance are the basis for dividing examinees at first stage of measurements. After that there is a further allocation of examinees subgroups to which adaptive tests are administrated within the model of multistage measurements (Chelyshkova & Zvonnikov, 2013; Yan, von Davier & Lewis, 2014).

In particular, as represented by **Figure 1**, three-stage adaptive measurements are shown. Each stage from second demands the construction some adaptive tests (modules) different on difficulty which optimizes for each examinee subgroup. As a rule, in multistage measurements every stage correlates to the separate range of scale showing the levels of measured construct development (knowledge, abilities, competencies or performance professional functions). Accordingly tests for first stage usually have multiple-choice items with four or more response options. The second stage includes measuring instruments with performance or competencies items demanding free constructed answers. And at the third stage mini-cases having creative problem character use.

For example, for the stages, represented by **Figure 1**, the range of the minimum competence can be correlated with the first stage, the range of base competence corresponds second stage and a range of high competence corresponds third stage.

The adaptability is shown by means of the modules which number increases from stage to stage. At the first stage test administration includes only one module. The results of first stage are the base for dividing group into two subgroups: better and worse prepared group of examinees. As the rule, as threshold for such division 50

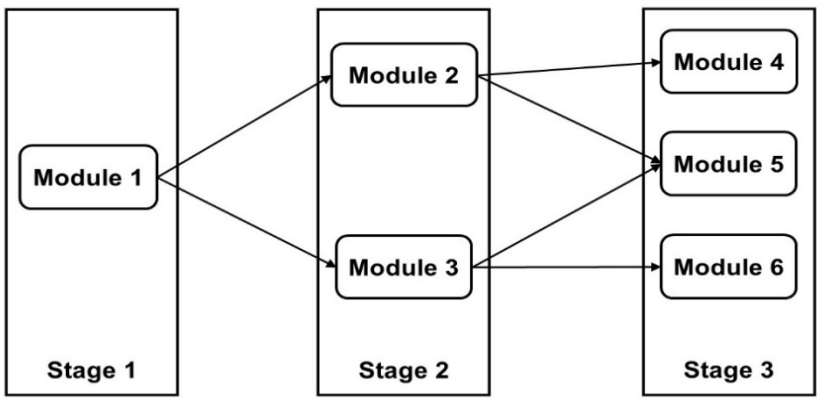

Figure 1. Three-stage adaptive measurements

% level of test performance is established. If the test includes multiple-choice items at the first stage which intend for scoring knowledge underlying professional functions performance, between first and the second stages the organizational break is not necessary. The automated check and number assigned to item responses as the scores (as the rule, 1 or 0) allow to divide group on two subgroups for few minutes after end of the first stage. The complicated variant of group dividing is possible, when the threshold point at first stage is established only for those whose raw scores exceed cut-point for minimum level of achievements or competency.

At the second stage measuring tool includes two modules: second and third. The second module contains more difficult items with free constructed answers and easier than the same form in third module. By results of modules performance examinees are divided by three subgroups. First subgroup includes all examinees which have successfully item performances from second module (exceeded 50 % as threshold or other threshold point). At the third stage they receive the most difficult items in the form of mini-cases from fourth module. Second subgroup combines the worst examinees from second module (they did not overcome the threshold point) and the best examinees from third module (they had passed the threshold point). These examinees receive the mini-cases of average difficulty included in the fifth module. At last, third subgroup intends for weakest examinees. They could not make successfully items from third module. At the third stage, they will receive most easy mini-cases from sixth module. As some experts are needed for checking items after second stage between second and third stages the organizational break is necessary. After checking the decisions about examinees allocation between subgroups are made.

Owing to adaptability each examinee in subgroups does not carry out too easy items or too difficult items. The contribution of such too easy or too difficult items to general reliability of measurements is insignificant. Therefore the optimization of items selection on difficulty and minimization of their number for each examinee will not lower the general reliability. Thus, the general high reliability of measurements will be provided despite minimization of items number in adaptive tests. The model has perspective character and has not found the realization in specialists' accreditation in area of public health services. Realization demands the existence of bank with calibrated items which is not created yet in Russia.

Structural Equation Modeling

The choice of independent variables and their number is the first step on the way of tool constructing for valid measurements (Chelyshkova, 2002; Klein, 1996). Structural Equation Modeling (SEM) is a general approach for the analysis of dependencies or independencies in a set of measured variables and common factors (Kramer, 2007). From the beginning the target model defining assumed structure of variables relations is constructed. The example of this model (path diagram) is represented by **Figure 2** and shows four competencies. As example it has simplified hypothetical character. With path diagram, it is possible to analyze the network of causal processes in terms of direct and indirect effects to check up causal hypotheses about connections between latent variables, factors of influence and results of training on the basis of competence approach (Zvonnikov & Chelyshkova, 2012).

The symbols «D» with a corresponding index designate disciplines, and each arrow specifies that discipline brings the contribution to competencies creation. In simplified variant the base for each professional competence consists from different disciplines. However, in real practice of training one and the same discipline can participate in creation some competencies then the arrows connecting small squares and ovals with competencies numbers will be repeatedly crossed.

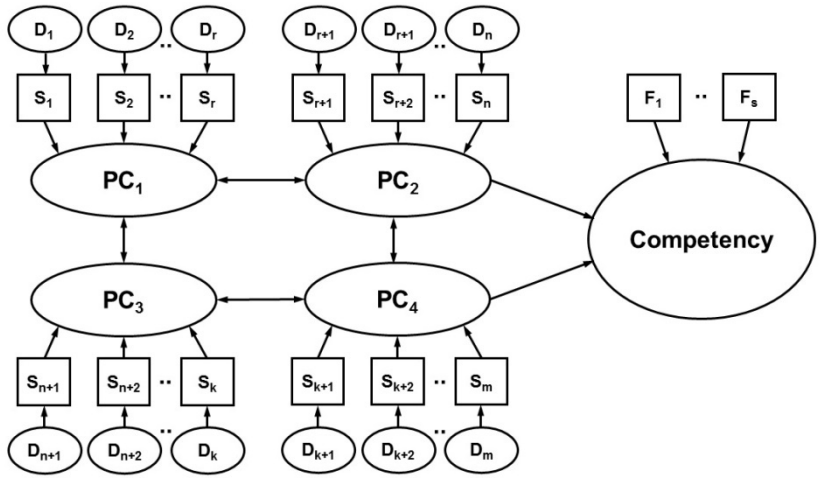

Figure 2. The model of casual relations between disciplines, latent variables (competencies) and factors

Symbol «S» is intended for designation of that contribution which is brought by corresponding discipline with the same index in professional competence creation. The symbol "PC" designates the professional competence, and symbols F_1 and Fs are chosen for the factors influencing in the process of competencies formation.

In SEM the simple logic model including only a few of latent variables and factors is constructed. If sufficient acknowledgement exists the model gradually becomes complicated the by additional variables or relations between them which, as a rule, have cause character. Otherwise, if acknowledgement is not observed, initial logic model must be changed by other variables or connections. As a result of SEM application the optimum set of variables for measurement is created.

The application of SEM is very important for optimization and validation of variables set for constructing measuring tools in accreditation. For practical application of SEM standard statistical packages of type LISREL or EQS are usually used (Joreskog & Sorbom, 2007). The application of SEM to measurement tools constructing for specialists accreditation in area of public health services are discussed in section "Results".

The Reliability of Multistage Measurements

In multistage measurements the estimation of reliability has special difficulty. Such estimation is carried out during some steps. From the beginning the reliability of separate parts of measuring tool is estimated by classical methods, and then the general estimation of reliability for multistage measurements is spent (Chelyshkova, 2002; Gates, 2005). The situation with reliability estimation becomes more complicated when multistage measurements are intended for acceptance high stakes decisions about examinees in accreditation. For accreditation measuring tools are developed within criterion-referenced approach and special methods of reliability estimation are demanded (Berk, 1980). The value of percent performance from full set of requirements in professional standards, and comparison this percent with threshold point (usually 70 % and more) allow to classify examinees on 2 groups: mastery and non-mastery.

For criterion-referenced approach in measurements intended for classification the reliability can be defined as relative stability of examinees groups' classification. According to method offered in the literature, one and the same test is administrated to group of examinees twice after small time interval and the associativity matrix is made. In this matrix there are four groups of examinees: group «a» - proportion of examinees who have done the pass through threshold point in both measurements (did not demonstrate the necessary level of competence or mastery), group «d» - proportion of examinees who have passed through threshold point in both measurements

(demonstrated the high level of competence or mastery), groups "c" and «b» - proportions of examinees which can be carried to classification errors as these examinees have not confirmed the results at double measurements, having changed them to the opposite.

Thus, groups "a" and «d» can be considered as area of classification decisions stability, and groups "c" and «b» can be considered as area of instability classification. Undoubtedly, that the values of proportions will depend not only on quality of measurements, but also from features of examinees samples. If group of examinees can be divided on two subgroups one of which has high level of competence or mastery, and another has the lowest then the minimization of errors classification will be the consequence of examinees distributions instead of measurement quality. Therefore estimations of reliability should be evaluated by representative sample of examinees.

Assuming that sample of examinees is representative, by associativity matrix the formula for reliability estimation in criterion-referenced measurements can be written as L. Crocker & J. Algina (2010).

$$\varphi = \frac{ad - bc}{\sqrt{(a+c)\cdot(b+d)\cdot(a+b)\cdot(c+d)}} \tag{1}$$

where symbol φ is chosen for designation of reliability estimation and other symbols were discussed above. It is coefficient of reliability for criterion-referenced measurements in the form as measure of qualifying decisions consistency (Berk, 1980). There is a normalizing factor in denominator, and numerator can be simply interpreted. From product of proportions reflecting the measure of qualifying decisions stability the measure of instability is subtracted. Accordingly, the greatest values of first product and the least of the second the best reliable of criterion-referenced measurements results corresponds.

The approach to reliability estimation in multistage criterion-referenced measurements is more difficult. The basic component of reliability estimation method for multistage measurements is the assumption that the compound score *C*, received by results *k* stages in measurements, can be presented in the form of *C* = *A* + *B* + … … where *k* composed scores correspond to *k* stages of measurements. If the compound score includes *k* components, the variance σ_C^2 of this observed score will be the sum *k* terms of variance and *k (k* - 1) terms of covariance, i.e.

$$\sigma_C^2 = \sigma_A^2 + \sigma_B^2 + \cdots + \sigma_K^2 + \sum_{i \neq j} \rho_{ij}\sigma_i\sigma_j$$

where $\sum_{i \neq j} \rho_{ij}\sigma_i\sigma_j$ is the sum of *k {k* - 1) terms of covariance, and symbols *i* and *j* designate any pair of components of measuring tool.

By analogy the variance of true score $\sigma_{T_C}^2$ for compound score *C* will be

$$\sigma_{T_C}^2 = \sigma_{T_A}^2 + \sigma_{T_B}^2 + \cdots + \sigma_{T_K}^2 + \sum_{i \neq j} \rho_{T_iT_j}\sigma_{T_i}\sigma_{T_j}$$

where $\sum_{i \neq j} \rho_{ij}\sigma_i\sigma_j$ is the sum *k {k* - 1) terms of covariance, and symbols *i* and *j* designate any pair of components of a measuring tool.

On the basis of the entered equalities and of some the hypotheses which have mathematical character and do not represent interest for developers of tools in education, the algebraic transformations are carried out. As the result the key inequality for value of reliability estimations in multistage criterion-referenced measurements can be written.

$$\rho_{CC'} \geq \frac{k}{k-1}\left(1 - \frac{\sum \sigma_i^2}{\sigma_C^2}\right) \tag{2}$$

where in the right part of inequality there is the expression known as coefficient alpha. It represents reliability of any component from *k* of stages of measurements.

According to this inequality the reliability of a compound score has the least reliability of components of a measuring tool as the lower limit. However, the reliability of compound score depends not only on reliability of each component of measuring tool, but also it depends from value of correlation between measurements results which are collected on separate components. In this connection, the method for reliability estimation in multistage measurements should reflect value of correlation between results in separate components (low or high) and must have branching character.

RESULTS

The Results of Structural Equation Modeling Application for Specialists' Accreditation in Area of Public Health Services

The application of SEM to the analysis of relations between disciplines and labour functions in professional standards has given the chance to choose optimum proportions of items which have formed the basis for measurement tools specifications for specialties: General medicine, Pediatrics, Dentistry. Pharmacy. Preventive medicine. Medical Biochemistry. Medical Biophysics. Medical Cybernetics. This specifications are presented by site

The Results of Reliability Estimation Methods Application in Multistage Measurements for Specialists' Accreditation in Area of Public Health Services

For approbation of methods for reliability estimation in multistage measurements 258 examinees were chosen from population examinees participated in approbation on 2017 in First Moscow State Medical University of I.M. Sechenov.

In connection with model of tools for multistage measurement in accreditation the forms included three stages: first - 60 multiple-choice items with one correct answer, second – 5 practical items for scoring practical skills, third – 7 mini-cases for scoring abilities to make decision in problem situations. For approbation of methods 5 parallel forms were used. All scores of examinees were presented in scales for criterion-referenced approach: pass or non-pass. The cut point was defined by the level of 70%.

As the base, the method of reliability estimation in multistage measurements for assessment in examinees accreditation is represented by **Table 1**. All steps of tool construction for multistage measuring are included in this **Table**, because the performance of each step influences the value of measurement reliability.

The performance of all steps presented by the **Table 1** will provide the professional approach to assessment in accreditation necessary at acceptance of high-stakes decisions.

For estimation of data reliability for every stage the Cronbach's alpha formula was chosen (Crocker & Algina, 2010). It does not demand parallel forms or double test administrations. Coefficient alpha is computed by the formula which is presented by right part in inequality (2). It allows to estimate an internal consistency of items which are dichotomously scored or scored by scoring rubrics with different weights.

The results of reliability estimations are presented by **Table 2.**

For reliability estimates it is necessary to compute correlation between results received by approbation of measuring tool components which include three stages. For correlation estimation the well-known formula of Pearson was used (Chelyshkova, 2002; Crocker & Algina, 2010). The results of application are presented by **Table 3.**

Table 1. The sequence of steps for tool construction with high reliability in multistage measurements

Number of step	Steps and rules for tool construction	
1	To develop the planned model of multistage measurements including number of stages and form of components for different stages in measuring tool, and to define the number of qualifying levels on scale of examinees scores	
2	To apply SEM, and to define the number of variables and common factors of influence	
3	To develop specifications of components content in measuring instrument for representation of professional standards requirements in the form of professional functions or actions	
4	To develop items according to specifications of measuring tool components and the rules for scoring answers in different form items	
5	To execute expertise of items content quality, and correction of their content by results of expertise. To estimate content validity of a measuring tool	
6	To spend approbation of tool by representative sample of examinees	
7	To process data of approbation on each component of a measuring tool by Classical Test Theory or by corresponding models of Item Response Theory, and to analyze test statistics for item calibration. To correlate the results of analysis with different components of a measuring tool and with planned skill levels. To correct item difficulty, to make cleaning and correction of a measuring tool by removal or addition items	
8	To spend repeated approbation of multistage measuring tool by representative sample of examinees	
9	To carry out the factorial and correlation analysis for optimization of number stages in measuring tool, to correct model and a measuring tool by results of the analysis, to estimate construct validity	
10	To define threshold points for each component of measuring tool and corresponding skill level and to spend its empirical validation	
11	To estimate reliability of each component in measuring tool by formulas 1 and 2	
12	To estimate correlation between results on measuring tool components	
13	Case of low correlation (not above 0,3)	Case of high correlation (above 0,3)
14	To choose minimum reliability of measurement results using reliability estimations on separate stages of measurements	To calculate average reliability of results on separat stages of measurements
15	To establish value of minimum reliability as the lower limit of reliability for compound score in multistage measurements	To establish size of average reliability as the lower limit of reliability for compound score in multistage measurements
16	To calculate average reliability of results on separate stages of measurements and to accept it as reliability of a compound score in multistage measurements	To calculate the reliability of all measuring tool by methods of correlation
17	To collect the data by external criteria about quality of graduates' work	
18	To estimate predictive validity of measuring instrument by similar samples of examinees and graduates	

Table 2. The results of reliability estimations for all stages

First stage	Second stage	Third stage
α_1 =0.72	α_2 =0.68	α_3 =0.63

Table 3. The correlations between stages

ρ_{12}	ρ_{23}	ρ_{13}
0.27	0.21	0.23

As **Table 3** shows there is the case of low correlation (not above 0.3). In accordance with methods for this case it is necessary to choose minimum reliability of stages as the *lower limit* of reliability in multistage measurements and then to calculate average reliability of results on separate stages of measurements and to accept it as reliability of a compound score in multistage measurements. So, the value of *lower limit* of reliability in multistage measurements is equal 0.63 and the value of reliability in multistage measurements is equal 0.68.

DISCUSSIONS AND CONCLUSION

The problems of efficiency increasing in assessment by multistage adaptive testing are new to scientists in the area of educational measurements. Basically, these problems began to be considered in the second decade of

XXI century and there are only few books in this area. As a rule, all publications about this topic are concentrated around technologies of adaptive testing (Yan, von Davier & Lewis, 2014). In them all questions are not considered in complex: from the moment of model measurement creation till the moment of quality analysis on the base of tests performance during its application as it is presented in given article.

As a whole, it is possible to notice that such innovative technologies, as multistage adaptive measurements, which applied in accreditation, and have been tested on reliability and validity, allow to raise efficiency of assessment and to motivate of examinees to performance items. Though the interest to using of multistage adaptive measurements worldwide grows, in Russia such researches practically are absent, despite a high urgency in connection with intensive development of qualifications independent assessment system. The reason of such backlog is quite clear: in our country there are no structures possessing banks of calibrated items with stability scores of parameter difficulty.

Using technology of adaptive testing at accreditation of public health services specialists and creation such banks with calibrated items are perspective directions for development of Methodical Centre for Specialists Accreditation in area of public health services (https://fmza.ru). The employees of Methodical Centre gradually develop theoretical base and software and analyze foreign experience. Though the decision of these problems is difficult and expensive, it the future of accreditation system.

As a whole, it is possible to draw the conclusion that carrying out researches on problems of adaptive testing opens new possibilities in creation of effective technologies and tool for assessment in accreditation.

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Higher Education Development and Regional Differences in China

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ABSTRACT
This paper analyzed the development of higher education and the regional differences in China, using the survey data and official statistics. Two indicators, the undergraduate students of per 100,000 population and higher education's contribution to GDP growth, were applied respectively to study the regional differences. The results showed that higher education in China was enjoying great development, fundamentally constructed talent cultivation system and comprehensively reasonable resource distribution. However, some colleges and universities still had some problems, such as incorrect orientation, overheated scale expansion and insufficient capital investment. Besides, higher education in China was suffering from considerable regional differences, namely higher education in East China is developing rapidly and contributing more to the economic growth, while the West China has presented slower rate of higher education development and smaller contribution to economic growth. Based on the problems lying in present reality of higher education development, this paper proposed the suggestions to enhance the development of higher education in China and to dispel the regional differences in higher education performance.

Keywords: higher education, regional differences, higher education quality

INTRODUCTION

With the advent of knowledge economy era, building an innovative country and enhancing national competitiveness become China's important strategic decisions in the context of adjustment of industrial structure and transformation of economic development pattern (Fang,2012; Ding,2015; Chen et al., 2017; Ekici et al., 2017; Gao et al., 2017). To build an innovative country, science and technology are the key, qualified personnel are the core, and education is the foundation. The training and growth of qualified personnel are inseparable from higher education. Higher education is the highest level of academic education before employment, main channel to enhance knowledge and ability, and an important component of China's education system. Making great efforts to develop higher education oriented to enterprise management, professional skills, high skills and social work personnel is an important part of the construction of qualified personnel, an important measure to build an innovative country and improve national competitiveness (Mok,2016; Huang,2017; Farhan & Aslam, 2017). By improving the management system and mechanism of higher education, improving qualified personnel training system, strengthening informatization construction, innovating teaching methods and improving service capabilities to make contributions to the construction of learning society and meet people's multi-level and diversified needs.

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Contribution of this paper to the literature

- Through the actual survey and official statistics, this paper analyzed the development and the main problems of higher education in China. The strategic layout of China's higher education has basically formed, but there is still much to be done for most universities to catch up with world-class universities.
- As for the regional differences of higher education in China, government should formulate a long-term plan to support the development of education in the western poverty-stricken areas, and set up the development of education in poverty-stricken areas fund.
- Government should strengthen education counterpart support efforts, increase the investment of the central government, and mobilize all social forces to develop the education business in China.

Chinese higher education has developed rapidly since 1990, and the number of colleges and universities has increased enormously (Hu, 2013; Gupta, 2015). In 1990, there were 1075 general institutes of higher education, and the number grew for 2560 in 2015. The gross enrollment rate also continues to rise, the rate of higher education reached 40**%**in 2015, and China will step into a stage of universal higher education. In the process of persistent and fast development of higher education, the acute problem of unbalanced development among different regions always exists. The development gap of regional higher education has become more and more serious recent years due to natural, historical, social, economic and other reasons, and it brings about directly the gap of regional personnel cultivating, finally it will become the key constraint of Chinese balanced economic development (Feng, 2013; Liu, 2016; Opitz et al., 2017). Therefore, the study on Chinese higher education development gap among different regions is significant to analyze the development status of Chinese higher education and development gap among different regions, it is also of great importance in making suggestions on the balanced higher education development among different regions.

This paper analyzed the development of higher education and the regional differences in China, using the survey data and official statistics. Two indicators, the undergraduate students of per 100,000 population and higher education's contribution to GDP growth, were applied respectively to study the regional differences. Based on the problems lying in present reality of higher education development, this paper proposed the suggestions to enhance the development of higher education in China and to dispel the regional differences in higher education performance.

DATA SOURCES

Survey Data

In this paper, combining the official data published by colleges, and referring to the data published by the Ministry of Education, the Ministry of Human Resources and Social Security and other relevant ministries, typical colleges were selected for research. Through field research, field interviews and questionnaires, the present situation and problems of China's higher education were discussed in the aspects of orientation of running college, training of qualified personnel and mode of running college. The information was collected from 553 colleges in North China, South China, East China, Northwest China, Southwest China, Central China and Northeast China. Among them, the number of effective samples of subordinate colleges, provincial colleges, municipal colleges and private colleges were: 84, 366, 53 and 50, respectively, among which, provincial colleges had the largest effective sample number, making up 66%. The number of recovered colleges in the seven areas was 63, 124, 204, 30, 55, 43, and 34, respectively. After the survey data were collected, a basic verification of the survey data was conducted. The basic verification referred to the evaluation of quality of the survey data from the aspects of standardization, correlation, accuracy and reliability, which can ensure the quality of basic data and lay a scientific basis for the objective analysis and observations of research report. Correlation, accuracy and reliability verification were the basis to reflect the representativeness and authenticity of survey samples, and the foundation for the objective reflection of this report, which were illustrated using **Table 1** as an example.

Table 1. Sample proof

	North China	south China	East China	Northwest China	Southwest China	Central China	Northeast China	Total
Subordinate colleges	23	7	21	8	9	12	4	84
Provincial colleges	34	82	150	21	43	25	11	366
Municipal colleges	3	18	14	1	0	5	12	53
Private colleges	3	17	19	0	3	1	7	50
Total	63	124	204	30	55	43	34	553

In this paper, after the survey data of different colleges were collated, they were counted, analyzed and evaluated objectively "with the investigation as the basis, data as the foundation, research as the core, and goal as the guidance". The survey data were collated according to the overall target and survey plan, and the indicators were designed according to research needs and processed into statistical data, including the classification system, quantification standard and data extraction principle of design statistics items, which guaranteed the unity of sampled data and the normalization of statistical data.

Official Statistics

This paper uses gross domestic product (GDP) to measure economic growth. To eliminate the sharp fluctuations in GDP caused by price factors, the annual GDP is calculated as the comparable price of 1990. The data are from the gross domestic product of all regions in the China statistical yearbook (2000-2016).

In this paper, the investment of education is used to measure the investment of education. The data are all from the financial statistics yearbook of China (2000-2016).

DEVELOMENT STATUS OF HIGHER EDUCATION IN CHINA

According to survey data, the strategic layout of China's higher education has basically formed. On the basis of setting up the systematic knowledge system, China's colleges actively dock the needs of society, and have initially formed the teaching mode of serving the national strategy and regional economic and social development. The formation of the strategic layout of higher education mainly consists of the formation of the diversification of college running subjects of higher education, reasonable allocation of resources and sound personnel training system.

Diversity of Investment and School - Running Mode

In view of college running subjects, China's colleges can be divided into four types: subordinate colleges, provincial colleges, municipal colleges and private colleges. The number of provincial colleges is the largest, and subordinate colleges have the largest average number of students. This shows that subordinate colleges are still the main body of continuing education talent training among colleges. Although municipal colleges and private colleges have no advantages in the number of colleges and the average number of students, they are still an important part of China's higher education, and make important contributions to the popularization of China's higher education. In terms of student training, different colleges train their students at different levels according to different market needs. Subordinate colleges basically have a complete system for training junior college, undergraduate college and graduate college students, and municipal colleges and private colleges basically have a complete system for training junior college and undergraduate college students. On the whole, the personnel training structure of China' colleges is basically reasonable. **Table 1** also shows that China's higher education has formed a structure where subordinate colleges, provincial colleges, municipal colleges and private colleges are college running subjects, and private colleges' participation in higher education shows that the diversification of the college running subjects of China's higher education has been basically formed.

Table 2. School-enterprise cooperation statistics

		Subordinate colleges	Provincial colleges	Municipal colleges	Private colleges
School-enterprise cooperation (sample size:127)	Enterprise investment assistance	31	63	6	2
	Enterprise training base	12	38	7	6
	Enterprise practice base	33	52	11	4
	Administration section for cooperation	3	6	2	1
	Scientific institutions for cooperation	8	19	7	1
Serving the enterprise (sample size:64)	Order - based cultivating mode	4	23	15	9
	Solving problems for enterprise	16	21	14	7

Well - Organized Personnel Training System

The popularization of higher education is a unification of quantity and quality, where "quantity" refers to 15%-50% enrollment rate of school-age young students, and "quality" refers to a series of changes, such as diversification of training objectives and education model, expansion of education function, change of educational philosophy, curriculum, teaching method, admission qualification, management mode and relationship between higher education and society. Judging from the development status of China's higher education, China's higher education has basically realized the unification of quantity and quality.

The positioning of personnel training of China' colleges is clear. The colleges carry out their personnel training from the two aspects of society and individuals, take the mission entrusted by the national educational undertakings as the core, and undertake the function of providing higher education for students. From a social perspective, it is a customized training formed to develop reserve personnel and to meet the development of country and enterprise. For example, some colleges focus on cadre education by actively carrying out the training of party and government personnel to train senior civil servants, senior scientific and technological personnel and academic backbone; some colleges actively serve China's western development strategy by supporting and encouraging the training of personnel in the western regions and increasing the intensity of the training of personnel in the western regions, making great contributions to the training of personnel in the western regions; some colleges actively participate in the "National Training Program" project by training backbone teachers for the national primary and secondary education.

According to statistical data, the colleges set up special personnel training programs, actively dock the needs of the state and society, actively serve the demands of enterprises' human resources, and develop "order form" training programs according to the development needs of enterprises. Take provincial colleges for example, they set up different majors, with an average of 92 majors. Th college-enterprise cooperation by the colleges with an increasing number can serve the enterprises better, for example, the colleges developing college-enterprise cooperation make up 47%, and the colleges undertaking social services make up 12%. The colleges actively explore the college-enterprise cooperation characteristic modes, such as investment in financing college students by the enterprises, setting up enterprise training base and practice base as well as cooperative scientific research institutions to train application-oriented personnel for the enterprises. According to statistical data, about 60% of colleges have set up enterprise training bases, 30% of colleges have set up college-enterprise cooperation management departments, and 70% of colleges have set up enterprise practice bases. Overall, the colleges actively dock the actual needs of enterprises to achieve win-win cooperation with the enterprises.

The Informatization of Higher Education has been Greatly Improved

Information platform is the main means for higher education and serve the society and students, and information resources are the foundation for higher education and serve the society and students. All the colleges actively accelerate the construction of digital resources, make efforts to increase the quantity of information digital resources, and actively build teaching websites and network platforms. The survey data shows that about 67% of colleges have actively carried out the construction of information digital resources, after development, they have built a large number of network courses, videos and other teaching resources, and have also formed special resources. For example, about 42% of colleges have set up information platforms to share resources; the colleges actively build network courses, shared courses and video courses with the help of Internet platform, and integrate education teaching, examination management and distance education policy, and provide multi-level and diversified educational services for all types of social members combining the informationization and quickness of knowledge economy. 32% of colleges have set up a perfect digital network teaching and management platform integrating teaching, management, service and scientific research to carry out network teaching and support services and monitor students' learning process and provide personalized service for students, possessing perfect supporting environment for teaching, learning and other informationization teaching. In view of the average input of colleges, the pilot colleges make a large investment in hardware investment, as they have constructed perfect hardware platforms and network frameworks, been equipped with adequate servers, routers and other network facilities, and built courseware broadcasting system and environment with good performance, laying a material foundation for the construction of network teaching resources.

Based on the analysis, it is observed that the higher education network teaching management platform and system of colleges are perfect, server and other hardware facilities are well established, the construction environment of teaching courseware and other digital resources are perfect, and the informatization level of network education is high. Especially the pilot colleges actively create characteristic network courses, actively explore and adapt to a variety of terminal learning needs as well as multiform and diversified new digital teaching resources such as "IMOOC class" and "micro class", and have built a number of digital learning resources with flexible forms, clearly content targeted and knowledge point as unit. For example, the pilot colleges have established 1,017 shared network courses of national resource, 227 shared network courses of a hundred of college resource alliance, and 209 state-level quality network courses, making useful exploration and positive contributions to the promotion of digital resource sharing and opening. The popularization of higher education informationization by the colleges promotes the innovation of educational concepts and teaching modes, and promotes the extensive application of information technology and network technology in the field of continuing education. The sample analysis shows that 11% of colleges make advantage of the information platform to improve their teaching quality by adopting various teaching modes.

MAIN PROBLEMS IN CHINA'S HIGHER EDUCATION

The Positioning of Some Colleges is not Accurate

Social development requires both research personnel and technical personnel. By training research personnel to improve management level, technical level and productivity level to promote economic and social development. By training technical personnel to train specialized technical personnel to transform knowledge technology into productivity. There is no doubt that these two kinds of education are important. However, in china it is generally believed that research-oriented higher education is more important than technology-oriented higher education, under the influence of this idea, the colleges focus on the training of research personnel instead of technical personnel, and some municipal colleges and private colleges' positioning of attaching importance to research instead of technology due to weak strength leads to decentralized teaching resources and low teaching quality. In fact, subordinate colleges and provincial colleges can attach importance to the training of research personnel, and municipal colleges and private colleges can attach importance to the training of technical personnel. At present, China's colleges do not have accurate positioning of their own development as their goal is just to build a comprehensive university.

The Education Scale Expands Too Fast

Since 1999, China's colleges have begun to develop too fast as they are upgraded too much and too fast: technical secondary schools are upgraded to junior colleges, junior colleges are upgraded to undergraduate colleges, undergraduate colleges are upgraded to graduate colleges, and graduate colleges are upgraded to doctoral colleges, after a round of upgrading, colleges have expanded too fast. At the same time, the enrollment scale of colleges is increasing rapidly. By 2015, as the number of China's colleges reaches 36,470,000, the scale of China's colleges has become the first in the world. This leads to a downward trend in college teachers' quality, standing in stark contrast to the surging growth of college students. The construction of college teachers cannot catch up with the growth of college students, so the overall education and teaching quality of higher education has been reduced. In the long run, the development of China's higher education is bound to be greatly affected.

According to survey data, 16.1% of colleges reflect that junior colleges and undergraduate colleges use the same training program and similar textbooks, which obviously does not accord with the basic teaching rules of higher education. Some colleges reflect that the colleges do not have the right to set up their own majors, which limits their ability to give full play to their academic and professional advantages and to serve the society. Moreover, all the colleges show low-level repeating major setting and strong homogenization, so they cannot meet the needs of the market. 67.9% of colleges believe that the current teaching material system and specialized curriculum system cannot meet the needs of application-oriented personnel training, so attention should be paid to the role of experimental teaching in the process of higher education. Furthermore, the construction of some specialized curriculum systems cannot meet the needs of personnel training by enterprises, as it cannot set up majors in response to enterprise requirements and is lack of practice and practical ability training; the teacher interaction mechanism and the system of "teacher entering the enterprise, the engineer entering the classroom" have not been established, and the practical skill training is lacked.

The Funding of Some Colleges is Inadequate

The fact that the tuition of China's colleges is low, pricing cycle is too long, and charging standard is single and lacks flexibility leads to colleges' failure to adapt to the needs of economic and social development for the higher education to serve the society. Some provincial colleges and municipal colleges don't increase their tuition for many years, leading to inadequate funding. Some private colleges don't have supporting funds as they are not financed by the state. The low tuition standard cannot maintain the necessary input in education and teaching, and seriously affect the construction of teachers, the reform of education and teaching as well as the improvement of education quality. Because of the low tuition standard, the students in some private college do not cherish the learning opportunity, and drop out of college randomly. Lack of financial input to private colleges leads to the fact that private higher education is often regarded as a profit-making activity, which affects the social reputation of private higher education.

REGIONAL DIFFERENCES OF HIGHER EDUCATION IN CHINA

Regional Differences in the Number of Undergraduates per 10,000 Population

The number of undergraduates per 10,000 population is an important indicator to measure education development in a region (Gao, 2017). Although the number of undergraduates in the total population of the country grows rapidly, but it varies widely across the country. The gap between eastern, central and western China is still very prominent. Taking the average number of undergraduates per one hundred thousand population in Chinese provinces in 2015 as an example, regional differences in higher education in different regions of China are analyzed, see **Figure 1**.

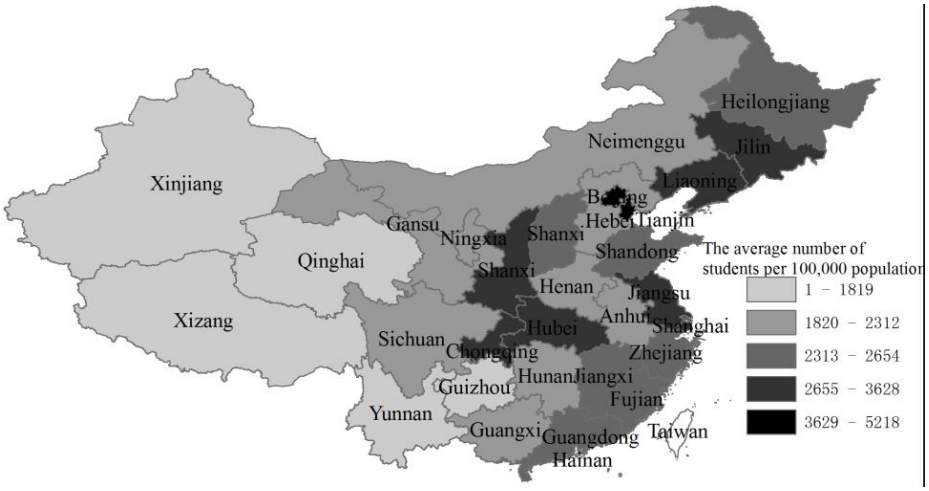

Figure 1. Regional differences in the number of undergraduates per 10,000 population

It can be seen from **Figure 1** that the number of undergraduates in the east is greater than that in the west. The three provinces with the most number of undergraduates per one hundred thousand population are in the east. It is Beijing (5218 undergraduates) followed by Tianjin (4185 undergraduates) and Shanghai (3330 undergraduates). The three provinces with the least number of undergraduates per one hundred thousand population are in the west. It is Tibet (1766 undergraduates) followed by Yunnan (1819 undergraduates) and Guizhou (1819 undergraduates).

Regional Differences of Contribution Rate of Higher Education to GDP Growth

The model of the Cobb–Douglas production function is

$$y = AK^{\alpha}L^{\beta} \tag{1}$$

where Y is the output, A is the technical level, K is the capital input level, L is the labor input level, α is the coefficient of the capital output elasticity,β is the coefficient of the labor output elasticity, $\alpha > 0, \beta > 0, \alpha + \beta = 1$.

Based on Cobb–Douglas production function to calculate education contribution to GDP growth, namely measuring which national output growth rate in proportion to the GDP growth rate. Its theoretical basis is that education can improve labor productivity, and thus can affect labor inputs (Fan, 2017). In this paper, we use the product of base amount of labor input L_0 and education input E to replace L. Take a logarithmic derivative of both sides of the production function, we get

$$y = c + \alpha k + \beta l_0 + \beta e \tag{2}$$

where y is the annual growth rate of the economy, c, k, l_0 and e are and the annual growth rate of technological progress, capital, labor input and education respectively.

Therefore, the model of education's contribution to economic growth rate is:

$$C_E = \frac{\beta e}{y} \tag{3}$$

β is different in different regions, and when study regions in China, scholars generally take between 0.7 and 0.8. The β in this model is 0.7, i.e., 1% increase in labor input and 0.7% in output.

Defines education comprehensive index:

$$e = \frac{\sum_{i=1}^{n} s_i}{n} \tag{4}$$

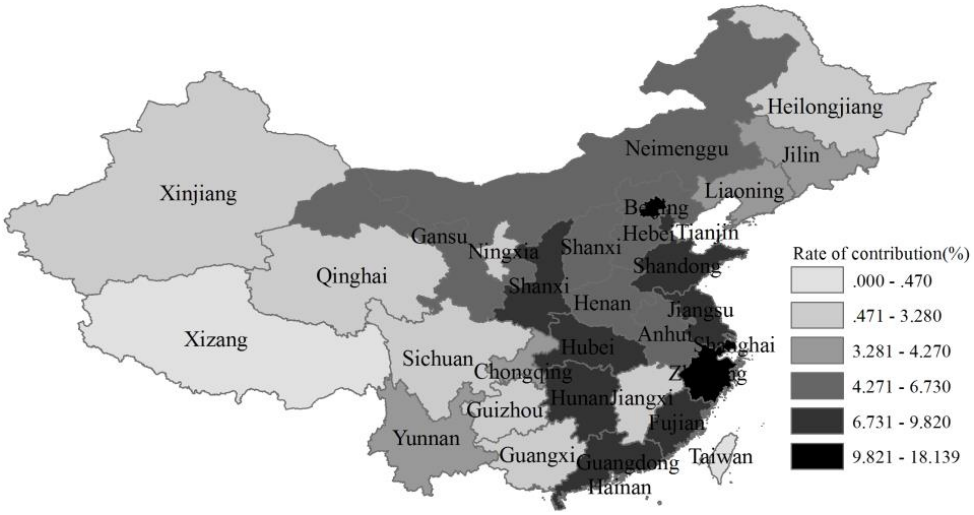

Figure 2. Regional differences of contribution rate of higher education to GDP growth

where s_i is the education evaluation index, this paper uses the students in institutions of higher growth rate, growth rate of higher school faculty, institutions of higher learning funding growth rate to calculate. Taking the higher education statistical data in 2015 as an example, calculate regional GDP annual growth rate and growth rate of higher education, in order to calculate local higher education contribution to GDP growth, the calculation results as shown in **Figure 2**.

Can be seen from the **Figure 2**, eastern China, such as Beijing, Shanghai, Tianjin, Shandong and other regions, the contribution rate of higher education to economic growth is generally higher, western regions such as Xinjiang, Tibet, Qinghai and other regions, the contribution rate of higher education to economic growth is generally low.

CONCLUSIONS AND SUGGESTIONS

In this survey, we strongly feel that the time for advancing higher education reform has come. In the long run, we should expand the scale of higher education and meet the needs of the masses for higher education, more importantly, we should improve the quality of higher education and put the quality of higher education in a more prominent position. After all, the ultimate aim of colleges is to train more top-notch personnel, first-class personnel and innovative personnel. Based on this, the following countermeasures and suggestions were put forward in this paper.

Appropriately improve the tuition standard of higher education, pay attention to the training of teachers, and increase the remuneration of teachers to ensure the stability of teaching staff so as to ensure the quality of teaching. Further enrich the teaching resources of higher education, and constantly develop new teaching resources and courseware to provide students with high quality learning resources; meanwhile, increase the places, equipment and instruments for higher education teaching. In terms of teaching methods and means, it is recommended to adopt “expert lecture”, “group discussion”, “role play”, “case teaching” and “field simulation” according to the characteristics and specific conditions of higher education, and combine the modern training with digital information technology, network technology, multimedia and other high-tech means to stimulate students’ thirst for knowledge. In addition, the formulation of teaching plan and organization of teaching should be specific. Emphasize the practicability of teaching materials when choosing teaching materials, and encourage teachers to compile teaching materials by themselves according to their learning objects so as to better meet the requirements of students’ thirst for knowledge.

Further increase investment, improve the online learning platform of higher education, speed up the development and application of multimedia teaching courseware, and promote the construction of informatization of higher education by using distance education technology; develop high quality online courses and educational software; by effectively using modern scientific and technological means to build resource sharing platforms, and to establish relevant curriculum system, quality guarantee system, credit certification system and network education platform; give full play to the social service function of colleges. It is suggested that the colleges make full use of the advantages of disciplines to produce high-quality digital teaching resources and publish them via Internet platform to meet students' needs to learn anywhere and everywhere, thereby greatly easing the contradiction between work and study.

As for the regional differences of higher education in China, we should formulate a long-term plan to support the development of education in the western poverty-stricken areas, and set up the development of education in poverty-stricken areas fund. Besides, we should strengthen education counterpart support efforts, increase the investment of the central government, and mobilize all social forces to develop the education business in the Midwest.

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A Computer Corpus-based Study of FOREIGN in English Newspapers and its Pedagogical Implications

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ABSTRACT
This study adopts the methodology of corpus-based analysis and Contrastive Interlanguage Analysis (CIA) and uses two corpora (Chinese English Newspapers Corpus and American English Newspapers Corpus) as the source of data to make an empirical study on the use of the word, *foreign*. Major findings show that firstly Chinese English newspapers tend to overuse *foreign* and collocations of *foreign* are more diversified in Chinese English newspapers than those in native English newspapers, and secondly Chinese English newspapers focus on the neutral sense of *foreign* while neglecting its derogative meanings. Based on the above findings, pedagogical implications have been stated at last.

Keywords: corpus-based study, *foreign*, English newspapers, Contrastive Interlanguage Analysis, pedagogical implication

INTRODUCTION

A corpus is defined as "a collection of examples of language in use that are selected and compiled in a principled way" (Huang & Yao, 2015; Duan, 2017; Sadi, 2017) and corpus linguistics as linguistic studies of such corpora. Corpus linguistics is considered a new scholarly enterprise in current years. Over the last forty years, there has been a great development in the compilation and analysis of corpora stored in computerized databases. According to Biber (2000), a corpus-based approach to linguistic studies and language teaching possess many advantages with which the traditional approaches cannot compete. Firstly, computers make it possible to identify and analyze complex patterns of language use; secondly, they allow the storage and analysis of a larger database of natural language than could be dealt with by hand; thirdly, they provide consistent, reliable analyses---they do not suffer from mental fatigue or indecisiveness; fourthly, they can be used interactively, allowing the human analyst to make difficult linguistic judgments while the computer manages all the record-keeping.

With its rapidly growing economy, China nowadays is more deeply involved in global cooperation and development than ever before. Therefore, a window for the world to learn more about China is greatly needed. Today Chinese English newspapers have become one of the major ways for the world to know more about China, so scholars now are more concerned about how Chinese English newspapers can express the intended messages effectively.

Yu Xi (2006) conducted a study on the usage of a specific word *foreign* to see whether there were differences in the use of *foreign* between Chinese English news reports and native English news reports. His research found the

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Contribution of this paper to the literature

- The present study uses corpus approach to analyze the word FOREIGN based on a large quantity of data, which is innovative in that the findings are more reliable compared with the previous studies in this field which usually used a small number of data to make analysis. The research findings can extend the scope of earlier studies of English lexis.
- The findings explored by the present study can offer pedagogical implications that English vocabulary teaching should focus on its all-round meaning so that learners can use words in appropriate situations.
- The corpus-based methodology used by the present study can be applied to help learners with English learning. Although textbooks and handbooks can offer meanings and usage of English words, there is little guidance as to how often and in what specific situations they should use these words to be able to approximate good native English writing. A large collection of native English corpus and software such as AntCont used in this study can fill this gap.

overuse of *foreign* in Chinese English news reports. However, there were some limitations in his study. He did not find out the specific reasons behind the overuse of *foreign*. More importantly, the material (English news report articles) which he used in the research has been out-of-date, and cannot reflect the current situation of the English news reports. Thus, there is an urgent need to collect the most updated data to conduct the research.

The present study aims to investigate the differences in the use of adjective *foreign* by China's English news reporters and native English news reporters. A corpus-based approach and Contrastive Interlanguage Analysis (CIA, hereafter) are adopted in the present study. Besides, a further study is conducted to explore the possible causes behind these differences. The present study is intended to help raise both teachers' and learners' awareness of the understanding and proper use of the word *foreign* in English writing.

RESEARCH DESIGN

Material

In this study, the researchers compile two new corpora to study the use of *foreign*. One is the American English newspapers corpus (hereafter AEC), which contains 366,221 words of the news reports from five major American English newspapers (The New York Times, The Washington Post, The Boston Globe, Los Angeles, Chicago Tribute). The other one is the Chinese English newspapers corpus (hereafter CEC), which gathers a total number of 304,682 words from four major Chinese English newspapers (China Daily, Beijing Review, Xinhua News, 21st Century). All the news reports were collected from 2011 to 2016, which the researchers believe can reflect the current trend of the word usage. The following are the descriptive data of the two corpora used in the present study.

Instrumentation

Table 1. The Descriptive Data of the Two Corpora Used in the Present Study

Corpus	AENC	CENC
Newspapers	The New York Times, The Washington Post, The Boston Globe, Los Angeles, Chicago Tribute	China Daily, Beijing Review, Xinhua News, 21st Century
Size of corpus	366,221 words	304,682 words

In this research, AntConc3.4.3 is used as the search tool in linguistic analysis. The program functions include wordlist, concordance, collocates, keyword list, concordance plot, file view and clusters. Moreover, online calculation instrument---Log-likelihood Calculation is used to test the keyness of the word *foreign*.

Table 2. Overall Frequencies of FOREIGN in CENC and AENC

	CENC	AENC
Total Number of Words in Corpus	304,682	366,221
Tokens	397	178
Tokens/10 000 Words	13.03	4.86

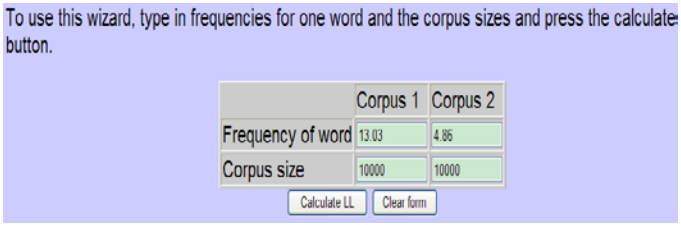

Figure 1. Log-likelihood Calculator

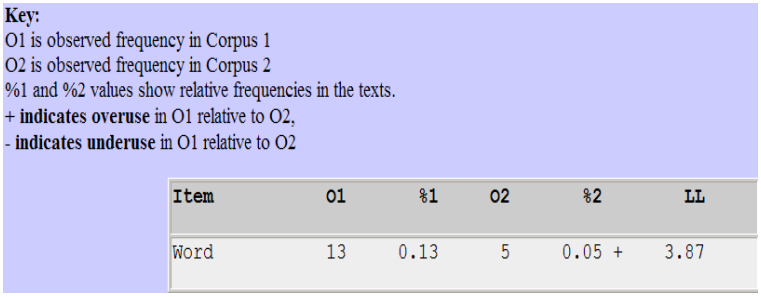

Figure 2. Log-likelihood Calculator Results of FOREIGN

RESULTS AND DISCUSSIONS

Overall Frequencies of FOREIGN

The overall frequency of *foreign* in the two corpora—CENC and AENC is first examined. **Table 2** shows the number of types and tokens of *foreign* in the two corpora. Since the corpora differ in size, the number of tokens per 10,000 words is also given.

Table 2 shows that the Chinese English newspapers tend to use *foreign* more frequently than the native English newspapers (13.03 vs. 4.86 per 10,000), which might indicate that Chinese English newspapers overuse the word *foreign*. The researchers will then conduct a test from a statistical perspective, to see whether the observed overall frequencies in the two corpora do reveal something significant.

The current study employs an online test, Log-likelihood Calculation. Following the instructions, the researchers enter the plain numbers respectively shown in **Figure 1**, then press the button "Calculation LL", and the result appears within a second as is presented in **Figure 2**. **Figure 3** tells how this tool works.

Figure 2 shows that G2 is 3.87, larger than G2 of 3.84 at the level of $p<0.05$ (as shown in **Figure 4**). And the "+" in **Figure 2** indicates the overuse in Corpus 1, the CEC, relative to Corpus 2, the AEC. The instructions in **Figure 4** show that the higher the G2 value is, the more significant is the difference between two frequency scores.

With the statistics shown above, the current research can draw a conclusion that the difference between word frequencies of *foreign* in the two corpora is of great significance (Ho et al., 2017). Next, a further study on *foreign* between the two corpora will be carried out.

Log likelihood is calculated by constructing a contingency table as follows:

	Corpus 1	Corpus 2	Total
Frequency of word	a	b	a+b
Frequency of other words	c-a	d-b	c+d-a-b
Total	c	d	c+d

Note that the value 'c' corresponds to the number of words in corpus one, and 'd' corresponds to the number of words in corpus two (N values). The values 'a' and 'b' are called the observed values (O), whereas we need to calculate the expected values (E) according to the following formula:

$$E_i = \frac{N_i \sum_i O_i}{\sum_i N_i}$$

In our case N1 = c, and N2 = d. So, for this word, E1 = c*(a+b) / (c+d) and E2 = d*(a+b) / (c+d). The calculation for the expected values takes account of the size of the two corpora, so we do not need to normalize the figures before applying the formula. We can then calculate the log-likelihood value according to this formula:

$$-2\ln\lambda = 2\sum_i O_i \ln\left(\frac{O_i}{E_i}\right)$$

This equates to calculating log-likelihood G2 as follows: G2 = 2*((a*ln (a/E1)) + (b*ln (b/E2)))

Figure 3. The Way Log-likelihood Calculator Works

Note: (thanks to Chris Brew) To form the log-likelihood, we calculate the sum over terms of the form x*ln(x/E). For strictly positive x it is easy to compute these terms, while if x is zero ln(x/E) will be negative infinity. However the limit of x*ln(x) as x goes to zero is still zero, so when summing we can just ignore cells where x = 0. Calculating ln(0) returns an error in, for example, MSExcel and the C-maths library.

The higher the G2 value, the more significant is the difference between two frequency scores. For these tables, a G2 of 3.8 or higher is significant at the level of $p < 0.05$ and a G2 of 6.6 or higher is significant at $p < 0.01$.

- 95th percentile; 5% level; $p < 0.05$; critical value = 3.84
- 99th percentile; 1% level; $p < 0.01$; critical value = 6.63
- 99.9th percentile; 0.1% level; $p < 0.001$; critical value = 10.83
- 99.99th percentile; 0.01% level; $p < 0.0001$; critical value = 15.13

Figure 4. The Way Log-likelihood Calculator Works

The Collocations of Adjective FOREIGN in CENC and AENC

This section will examine the collocations of *foreign* in the two corpora and try to find out whether there is any difference between the two corpora in the collocation of this word.

First of all, AntCon3.4.3 is used to search the top ten collocations of *foreign* in CENC and AENC. The top ten collocations of *foreign* in CENC and AENC are listed in the following table.

Table 3. The Top Ten Collocations of Adjective *FOREIGN*

List	CEC	Tokens	%	AEC	Tokens	%
1	exchange(s)	44	11.1	minister(s)	22	12.4
2	minister(s)	39	9.8	policy	15	8.4
3	investment(s)	27	6.8	ministry/ ministries	13	7.3
4	company/companies	24	6.0	exchange	10	5.6
5	ministry	23	5.8	journalists	8	4.5
6	country/countries	20	5.0	investment	7	3.9
7	affair(s)	18	4.5	governments	6	3.4
8	policy/policies	16	4.0	relation(s)	5	2.8
9	investor(s)	13	3.3	secretary	4	2.2
10	trade	11	2.7	affair investor(s)	3	1.6

From the above table, it can be see that there are some similarities in the use of frequent collocations of *foreign* in the two corpora. Among the top ten collocations, there are six collocations appearing in both corpora. They are: *foreign* minister(s), *foreign* exchange(s), *foreign* policy/policies, *foreign* investment(s), *foreign* affair(s), and *foreign* investors. The researchers also find that in CEC and AEC, most of *foreign*'s collocations are noun phrases. But when it comes to the tokens and types, it is found that CEC's three frequently used collocations: *foreign company (companies), foreign country (countries)* and *foreign trade* are rarely seen in AEC. Furthermore, in CEC there are 87 types of nouns which are modified by *foreign*, while in AEC, there are 46 types of nouns modified by *foreign*. Generally speaking, native English speakers tend to use words in a more flexible way, and the collocations of the words may appear to be more varied. But with regard to the types of nouns modified by *foreign* in the two corpora, the Chinese English newspapers collocate *foreign* with more various kinds of nouns. Unexpectedly, the native English newspapers use fewer types of nouns. Thus, in terms of the meaning of *foreign*, it is assumed that the native English newspapers might replace *foreign* with other words to express the similar meaning. So in the next step, a comparison on the most frequent collocations of *foreign* will be made between CEC and AEC.

Specific Analysis of the Top Ten Most Frequent Collocations of FOREIGN in CENC and AENC

As discussed before, the collocations *foreign exchange(s), foreign minister(s), foreign ministry/ministries, foreign policy/policies, foreign affair(s)* and *foreign investor(s*) appear in the top ten frequent collocation lists in both corpora. In these high frequent collocations, except for the fixed phrase *foreign exchange* which means a system of buying and selling, the word *foreign* in the other five collocations is defined in *Oxford Advanced Learner's Dictionary* (Hornby, 2005) as follows:

1. of, in or from a country or an area other than one's own;
2. dealing with or involving other countries.

However, as mentioned before, CEN's top three most frequent collocations *foreign company/companies, foreign country/countries*, and *foreign trade*, are rarely seen in AEC. Why do native English newspapers seldom use these collocations? According to *Chamber Maxi Paperback Dictionary* (Schwarz, 1992), *foreign* has other definitions: alien; extraneous; not belonging; unconnected; not appropriate.

Apparently, the meanings have a derogative tincture, which can be found in the following example in AEC:

> *But this small, working-class neighborhood, known for its sometimes kitschy embrace of Old World pride, seems determined to restore a connection with a country few of its residents have visited, a language that fewer speak, and a culture that has already grown increasingly foreign.*

The sentence above is taken from a news report: *Reclaiming An Identity Washed Out In A Flood* in *New York Times* on March 20, 2011, which is about a small Czech community living in Iowa and trying to protect their own culture from disappearing. Considering the context of this news report, "*foreign*" means that the Czech culture has become strange when people have lost the sense of belonging to their own culture.

From the example above, it can be seen that native English newspapers sometimes use *foreign* with negative connotations, while in CEC the researchers cannot find such kinds of usage. This is one of the differences on the use of *foreign* between the two corpora in terms of the word's semantic meaning. In the next step, the researchers will continue to analyze another difference on the use of *foreign* between CEC and AEC.

Specific Analysis of the Frequent Collocations of FOREIGN unique in CEC

As mentioned before, in CEC, the collocations *foreign company/companies, foreign country/countries*, and *foreign trade* are widely used, while in AEC they are rarely seen. So, here come the questions: why do Chinese English newspapers overuse these collocations? What other expressions do native English newspapers use when they want to express similar meanings? The following part will focus on the above questions and make a specific analysis of these three collocations.

1. The first collocation is "*foreign* company/companies", which refers to companies that belong to other countries or companies with investments by other countries in China. In China, "foreign company/companies" has become a common phrase after 1978 due to economic policies. From then on, companies from developed countries flooded into China to develop new markets. The large amount of *foreign* capital brought by these companies has greatly boosted China's economy. Since then, "*foreign* company/companies", which is the English translation of the Chinese term "waiguo gongsi"or "waizi gongsi", has been widely used around China. But such a popular phrase is rarely found in AEC. In order to get more details, the researchers study the synonyms of *company*: *firm* and *corporation*, to see whether there are "*foreign* firm/firms" or "*foreign corporation/corporations*" used in AENC. The searching result displays one for "*foreign firms*". Therefore, it is clear that native English news reports seldom use this collocation. After trying another search words for the similar meaning with "*foreign company/companies*" in AEC, the researchers get 3 instances of "*international firms*", 3 instances of "*international company/companies*", and 1 instance of "*international corporations*", which have similar meaning to "*foreign company/companies*". According to Collins Cobuild Dictionary (Sinclair, 2000), "international" is defined as "*between or involving different countries*". Clearly, this definition is neutral, and by referring to other dictionaries, the researchers get similar definitions. Thus it is easy to understand why native English newspapers prefer to use "international".
2. The second collocation is "*foreign country/countries*" in CEC, which cannot be found in AEC. So how do native English newspapers express the same meaning? the researchers search for the frequent collocations of "country/countries" in AENC, and find that there are 30 "other country/countries" used to express the same meaning. It seems that "other country/countries" might have less subjective bias.
3. As for "*foreign* trade", the researchers find that there are several similar expressions in CEC. They are "*international trade*", "*global trade*", "*multilateral trade*", and "*world trade*". However, in AEC, there are only 3 instances of "*international trade*", which might be a substitution for "*foreign* trade". The cause of overuse of "*foreign* trade" is similar to the case of "*foreign company/companies*". With the rapid development of economy and new technology in China, especially the One Belt, One Road Initiative, international trade has become very popular among countries, which, to some extent, leads to the overuse of "*foreign* trade" in China.

After the above analysis of "*foreign company/companies*", "*foreign country/countries*" and "*foreign trade*", the current study concludes that there are external and internal factors which lead to the overuse of these collocations. As to the external factors, the Reform and Opening-up policy allows other countries' investments in China, and the Chinese people may have greater chances to know more about "*foreign*" things and use this word based on these

cross-border economic activities. For the internal factors, they may come from a linguistic perspective. In Chinese English dictionaries, the word *foreign* does not suggest anything negative. However, in some native English dictionaries, this word has negative meanings.

Possible Causes of the Results

The possible reasons for the overuse of *foreign* in Chinese English newspapers might be explained from the two perspectives.

Social background is considered as the first reason. It is well known that China nowadays has much more frequent contact with other countries in many fields, especially in the areas of economy and culture. Since there are much exchange and international cooperation with the outside world, the Chinese phrase "waiguo" (other countries), which is translated as "*foreign*", is commonly seen in Chinese mass media when they describe the things dealing with or involving other countries. As a result, the wider the Chinese phrase "waiguo" is used, the more frequently *foreign* might appear in Chinese English newspapers, hence the overuse of it.

The second reason is explained from the linguistic perspective. In most English-Chinese bilingual dictionaries, the first definition of *foreign* is "waiguode", which does not carry any negative meaning. After studying all the collocational patterns of *foreign* in CEC, the researchers found that *foreign* is mostly used in the first definition. That is to say, Chinese English newspapers focus on the core meaning of *foreign* while overlooking its other meanings. Thus, the current study can conclude that the lack of all-round understanding of *foreign* may result in its overuse in Chinese English news reports.

PEDAGOGICAL IMPLICATIONS

The major findings are summarized as follows:

Firstly, Chinese English newspapers tend to use *foreign* more frequently than English native newspapers and they focus on the neutral meaning of *foreign* while neglecting its derogative meanings. Secondly, Chinese English newspapers use *foreign* in more variety of situations to express the meaning of between or involving different countries, while English native newspapers use international to express the similar meaning.

These findings bring some pedagogical implications for English teaching in China.

Firstly English teaching should call the learners' attention to the all-round meaning of *foreign*, especially its derogative meaning; Secondly learner should be made aware to use more appropriate word like international to express the intended meaning in some situations. Lastly but least, English learner can be taught to use native English corpus to guide their writing. Textbooks and handbooks can offer the meanings and usage of the English words, but there is little guidance as to how often and in what specific situations they should use these words to be able to approximate good native English writing. A large collection of native English corpus and software such as AntCont used in this study, makes complements for the textbooks. While the concordance from the learner corpus provides the actual illustration for the learners' typical problems, the concordance from the native corpus provides resources of reference when the teachers or learners need information concerning the actual use of the focused usage by the native English speakers.

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The Use of Digital Storytelling in Nursing Education, Case of Turkey: Web 2.0 Practice

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ABSTRACT

The aim of the study was to evaluate the effects of nurse candidates' digital storytelling boards and hand-drawn storytelling boards (the current method) on processes of empathising with patients and analysing the case. The study designed in mixed research model was conducted with the 1st year nursing students in Turkey. While the experimental group used web 2.0 tools to prepare their storytelling boards, the control group used paper and pencil to prepare their storytelling boards. Storytelling boards designed by the students were analysed under the titles of empathising with patients and analysing cases and opinions of the nurse candidates about the process were assessed. The experimental group analysed cases more easily and tried to see the incidences from the others' eyes more compared to the control group. Besides, this process was an interesting and enjoyable one. Digital storytelling would be an alternative and effective teaching method for nursing education.

Keywords: digital storytelling, nursing education, empathy

INTRODUCTION

For centuries, individuals have effectively narrated their experiences to the other side through storytelling supported by appropriate statements and gestural expressions (Gere, Kozlovich & Kelin, 2002). Events experienced by people, their perceptions and their thinking ways are inserted, interpreted, and concluded in storytelling from their own point of views (Yiğit, 2007). Today, storytelling is named as digital storytelling as result of being shaped by digital technology and the combined use of multimedia components such as visuals, sounds, and musical effects in computer environment (Mellon, 1999; Robin, 2006; Lambert, 2013).

Teaching process given by conventional patterns has fallen short of meeting needs and expectations of today's learners (Prensky, 2001). While learning process is prepared, it is important to acquire key skills of 21st

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Contribution of this paper to the literature

- Since development of storyboards by using web 2.0 tools in digital stories facilitate users to focus on process instead of product, it can give a different direction to future studies.
- Digital stories can bring individuals empathic skills required for effective communication or increase these levels. Additionally, opinions about the process can be taken in a healthier way. Thanks to these aspects, the study is thought to likely make contribution to different studies in the literature.
- Digital stories may contribute to studies aiming to bring skills of looking at events from a different perspective, critical thinking and problem solving, which are important indicators of scientific approach or develop these skills.

century such as critical thinking, problem-solving, taking responsibility, creative thinking, digital literacy, collaboration, and communication (ISTE, 2016). It is necessary to use effective and interesting teaching methods, which are alternative to traditional teaching methods, support meaningful learning, and address the changing characteristics of learning (Bromberg, Techatassanasoontorn, & Andrade, 2013). Herein, digital storytelling allows to form a student-centred and technology-enriched learning environment for learners (Barrett, 2006). Digital storytelling provides learners with an opportunity to narrate their own personal experiences and to develop emotional communication skills with the help of storytelling (Dörner, Grimm, & Abawi, 2002). Besides, it is known that digital storytelling, which enhances creativity, imagination, and motivation of learners (Duveskog, Tedre, Sedano, & Sutinen, 2012; Nicoletta Di & Paolo, 2013), improves their writing, critical thinking, and literacy skills (Xu, Park, & Baek, 2011), increases their knowledge, contributes to academic achievements, and enhances problem solving skills and creativity (Hung, Hwang, & Huang, 2012; Yang & Wu, 2012), is an entertaining method (Rossiter & Garcia, 2010; Mutalib, Aziz, & Shaffiei, 2011; Suwardy, Pan, & Seow, 2013; Karakoyun, 2014).

It is significant for learners to share their learning experiences by facing the past and thus designing their future in order to make contributions to their learning achievements (Burgess, 2006; Merritt, 2006; Guajardo et al., 2011; Cushing & Love, 2013). During this process, digital storytelling helps students to correct their behaviours and to develop the feeling of empathy, which enables them perceive the world from others' eyes (Neal, 2001; Kieler, 2010; Sawyer & Willis, 2011; Iseke, 2011; Hess, 2012). Additionally, learners reflect their life experiences, opinions, and emotions with digital storytelling (Brushwood Rose, 2009; Sanchez-Laws, 2010; Kearney, 2011; Condy, Chigona, Gachago, & Ivala, 2012) on the other hand, they analyse their own opinions and behaviours (Hull and Katz, 2009) and interpret matters from different point of views (Reed & Hill, 2010; Sawyer & Willis, 2011).

When literature is reviewed in terms of designing an effective digital storytelling, it is seen that although there are similar definitions concerning functioning of digital storytelling, there are differences in its phases (Tatli, 2016). In this sense, Jakes and Brannon (Jakes & Brennan, 2005) specify these phases as writing the script, scenario, storyboard, locating multi-media, structuring digital storytelling, and sharing. Schuck and Kearney (Schuck & Kearney, 2008) summarize these phases as capturing pedagogical frame and developing the idea, structuring story board, arranging storyboard, preparing the video, video-recording, arranging the video, presentation of the video to a small group, presentation of the video to general audience/classroom, and dissemination.

Nursing is a health discipline that requires theoretical knowledge and clinical practice skills. Basic objective of nursing education is to bring nurse candidates a professional view, to prepare them for professional life in the future, and to raise qualified and conscious nurses who are aware of their responsibilities and duties towards their country, comprehend importance of health protection and promotion, and are able to answer the existing health problems (Bektas, 2004; Orgun, Ozkutuk, & Temel, 2007; Kumcagiz et al., 2009; Celikkalp, Aydin, & Temel, 2010). Behaviours aimed to be acquired by nursing students in line with teaching process are closely associated with quality of nursing care to be provided to individuals and the community. Since nursing is a profession that requires to acquire cognitive, psycho-motor, and attitudinal behaviours, it is crucial to use innovative practices and methods in education (Goris, Bilgi, & Korkut Bayindir, 2013).

Considering that nurse candidates are likely exposed to negative circumstances such as withdrawal, professional alienation, and feeling of inadequacy when they have a problem with patients or their significant others during education process, it is thought that they can overcome these negative circumstances through empathy or by gaining empathic skills. It may be asserted that students can modify learning styles and methods by producing new understandings that will support formation of their professional identity through generation of meanings, emotional participation, and reflection by involving digital storytelling in the nursing education; and as a result, this modification in learning styles is also quite effective on promoting learning and developing patient-centred practices (Christiansen, 2011), increasing students' self-esteem, improving critical thinking ability, providing ethical and cultural awareness, and designing communication techniques (Davidhizar & Lonser, 2003).

Therefore, we are of the opinion that digital storytelling in nursing education will make contributions to literature, improve patient care skills and provide students to analyse situations with a different point of view. The aim of the present study was to evaluate the effect of nurse candidates' digital storytelling boards and hand-drawn storytelling boards (the current method) on processes of empathising with patients and analysing the case.

MATERIALS AND METHODS

Study Design

The study was designed in the mixed research design integrating strengths of qualitative and quantitative data (Johnson & Christensen, 2004; Johnson & Onwuegbuzie, 2004; McMillan & Schumacher, 2010; Tashakkori & Teddlie, 2010). In the present study, the explanatory design -in which researchers collect and analyse quantitative data and then collect and analyse qualitative data in order to define these data- was preferred (Creswell & Tashakkori, 2007).

Study Group

The study was conducted with 1st-year nursing students who studied at Nursing School of a public university located in the Province of Trabzon in Turkey. In the study, a class was randomly assigned to the experimental group (25 female students and 5 male students, n= 30) and the other class was assigned to control group (23 female students and 7 male students, n=30). Both groups presented the duties through digital storytelling but while preparing storyboards in this process, the experimental group used the Web 2.0 applications and the control group used the hand-drawing technique. At the end of the process, digital storytelling was designed and the students' opinions were discussed and reviewed. While presenting the qualitative data, the students in the control group were coded as C1, C2, …, C30; whereas, the students in the experimental group were coded as E1, E2, …, E30.

Implementation Phase of the Study

During the study, nurse candidates' –firstly- were given training on improvement of digital storytelling and then two duties were assigned to them: empathising with patients and analysing cases. Nurse candidates in the experimental group were taken to a computer laboratory. The students were seated in such a way that one computer was allocated for each student and storytelling boards were described by one expert. Each of the nursing students in the control group was seated in a separate desk (in order to prevent the students' effect on each other) and received a blank A4 paper and a pencil. At this phase, steps of digital storytelling designed by Jakes and Brannon (2005) were used. These steps were –in order- writing, script, storyboarding, locating multimedia, structuring digital story, and sharing. In the writing process –which was the first step-; the same patient story was distributed to the nurse candidates and then both groups were asked to write a scenario about this patient story. The experimental group was asked to design digital storytelling boards; whereas, the control group was asked to draw storytelling boards by hand. Afterwards, both groups incorporated sound and music effects into their storytelling boards designed in line with their scenarios, transformed them into digital storytelling, and shared. In last phase of the study; the nurse candidates were asked to assess the process through questionnaires and rubrics

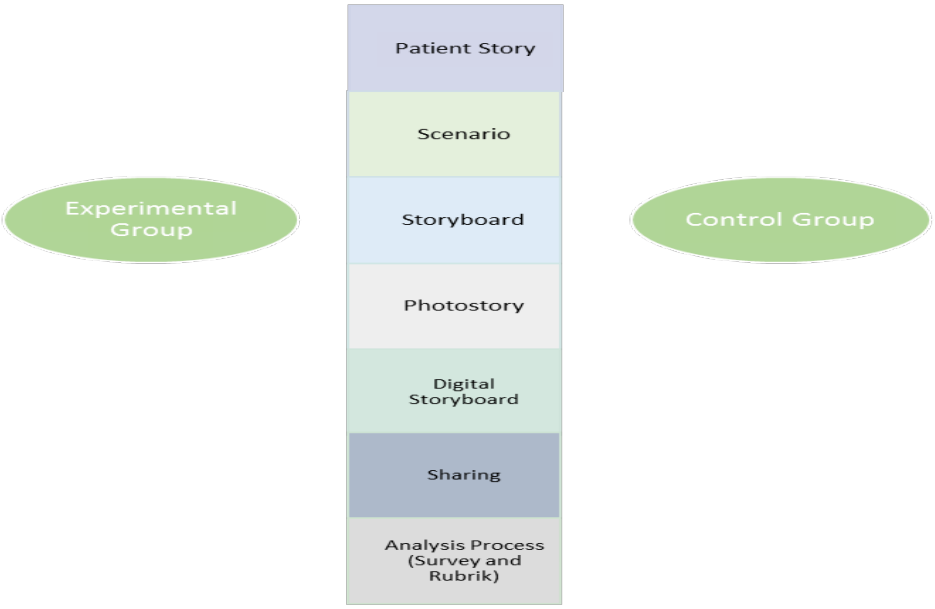

Figure 1. The implementation phase executed by the nurse candidates

Figure 2. Screen shots of digital storytelling boards designed by the experimental group

developed by the researchers. **Figure 1** shows the implementation phase for the nurse candidates in the experimental and control groups.

While **Figure 2** shows screen shots of digital storytelling boards created by the experimental group, **Figure 3** shows screen shots of hand-drawn boards created by the control group.

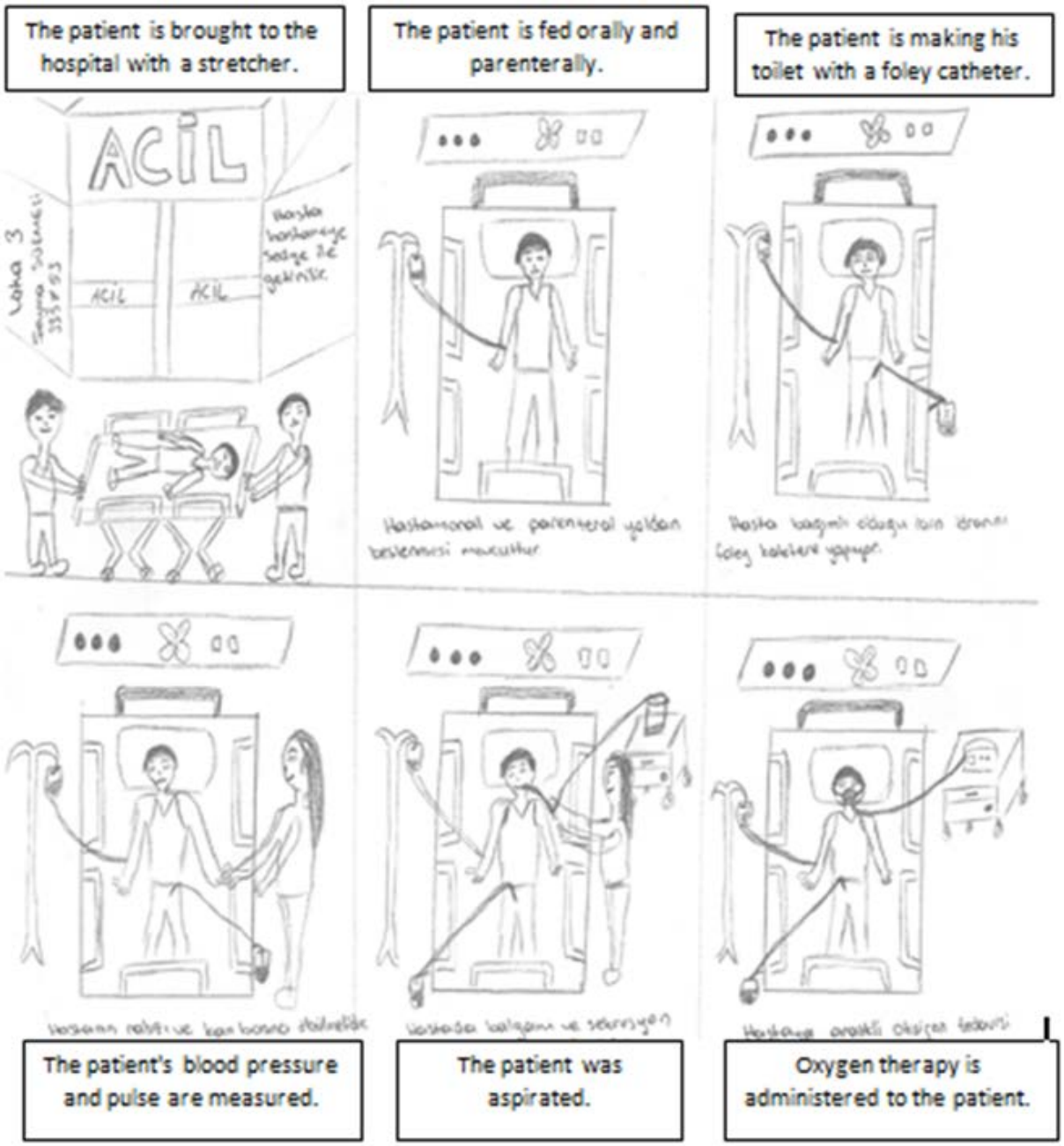

Figure 3. Screen shots of hand-drawn storyboards by the control group

Data Collection Techniques and Tools

Storyboards that were designed through digital storytelling by the nurse candidates in the experimental and control groups were analysed under the titles of empathising with patients and analysing cases. Besides, the opinions of the nurse candidates were taken by using semi-structured questionnaires. The questionnaire included 15 questions; 4 of these questions addressed socio-demographic characteristics of the participants and the other questions addressed digital storytelling in the experimental group and the hand-drawn storyboards in the control group. Additionally, a rubric that assessed patients' physical characteristics, emotional characteristics,

Table 1. Storyboard Rubric

Criteria	1	2	3	4
Patients' physical characteristics	Extremely incomplete (0-1 characteristic is depicted.)	Partly incomplete (2-3 characteristics are depicted.)	Partly satisfactory (4-5 characteristics are depicted.)	Satisfactory (≥ 6 characteristics are depicted.) • Old age status • Obese/ • Patient position • Loss of strength • Care need • Short of breath • Exercising • Others …
Patients' emotional characteristics	Extremely incomplete (0-1 characteristic is depicted.)	Partly incomplete (2-3 characteristics are depicted.)	Partly satisfactory (4-5 characteristics are depicted.)	Satisfactory (≥ 6 characteristics are depicted.) • Verbal expression of joint pain • Pain in facial expression • Expression of fatigue (verbal) • Expression of fatigue • Not doing exercises • Unwillingness • Being unhappy • Others ….
Communication	No communication	Partly poor (0-1 characteristic is depicted.)	Partly satisfactory (2 characteristics are depicted.)	Satisfactory (≥3 characteristics are depicted.) • Speech bubbles • Facial expression • Use of body language • Others …
Facial expressions of patients	No expression (No expressions of characters are depicted.)	Partly poor (One expression is in each box.)	Partly satisfactory (2 expressions are depicted in each box.)	Satisfactory (There are ≥ 2 expressions in each box.) • Painful • Helpless • Tearful • Compelled • Happy • Angry • Others …
consistency of story with each storytelling board	No consistency of story with each storytelling board	Poor consistency of story with each storytelling board	Partly satisfactory consistency of story with each storytelling board	Satisfactory consistency of story with each storytelling board
Setting properties	Extremely incomplete (0-1 property is depicted.)	Partly incomplete (2-3 properties are depicted.)	Partly satisfactory (4-5 properties are depicted.)	Satisfactory (≥ 6 properties are depicted.) • Bed • Wheel-chair / chair • Shelf • Vital signs • Patient board • Patient safety/ asterisk • Serum • Walking cane /walker • IV-serum • Room number • Name of the clinic • Tray • Others …
The stage - story consistency	Inconsistent stage and story board	Poor stage and story (1 or 2 properties are depicted.)	The stage and story are fine but not well-organized.	The stage and story are fine and well-organized.

communication, facial expressions, consistency of story with each storytelling board, properties of the setting, and stage-story consistency was used in order to evaluate works done by both groups. Each subtheme in the rubric was scored between 1 and 4 (min. 1, max. 4 points). Total score was calculated out of 100 by summing the scores of 7 subthemes. **Table 1** shows the rubric.

Data Analyses

The quantitative data were assessed by using SPSS 22.0 packaged software and the results were analysed by using means, frequency, and Mann-Whitney U test. Since histogram and normal Q-Q plots indicated that the data did not show a normal distribution, it was found out that it was appropriate to employ non-parametric tests (Buyukozturk, Cokluk-Bokeoglu, & Koklu, 2015). The qualitative data were analysed by using content method because texts were arranged, classified, and compared and theoretical assumptions were drawn (Cohen, Manion, & Morrison, 2007). Once the data were arranged, data reduction was performed and codes were formed. Afterwards, themes were drawn from these codes constructed and code and theme tables were created.

Mixed studies should be analysed both quantitatively and qualitatively in order to achieve reliability and validity (Creswell & Tashakkori, 2007). Similarly, Johnson and Christen (2004) assesses this process as cyclical, recursive, and interactional. Strategies such as credibility (internal validity), transferability (external validity), dependability (internal reliability), and conformability (external reliability) should be taken into consideration for achieving reliability and validity (Yildirim & Simsek, 2011). Different data collection techniques and research approaches were employed together in the present study in order to achieve validity and reliability and the researchers were in contact with the participants and avoided subjectivity in order to present the actual situation. Additionally, the data collected were analysed at a different time and the findings, codes, and themes were tested by the researchers. In the test, the percentage of agreement was found as 95% by using Miles & Huberman's (1994) percentage of agreement formula:

Number of agreement / number of disagreement * 100

In addition, intervention, data collection process, participants, and data collection tools were compatible.

RESULTS

The data obtained from the study by using questionnaires and rubrics included nurse candidates' processes of empathising with patients, analysing cases, and their experiences at the end of the process.

Figure 4 shows number of boards of the nurse candidates, characters in the scripts, and comparison of nursing diagnoses.

It was observed that the number of boards designed by using Web 2.0 tool increased up to 8 boards in the experimental group. However, most of the students in the control group (86.66%) limited their story with 3 boards. Also, when the characters in the boards were examined, it was determined that while 46.66% of the experimental group used 4-5 characters, 24.16% of the control group used 4-5 characters. 53.33% of the nurse candidates in the experimental group established at least ≥3 diagnoses; whereas, 90% of the nurse candidates in the control group established ≤2 diagnoses.

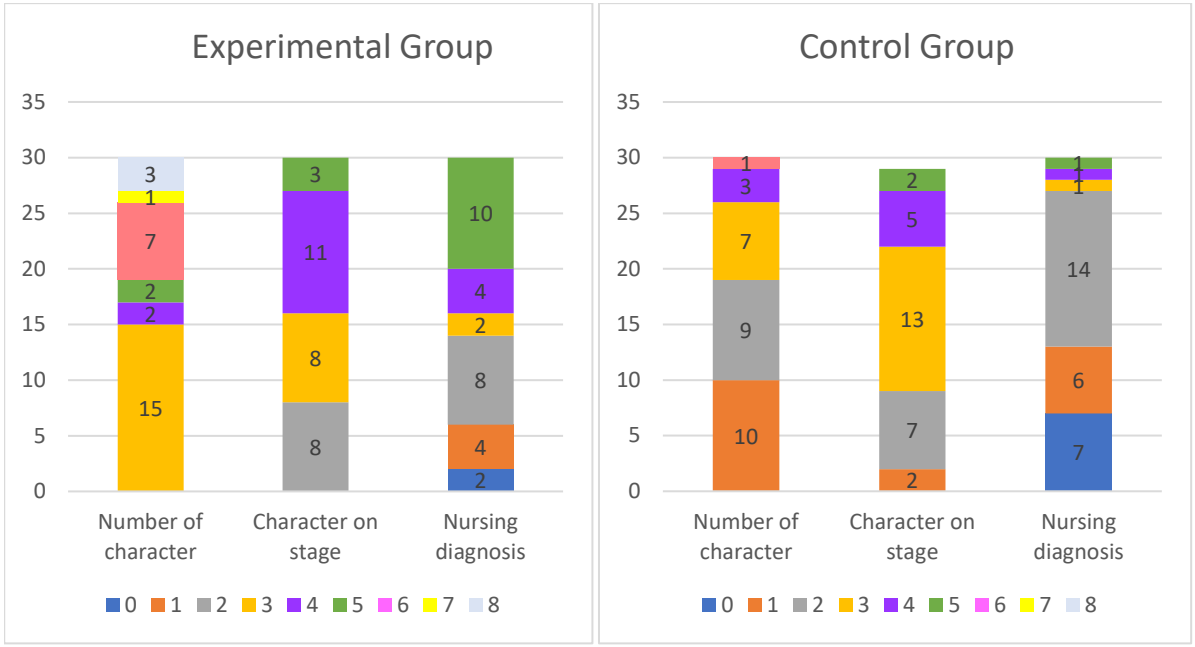

Figure 4. Number of boards, characters in the scripts, and comparison of nursing diagnoses

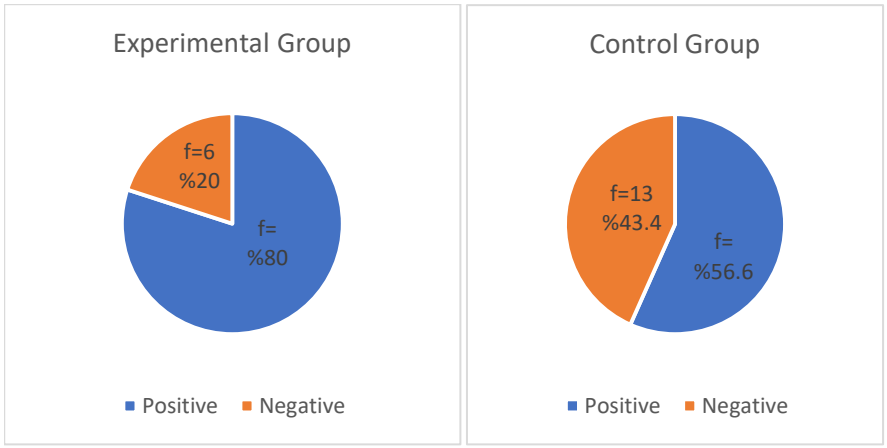

Figure 5. Comparison of the point of views of the nurse candidates about cases

When the nurse candidates' storyboards were investigated, it was found that the point of views of the experimental group (80%) about the cases were more positive compared to the control group (56.6%) (**Figure 5**).

Persons with whom the nurse candidates in the experimental group communicated about the cases were spouses, nurses, doctors, children, and neighbours; whereas, the control group limited their storytelling with spouses, children, and neighbours. In other words, it was found that the experimental group reflected more different point of views upon their storytelling but negative situations and events depicted in their storytelling process were communicated more positively. One of the study findings indicated that the nurse candidates tried to understand how the circumstance/event was perceived by patients' or their significant others' eye and how doctors or other nurses felt and thought against a negative situation (**Figure 6**).

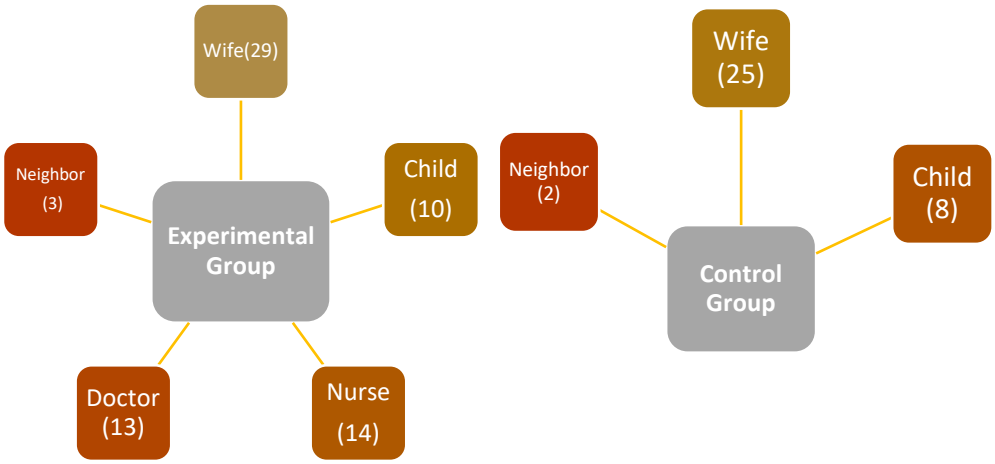

Figure 6. The person with whom the nurse candidates communicated about the cases

Table 2. Rubric Mean Scores and Their Comparisons

RUBRIC ITEMS	Experimental Group (n: 30)			Control Group (n: 30)			Mann-Whitney U Test
	Mean±SD	Median	Mean rank	Mean±SD	Median	Mean rank	
Patients' physical characteristics	2.73 ± 0.944	2.00	37.86	1.89±1.030	2.00	23.13	U: 229.000 p: 0.001
Patients' emotional characteristics	2.96± 0.850	3.00	40.75	1.75±0.844	2.00	20.25	U: 142.500 p: 0.000
Communication	3.63±0.490	4.00	40.33	2.60 ±0.916	3.00	20.67	U: 155.000 p: 0.000
Facial expressions of patients	3.26± 0.691	3.00	36.90	2.57 ±0.920	3.00	24.10	U: 258.000 p: 0.002
Consistency of story with each storytelling board	2.63± 0.850	2.00	30.85	2.53±0.637	2.50	30.15	U: 439.500 p: 0.863
Setting properties	3.03± 1.09	4.00	38.22	2.00±0.942	2.00	22.78	U: 218.500 p: 0.000
The stage and story consistency	3.33± 0.802	3.50	39.03	2.57 ±0.503	3.00	21.97	U: 194.000 p: 0.000
Rubric total score	77.13±13.512	73.20	41.45	56.88±13.638	57.136	19.55	U: 121.500 p: 0.000

The storytelling boards designed by the nurse candidates in the experimental and control groups were examined in terms of "patients' physical characteristics, emotional characteristics, communication, facial expressions, consistency of story with each storytelling board, and properties of the setting and stage-story consistency" in **Table 2**.

When the nurse candidates' case assessments in the rubric were reviewed based on items, it was found that the nurse candidates in the experimental group had higher mean scores than nurse candidates in the control group. Besides, although the nurse candidates in the experimental group had higher mean scores in consistency of story with each storytelling board, no statistically significant difference was found between the experimental group and the control group ($p>0.05$). In all other subthemes, the comparison of experimental and control groups revealed a statistically significant difference and the difference was caused by the nurse candidates in the experimental group

Table 3. Nurse candidates' digital storytelling process and its reflections

	Themes and Codes	Frequency	Percentages	Samples from the answers given
Theme 1. Digital storytelling education program				
Process	Entertaining	22	73.33	E_4: "*Story designed using this method made the process more entertaining.*"
	Interesting	20	68.96	E_6: "*The ready characters and objects used in the process were interesting during creating of digital storytelling.*"
	Hard: Stage design / *Creating of* digital storytelling	2	6.89	E_{29}: "*I had difficulty in creating the story and I was unable to place the objects as I wanted.*"
	Boring	2	6.89	E_{18}: "*Although I was doing willingly at first, it became quite boring later on.*"
	Easy	1	3.44	E_8: "*Drawings made with digital stories were a useful and easy method so that the process could correctly be reflected.*"
Theme 2. Process of learning with digital storytelling				
Achievements	Empathy	26	86.66	E_{16}: "*Since I wrote the story from patients' views, I became able to understand them better.*"
	Understanding cases more easily	23	76.66	E_2: "*It helped me to understand events/cases more effectively and in a shorter time.*"
	Improving imagination	10	33.33	E_{17}: "*During the draft phase, the method enriched and developed our imagination.*"
	Enhancing retention of knowledge	5	17.24	E_{24}: "*For me, the more pictures there were the more retention of knowledge occurred. Therefore, this technique was highly effective in learning educational materials.*"
	Noticing deficiencies in the use of technology	3	10.34	E_{27}: "*I noticed my incompetency in the use of technology.*"
	A new learning method	3	10.34	E_1: "*I have learnt that there are different methods in learning process and as a result, my point of view has changed.*"
	Enhancing analysis skills	2	6.89	E_{20}: "*Analyses made by using technology made me diagnose more easily.*"
	Strengthening of knowledge	1	3.44	E_5: "*It was a good method in terms of strengthening the existing knowledge.*"

($p<0.05$). When total scale scores of experimental and control groups were compared, it was determined that the nurse candidates in the experimental group had higher scores (77.13±13.512) than those in the control group (56.88±13.638) and the difference between them was significant ($p<0.05$). These results pointed out that the nurse candidates in the experimental group focused on physical and emotional characteristics of the patients more during the case analysis, analysed the cases by consulting more healthcare professionals, and reflected patients' mood upon their stories more compared to the nurse candidates in the control group. Moreover, it was found in the digital storytelling on case analysis that the nurse candidates in the experimental group paid more attention to properties of the setting and were able to fictionalise stage-story consistency more easily.

Table 3 shows the opinions of the nurse candidates in the experimental group about digital storytelling application

When educational process of the nurse candidates about digital storytelling was examined, most of them described this educational process as entertaining (73.33%) and interesting (68.96%). The candidate E6 told that

Table 4. Nurse candidates' hand-drawing process and its reflections

Themes and Codes			Frequency	Percentages	Samples from the answers given
Theme 1. Hand-drawing education/training					
Process	Hard	Drawing characters / Colouring objects	25	83.33	C_{25}: "*We had difficulty during hand drawing since we did not have the ability to draw by hand.*"
Process	Interesting		8	27.58	C_{11}: *"It was interesting to learn the course by using a different method."*
Process	Boring		8	27.58	C_{8}: *"Depicting the cases by hand-drawing was time-consuming and boring for diagnosis."*
Process	Inability to express things in mind		4	13.79	C_{1}: *"Even though I could not express many things by drawing, I drew some certain images in mind."*
Process	Entertaining		2	6.89	C_{7}: *"I think it is an entertaining application."*
Theme 2. Process of learning through hand-drawing					
Achievements	Understanding cases more easily		11	36.66	C_{5}: *"I found the cases in the texts more easily."*
Achievements	Improving imagination		9	31.03	C_{27}: "*It did not change me, even if I did not draw the cases, they were in my mind; it did not create any effect in my imagination."*
Achievements	Empathy		4	13.79	C_{22}: *"It has changed my views about patients, I have dealt with patients holistically."*
Achievements	Visual meaning		4	13.79	C_{21}: *"By drawing, I have understood what and how it is better and found better solutions."*
Achievements	Inability to express objects		4	13.79	C_{28}: *"Since my hand-drawing was bad, I could not depict things in my mind, reflect my ideas and opinions, and express myself."*

"The ready characters and the objects used in the process were interesting during creating of digital storytelling.". E4 told that "*Story designed using this method made the process funnier.*" On the other hand; only a few of the candidates (6.89%) considered the process as difficult and boring. Actually, E_{29} expressed her inability about computer proficiency saying that *"I had difficulty in creating the story and I was unable to place the objects as I wanted."*. E_{18} told that "*Although I was doing willingly at first, it became quite boring later on.*" Also, only one of the nurse candidates (3.44%) emphasised that educational process was easy. In this sense, E_8 told that "*Drawings made with digital stories were a useful and easy method so that the process could correctly be reflected."*

When the nurse candidates' process of learning with digital storytelling was examined, the majority of the candidates (86.66%) stated that it improved their empathic skills and helped them understand cases more easily (76.66%). In this regard, E_{16} told that "*Since I wrote the story from patients' views, this enabled to understand them better."* E_2 told that "*It helped me to understand events/cases more effectively and in a shorter time."* 33.33% of the candidates emphasised that process of learning through digital storytelling improved their imagination. In this regard, E_{17} stated that "*During the draft phase, the method enriched and developed our imagination."* Also, 17.24% of the candidates expressed that this method increased retention of the knowledge and E_{24} emphasised the learning process through digital storytelling by saying that "*more retention of knowledge occurred with more pictures for me; therefore, this technique was highly effective in learning educational materials."* 10.34% of the candidates expressed that learning through digital storytelling was a new method and thus noticed the deficiencies in the use of technology. One of these students - E_{1}- told that "*I have learnt that there are different methods in learning process and as a result, my point of view has changed."* And E_{27} indicated that *"I realized my incompetency in the use of technology."* In addition, it was found out that learning through digital storytelling enhanced analysis skills more (6.89%) and was effective upon overlearning of knowledge (3.44%). One of these candidates - E_{20}-emphasised that "*Analyses made by using technology made me diagnose more easily."* Also, E_5 told that *"It was a good method in terms of strengthening the existing knowledge."*

When the process of hand-drawn storyboards by the nurse candidates in the control group was examined, 83.33% of the nurse candidates told that they had difficulty in drawing characters and objects. C25 explained that "*We had difficulty during hand drawing since we did not have the ability to draw by hand.*" Yet, 27.58% of the candidates told that hand-drawing was interesting. The nurse candidate -C_{11}- told that "*It was remarkable to teach the course using a different method*". However, 27.58% of the candidates told that hand-drawing was boring. In this sense, C_8 expressed that "*Depicting the cases by hand-drawing was time-consuming and boring for diagnosis.*" Similarly, they told that hand-drawing (13.79%) was a boring method to express things in mind. In this regard, C_1 said that "*Even though I could not express many things by drawing, I drew some certain images in mind.*" 6.89% of the nurse candidates stated that hand-drawing was amusing. C_7 stated that "*I think it is an amusing practice.*"

When the process of learning through hand-drawing of the nurse candidates was examined, some of them (36.66%) emphasised that it was effective upon understanding the case more easily. One of these candidates -C_5- told that "*I found the cases in the texts more easily.*" However, 31.03% of the candidates pointed out that this technique was not effective in terms of improving imagination. In this regard, C_{27} told that "*It did not change me. Even if I did not draw the cases, they were in my mind so it did not create any effect in my imagination.*" 13.79% of the nurse candidates stated that hand-drawing was effective upon empathy and visual interpretation process. C_{22} told that "*It has changed my views about patients, I have dealt with patients holistically.*" and C_{21} explained that "*By drawing, I have understood what and how it is better and found better solutions.*" 13.79% of the candidates told that they were unable to express their ideas, opinions and feelings by hand-drawing. C_{28} told that "*Since my hand-drawing was bad, I could not depict things in my mind, reflect my ideas and opinions and express myself.*"

DISCUSSION AND CONCLUSION

In the present study reviewing the processes of empathising with patients and analysing the cases through storyboards designed by the nurse candidates using Web 2.0 and traditional methods during the development of digital storytelling, it was determined that the experimental group assessed the cases by using more scenes and characters in their storytelling through Web 2.0 applications. Additionally, it was concluded that the nurse candidates who designed storyboards using Web 2.0 made more nursing diagnoses compared to those who designed the storyboard by hand-drawing; which revealed that the nurse candidates defined the cases more clearly. Therefore, it was thought that digital storytelling boarding technique was prepared more easily than hand-drawing, offered more options and users focused on cases rather than details during the process. In the literature it is reported that Web 2.0 tools introduce diversity in applications in classroom environment and offer an easy and effective learning setting for users through multi-media components such as pictures/photos, videos, and sounds (Nichols, Berliner, & Noddings, 2007; Rossiter & Garcia, 2010).

It was found that the experimental group dealt with cases more positively and from more different point of views and communicated with more people during the storytelling process compared to the control group. It was considered that the use of Web 2.0 tool was associated with the fact that the experimental group examined the cases positively. Through this easy-to-use application the nurse candidates designed storyboards using more characters and tried to reflect the negative situations with point of views of others. In this regard, it was observed that the convenience and customization of Web 2.0 tools used in designing storyboards allowed to close the gap particularly in e-learning environment and helped to empathize by giving an opportunity to establish a comfortable and significant relationship (Tatum, 2009). It was important for candidates to design and communicate stories from the eyes of others in terms of improving their empathic skills. Similarly, Bran (2010) stated that the use of digital storytelling boards in education helped learners to discover and make relations with outside world. As a result, it may be expressed that storytelling boards designed by users using their own sounds/voices by means of digital storytelling boards can improve empathic skills.

It was considered that in the case analysis, the nurse candidates in the experimental group, who designed digital storytelling, internalised the cases more. The nurse candidates who designed digital storytelling were asserted to reveal patients' physical characteristics and environmental properties and even their emotional characteristics and facial expressions more easily. Eroglu (2013) stated that our words, voice tone, and body

language were effective upon expressing what we have understood to the recipient. In this sense, it was considered that the nurse candidates were able to think like patients and speak on their behalf –that is, the nurse candidates evaluated conditions and situations from patients' and their relatives' eyes and empathised more easily. It may be asserted that the nurse candidates in the control group had more difficulties in designing the storyboards by hand than the nurse candidates who designed digital storyboards. This may be associated with the fact hand-drawing is related to ability of individual but it was also remarkable that design of digital storytelling through Web 2.0 technology caused a significant difference compared to hand-drawing method. It was thought that nurse candidates who drew by hand had difficulties in describing and displaying patients. Thus, it was observed that the nurse candidates in the experimental group had higher level of awareness and empathic skills in nursing care. Accordingly, negative situations such as withdrawal, professional estrangement, and feeling of inadequacy which can be experienced by the nurse candidates when they had a problem with patients or their relatives can be prevented by empathizing and acquiring emphatic skills.

It was identified that the majority of the nurse candidates found the use of digital storytelling boards in learning process as entertaining and interesting, developed their empathic skills and analysed the cases more easily. In this regard, Robin (2006) pointed out that digital storytelling was interesting for students with different learning styles. Yakinci, Almis and Kavruk (2012) stated that health education is a difficult and demanding process and information supposed to be learnt in this process are easily forgotten but the use of teaching techniques like digital storytelling may eliminate this disadvantage by making learning process entertaining. This may be associated with the fact that digital storytelling boards provide learners with interactive venues and offer them an opportunity to design their own storytelling. Unlike digital storytelling boards; the nurse candidates who designed storytelling by hand-drawing had difficulty in drawing characters and colouring objects. It may be asserted that through opportunities offered by digital storytelling board programs, the candidates drew their dreams and made necessary changes on them more easily. Besides, it is known that the nurse candidates analyse the cases more easily through digital storytelling boards. Learners who use digital storytelling board techniques reach, produce, search, discover, question, criticise, analyse, and synthesise information (Turkmen & Unver, 2012). Therefore, it could be asserted that with this technique, the candidates comprehended clearly the information taught during the process and reflected it upon their stories.

RECOMMENDATIONS

In the light of the study results; the following recommendations were made:

- The use of digital storytelling boards in learning setting may make the information to be acquired more entertaining and interesting. Since this process gives learners an opportunity to involve in story, their empathic skills may be improved. Thus, it is recommended to use digital storytelling boards in teaching of different disciplines.
- It is known that case analyses in nursing education are important. The present study revealed that case analyses with digital storytelling were more effective. Thus, it is recommended to use digital storytelling boards especially for case analyses in nursing education.
- There are many different storyboard applications provided by Web 2.0. Although the students in the experimental and control groups agreed with the necessity to use digital storytelling, the students in the control group complained its difficulty. However, the students in the experimental group did not complain because they designed storytelling boards by using Web 2.0 tool. In the future studies; it may be recommended for researchers to design storyboards with Web 2.0 tool and conduct studies that will compare different Web 2.0 tools.

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Accounting Education, Knowledge Management and Working Capital Management Performance: Evidence from China

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ABSTRACT

With the advent of the era of knowledge economy, skills training, knowledge acquirement and management are increasingly combined with business management practices. There is preliminary evidence show that the education, learning and management of accounting knowledge have a significant correlation with the enterprise performance. Based on the theory of accounting education and knowledge management, this paper investigates the influence of internal control on the performance of working capital management from the perspective of internal control acquisition, direct learning and indirect learning. The empirical study on China's capital market shows that with the improvement of accounting education and knowledge management, the quality of internal control of enterprises will also be improved, furthermore, the performance of working capital management will be obviously improved. The conclusion of this paper not only enriches the literature in the field of accounting education and knowledge management, but also provides the crucial evidence that how Chinese enterprise can improve the rationality and scientificity of working capital management decision.

Keywords: accounting education, knowledge management, working capital management, internal control

INTRODUCTION

The advent of the era of knowledge economy not only promoted the importance of enterprise to knowledge education, knowledge learning and knowledge management, but also promoted the importance of accounting education to the content of knowledge management. AACSB recently began to emphasize the importance to take big data and technology into accounting courses (Sledgianowski et al., 2017). There is preliminary evidence show that knowledge learning and management have a significant role in promoting enterprise performance (Reich et al., 2014; Cohen & Olsen, 2015; Zheng et al., 2017). In the information age, knowledge has become the most important source of wealth, it has become one of the hot issues for many scholars that how to use the knowledge and skill to enhance the enterprise performance (Andreeva & Kianto, 2012). Among all of the knowledge resources of the enterprise, the mastery and learning of accounting knowledge may be the most fundamental way to promote the improvement of enterprise performance. Especially, in recent years, the enterprise's internal control knowledge and system praised by many scholars, may become the booster for the improvement of enterprise performance. Since the promulgation of the SOX Act, internal control has gradually developed into an important part of corporate accounting system. Most of the listed companies in China have established internal control system. While this kind

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Contribution of this paper to the literature

- Based on the relevant contents of accounting education and knowledge management, this study examines the impact of internal control on working capital management, and expands the scope of the research on the economic consequences of internal control.
- This paper analyzes the influence of internal control on working capital management from two dimensions, direct and indirect, and defines the mechanism of internal control on working capital management.

of system establishment is a long-term learning and a process of improvement, and the impact on enterprise performance may also be gradual.

The impact of knowledge management on enterprise is realized mostly through the ways of the communication, sharing, cooperation, innovation of the enterprise members, and running through the whole business process of the enterprise. As one of the crucial parts of enterprise financial decision-making (Aktas et al., 2015), working management decision may be mostly influenced by accounting policies and knowledge management. Since 1930s, along with ever-changing global economic situations as well as intensified market competition, working capital management has increasingly drawn wide attention from the theoretical circle and the practical circle. Its content has expanded stepwise from the initial stage to the comprehensive stage that covers income management, supply chain management, and expenditure management. Compared to investment and financing management and profit distribution management, working capital management decisions are equally important to the financial management system as a member of the decision field. Existing research has proved that quite a great component of balance sheets of listed companies in various countries involves current assets and current liabilities as an important part of working capital (Mian & Smith, 1992). Operating risks and enterprise revenue are linked to the effectiveness of working capital management, which further impact on the realization of maximum enterprise values. Highly efficacious working capital management decisions are of great value relevance. A company is endowed with much better profitability, stock performance, and business performance if its working capital management decisions converge to the optimum value (Hassan, 2011; Baños-Caballero, 2014; Aktas et al., 2015; Mun & Jang, 2015).

However, the blossom of theoretical studies fails to promote leapfrogging development of working capital management practice in a real sense. When the Chinese government reformed the accounting system in 1993, the concept of working capital management was introduced into China – for its financial meaning – so that complying with the trend of international convergence. Through tracking and survey on working capital management of Chinese listed companies during the period 1997-2014, Pro. Wang et al. from China business working capital management research center conclude that working capital management of Chinese listed companies tends to: (1) have focused on and will focus more on investment activities; (2) lead to nonstop slight increases in the proportion of short-term financial liability and a constantly magnified working-capital-funded risk; (3) witness a continuously deteriorating management performance where accounts receivable and marketing channel gradually become the key to performance enhancement; (4) endow state-owned listed companies with much better performance and relatively higher short-term financial risk in comparison to non-state listed companies. Viewed as a whole, despite over 20 years of development, research on working capital management has still been underestimated such that risks and performance of working capital management remain trapped in the disadvantageous situation of continual exacerbation and that there still lacks systematic research into influential factors of working capital management (Wang et al., 2007). Based on the era of knowledge economy and the environment of China capital market, this paper holds the view that it is necessary to study the working capital management decision from the perspective of internal company, especially the internal control and knowledge management, and discuss the impact of internal control quality on enterprise working capital management performance. The significance of this study lies on that from the perspective of knowledge management, internal control may directly and indirectly affect the efficiency of the enterprise working capital allocation, thus promoting the substantial improvement of the overall working capital management performance of China's listed companies.

Theoretically, there are at least three reasons why it is from the internal control perspective that studies are conducted on the access to promoting WCMP: 1. The Chinese Application Guidelines for Enterprise Internal Control raises claims for working capital management and its contents with regard to risk control and business procedure. The Application Guidelines for Enterprise Internal Control No.6 (finance activities), No.7 (purchasing business), No.8 (assets management), and No. 9 (sales business), respectively, list detailed operating guidelines for such components of working capital management as working capitals, supply chain management, inventory management, accounts receivable management, and prepayment management. 2. According to the stakeholder theory, high-quality internal control may spur stakeholder groups such as shareholders, employees, suppliers, and governments to change their behaviors towards a more efficient operating actions and working capital management for the company. 3. Present-day focus on working capital management decisions is mainly measurement of WCMP indices, rather than the connotations of internal control behind them. Direct requirements of the internal control system will significantly vary such indices as receivables turnover, inventory turnover, and current assets turnover. All in all, it is reasonable and of great theoretical and practical value to research into WCMP based on internal control, as what the paper does.

Given this, We intends to base on a comprehensive measurement of WCMP and the multiple regression analysis method as well to empirically test the impact of enterprise internal control on WCMP, with panel data of A-share main-board companies on Shanghai and Shenzhen stock markets from 2004 to 2013 as the research objective. According to relative research result, premium internal control with either DWC or WCP as the index can steadily enhance WCMP. Further studies show that with internal control, a company can effectively shorten DSO and DIO, albeit cutting down DPO at the same time. For the first time, the research achievements in the paper provide experimental experience for the positive correlations between enterprise internal control and WCMP. It not only identifies the access to upgrading WCMP, but also helps deepen recognition and understanding of the economic consequences arising from enterprise internal control.

THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

Knowledge Management and Enterprise Performance

During the era of knowledge economy, knowledge has become an important means and resource for enterprise to gain competitive advantage, increase their wealth and improve their innovation ability (Bogner & Bansal, 2007). Wang (2009) proves the positive correlation between knowledge management orientation and enterprise performance based on the concept of knowledge management orientation. Enterprise through the knowledge learning and knowledge structure optimization, to promote knowledge sharing, transformation, innovation and application in internal enterprise. Optimization of knowledge and orderly process of knowledge management will effectively improve enterprise performance (Gold & Arvind Malhotra, 2001).Chang Lee et al. (2005) provides a new metric, knowledge management performance index (KMPI), for assessing the performance of a firm in its knowledge management (KM) at a point in time. Chen (2009) proposes an approach of measuring a technology university's knowledge management (KM) performance from competitive perspective. Mills (2011) uses survey data from 189 managers and structural equation modeling to assess the links between specific knowledge management resources and organizational performance. The results show that some knowledge resources (e.g. organizational structure, knowledge application) are directly related to organizational performance, while others (e.g. technology, knowledge conversion), though important preconditions for knowledge management, are not directly related to organizational performance. The above conclusions show that there is a significant positive correlation between knowledge management and firm performance.

Based on the above analysis, it can be seen that knowledge management has become a key factor of enterprise performance growth. In view of this, this paper will draw lessons from the related theory of knowledge management, take the process of enterprise internal control establishing and perfecting as the process of enterprise knowledge accumulation and the process of management optimizing. Furthermore, from the perspective of knowledge management, this paper will analyse the impact of internal control on enterprise working capital management performance.

Direct Impact of Internal Control on WCMP

Compared to the initial stage, the present-stage concept of working capital management has expanded greatly for its connotation and extension. Working capital management has been lifted to a comprehensive one where revenue (accounts receivable, procurement procedure, payments and receipts of accounts), supply chain (inventories and logistics), and expenditures (procurement and payments) are all managed (Kieschnick et al., 2013). As an important means of enterprise internal control, the internal control system is endowed with unique perspectives and efficacies in terms of controlling working capital risks, arranging working capital business procedures, and lifting WCMP. According to the specific requirements of the Chinese Application Guidelines for Enterprise Internal Control, there are several direct impacts of internal control on WCMP.

According to the Application Guidelines for Enterprise Internal Control No.6 – finance activities, the objective of internal-control-based working capital management is to realize balance between physical flow and fund flow and to comprehensively enhance the efficiency of fund operation as well. In addition, No.6 proposes detailed measures of lowering operating risks and upgrading fund benefits at the same time from the perspectives of capital budget management, short-term capital deployment, accounting system control (receipt, payment, examination and approval of funds), etc.

The Application Guidelines for Enterprise Internal Control No.7 – purchasing business arranges and improves the working capital management procedures related to supply chains of materials (labor service) procurement and payments, for example. Measures such as establishing, examining and approving the procurement system, separating authority from responsibility, and improving the evaluation mechanism are all complementary to the promotion of WCMP.

According to the Application Guidelines for Enterprise Internal Control No.8 – assets management, a company is supposed to introduce the modern concept of logistic management to regulate inventory management procedures. It should take full advantage of information system for a reasonable determination of the optimal inventory status, and ensure effective control on all risks of inventory management, in a way that promoting efficacious increase of inventory turnover.

The Application Guidelines for Enterprise Internal Control No.9 – sales business provides quite referential application measures with regard to enterprise sales business and accounts receivable management, which is considered by Wang et al. (2014) as the key for listed companies to upgrade their WCMP. On the one hand, No.9 accurately seizes the critical risk points of sales channel, and controls the business procedures of such links as market survey, conclusion of sales contract, sales process and after-sales service, so that the efficiency of assets management for the sales channel is substantially promoted. On the other hand, No.9 details control requirements of accounts receivable, the obstinate illness of WCMP, including receivables management, bill management, accounting system control, and bad debt treatment. The implementation of internal control on accounts receivable can reduce the probability of producing bad debt in an effective manner, accelerate accounts receivable turnover, and improve WCMP as well.

As can be seen from above, the direct impact of enterprise internal control on WCMP is mainly realized by formulating direct system requirements or detailed business procedure control requirements to intervene the indices of working capital management including content construction, risk control or evaluation indices. The intention is to radically free listed companies from invalid or inefficient management of working capitals.

Indirect Impact of Internal Control on WCMP

Internal control exerts direct impact on WCMP by posing requirements to the internal control system or by controlling relevant business procedures. Apart from this, enterprise internal control also has indirect influences on WCMP by promoting stakeholders to change their behaviors so that improving the operating management strategies. According to the stakeholder theory, stakeholders are realistic society subjects with the motivation for safeguarding self-interests (Donaldson & Preston, 1995). Stakeholders will adopt corresponding actions to maintain

positive influences or reverse negative influences exerted on their interests under the internal control system once they perceive such influences and feel the need. This will in turn impede the realization of WCMP or its objective. Theoretically, the essence of internal control is to protect and maximize the interests of stakeholders such as shareholders (investors), creditor, manager, employee, supplier, consumer, and government (Hoitash, 2009). High-quality internal control will urge stakeholder groups to optimize resources by intensifying superior resource allocation (Zhang, 2007), in a way that improving WCMP. The paper selects several typical kinds of stakeholders for a representative sketch of the access to indirect influences of internal control on WCMP.

From the perspective of shareholders, premium internal control brings cash holding appreciation (Huang et al., 2015), and helps improve stock performance and its execution achievements in the market (Hammersley et al., 2008). Shareholders who are informed of internal control information can precisely perceive the consequences of corresponding economic behaviors, and will thus decide to take measures such as inputting more assets or other superior resources to the company. The company that may expand its cash resource accordingly will finally have its WCMP improved in an indirect way.

From the perspective of creditors, the perception of high-quality internal control information will strengthen their confidence in continuous operation of the company, and promote them to upgrade the company's credit rating, extend the limitations of debt covenants or reduce loan interest rate (Costello, 2011; Sun et al., 2017). Any one of the above measures will benefit the company greatly by supplementing its capability of short-term financial loans or cash flow, whose WCMP is then be improved remarkably.

From the perspective of employees, effective internal control will both restrict and stimulate them so that improving their work efficiency and production enthusiasm. The implementation of internal control will not only enhance the company's productivity as a whole, but also curtail employee management costs, which will in turn supplement WCMP.

From the perspective of consumers or clients, high-class internal product control and corresponding information disclosure will strengthen their confidence in product quality. As a result, the company will not only have more products sold and payed in time, but also reinforce communication and interaction with consumers or clients (Su et al., 2014). The corresponding promotion of sales performance and payment reclamation as well as the reasonable arrangement of production schedule are particularly crucial to improving WCMP in relation to the company's sales channel.

From the perspective of suppliers, the rational system of procurement management will strengthen suppliers' confidence that the company will execute the contract and pay up on time. They will provide product support with larger discounts and longer credit extensions. In this way, not only can the company invest less assets than planned before, but the procurement period can be shortened, so that significantly enhancing WCMP in relation to the company's procurement channel.

From the perspectives of government, a safe and sound internal control with high efficiency can improve the quality of a company's accounting information (Doyle et al., 2007; Altamuro & Beatty, 2010), and can strengthen the protection of investors (Gong et al., 2013; Peng, 2017). This will benefit the company in that the government will provide relatively loose regulatory environments and more policy support. A sound operating environment and favorable policy support provides certain help for the improvement of WCMP.

To sum up, no matter with direct constraints by system regulation, or with indirect constraints based on stakeholders' behavioral perception, the implementation of internal control will exert great positive influence on WCMP. On such foundation, we proposes the following research hypothesis H1 for verification:

Hypothesis 1: Internal Control is positively related to a firm's working capital management performance.

Table 1. Sample Distributions

Panel A: Sample Distribution by Calendar Year					
Year	2004	2005	2006	2007	2008
N	910	948	969	945	930
Percent of Sample	10.2	10.7	10.9	10.6	10.5
Year	2009	2010	2011	2012	2013
N	786	812	821	849	917
Percent of Sample	8.8	9.1	9.2	9.6	10.3
Panel B: Sample Distribution by Firm Type					
Firm Type	State-Owned		Non-State-Owned		Full Sample
N	6109		2778		8887
Percent of Sample	68.7		31.3		100

RESEARCH DESIGN

Sample and Data

Panel data of A-share main-board companies on Shanghai and Shenzhen stock markets from 2004 to 2013 was selected as the research objective. For sample data selection and follow-up data processing, we mainly: (1) excluded the listed financial companies due to discrepancies of accounting criteria; (2) excluded the listed companies whose sample data for those years was in ST, *ST and PT; (3) excluded the listed companies that underwent IPO for those years; (4) excluded the listed companies with financial data loss; (5) conducted Winsorize processing on 1% quantile and 99% quantile of major continuous variables, with the intention of restricting possible impact of extremums on research conclusions. After the above processing, there was a total of 8,887 companies that satisfied our requirements and that spanned a decade's sample interval. For sample selection, we referred to the Guidelines for the Industry Classification of Listed Companies (2012 Revision), so that the selected sample covered all the 19 industries but the financial industry and were strongly representative.

As can be seen from **Table 1**, during the period of 2004-2013, samples of different years have similar numbers and fluctuate at the mean value of 888.7. The fluctuation is controllable and reasonable. In view of the samples' nature, there are 6109 state-owned companies and 2778 non-state companies, which occupies respective 68.7% and 31.3% of the total number of samples. This data distribution complies with the current special economic mechanism that state-owned business predominates national economy.

All the internal control index and other relevant financial data required in the research are derived from the following several database: (1) DIB internal control and risk management database; (2) CSMAR database; (3) CCER database. SPSS21.0 and Stata12.0 are used as the data processing software and the statistical analysis software for the research.

Model Design

The paper intended to construct a panel-based multiple regression model 1 to study on WCMP response to enterprise internal control, where Performance denoted the proxy index of WCMP. DWC and WCP were used for measurement of specific parameters required by the research. The internal control index (ICI) was chosen as the independent variable based on internal control objectives that were provided by DIB internal control and risk management data. The rest of variables were control variables. In the model, η_i was unobservable individual effects, e_t was time effect, and $v_{i,t}$ represented random disturbance terms. The specific model 1 was seen as follows:

$$Performance_{i,t} = \alpha_0 + \alpha_1 ICI_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 ROA_{i,t} + \alpha_4 LEV_{i,t} + \alpha_5 Growth_{i,t} + \alpha_6 State_{i,t} + \eta_i + e_t + v_{i,t} \quad (1)$$

The relationship between internal control and WCMP was identified by the signal and significance of the internal control parameter α_1 in the model.

Variable Definition

Dependent variable: WCMP

There has long been research on WCMP evaluation. Financial evaluation indices that were used to reflect WCMP for most early-phase studies included accounts receivable turnover (period), inventory turnover (period), and current assets turnover (period). However, as the concept of working capital management expands, it is increasingly isolated and single-faceted to describe working capital management with financial evaluation indices. Comprehensively, there are mainly two types of indices that are universally recognized in theories and practice of working capitals: DWC and WCP.

DWC: The early-stage indices of inventory turnover and receivables turnover that correspond to contents of working capital management studies have been no longer adaptable to current tendencies of diversified working capital management. Early-stage evaluation indices in relation to working capital management emphasize on managing current assets, but ignore inherent relationships between evaluation indices. As a result, conflicts and contrasts occur during the process of actual application (Wang et al., 2007). More importantly, as the current liability part is completely excluded from early-phase evaluation indices, it is rather difficult to figure out the overall impact of such indices as inventories, accounts receivable, and accounts payable on working capitals.

Given that it is defective to measure WCMP with the pure index of current assets turnover, Richards and Laughlin (1980) proposed the idea of using days of working capital as the WCMP index. Days of working capital can be simplified as the mean time span needed from cash payment to cash receipt, and can reflect the entire process of a company's working capital management activities. Therefore, days of working capital has been widely applied to empirical studies of WCMP (Deloof, 2003; Knauer & Wöhrmann, 2013). Below is the formula of days of working capital:

Days of working capital (DWC) = days of sales outstanding (DSO) + days of inventory outstanding (DIO) – days of payable outstanding (DPO)

where

DIO = [(initial inventories + ending inventories) × 365] / [2 × operating costs]

DPO = [(initial notes payable + initial accounts payable + ending notes payable + ending accounts payable) × 365] / [2 × operating costs].

The American REL consulting company and CFO magazine began to investigate working capitals of American listed companies based on the indices of DWC and cash conversion efficiency (CCE) in 1997. Since 2003, they have employed the aforementioned formula "DWC=DSO+DIO-DPO" to rank WCMP of American listed companies, which played an important role in promoting universal application of WCMP. This phenomenon also reflects that it is objective and rational to measure WCMP with DWC. Therefore, the paper used DWC as the first index to evaluate WCMP.

WCP: Initiated by the Boston Consulting Group (BCG), the concept of WCP takes comprehensive account of a company's working capital management efficiency and its business level, and acts as an integral index system to measure WCMP as a whole. This simple and practical index has been unanimously approved by the theoretical circle and the practical circle. WCP is hence used as the second means to evaluate WCMP in the paper. The corresponding formula is:

WCP = net sales / annual average working capital volume

Independent variable: ICI

Internal control index (ICI) that were provided by DIB internal control and risk management data was chosen as the proxy index to measure the internal control quality of Chinese listed companies. ICI is founded on

the basic norm of enterprise internal control, and combines five internal control objectives including operation, compliance, assets safety, strategy and report. It also reflects dynamic information of rectifying shortages of internal control for a consecutive publication from 2000 to 2014. The application of ICI will remarkably render the research conclusion more comparable and reliable. ICI refers to the quality of internal control of the firm and is represented by the natural logarithm of Dibo Company's internal control index.

Control variables

There are various influencing factors of WCMP according to relative studies, in line with the literature, we also control for other relative factors in the model 1. SIZE refers to the scale of the firm and is represented by the natural logarithm of total assets. Firms that are large in scale generally have more working capital to satisfy their business (Almazari, 2014), Scale will directly lead to a decline in efficiency of working capital. Therefore, we predict this variable also to be negatively related to a firm's WCMP. ROA refers the ratio of income before extraordinary items over total assets. According to the study by Palazzo (2012), the stronger the company's profitability, the more money it holds. LEV refers the ratio of total debt divided by total assets. According to the pecking order theory proposed by Myers (1984), Debt ratio is one of the important factors influencing the demand of working capital. Growth refers the firm's year-on-year sales growth. Kim et al. (1998), Opler et al. (1999) Consensus, the growth of the company will affect its future funding requirements. In view of the current nature of China's state owned economy, we also add a State variable to represent whether a firm is a State-Owned. State-Owned equals one if the ultimate owner of the firm is the government, and is otherwise equal to zero. In addition, we also control the time and industry dummy variables may influence the conclusions of the study (Nunn 1981).

EMPIRICAL RESULTS

Table 2 reports the descriptive statistics of the variables. As can be see, the mean value, maximum value, minimum value and range of DWC are 4.674, 8.143, 0.795, and 7.348, respectively, which is just slightly different from the survey data of DWC obtained by Wang (1997-2014). The mean value, maximum value, minimum value and range of WCP are 6.508, 92.703, -38.535, and 131.238, respectively. This result shows that different listed companies have diversified performance and efficiency of working capital management. The mean value, maximum value, minimum value and range of internal control index are 6.512, 5.926, 6.849 and 0.923, respectively. The possible reason for little discrepancies between internal control index/quality of different listed companies is that the domestic internal control system is still in a preliminary stage which is far from forming great quality diversification. Below shows the descriptive statistics of the rest of control variables. We will not repeat them.

Table 2. Descriptive Statistics

Variables	N	Mean	SD	Min	Median	Max
DWC	8887	4.674	1.418	0.795	4.680	8.143
WCP	8887	6.508	13.909	-38.535	3.323	92.703
ICI	8887	6.512	0.156	5.926	6.531	6.849
SIZE	8887	21.770	1.194	19.244	21.656	25.274
ROA	8887	0.034	0.062	-0.220	0.030	0.223
LEV	8887	0.513	0.191	0.082	0.519	0.996
Growth	8887	0.235	0.641	-0.655	0.134	4.740
State	8887	0.687	0.464	0.000	1.000	1.000

Table 3 reports the difference examination in State-Owned and Non-State-Owned. Against the backdrop of the current special economic mechanism that state-owned business predominates national economy, the paper divided all the sample data into two sub-samples: state-owned companies and non-state companies. According to the ultimate nature of actual controllers in sample companies. The paper also conducted T test on the differences of paired sample's mean values and Wilcoxon rank sum test on the differences of median for the variables DWC, WCP, DSO, DIO, DPO, ICI. As can be seen from statistics in **Table 3**, compared to non-state listed companies, the state-owned companies have quite shorter DWC (4.518<5.018 / 4.523<4.968) and higher WCP (7.240>4.897 /

Table 3. Difference Examination in State-Owned and Non-State-Owned

Variables	Mean		Median	
	State=1	State=0	State=1	State=0
DWC	4.518	5.018*	4.523	4.968*
WCP	7.240	4.897*	3.784	2.534*
DSO	84.656	100.708*	60.026	67.204*
DIO	237.488	376.190*	94.845	125.200*
DPO	87.555	103.197*	69.716	77.690*
ICI	6.524	6.486*	6.535	6.520*

Notes: *Significance at 5 percent.

3.7784>2.534), which means that state-owned companies outstrip non-state companies with regard to WCMP. Wang (2013) also had similar conclusion. Meanwhile, state-owned companies predominate with shorter DSO, DIO and DPO than non-state companies. According to significance test on ICI, the internal control quality of state-owned companies surpasses that of non-state companies (6.524>6.486 / 6.535>6.520), which means that Chinese state-owned listed companies are ahead in developing the construction of the internal control system and in upgrading WCMP than non-state counterparts.

Table 4 and **Table 5** reports the regression results of Model (1). Given the panel characteristics of sample data, the panel-based multiple regression analysis method was used to conduct research on the impact of internal control on WCMP. Frequently-used panel-based multiple regression models are hybrid effect model, random effect model, and fixed effect model. The entity fixed effect model is mostly employed in empirical research by presuming that the error item of regression equation is related to a certain explanatory variable. The problem is that this model ignores time effect. This ignorance may cause the corresponding research results to greatly deviate from a real one in a way that deviating greater with the intensification of time effect (Zhao et al., 2012; Liu, 2017). To this end, we tested the joint significance of annual dummy variables of the sample data (F=497.86, P=0.0000. The test result that the null hypothesis of "no time effect" is strongly rejected shows that time effect should be considered in the model. Furthermore, in terms of the selection between fixed effect model and hybrid effect model, since F statistics is highly significant (as shown in **Table 4**) which corresponds to a significant individual effect for the model estimation, the fixed effect model should be the optimal one. When the fixed effect model and the random effect model is compared with each other, according to the result of Hausman test, the chi2 statistics is rather significant. This demonstrates that these two models have no noteworthy differences of model parameter estimation. In this case, we are supposed to be as conservative as selecting the fixed effect model.

Table 4. The regression results of DWC and ICI

$$DWC_{i,t} = \alpha_0 + \alpha_1 ICI_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 ROA_{i,t} + \alpha_4 LEV_{i,t} + \alpha_5 Growth_{i,t} + \alpha_6 State_{i,t} + \eta_i + e_t + \nu_{i,t} \quad (2)$$

Variables	Coeff.	t-stat.	Prob.
Constant	4.148***	6.22	0.000
ICI	-0.450***	-5.65	0.000
SIZE	0.195***	9.42	0.000
ROA	-0.739***	-3.54	0.000
LEV	-0.078	-0.91	0.362
Growth	-0.192***	-14.43	0.000
State	-0.023	-0.52	0.600
Year	Control		
Ind	Control		
N	8887		
F Test	13.04 (0.000)		
Hausman	418.76 (0.000)		
Model	FE (fixed effect model)		
R^2	0.3613		

*Significance at 10 percent; **significance at 5 percent; ***significance at 1 percent.

Table 5. The regression results of WCP and ICI

$$WCP_{i,t} = \alpha_0 + \alpha_1 ICI_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 ROA_{i,t} + \alpha_4 LEV_{i,t} + \alpha_5 Growth_{i,t} + \alpha_6 State_{i,t} + \eta_i + e_t + \nu_{i,t} \quad (3)$$

Variables	Coeff.	t-stat.	Prob.
Constant	18.010*	1.69	0.092
ICI	3.554**	2.49	0.013
SIZE	-1.734***	-5.20	0.000
ROA	-1.534	-0.46	0.648
LEV	-2.416*	-1.75	0.080
Growth	0.390*	1.82	0.069
State	0.398	0.56	0.574
Year	Control		
Ind	Control		
N	8887		
F Test	4.11 (0.000)		
Hausman	125.15 (0.000)		
Model	FE (fixed effect model)		
R^2	0.2681		

*Significance at 10 percent; **significance at 5 percent; ***significance at 1 percent.

Table 4 is the multiple regression result based on WCMP and the internal control index in model (2) where WCMP is represented by DWC. According to specific regression analysis results, the estimation parameter of the internal control index is obtained as -0.450, and has passed the 1% significance test. This result shows that on the premise that other variables that DWC responds to are controlled unchanged, the higher the internal control index (quality) is, the shorter the DWC is, and the higher the WCMP is. Therefrom, the research hypothesis H1 is directly proved true.

Table 5 demonstrates the multiple regression result based on WCMP and the internal control index in model (3). According to the results of F test and Hausman test, the fixed effect model is the best for multiple regression analysis on model (3) where WCMP is represented by WCP. The regression results show that the estimation parameter of the internal control index is obtained as 3.554, and has passed the 5% significance test. This result shows that on the premise that other variables that WCP responds to are controlled unchanged, the higher the internal control index (quality) is, the shorter the WCP is, and the higher the WCMP is. Therefrom, the research hypothesis H1 is directly proved true.

As can be seen from the above summaries, WCMP is positively correlated with the internal control index (quality) no matter being represented by DWC or by WCP. Namely: the less deficiencies the internal control system has, the higher the internal control quality is, and the better the WCMP is. This conclusion is uniform to the theoretical analysis and research hypothesis in the paper that premium internal control can directly or indirectly promote WCMP of Chinese listed companies to accelerate continuously.

It can also be seen that the impact of internal control on WCMP can be realized from two aspects: 1. Shorten DWC. The internal control system can be constrained through a series of regimes such that the DWC is shortened, which is of great significance to optimizing a company's working capital management decisions. 2. Improve WCP. Apart from direct constraints on the internal control system, WCP can be improved by means of information disclosure and other information transfer methods both within the enterprise and out of the enterprise. The combination of the above two aspects will together upgrade WCMP of Chinese listed companies.

Further Empirical Test

Conventional measurement indices of WCMP which are supposed to cover current assets turnover indices such as DSO and DIO significantly function in empirical research on the field of working capital management. However, as the scope of working capital management expands, these conventional indices have been shrunk to a mere part of DWC. Nevertheless, they still play an important part in evaluating WCMP. Therefore, in order to

ensure the prudence of the conclusions to be obtained herein, the paper conducted a further regression on the relationship between internal control and such indices as DSO, DIO, and DPO. This also aims to better clarify the correlations of internal control with various components of WCMP. The regression model required is shown as follows:

$$DSO_{i,t} = \alpha_0 + \alpha_1 ICI_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 ROA_{i,t} + \alpha_4 LEV_{i,t} + \alpha_5 Growth_{i,t} + \alpha_6 State_{i,t} + \eta_i + e_t + \nu_{i,t} \quad (4)$$

$$DIO_{i,t} = \alpha_0 + \alpha_1 ICI_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 ROA_{i,t} + \alpha_4 LEV_{i,t} + \alpha_5 Growth_{i,t} + \alpha_6 State_{i,t} + \eta_i + e_t + \nu_{i,t} \quad (5)$$

$$DPO_{i,t} = \alpha_0 + \alpha_1 ICI_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 ROA_{i,t} + \alpha_4 LEV_{i,t} + \alpha_5 Growth_{i,t} + \alpha_6 State_{i,t} + \eta_i + e_t + \nu_{i,t} \quad (6)$$

Table 6 is the multiple regression results of the internal control index and various components of WCMP. According to the results of F test and Hausman test, the fixed effect model should be used for multiple regression analysis on model (4), (5), (6).

According to the regression result in **Table 6**, the regression coefficients of DSO, DIO, and DPO against internal control index are -118.393, -50.129, and -42.322, respectively, and separately passed the significance test at the significance level of 1%, 10%, and 1%. This shows that when other influencing factors remain unchanged, the internal control index and DSO, DIO and DPO are negatively correlated. Namely: the implementation of high-quality internal control can significantly shorten a listed company's DSO, DIO and DPO.

According to the regression analysis result in model (2), it is easy to find that the negative correlations between internal control and DWC was not realized by shortening DSO and DIO at the same time when prolonging DPO, but by simultaneously shortening DSO, DIO and DPO albeit the smaller changing magnitude of DPO. According to the regression result of DPO in model (6) in **Table 6**, the absolute value of the correlation coefficients of ICI is 42.322, much less than those of respective 118.393 and 50.129 for DSO in model (4) and DIO in model (5). This research result is similar to the research on WCMP by Kong et al. (2009) and the research on accounting prudence and WCMP by Du (2014).

Table 6. The regression results of the components of DWC and ICI

Variables	Model (4)		Model (5)		Model (6)	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
Constant	638.169***	9.76	-1656.353***	-5.76	102.818**	2.10
ICI	-118.393***	-13.64	-50.129*	-1.31	-42.322***	-6.51
SIZE	13.070***	6.44	97.627***	10.93	9.281***	6.11
ROA	-175.272***	-8.56	67.034	0.74	-3.863	-0.25
LEV	19.744**	2.35	143.695***	3.89	96.892***	15.42
Growth	-23.913***	-18.30	-92.094***	-16.02	-21.103***	-21.58
State	13.220***	3.06	4.105	0.22	8.523***	2.64
Year	Control		Control		Control	
Ind	Control		Control		Control	
N	8887		8887		8887	
F Test	6.63（0.000）		5.00（0.000）		7.30（0.000）	
Hausman	300.31（0.000）		530.58（0.000）		167.38（0.000）	
Model	FE (fixed effect model)		FE (fixed effect model)		FE (fixed effect model)	
R^2	0.2909		0.3350		0.2466	

*Significance at 10 percent; **significance at 5 percent; ***significance at 1 percent.

DISCUSSION

With panel data of A-share main-board companies on Shanghai and Shenzhen stock markets from 2004 to 2013 as the research objective, the paper used the panel-based multiple regression model to have conducted empirical research on the relationship between internal control and WCMP. Based on the Application Guidelines of Enterprise Internal Control and the stakeholder theory, the paper first summarized the direct and indirect impact of internal control on WCMP, and proposed the core research hypothesis HO accordingly: internal control is positively correlated with WCMP. Then, the paper conducted follow-up multiple regression analysis on HO, and ascertained that with any of DWC and WCP as the alternatives of WCMP, internal control and WCMP presented positive correlations with each other, namely: better internal control leads to shorter DWC or higher WCP, through which resulting in better WCMP. (2) according to further regression analysis result, the negative correlations between internal control and DWC was not realized by shortening DSO and DIO at the same time when prolonging DPO albeit its smaller magnitude. The research achievement in the paper remedies shortages of contents in research on the economic consequences brought by internal control, and expands the connotations and extensions of economic consequences brought by internal control.

CONCLUSION

The results of this paper show that through in-depth accounting training and education, internal control can help the enterprise's knowledge management system to play an important role. Based on the optimization of knowledge structure and knowledge learning, can make the internal control of the quality of enterprises to be orderly upgrade and improve, and then applied to the enterprise's working capital management performance. This is a complete research chain, and the conclusion of the study not only enriches the research literature in the field of accounting education and knowledge management, but also provides an optimized path for enterprises to improve the performance of working capital management.

The research in the paper is of great guiding significance to tipping the scales against deteriorating working capital management of Chinese listed companies. Specifically, (1) it provides a practical access to upgrading WCMP. It is useless to apply conventional corporate governance strategies such as incentives and constraints, accounting control, information disclosure, and corporate culture constraints to manage working capitals in a modern sense, especially when the contents of working capital management has expanded to cover the supply chain channel. The paper has testified that the implementation of internal control plays a pivotal role in fully covering the contents of working capital management as well as in upgrading WCMP. Against the background of Chinese government departments striving for construction of the internal control system, it is undoubted a practical and low-cost shortcut to realize high-efficient working capital management via implementing internal control. (2) It is suggested to take advantage of the signal transmission function of internal control information, so that rationally arranging working capital activities ranging from short-term financing plan, production plan, sales plan to business credit. The quality of working capital activities exert profound influence on the company's risks and revenues. Research results show that disclosure of high-quality internal control information can drive the aforementioned stakeholders to change their behaviors by providing loose credit environment, higher business credit, and useful information of product demand to the company, which is conducive to the company's working capital management practice. Therefore, a company with relatively high-quality internal control is capable of scheduling its working capital management plan at will, and can realize maximum WCMP on the premise of balancing risks and earnings.

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Comparison Study of Advertising Videos of Tourism City Image-Based on the Content Analysis Method

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ABSTRACT
Since the mid-1990s, both domestic and international tourism in China has grown rapidly in many destinations. In particular, city tourism plays an important role as a major destination in regional tourism development. To promote tourism, understanding image and promotion has become the key point in the development of regional tourism economy. Tour cities image advertising videos, the most visual description and most vivid illustration, have been one of the most important means in the images advertising videos of city destinations. Based on the internet, this article takes advertising videos of main tour cities in China as research data, acquires methods of movie reviews, and studies the content and techniques of the photographers. Moreover, this author puts forward suggestions on the images advertising videos of tour cities from the angles of subjects, contents and techniques of shooting.

Keywords: tourism city image, tourism advertising videos, content analysis method

INTRODUCTION

With the development of tourism industry, tourism plays a more and more important role in the progress of main cities in China and has become the new economic growth point, and thus many cities have given the priorities to the tourism development. Meanwhile, with the increasing fierce competition of tourism market, understanding marketing decision process of tourists will be a main task for marketers in city destinations since tourists have many destination options to choose from. One of key selecting factors of destination is the individual's perceived image of a destination (Chon, 1990), which has been concerned in the past decades(Pike, 2002).A complete destination image was reported to include attribute-based images, holistic impressions, and functional, psychological, unique and common characteristics (Echtner and Ritchie, 1993).Hence, the media and communication technology in its many forms has been instrumental in popularizing tourist venues and can have the impact of introducing tourism to these places or boosting tourism numbers. These are facilitated by intermediaries and produced imagination in, for instance, the media, literature, arts, and popular culture (e.g., motion pictures, TV shows, or music) (Cohen-Hattab and Kerber, 2004). For example, the visual rhetoric of advertising was widely used in the marketing of destinations and place branding (Campelo et al., 2011). In China, more and more city destinations use a promotional video/video clip via TV, the Internet and YouTube as a way to improve and create their images in tourists' mind, which are directly related to the success of city tourism promotion efforts. Tourism promotional film is a kind of artistic creation which is based on the combination of the related elements of tourism destination or scenic spot through the sound, light and television technology. Taking the image film- "Hospitable Shandong" as an example, according to data of CCTV cable Furui Company, in 2008, the 71% of television viewers, about 9.12 million people

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Contribution of this paper to the literature

- Advertising videos of tourism city image play a more and more important role on the individual's perceived image of a destination. So, how to make an efficient video will be a challenge work. In this paper, we want to achieve best image advertising videos of the tour city by finding the basic issues from a lot of videos.
- Advertising videos of tourism city image are made by different production organizations, and some by companies, some by governments. How to judge these videos and make useful suggestion to those producers will be an important work.
- In this paper we not only analysis the diversity of content or the complex of performance techniques of these videos by using content analysis method, but also audience and media must be taken into consideration in the further study.

watched this film; 2.68 million people of them have seen more than 3 times. In 2012, a total of more than 400 films of provinces, cities and scenic spots were broadcast on the CCTV.

The relative researches about tourism advertising videos started from early 1970s, with their stresses on 1) the analysis into the inherent law and their behavior responses from the subjective perception of tourists and potential tourists to tourism destination image; 2) the abstraction of influencing elements of destination image, 3) the researches on the estimation of destination image by using lots of pharmacy mathematical statistics and computer aided technique; 4) the researches on the market positioning strategy, competition strategy of destination image, as well as the basic theoretical exploration based on "human". (Baloglu and McCleary, 1999).

The researches in Chinese developed comparatively lately, from the middle 1990s. They showed interests in the plan and design of tourism images, emphasized the practical theoretical research and follow the rules of pragmatism (Li, 1999). Studies in China mainly focused on the field of practical research on the tourism destination's image planning by way of CIS mode, however, there were d not enough in acquiring quantification study on the basis of experimental data. Li (Li, 1999) concluded the general method of image propagating. Huang (Huang, 2002) studied the tourism city image from the angle of advertisement. Cheng (Cheng, 2011) divided the image into visual image, auditory image, olfactory image, taste image and tactile image; while the television image is the integration of the visual and auditory image. This study illustrated the modes of tour destination image promoting from the aspects of promotion organizing and integration. In recent years, domestic researches on tourism destination image showed a trend of quantification and theoretical. Wang (Wang, 2008) put forward the innovative ways of promoting image of tourism destination such as making media focus, arousing public interests and propagating flexible implicit through qualitative and quantitative researches by using SPSS software, questionnaire and interview; Tao et al (Tao et al., 2010) assessed the influencing factors of city tourism image based on the Structural Equation Model (SEM).

Most studies paid attention to tourism media due to the importance of tourism image. Mercille(Mercille, 2005) studied the effects of media expression (including movie, tour guide and magazine) on tour destination image, taking the media effect as the theoretical framework; Meaney and Robb (Meaney and Robb, 2006) discussed the influence of the media of film on the audience and tourism market through the promotion of tourism attractions or site of technology management. The tourism television advertising (TVCs) was viewed as the channel or agent to construct the destination image; the effect of TVCs was related to the recognition of visual elements and the tour destination image (Pan, 2011). In recent years, domestic studies began to concern about the tourism image, including the relative researches on TVCs strategy, tourism destination image and TV media strategy of China's tourism market (Zhou and Fang, 2010; Li and W., 2006).

Content analysis (CA) became one of the main methods in social researches. CA is a research technique of copy and effectively utilization from data to text content. It is a systematic, objective and quantitative analysis of information characteristics (Krippendorf, 1980; Neuendorf, 2002). CA method has been widely used in tourism research, from the analysis of the issue of tourism policy to the analysis of various contents published in the academic journal of tourism. Such as tourism industry code of ethics content investigation and study (Malloy and

Fennell, 1998; Swain et al., 1999; Padgett and Hall, 2001; Choia et al., 2007; Yan and Zhang, 2010; Mackay et al., 2017). Therefore, the CA method has a wide range of applicability in the field of tourism research.

In order to examine the tourism city image strategy, this study starts from the research of advertising videos of main tourism cities in China, with the wishes to do some beneficial analysis and attempts for the propagating strategies into tour city images. Thus, the goals of our study are to examine the content and expression techniques of ten city tourism image advertising videos through the CA method from the perspective of tourism elements.

RESEARCH METHOD

Research Framework

The angle refers to the contact relationship between the subjects and objects of movie reviews. Because of the variety of contact relationship, different angles will have different effects. As a result, it is necessary to choose the angle of movie review.

Movie Reviews point of view can be divided into the following:

1) Viewpoint. Viewpoint, as the cut point of works, can be divided into subjects, objects and multidimensional view. Subject viewpoints are anchor points and inspecting points based on sociology, philosophy, politics and psychology. Object angles are the targeted parts such as plots, style, works and real life, art form, ideology.
2) Perspective. Perspective is the range of object target, including partial perspective, overall perspective and macro perspective. Partial perspective refers to factors as photography, as unexpected factors in the plot and scenery shots in the frame. Overall perspective is something such as style, ideological and artistic tendencies, art ideas, and aesthetics and so on. Macro perspective is the movie phenomenon formed by a series of works, such as general tendency, regular features and the development path of a period or a certain type.
3) Comparison. To compare different movie phenomena in certain relationships, the comparing targets must have comparability. It can be divided into vertical and horizontal comparison. The angle of vertical comparison puts the comparing targets in the historical evolution. While horizontal comparison compares the targets in certain environment.
4) Starting point is to make clear the motives, intentions of reviews. It includes reality, enjoy requirements, personal feeling and meaning of work itself. Taking meaning of work itself as starting points mainly refers to the study into content and form of itself; meaning and value; characteristics and relationship.

Study Design

There are not many works on researches of propagating strategies about tour cities image by means of analysis advertising videos through film review. Except for some reviews made by professional films commentators, most of the reviews are made by laypeople. Film review is seldom acquired by tourism researchers. As far as film review is concerned, its essence is by way of analyzing the content and technique of expression of video works to analyze and find out its theme, leading function to the public and technique direction so as to explore its law of development and draw out the strategies and methods.

Thus, this article mainly acquires methods of form-analysis-oriented film review, taking mass communication as its subjective viewpoint, works' meaning itself as starting point, choosing holistic style, structure, elements representation and voice as objective viewpoint, compares transversely the content and techniques of expression in the advertising videos of China top ten tour cities. The technical route of this article is as **Figure 1**.

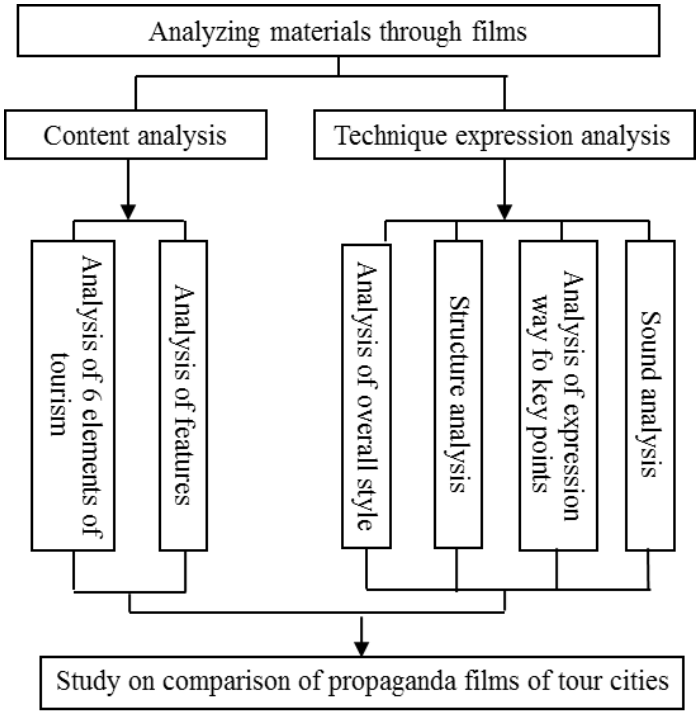

Figure 1. Research framework

Data Research and Analysis Methods

Data collecting

Internet, as the forth media besides television, broadcasting, magazines and periodicals, plays more and more important and indispensable tool for people's life, work and study. Moreover, the cyberspace is carrying big virtual capacity and rich resources. It is more convenient to download data through internet free from the limitation of paper files with longer file duration. Therefore, this article obtains research data through internet. http://u.cctv.com and www.chinacity.org.cn are chosen as fundamental websites on the basis of their authority and reference value. Considering the major rating, major tour cities as Beijing, Shanghai, Chongqing, Xi'an, Qingdao, Chengdu, Hangzhou, Nanjing and Xiamen are chosen as the study target of advertising videos.

Method of data analysis

CA is a study method upon advertising videos content, system and quantitative. Its nature is to analyze the information in the content and its variety which is the process to infer the exact meaning from meaningful sentences. The process of content analysis is reasoning.

According to the categories of visual elements, the indicators of content analysis can be divided into content indicators and form indicators. Content indicators mainly refer to the content of advertising videos content, mainly categorized according to the six key elements of tourism such as catering, housing, transportation, travel, shopping and entertainment. Form indications are the Performance practices of advertising videos. From the study into overall characteristics of advertising videos, there are elements such as overall style, structure, elements of performance and voice. The following quantitative analysis are going on according to the above mentioned standard.

Table 1. Overall Style Comparison of the Tourism city image

City	Overall Style	Characteristics of the style
Beijing	Sightseeing films with the painting style	Traditional & exquisite
Nanjing		Soft & ancient
Chengdu	Feature films with TV style	Leisure & charming
Chongqing		
Xi'an	Invitation for investment films in documentary style	Ancient & modern
Qingdao		European style
Shanghai	Urban comprehensive film with co-occurrence style	Fashionable & soothing
Shenzhen		Cheerful & rapid
Xiamen	Advertising videos with argumentative style	Island flavor
Hangzhou	Films of tour agency with painting style	River and lake flavor

RESULTS

Deconstruction of Expression Techniques of Advertising Videos

Overall style of the tourism city image

There are several styles to express the image of tourism city, including the painting style, the TV style, the co-occurrence style, the documentary style, and the argumentative writing style. The painting style pay attention to the pure appreciation, the graphic design, and strive to express the content of the film through the graphic and stylized static image. The TV style is with the feature of the TV drama through the dramatic plots. The documentary styles pursue the authenticity of life, pay attention to the real description of the details, usually use collage, clip to express. The co-occurrence style adopt the structure of multi thread, multi-level and multi angle, which has the characteristics of multi parts and big capacity. The style of augmentative writing is based on the typical structure of argumentation, provide the different arguments on the basis of the theme.

Structure of advertising videos image

The structure of the advertising videos can be analyzed from narrative/ non-narrative style, presentation perspective, internal logical relationship, time conversion of the content.

1) Narrative or non-narrative style. The films of Chongqing and Chengdu belong to the narrative one, the films of Shanghai and Shenzhen are comprehensive films with plots, while other films are non-narrative films.
2) Presentation perspective. The presentation perspective mainly refers to the angles that story unfolds, such as from the perspectives of the tourists, the third person, the government, and so on. Almost all films are produced and filmed by government, of which Xi'an and Chongqing are typically produced from the perspective of government. Yet there are more and more plots are shot from the perspective of tourists. For example, the film of Chongqing starts the story from a heroine back to her hometown and describes the image of Chongqing through what she sees and hears. The film of Chengdu uses the activities of tourists as its clue. The films of Shanghai and Shenzhen describe the interesting stories of foreign tourists in the course of sightseeing. In Shenzhen film, using foreign tourists' feeling as finishing touch, ending the story by engraving the theme slogan "Wonderful Shenzhen, Happy City" on the tourist's ceramic works; while some foreign tourists take photos of citizens' life in Shanghai film.
3) Internal logical relationship. In most films, the relationship between each element is mostly parallel, for example, from one second "sightseeing" cutting quickly transform to "entertainment" cutting, and return back to "sightseeing" cutting within 3 seconds. The kind of expression technology is some confusing. The films seldom embody the relationships of whole-to-part, sequence and comparison. For

example, the film of Xiamen is the obvious whole-to-part structure with the argumentative style; it straightly puts forward the theme of "Warm Xiamen, Island Garden", and then raises different sub-arguments to bring to the theme, e.g. the convenient traffic. In the film of Shanghai, it shows the relationship of sequence by using the coherent shots to explain plots of marriage, giving birth, children growing and going to university.

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Content Analysis of Six Tourism Elements

There are six key elements in tour cities elements, including catering (special snacks), accommodation (star hotels), transportation (water transport, land transport, air transport), sightseeing (overall outlook of the city, scenic

Table 2. Comparative Analysis of the tourism elements in Advertising videos

Tourism elements	Comparative analysis of content
Catering	Most advertising videos give introduction to special snacks. About 30% of the films only show the specialties and scene of enjoying but not the production process. It shows the universality of specialty in the films. The contents of tea are involved in 50% of the advertising videos. Films concerning cuisine are comparatively less with a proportion of 30%. The contents of dining places are involved in about 40% of the films.
Accommodation	There are 80% of the films introducing star hotels. It indicates that star hotels are commonly accepted. Budget hotels and residential homes are mentioned in the film of Xiamen. It shows that cities are paying more attention to the diversified development of accommodation and enhance the advertising videos of special accommodation service to meet requirements from different levels of customers.
Transportation	There are four kinds of transportation in advertising videos, including water transportation (70%), land transportation (80%), air transportation (80%) and others (70%). The accessibility is very important for tourists. In addition, Pedi cab in Beijing, motor bikes and bikes in Xi'an and Chongqing, cable car in Chengdu, painted pleasure boats in Hangzhou, bicycles in Xiamen, as the special transportation ways not only advocate the regional characteristics but also increase the interest of tour transportation.
Sightseeing	There are 50% of the films introducing historical scenic spots, 70% displaying overall outlook of the cities. Shaping the overall image of the city is the most commonly used promotional techniques, objectively reflecting the advocacy role of tourism on the city. Only 10% of the videos are not related to tourism and recreational scenic spots, which reflects these themes has been widely respected and applied by the photographer. Videos related to the museum are only 20%; only 20% of the videos mention recreation and leisure resort, which reflects the current need trends of the domestic tourism market. The 50% of the advertising videos describe special interest program, such as Beijing's Hutong Tour, Chongqing's Red Tour, Sichuan Panda and Folk Tour, Xiamen's Island Tour and Strait Tour.
Shopping	The 80% of the films present souvenirs, indicating that souvenirs are widely recognized by tourists. There are commercial districts (30%), characteristic lanes and streets (40%), shopping malls (40%) and non-department store shopping places (30%) in the films. It indicates that these different types of shopping areas are complementary and mutually reinforcing. However, the intentions of photographers are not very obvious and random. The shopping parts are not the necessary component of image promotion.
Entertainment	The elements of science and education are involved in 60% of the videos, especially in Beijing, Shanghai, Chongqing, Xi'an, Qingdao and Xiamen, which are all famous cities for their advancement of high education and renowned universities and scientific research institutions. All films focus on the introduction of culture. That means culture is the core of tourism city images. The 40% of films introduce festivals and events, which shows the interaction and transferring of cities' economy and tourism.

Table 3. Expression Comparison of the City Tourism image

City	Time proportion (%)					
	Sightseeing	Accommodation	Shopping	Entertainment	Catering	Transportation
Beijing	57.55	2.83	2.83	31.13	2.83	2.83
Shanghai	20.00	1.27	9.84	48.25	6.67	13.97
Chongqing	22.03	3.45	21.84	7.66	6.32	38.70
Xi'an	51.38	0	1.58	39.13	1.98	5.93
Qingdao	46.53	2.26	6.46	27.30	4.68	12.76
Chengdu	42.34	0.58	7.42	25.99	15.55	8.12
Hangzhou	30.00	0	10.00	33.33	16.67	10.00
Nanjing	64.86	0.71	3.54	17.69	1.89	11.32
Shenzhen	25.81	4.51	5.01	54.39	3.26	7.02
Xiamen	40.51	5.19	5.63	36.75	8.17	3.75

spots), culture and entertainment, which are the main body of the advertising videos. Other parts besides six elements are the necessary complements for the advertising videos show the characteristics of the city. The cultural elements constitute 60% of the samples, the economic elements and humane elements are both 40%, the environmental elements are 30%, while the geographical elements are only 20%. In addition, all advertising videos contain the relative themes. Except for Hangzhou and Nanjing, all the films includes the characteristic elements besides six key elements of tourism, which support the theme. For example, the introduction of location and island environment are to foil the theme of "Warm Xiamen, Island Garden".

Table 3 shows the time length, proportion of the tourism elements in advertising videos. Whether from the sequence or from the time length, "sightseeing" and "entertainment" are key points in the six elements and play the leading roles in unfolding stories and advocating themes. "Accommodation" has the most limit time or even is not involved in the film. "Shopping" and "transportation" are necessary part of the films and sometimes have obvious randomness.

Voice in Advertising Videos

The voice of the advertising videos is the important expression pattern. This is somewhat different from the usual product placement because it may involve promotion of an image. However, it does mean that by choice of the type of song that specific age groups could be targeted. A notable benefit may be that apart from the destination being featured in the lyrics, it may also be featured in an accompanying video clip. (Kay, 2006)Our results showed about half of the films have the voice-over. These films usually use the commentary (in donut or monologue) to implement the combination of sound and picture. Other films without voice-over combine the music with picture, which are synchronous and can change according to the rhythm of each other. Sometimes the voice-over also can be combined with music, which is to help heightening the atmosphere, adding images, and deepening the role of the theme. For example, the piano accompaniment of famous pianist from China-Lang Lang -in the film of Shanghai not only set off the solemn and elegant atmosphere, but also gives guidance for the paly speed for film with the music goes up and down.

CONCLUSIONS

Content Orientation of the Films

As for the content of the advertising videos, the photographers emphasize two aspects of the tourism six elements, i.e. Sightseeing and Entertainment, to highlight the city tourism image; while another three aspects, Catering, Shopping and Transportation, are the necessary supplements in the film. However, the information about last element "Accommodation" is seldom expressed or ever neglected in the film. In addition, the advertising

videos tend to display the trend of development of tour city images by adding cultural, economic, humane, environmental and geographical elements.

Performance Techniques Orientation of the Photographers

As for the expression technique of the advertising videos, the styles are more and more various, for example, the painting, TV, co-occurrence, documentary and argumentation style in the samples. Most photographers build the framework of the films by using non-narrative structure to depict tour city images in a concise and simple way. The reason maybe most films are produced from the perspective of government. However, the diversity and infectivity of narrative structure is cannot be ignored, and show its advantage in some films. Based on the structure and perspective of the film, the interior logical relationship tends to be parallel, paratactic, with only few using structures of whole-to-part, sequence, comparison. As a result, the richness and logic of internal relationships should be strengthened so as to avoid the confusion or rigidness. The photographers usually acquire time transformation, especially day and night transformation, to express the change of scenery; while the space transformation is seldom used. As for the voice of the films, the voice-over and music are usually used in most films. The combination of sound and picture, and the wide application of multimedia become the new trend.

SUGGESTION

Some Suggestions on Shooting Advertising Videos for Tour City Image

(1) On shooting subject. To realize diversity of the subject. At present, most subjects are limited to government institutes such as Tourism Bureau, News Office, etc. More subjects such as citizens, tourists and press should be encouraged to take part in to shoot more creative and more appealing films.
(2) On content. The six tourism elements are unevenly distributed in the films. The proportion of "Sightseeing" and "Entertainment" is as much as 2/3; while there are little information on "Accommodation". The other three elements are with randomness. The local elements of culture, economy, human, environment and geography tend to become more important. Therefore, the six elements need to be re-organized under the premise of balanced distribution. It is allowed to add the proportions of the individual elements when the elements are typical or strongly recommended. Meanwhile, the more attention should be given to the information of "Accommodation". With the integration of tourism industry with other industries, the new tourism format should be considered and presented as the element in the film, for example, the high-speed railway tourism, the self-driving camp, the industrial tourism, and so on. Last but not least, the characteristic elements such as cultural element can be appropriately added into the film.
(3) On techniques of the photographers. The future films pursue the novel and creative idea to avoid the single story. Hence, the theme is unfold through the combination of non-narrative and narrative structure, the clear interial logical relationship, the combined transformation of space and time, the clever use of voice.

Some Advice on Promoting Tour City Image

On the basis of above mentioned example research, and referring to some other image advertising videos in the course of research, the following suggestions are put forward:

(1) Comprehensive and diversified contents. In addition to the traditional six elements of tourism, elements as cultural, economic, humane, environmental and geographical need to be taken into consideration so as to enhance the overall image of city tourism.
(2) Special results. The special result is usually made through special effects such as celebrity, branding and implied effects. The advertising videos of the famous land of rivers and lakes –Wuzhen is an example of star effect by inviting the famous Taiwan singer and film star -Liu Ruoying.

(3) Diversification in forms. Some advertising videos adopt form of TV series to analyses image by chapters, such as the chapter of landscape, humanity, ect.
(4) Diversification in methods. Besides making use of advertising videos, it is also good choice to combine net advertisement, TV advertisement, publicity materials, newspaper and magazines and outdoor advertising signs.
(5) Emotional communication. It is the ultimate goal of image advertising videos to form the emotional consensus with tourists, adding emotion part to the process of advertising videos, through which the public can interact affectively with the city.
(6) Public-oriented. It is the direct intention of image advertising videos to the targeted market through adopting different methods and content to different people groups.
(7) Times. The obvious characteristics of times of images are to keep up with the time and constantly bring forth new ideas. Only by keeping the pace of times and practice can the advertising videos works remain invisible. The images of World Expo in Shanghai with the theme "City, Better Life", and Olympic Games in Beijing with the theme "Experience Beijing, Experience Olympic" are highly contemporary examples of image advertising videos.

From the process of analysis, we can see that the shooting subjects have obvious intention to advertising videos while shooting image films. No matter it is the diversity of content or the complex of performance techniques, the purpose is to achieve best image advertising videos of the tour city. Researches nowadays are mainly based on the method of movie reviews. Therefore, they are, to some extent, subjective. It order to get more objective, convincing data and conclusion, we need to study further. Audience and media analysis must be taken into consideration in the further study. Promotional media make improvements after combining audience perception and getting feedback from audience. Or draw conclusion and general strategies from massive films combining with other media forms. All these are valuable to academic research.

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Embodiment of University Counselor's Professional Ability in Student Work

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ABSTRACT
University counselors are the main force for university student work, their professional ability directly affects the ultimate effect of university student work. Therefore, professional construction of university counselors has an unignorable optimistic and positive guiding effect on management of university students. The professional construction of university counselors requires provision of clear promotion ways for university counselors, constant exploration into theoretical research and practice way of university student work, so as to promote improvement in university counselors' comprehensive quality. Clear promotion way will stimulate enthusiasm of university counselors in student work, so that excellent university counselors specialize in professional work of counselor, thus enhancing the overall level of university counselors in managing university students. University counselors should emphasize the integration of education and management, and integrate individual education guidance with group management and construction. At the same time, university counselors should not only focus on shaping the social mainstream ideology of university students, but also take the initiative to study the current life demands of university students, integrate social norms into actual life of university students, devote to instructing university students to develop the basic criteria to follow when dealing with interaction between people and society. That is, promote the socialization of university students, so that university students achieve better socialization in growth and education. The professional ability of university counselors should be constantly innovated centering on the actual needs of university student management work. Efforts should be made to create a model combined with university student work, constantly explore the optimization path under the view of university student work, and finally make university counselors' professional ability better embodied and displayed in university student work.

Keywords: university counselors, professional ability, student work

INTRODUCTION

In the education management of ordinary universities in China, university counselors, as the main force for university student work, play an important role in maintaining the harmonious educational environment of universities and promoting the comprehensive development of university students. China is in the stage of social transformation and development, the increasing richer growth environment and increasing diversified development demand of university students increasingly demonstrate the importance of university counselors in carrying out university student work (Zhao, Guo, Zhong, 2016). University counselors are a complex group with

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Contribution of this paper to the literature

- Through experiment argumentation, 10 major causes to university students' crime are revealed, which provide theoretical and practical reference for prevention of university students' crime in the future.
- University students' psychologies statues are vulnerable to external factors, including family education, school education, social environment, etc. Therefore, family, school and social community should take joint effort to create healthy atmosphere, thus positively guiding university students' psychologies.
- This study provides several suggestions to release negative moods of university students, such as doing exercise, chatting with others. This study provides theoretical basis for university students to take self-regulation of mood.

multiple identities and multiple roles. As an important component of teachers and management teams in universities, university counselors have the dual identity of teachers and cadres, so they should become the life mentor of university students in pursuit of study and intimate friends during growth (Yang, Zheng, 2015).

LITERATURE REVIEW

Under the background of the new media era, the network has penetrated into all aspects of university students' learning and life. University students seek information exchange, interaction of thoughts and infusion of ideas in the network. Therefore, the network has become an important platform with sustainable attraction for students to vent their emotions, express individuality and maintain social relations (Cao, Xu, 2017; Yang, 2015). In view of the fact that university students often express their views and opinions through the network platform, foreign university research shows that counselors should pay attention to improving their ability to use new media in work, mastering the network platform and network community which university students are willing to get involved with, so as to further familiarize with students' dynamics in study and life and grasp the initiative in university student work. University counselors should establish new work consciousness of new media first, construct a network culture team of university counselors, form the network site for university students' thought exchange, strive to spread the positive energy of the times, and actively guide the new trend in network (Huang, Xie, Chen, et al. 2015). At the same time, domestic university research shows that counselors should use the network to gather popularity, get closer to students in the network, thus becoming the discourse leader with strong affinity. Meanwhile, some domestic scholars believe that, for university students' obsession with network entertainment, university counselors should use the network platform to combine education service and entertainment functions of network, permeate the main theme of society to new media carrier and content favored by university students, seek three-dimensional multi-dimensional approaches in carrying out university student work, thereby increasingly enhancing effectiveness and innovation in student work (Chen, Yang, 2016; Chen, 2016).

METHODS

The university student work should pay attention to the influence of some social phenomena on university student education, use multiple forms of hotspot education and new media education, exert the advantages of emotional education in university student work, carry out responsibility education and honesty education. The grassroots nature of university counselors' professional ability highlights the job intermediary and education depth of university student work (Knight, 2015). In terms of the overall system of university student work, university counselors serve as a link and bridge in upper and lower communication. Therefore, university counselors should not only be the conveyors of national policies and the enforcers of university directives, but should become grassroots commander and management implementer of university student work, to liberate the university students from the object-oriented model of inculcation, and fully mobilize their consciousness and autonomy in participation in education work (Hemanth, and Fisher, 2015).

This paper uses the professional ability analysis model of university counselors, which includes professional ability variance and conditional variance to form statistical analysis model formula. The concrete formula is expressed as follows:

$$Y_1 = \beta_0 + \sum_{i=1}^{n} \beta_i Y(T-1) + \varepsilon_1 \quad (1)$$

$$\varepsilon_1 = \varpi T.V_0 + E(V_i) = 0E(V_i^2) = 1 \quad (2)$$

$$\varpi_t^2 = \alpha_0 + \sum_{i=1}^{\eta} \alpha_j \varepsilon_{t-j} + \sum_{i=1}^{\eta} \beta_i \varepsilon_{1-i}^{\eta} \quad (3)$$

The Communication between University Counselors and University Students is Strengthened

The professional construction of university counselors requires counselors to have professional communications with university students, which is beneficial to the evaluation of university counselors' work, thus constructing a team of excellent university counselors. In the face of the need to solve complex and changeable problems of university students, university counselors should adopt professional attitude in occupation, form a clear mechanism for internal division of labor: psychological counseling counselors are mainly responsible for professional management of university students' psychological problems; job guidance counselors are mainly responsible for providing policy advice on employment for university students and assisting students in development of career development programs; ideological and political counselors are mainly responsible for managing the ideological and political problems of university students (Binnur, Murat, 2015; Zhang, 2017). Under the background of comprehensive professional division of labor, university counselors can effectively communicate with university students, which is conducive to improving the effectiveness of university student work management (Wang, 2016).

University Counselors' Management Demands to Deal with Student Diversification are Met

The professional construction of university counselors requires that university student work undertaken by university counselors can cope with the increasingly diversified management demands of university students. University counselors should gradually adapt to their professional roles, gradually improve their professional accomplishment, to achieve profession and specialty in management of university student work (Shi, 2016; Yuan, 2016). As a young teacher or a university counselor who has just turned into a teacher from a student, although it is usually possible to familiarize with university students' thoughts and ideas, some university students' unhealthy thoughts and backward ideas shall not be accommodated or even condoned. To convey positive and progressive life goals to university students and achieve good results in professional positions, university counselors should always keep abreast of development and evolution in situation of the times, study new situation and new problems encountered in depth in university student work, pay attention to hot issues, focus and difficult situation concerned by university students, and meanwhile, frequently summarize the work experience gains and losses, dare to advance with the times and forge ahead, so that diversified management demands of university student work can be met(Xie, Xie, Marxism , et al. 2016).

RESULTS

Through the analysis of the professional ability of university counselors by professional ability analysis model, and the results are obtained as shown in **Table 1**.

Table 1. Analysis result

Index	Value	Index	Value
Mean dependent var	10.0928	S.D. dependent var	14.1948
S.E. of regression	12.7566	T-statistic	142.3191
Sum squared resid	75.2345	Hausman criter	3.2996

It can be seen from **Table 1** that, university student work should pay attention to the docking of historical education with national condition education among university students, and the link of real life with the network life, concern about university students' differentiated and diversified needs. The educational nature of university counselors' professional ability is mainly demonstrated in comprehensiveness of university student work. The counselor-led university student work runs through the whole educational process from enrollment to graduation of university students. Therefore, university counselors should resort to various education channels of face-to-face emotional enlightenment, media transmission, influence penetration, practical observation and thinking to fully meet the practical diversified needs in university student work and education (Zhang, et al., 2015).

University counselors should clarify their career planning, understand their professional characteristics, clarify their role positioning, strengthen their professional identity, really treat counselor as a career or even a cause, avoiding viewing counselor as a springboard or a transit point for career. University counselors should love their job, shape noble spiritual pursuit and excellent professional ethics, subjectively have a strong sense of professional identity, correct career mentality, enhance professional patience and career input, strengthen the sense of professional satisfaction and sense of accomplishment. In addition, universities should also follow strict access criteria in the recruitment of university counselors, choose excellent talents truly loving the career of university counselor, meanwhile, strengthen the external incentives for university counselors, provide effective salary and career development protection for university counselors, enhance the community's recognition and support to university counselors, and enhance professional well-being of university counselors.

University counselor team should speed up the process of professionalism to dispel strong experience elements in traditional sense of the career, so that counselors change from a versatile person to an expert in student work. Specifically, implement long-term and normalized university counselor training, to comprehensively enhance counselor's professional ability in student work, so that they develop "multi-skilled" professional ability in student work, free from busy student work and improve professional knowledge and ability in student work. Second, university counselors should continue to learn, timely enrich knowledge, optimize the knowledge and ability system, accept the cutting-edge development concept of the times, and enhance professional ability in university student work. Third, university counselors should possess professional concept of education, combine professional services and student work together, view student development as the basis, pay full attention to and respect students' development of individual personality, send more humanistic care to students, thereby enhancing their professional level in university student work.

DISCUSSION

University counselors are the most intimate and familiar objects for university students in the whole period of higher education. If university students are regarded as the demanders of higher education services, university counselors are the providers of higher education services. University students certainly have both rights, qualification and necessity to evaluate student work of university counselors, then promote the work of university counselors by the evaluation. Therefore, the construction of student-centered university counselor evaluation system will help university counselors increasingly improve their professional ability, improve the working methods, enhance work quality, internalize the growth demands of university students, and enhance the intimate relationship with university students so that university counselors become trustable intimate friend and life mentor of university students. In institutions of higher learning, appraisal of university counselors usually takes their job performance and achievements in student work as the standard, while construction of student-centered university

counselor evaluation system can help comprehensive improvement in professional ability of university counselors, so that counselors pay more attention to student growth and demand in work.

At the same time, construction of student-centered university counselor evaluation system can strengthen the interaction between university counselors and university students, and enable counselors to obtain timely feedback from university students and improve effectiveness of university student work. In short, based on the traditional university counselor evaluation system, student growth needs should be integrated to build a diversified university counselor evaluation system, so that professional ability of university counselors is better displayed in university student work.

CONCLUSION

University counselors should pay attention to improvement of professional ability in student work, construct the path of sustainable development of professional ability in student work from two aspects: improving the external environment and developing their own ability. University counselors need familiarize with their own strengths and weaknesses to meet the actual needs of university students, actively respond to the new problems and new situations in student work, innovate methods and ways in student work, and enhance sense of belonging and professional identity, thereby maximizing self - value of university counselors. The sustainable development of professional ability of university counselors in student work also demands universities to provide corresponding platform mechanism, so that student work of university counselors is full of vitality.

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An Evaluation Based on Teachers' and Students' Opinions on Art Curricula in Northern and Southern Cyprus

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ABSTRACT
The purpose of this study is to make an evaluation based on opinions of teachers and students on the Year 8 visual art curricula implemented at the secondary education level in both northern and southern Cyprus schools. Ten Year 8 Visual Art teachers from Northern Cyprus (n=10) and Southern Cyprus (n=13), and 1200 students from both sides participated in this research. Opinions of teachers on the visual art curricula gathered through semi-structured interview forms whereas opinions of students gathered through the "Visual Art Curriculum Evaluation Scale". The findings of research reveal that the value given to the visual art curricula in both communities is low in terms of communal, administrative, managerial and senior managerial perspectives. Furthermore, the findings indicate that compared to Southern Cyprus, there is a further need of financial support, an update and development of the content of visual art curriculum implemented in Northern Cyprus.

Keywords: art education, comparative education, Cyprus, program evaluation

INTRODUCTION

The 21st century also called the technology era, brings constant and rapid developments, causing a change in communities and triggering the quest to make improvements especially in the education systems. During the process of this change, individuals are directly affected by the requirements of the era in relation to social and cultural dynamics, requiring the individual to question, search and display a contemporary profile. In this regard, individuals in need of competencies, which nurture their intellectual capacity, are provided with their needs through quality education. In order to provide the expected competencies, social development, cultural and artistic gains, there is a need for a well-planned educational program (Matthews at al., 2016; Savery, 2015).

An educational program in its broadest terms involves courses and the planning of these courses for the purpose of achieving the targeted goals in individuals. Configuring the educational programs for improvement and enhancing a structure that enables the program to keep up to date are significant necessities of today (Phillips, 2015). Renewing by configuring programs meets the educational needs of individuals and at the same time, suffices future goals of communities (Altbach, 2015; Savery, 2015). Moreover, in addition to the acquisitions of individuals, educational programs also hold a significant effect on countries, communal and cultural functions (Chin, 2016; Karapati et al., 2016). According to specialists, national and cultural identity formation of communities and their relative needs are facilitated through the cultural dimension of education (Hung &Smith, 2015). Culture in education refers to experiences, which initiate from an individual's own national culture, expanding to an international culture dimension.

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Contribution of this paper to the literature

- It is believed that this study will shed light on bi-communally conducted scientific research.
- It is the first scientific research on arts education at secondary education level in Northern and Southern Cypriot communities and it is believed that this study will be a reference to similar studies in other arts fields.
- It is believed that this study will contribute to the peace process which is in progress in the island of Cyprus, and will bring in a different insight and contribute to the studies of the civil society, politics and cultural studies, as well as having a positive impact on the environment of bi-communally conducted scientific research.

Learning the culture and raising intercultural awareness are gains, which are only acquired through courses, which include a cultural aspect. In this regard, Dewey (2008), emphasises the role of education in extending both local and national cultural aspects in individuals and points out the direct relationship with contemporary art in education programs. Furthermore, the significance of art as an aspect of culture, and art in education are also emphasised as these lead to the acquisition of skills in extensive areas and enable the transmission of information among different cultures. The presence of art in education is a building block of contemporary education as it nurtures practical skills and intellectual needs of learners

Art education is included in educational programs developed in various different disciplines (Kroflic, 2007) and it adopts a goal which targets to develop artistic skills in individuals. Furthermore, art education aims to develop mutual empathy between individuals and equip them with problem-solving, intellectual thinking, courage, and entrepreneurship skills; especially via visual art education. The new tendencies related to visual art courses emphasise the need to multi-dimensionally learn art, alongside the need to develop aesthetic skills in individuals; visual art courses also play a role in the progress of socialisation (Winkler & Denmead, 2016). Cremin (2016), refers to Johan Galtung's view on art education, "*stating that visual art are a means of developing empathy between individuals and equipping them with social skills; such as finding creative, constructive and peaceful solutions to conflicts*". The literature on visual art curricula also points to the significant role which visual art play in facilitating aesthetic gains and creating a common language in European countries (Kraehe et al., 2015). Furthermore, Jeong (2017), also emphasises that visual art courses had the potential to remove the borders between communities, joining them economically and culturally by creating awareness on universal values, without tampering national and local values.

As can be inferred from the available definitions, visual art curricula have a direct impact on equipping individuals with skills which enables them to take communal art to universal values, and with analytical skills to approach issues in their environment. Bringing a different perspective to the subject, Bamford (2006), states that in terms of the relationship between international education systems and visual art curricula, the validity and up-to-datedness of educational programs can be maintained via reforms in education. Over and above, Leigh (2015), stresses that, just as it is the case with curricula of all subjects, it was necessary to make evaluations of visual art curricula by making comparisons between different countries so as to improve their effectiveness. Moreover, Sullivan and Margo (2006), take a different approach to the matter of comparative education and express that the education systems of different countries could be holistically or partially compared, which could then help to identify common and or differing aspects. On the other hand, Leeman and Reid (2007), describes the comparative approach in art education as a scientific discipline in terms of theory and application; education policy; education reforms; moderation in international relation and ensuring a peaceful environment. In conclusion, it could be stated that making a comparison of the curricula of different communities while considering the mission and vision of visual art curricula provides the opportunity to ease the relationships between communities, and make comparisons between the differences and similarities among them, which in return enables communities to construct new judgements (Turner, 2016). The two different communities living in Cyprus separated as Northern and Southern Cyprus, use different curriculums and once considering what has stated above, making a comparison of the two communities is seen beneficial for the two communities. In fact, the solution continuum for the Cyprus

issue, which has been ongoing for 42 years, and the current socio-political status, studies carried out in both communities is seen rather important; especially a comparison of the curriculums of visual artin both the communities. The 42-year continuum has created two distinct education systems independent from each other, one for the Turkish Republic of Northern Cyprus and another for Republic of Cyprus, (Zembylas et al., 2010). In 1960, the education systems of Northern and Southern Cyprus were managed by a joint commission. This later ended when the Turkish community withdrew in 1965 (Kambouri, 2008; Papadakis, 2008). Greek Cypriot community took the Greek education system as their model and from the date they entered the European Union in 2004, shifted their education system to a global platform, improving the cultural dimension of education (Zembylas, 2002).

On the other hand, since 1965 the Turkish Cypriot community took the education system of Republic of Turkey as a model (Gökel & Dağlı 2015). The literature review reveals that there has been a high interest in conducting research on bi-communal communities in terms of comparative education. However, comparative studies conducted in Cyprus were politically oriented; rather than involving factual values, they involved subjective notions directed to Cyprus History educational programs (Zembylas & Charalambous & Charalambous, 2016). On the other hand, Kızılyürek (2016), emphasises the significance of activities involving art in education in schools of both Greek and Turkish Cypriots. He further adds that education required reconstruction to integrate the above-mentioned concepts; which then causes the individuals, which share the same country, to get to know each other as they sought for a joint future while getting rid of their prejudices. In this regard, the mission of art and visual art courses is seen rather significant as they lead to a universal language, binding communities and forming objective expressions; and with such significance conducting a study which focuses on a comparative evaluation of visual art curriculums is similarly important. The literature review also points out that a study on the comparative evaluation of the visual art curricula across the island has not been previously conducted. Thus, this particular study is expected to make a contribution to the field. It is also believed that through this research, educators, artists and students will find the opportunity to make a bi-communal evaluation. In this regard, the purpose of this study is to make an evaluation based on the year eight teachers' and students' opinions on visual art curricula implemented in Northern and Southern Cyprus. Therefore, this research sought the answers to the following questions:

(1) What are the opinions of teachers working in Northern and Southern Cyprus on visual art curriculums implemented in year eight, secondary education?
(2) What are the views of year eight teachers, working in Northern and Southern Cyprus, regarding the physical environment where visual art curriculums are applied?
(3) What are the opinions of year eight students, studying in Northern and Southern Cyprus, on visual art curriculums applied in secondary education?
(4) Do taking private lessons for visual art have an influence on year eight students' views regarding the visual art curricula implemented in secondary education in both Northern and Southern Cyprus?

METHODOLOGY

The purpose of this research was to make an evaluation based on teachers' and students' opinions on year eight visual art curriculum currently implemented both in Northern and Southern Cyprus. For this purpose, a mixed methods approach was utilised and the data for the study was collected via two different methods. Political difficulties on the island were considered and therefore a "convenience sample" was used as the sampling method.

Participants

The participants of this study selected from teachers working under the body of Ministries of Education of both Turkish Republic of Northern Cyprus and Republic of Cyprus. The participants were a total of 23 teachers (71.9%), teaching visual art to year 8 students, and a total of their 1200 students (36.5%). That is, 10 visual art teachers from Northern Cyprus (100%) and their 600 (63.8%) students; and 13 visual art teachers from Southern Cyprus (59.1%) and their 600 (25.5%) students participated in the research. 15 of the 23 teacher participants were female (52.2%) and 8 were male teachers (34.8%). Furthermore, 5 of the participating teachers (21.7%) aged between 31 and

45, 15 of the teachers aged between 36 and 40 (65.2%) and 3 aged between 41 and 45 (13%). Moreover, 1 of the teachers had a postgraduate degree (PhD) (4.3%), 12 had a master's degree and 10 had a graduate degree (43.5%). Additionally, the teacher participants from Northern Cyprus had different years of experience; such that 1 (10%) had 5 years of experience; 2 had (20%) experience ranging between 11-15 years; 4 had (40%) 16-20 years of experience; and 3 teachers (30%) of 21 and above years of experience. On the other hand, 2 of the teachers working in Southern Cyprus (15.5%) had an experience of 5 years; 4 (30.8%) had experience ranging between 6-10 years; 5 (38.5%) of which had 21 years and above experience.

While the teachers in Northern Cyprus had previously attended 1-2 in-service training programs, the teachers in Southern Cyprus had attended 5 and above in-service programs. Once the teachers' background on participating in exhibitions was investigated, it was found that the Turkish teachers had participated in 1-2 exhibitions; whereas the Greek teachers had participated in exhibitions 5 or above each year.

Data Collection Instruments

As the purpose of this study was to make an evaluation based on the year eight teachers' and students' opinions on the visual art curricula and for this purpose, the data collection instruments were developed by in line with the scope of this study. In order to identify the students' opinions, a "Visual Art Curriculum Evaluation Scale" was developed; whereas to identify the teachers' opinions, an interview form for "Visual Art Teachers' opinions on Visual Art Curriculum" was developed. Details regarding the data collection instruments can be found below.

Visual Art Curriculum Evaluation Scale

In order to collect the quantitative data to identify the opinions of year eight students on the visual art curriculum implemented, a data collection instrument titled as "Visual Art Curriculum Scale" was developed. This scale was developed by the researchers of the study based on Stufflebeam CIPP evaluation model, which requires the evaluation of context, input, process and product. Furthermore, there are two main aspects of this data collection instrument; first of which include demographic features of the participants; and second which focuses on students' opinions on the process and product of the curriculum. The aforementioned demographic features include gender; nationality; parent income status; number of a siblings; status of family members involved in art; whether private lessons are taken on visual art; participation in an art exhibition; and feelings for the visual art course. While developing the Visual Art Curriculum Evaluation Scale, the following three stages were followed;

The first stage is based on the literature review, the second was the establishment of the item pool and the third focused on the evaluation of specialists' views. After the first stage was completed, it was moved on to the second stage. While the item pool was being made it was assured that there was not a loss in meaning and therefore; 2 Turkish and 2 Greek Cypriot teachers were consulted. Subsequent to this stage, the scale items were consulted to 1 program development, 2 assessment and evaluation and 2 visual art education specialists and 5 academicians. The necessary changes were made according to their feedback and the scale was completed as a final draft form with 42 items. Since the pilot of the prepared draft form was going to be implemented in both communities, it was written in two languages; the form to be implemented in southern Cyprus was written in Greek, whereas the form to be implemented in Northern Cyprus was written in Turkish. During the first phase of translated into form to Greek to be used in southern Cyprus, the expressions which were written in Turkish was translated to Greek and then translated back to Turkish. Finally, to check the meaning similarities and differences of the two they were tested on 8 samples.

The pilot questionnaire was administered to Year Eight students (n=800) in 4 different secondary schools in Northern and Southern Nicosia. In order to test the validity of the draft scale, a factor analysis was realised, and the Kaiser-Meyer-Olkin (KMO) value was calculated as 0.954. The attained value revealed that the scale was valid. Moreover, the reliability factor was identified as Cronbach's Alpha 0.91. This indicated that the scale was reliable. The data collected from the pilot study was also analysed through Exploratory Factor Analysis and Confirmatory Factor Analysis. Considering the Exploratory Factor Analysis, Principal components analysis and varimax rotation were calculated, and from the 42 item draft form, 16 items were removed since their factor load value was found

to be below 0.50. Moreover, in two factors of the scale, factor I and factor II, a total of 26 items were identified. Furthermore, it was identified that Factor I was 27.03% of the total variance and Factor II was 17.60% of the total variance; two-factored structure total variance was 44.62%. Literature shows that the expressed variances changed between 40-60 % (Arkün & Aşkar 2010). The two factors expressed in this research are over 40% and therefore shows that it is an acceptable percentage. The two dimensions identified as a result of the factor analysis were named as "continuum dimension of visual art curriculum" and "product dimension of visual art curriculum". Furthermore, in order to test the validity of the two-factored structure identified through Exploratory Factor Analysis Confirmatory Factor Analysis was also calculated. According to the results of the confirmatory factor analysis (CFA) and when the fit index was considered Root Mean Square Error of Approximation ordinal value was 0.05 and therefore, below the accepted 0.08 value. The GFI value was 0.92, above the accepted 0.90 value; and the calculated CFI value was found as 0.94 and therefore above the 0.90. The NFI value was found as 0.91 and thus identified as above the accepted 0.90. When examining the Randall and friends fit index (2004), the findings of the analysis were statistically approved.

Interview Form

An interview form was prepared by the researchers of this study to identify the teachers' opinions on visual art curriculum. Before the interview form was prepared, the literature was reviewed and the current statuses of the curricula of the two communities were investigated. The interview form consisted of two dimensions. First, the demographic features of teachers were decided to include: gender, professional experience, education level, age ranges, nationalities, in-service training statuses, and participation in exhibition statuses. In the process of constructing the semi-structured interview questions, face-to-face meetings were held with 4 visual art teachers working in the two communities and their views and opinions were consulted. An item pool was constructed according to the literature review and meetings with the teachers and specialists were held. Moreover, a meeting was also held with 3 program development specialists working in the two communities, 4 art education specialists and 2 assessment and evaluation specialists and the necessary corrections were made. The interview form was designed as 4 items, and after the specialists were consulted, relatedness of the scope and field was re-checked and the 2 items which were found as unnecessary by the specialists were removed. As a result, 2 items were removed from the interview form based on their feedback. Content validity was achieved with 3 Greek Cypriot and 3 Turkish Cypriot visual art teachers through a pilot study and data analysis. The form to be used for the southern community was prepared in English and the form to be used in the northern community was prepared in Turkish. Furthermore, the English form to be administered in the south was prepared by 2 translators whose native language was Turkish and English. Also, the translation method used for the research was the traditional method (Rogers et al., 2016) and in the first stage, the Turkish expressions were translated into English to the targeted audience. Later, this translation was translated back into Turkish, and the validity of the two translations was checked. Moreover, a semantic unity of the translations was checked during this process and tested by 4 bi-lingual specialists who speak both Turkish and English.

Data Analysis

The qualitative data of the study was analysed by the researchers of the study through grouping the data via descriptive analysis. The interview questions were accepted as themes and sub-themes were constructed from the teachers' responses to these questions. On the other hand, the quantitative data was analysed in terms of percentages, mean, standard deviation, independent t-test and interpreted through 0.05 value.

Preliminaries

The first phase of the research involved a pilot study in Northern and Southern Nicosia schools. The questionnaire based on a scale was administered in selected 4 private secondary schools and delivered to 800 students and the findings were analysed accordingly. The other phase of the research continued in Northern Nicosia. Before the pilot of the scale was administered in Northern Cyprus, the necessary permissions were taken from the Ministry of Education in the North. Then, the principals of the schools which agreed to participate in the

research were visited to arrange the research application date. The researchers went to the Turkish schools in Northern Nicosia at the agreed date and time. The students were informed regarding the scale and then the scale was administered.

The other phase of the research was collecting the opinions of visual art teachers. The interview forms first given to the teachers in Southern region. The Greek Cypriot teachers who participated in the face-to-face interviews showed a positive approach to the research and no problems have been encountered by the researchers during the research conducted in the Southern part of Cyprus. After the interviews in the Southern Nicosia were completed, the teachers in the Northern region of Cyprus were interviewed. The interviews were all completed within two months and without encountering any problems either in Northern or in Southern Nicosia.

FINDINGS

Teachers' Opinions on Visual Art Curriculums Implemented in Year Eight, Secondary Education in Northern and Southern Cyprus

As the purpose of this research was to identify the opinions of Greek and Turkish Cypriot teachers on visual art curricula used in year eight, secondary education, the opinions of teachers about the visual art curricula were examined, similarities and differences between the curricula used in the two communities were also identified and compared. The first theme created by analysing the qualitative data obtained from the research was the positive and negative aspects of visual art curricula. This theme was then sub-categorised within itself as: "Preparatory level of students", "Up-to-datedness of the curriculum", "Hand skills and power of expression" and "The effects of the program on students' identity and psychology". Referring to the necessity of bringing art education to the students at an early age, teachers stated that there was a deficiency in teaching programs since the consideration to include the students in the creation of teaching programs were not taken into account. Moreover, the participating teachers expressed their belief that the study held significance for both the communities on the island. For example, a Turkish Cypriot Teacher (TCT1): "*Children's perceptions are weak, they are not aware of what is going on around them. For this reason, it is difficult for me to reach the basics of the course. Students' knowledge on art is low from primary schools. I believe that this course should be taught more sufficiently and entertaining way at the primary school level*." On the other hand, a Greek Cypriot teacher (GCT9): "*I find students' knowledge of art at primary school level insufficient, the topics are not up to date. Once the student moves to secondary education level with insufficient knowledge, the knowledge presented at secondary education is never permanent*." Bringing a different perspective to the issue, the teachers have expressed the need for visual art curriculum content to be developed; making it contemporary and suitable for today's conditions. "*I think that the topics are classic and based on memorization, which does not develop the students' knowledge. Art education curricula should be more creative, allowing room for original ideas, discovery and freer topics*".

Greek Cypriot Teacher (GCT7) expresses a similar expression: "*The visual art curriculum does not involve sufficient artistic skills. Rather, it includes a restrictive approach such as drawing what can be seen. In contrast, I believe that it should be freer and directed towards the learners. The curriculum should not be filled with pre-determined subjects and should be designed in a way that sets the students free*". As can be seen, the qualitative data collected reveal similarities between the Turkish and Greek Cypriots regarding the negative aspects of the visual art curricula.

The positive aspects expressed by the year eight visual art teachers emphasised that the curricula implemented particularly included: "free expression", "creative skill", "aesthetic perception", "hand skill", "cultural learning and identity developing" features. For example, Greek Cypriot Teacher (GCT1) points out, "*Students were provided with space to freely express themselves. We are following up on communal incidents and are including them in art projects*". On the other hand, Turkish Cypriot Teacher (TCT4) expressed that: "*The curriculum we administer provides the students with the opportunity to discover and display their talents. They can developing their imagination and concretely display these. They can establish empathy and respect humans. In other words, they take steps which make them humanists*". Another teacher (GCT7), emphasised the positive effect of the curriculum as it made a contribution to develop identity: "*In my view, the strongest aspect of the curriculum is that it enabled individuals to express themselves and most importantly, allowing the students to freely express themselves, and quip them with skills to communicate*

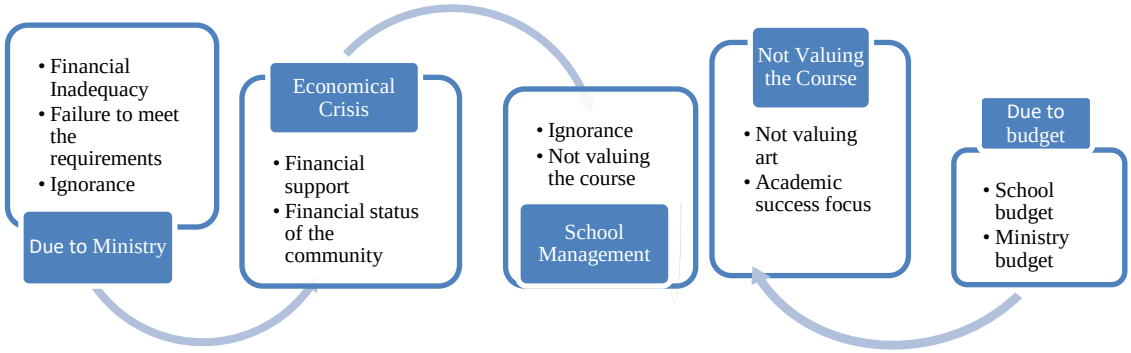

Figure 1. Teachers' opinion on the physical setting in which year eight visual arts curriculum

with others and also raising their awareness of reconciliatory identity." Moreover, Greek Cypriot Teacher (GCT11) said, "*Unlike other courses, this course does not stress the students. Students are usually happy about drawing a picture and find the opportunity for a freer time. That is, during the intense courses of the daily program, students need courses such as music and art*". Turkish Cypriot Teacher (TCT5) expressed, "*Students are constantly preparing for examinations and are constantly encountering intense educational programs. For this reason, art lessons are very important as they create opportunities for students to discover themselves and spend freer times*". In conclusion, it was observed that the data collected was on visual art curricula were positive.

Northern and Southern Cyprus Teachers' Opinions Regarding the Physical Settings in which Year Eight Visual Art Curricula are Implemented

This research also aimed to determine the opinions of teachers from Northern and Southern Cyprus regarding the physical settings in which Year Eight visual art curricula are implemented. That is, the opinions of teachers working in Northern Cyprus were identified regarding the physical settings in the north; whereas the opinions of teachers working in Southern Cyprus were identified on the physical settings available in the south. The data collected from both the communities were grouped under five main themes. The five themes are summarised in **Figure 1**.

As can be seen in **Figure 1**, the Turkish and Greek Cypriot Teachers' Opinions on the physical setting in which the year eight visual art curricula administered is grouped under five main themes. Furthermore, the teachers who provided their opinions also provided their views on ideal features of the physical setting necessary for this course. Additionally, the teachers expressed negative opinions on the current physical setting in which the curriculum is implemented. The sub-themes identified from the Turkish and Greek Cypriot Teachers' Opinions on the physical setting are as follows:

- Shortcomings caused by the Ministry
- Economical crisis
- Shortcomings due to school management
- Not valuing the course
- Shortcomings due to budget

Teachers from both communities have expressed that the eighth-year visual art courses are done in workshops which lack equipment. However, compared to the equipment that Turkish Cypriot teachers have in their workshops, the workshops which the Greek Cypriot teachers have been found to be better equipped. Furthermore, while some Greek Cypriot teachers expressed that their workshops lacked equipment, others have expressed that their equipment were adequate. On the other hand, once the views of Turkish Cypriot teachers were asked on the same issue, teachers have expressed agreement that the workshops were extremely inadequate in terms of equipment. In this regard, it is clear that compared to the schools in the South, the schools in the North have more inadequacy related to the physical settings in which the courses are done. The vast majority of the

Turkish Cypriot teachers indicated that these shortcomings stemmed from the Ministry of Education. One of the Turkish Cypriot Teachers who participated in the research has expressed these shortcomings as follows: ''*The Ministry of Education does not show interest to our needs. We must have independent workshops, enough materials should be provided to the students, smart boards and technological goods must be available in the workshop environments. However, these needs are not being provided to us by the Ministry of Education*" (TCT1).

Another Turkish Cypriot teacher expresses opinions on the matter as: "*First of all, I need a projection to be able to project relevant visuals to the students in my class. The Projection device is only one of the things we need...Whenever I inform the Ministry of our needs; I am told that the budged is insufficient. In this regard, we as teachers are struggling and are trying to obtain our needs through our own initiatives. We have succeeded to get support from the EU and the TR Support Committee*" (TCT10).

Furthermore, other Turkish Cypriot Teachers (TCT7 & TCT10) have made similar statements: "*I need equipment such as a smart board and a projection. While teaching great artists, I wish to support my teaching with visuals. However, I have not asked the Ministry of Education to provide my needs as I know that they prioritise other lessons. Furthermore, the Ministry of Education is displaying an approach fully focused on academic success. Most probably, they will not consider the needs of visual art lessons*".

Therefore, the teachers have expressed that the physical settings in which visual art lessons are conducted are insufficient in terms of equipment. Moreover, differently, from other teachers, TCT7 emphasised belief that the Ministry of Education focused on academic success; stressing that the visual art lessons were pushed towards the end of the line in terms of importance. On the other hand, TCT6 expressed; "Currently, the workshop is in a good state since it is supported by the Parent-School Association and School Management. However, I have to bring my own things to provide the students' needs. I want to provide our needs to the inspector in charge at the Ministry of Education. Each year, I inform them regarding our needs by making a list but nothing happens resultantly. I believe that the visual art lessons are not taken seriously at all. We have achieved everything with our own efforts. There is a need to support the students who do not have good economical statuses, and this needs to be done by the Ministry", which means that the needs of the visual art workshops were provided by school management and the school-parent association, therefore provided with their own means.

Therefore, it is apparent that all of the Turkish Cypriot teachers are complaining regarding the inadequacy of the physical settings in which visual art lessons are conducted in. On the other hand, when the Greek Cypriot teachers' opinions were examined on the matter, some teachers have expressed their belief that the inadequacy of the workshops was due to the economic crisis that their country was in. One of these teachers has expressed this belief as follows: ''the workshop which I teach in is insufficient; I need more materials and fixture. However, due to the economic crisis, the Ministry of Education is encountering difficulties in providing these. Sculpture, ceramics and better-quality paint are among my most important needs" (GCT3).

Similarly, GCT8 expressed a need for many materials: "In the past, we had a bigger budged, however, this year we are on a more restricted budget due to the economic crisis. I want to get projects done with different materials. For example, I need materials to make ceramic, mud and metal work.

On the contrary, some Greek Cypriot teachers have expressed that the physical setting in which they did their visual art lessons were adequate. One teacher expressed this opinion as: "*I am pleased with my workshop. Every year, we are provided materials and paints from the budget*" (GCT4).

Expressing that they were supported by the Ministry of Education, GCT9 has expressed similar thoughts as: "*The physical setting that we are in is suitable for drawing. We are benefitting from the budget which the Ministry provides for us to obtain the materials and other needs, each year. Therefore, I am not encountering any serious problems. We are using recyclable material to make different projects*".

To sum up, while the Turkish Cypriot teachers all agree that the physical setting in which visual art lessons are conducted had many inadequacies, it was observed that the Greek Cypriot teachers' opinions on the matter varied. Some Greek Cypriot teachers argued that the workshops were inadequate; others have said that the

Table 1. Score distribution of Turkish and Greek Cypriot students' opinions on visual art curriculums

Nationality	Dimension	N	Minimum	Maximum	Mean	SD
Turkish Cypriot	Process	600	1.00	5.00	3.28	.872
	Product	600	1.00	5.00	2.96	.764
	Total	600	1.00	5.00	3.17	.793
Greek Cypriot	Process	600	1.00	5.00	3.48	.840
	Product	600	1.00	5.00	3.37	.790
	Total	600	1.00	5.00	3.44	.784

workshops were sufficiently equipped. The difference between the opinions of the Greek Cypriot teachers is believed to be due to the socio-economic statuses of the schools in which these teachers are working in.

Students' Opinions Regarding the Visual Art Curriculums Implemented in Year Eight, Secondary Education in Northern and Southern Cyprus

This research aimed to identify the year eight students' opinions on the visual art curriculums implemented in secondary education in Northern and Southern Cyprus. The opinions of Turkish Cypriot students studying in Northern Cyprus were examined in the year eight visual art curriculums implemented in Northern Cyprus. On the other hand, the opinions of Greek Cypriot students studying in Southern Cyprus were examined in the year eight visual art curriculums implemented in Southern Cyprus. The students' opinions gathered through the "Visual Art Curriculum Evaluation Scale" are provided in **Table 1**.

As can be seen in **Table 1**, the Turkish Cypriot students' opinions on the process dimension of year eight visual art curriculum are within the "Indecisive" range (M=3.28, Sd=.872). The Greek Cypriot students' opinions are within the "I agree" range (M=3.48, Sd=.840). The findings of the research reveal that the Greek Cypriot students' opinions on the process dimension of the curriculum implemented in Southern Cyprus are more positive than those of the Turkish Cypriots. In contrast, it has been determined that both the Turkish (M=2.96, Sd=.764) and the Greek (M=3.37, Sd=.790) students' opinions on the product dimension of the visual art curricula was not positive enough. Furthermore, as represented in **Table 1**, the students in both the communities were abstaining on the product dimension of the curricula. Therefore, the re-evaluation of the product dimension of the visual art curricula is seen as a necessity.

The total score distribution of Year Eight Turkish Cypriot students who provided their opinions on visual art curricula is (M=3.17, Sd=0.793); whereas the score distribution of the Greek Cypriot students has been calculated as (M=3.44, Sd=0.784). The findings of the research indicate that the Greek Cypriot students' opinions on the visual art curriculum implemented in Southern Cyprus are more positive than the Turkish Cypriot students' opinions on the visual art curriculum implemented in Northern Cyprus. Such that the Turkish Cypriot students' opinions on visual art curriculum are within the "indecisive" range; whereas the Greek Cypriot students' opinions on the visual art curriculum implemented in Southern Cyprus are identified to be within the "I agree" range. The fact that the Turkish Cypriot students' opinions on the visual art curriculum implemented in Northern Cyprus are generally "indecisive" indicates that they are in an abstaining attitude towards the program.

Similarly, it was found that the Greek Cypriot teachers' opinions on the visual art curriculums and the physical setting the program is implemented in are more positive than the opinions of the Turkish Cypriot teachers (See 3.1 and 3.2). Therefore, it is possible to conclude that the year eight visual art curriculum implemented in Southern Cyprus comprises more positive features than the one implemented in Northern Cyprus.

While evaluating the year eight visual art curricula, developed independently from each other and implemented in Northern and Southern Cyprus, the Turkish and Greek Cypriot students have provided expressions which indicate that they are of the same mind regarding the positive aspects and the deficiencies of the curriculum. For example, to the "I learn topics related to our culture" expression both the Turkish Cypriot students

Table 2. A comparison of taking private visual art lesson of year eight students studying in Northern and Southern Cyprus

Nationality	Dimension	Status on taking private lessons	N	Mean	SD	df	T	P
Turkish Cypriot	Process	Yes	29	3.10	.999	598	1.540	.124
		No	566	2.87	.752			
	Product	Yes	29	3.49	.956	598	1.223	.222
		No	566	3.29	.867			
Greek Cypriot	Process	Yes	203	3.60	.766	598	5.894	.000
		No	397	3.21	.785			
	Product	Yes	203	3.80	.739	598	6.652	.000
		No	397	3.34	.841			

(M=3.49, Sd=1.174) and the Greek Cypriot students (M=3.55, Sd=1.18) have stated opinions within the range of "I agree". From the findings, it is clear that the curricula used in both the communities value 'cultural values'.

Furthermore, both the Turkish Cypriots (M=3.42, Sd=1.31) and the Greek Cypriots (M=3.57, Sd=1.25) have responded positively to "The drawing topics encourage me to create original ideas". Moreover, on the "My imagination improved" expression, both the Turkish Cypriot students (M=3.62, Sd=1.30) and the Greek Cypriot students (M=3.66, Sd=1.20) responded positively. It was determined that the Greek Cypriot and Turkish Cypriot students provided similar responses related to the deficiencies of the curriculum through their responses to "We read art books" and "My teacher takes us to out-of-school exhibitions". Such that, to the "We read art books" expression, Turkish Cypriot students (M=2.42, Sd=1.27) responded as "I do not agree" and the Greek Cypriot students (M=2.91, Sd=1.32) responded as "I am indecisive". The findings of the research show that both the Turkish and the Greek Cypriot students negatively responded to "We read art books".

Additionally, the Turkish Cypriot students responded to "Our teacher takes us to out of school exhibitions" as "I do not agree" (M=2.03, Sd=1.27); whereas the Greek Cypriot students responded as "I am indecisive" (M=2.87, Sd=1.40). Moreover, the research findings reveal that most of the events related to visual art in both the Greek Cypriot and the Turkish Cypriot communities take place in the school settings and are related mostly to theoretical knowledge.

Findings Related to Year Eight Visual Art Students' Statuses on Taking Private Visual Art Lessons in Northern and Southern Cyprus

This research also included a focus on determining whether taking private visual art lessons made a strong impact on the year eight visual art students' opinions regarding the visual art curricula implemented in Northern and Southern Cyprus. For this purpose, independent sample t-test analysis was used to the data collected. **Table 2** shows the score distribution related to Turkish and Greek Cypriot students' status of taking private visual art lessons.

As indicated in **Table 2**, a significant difference between the opinions of Turkish Cypriot students who take private visual art lessons (M=3.10, Sd=.999) and opinions of students who do not take private lessons (M=2.87, Sd=.752) has not been identified in terms of the process dimension of the visual art curriculum. Similarly, there was no significant difference in the opinions of the Turkish Cypriot students (M=3.49, Sd=.956) who take private visual art lessons and students who do not take a private lesson in terms of product dimension of the visual art curriculum. Therefore, the findings of the research reveal that taking private visual art lessons does not make a significant difference in the Turkish Cypriot students' opinions on the year eight visual art curriculum.

On the other hand, when examining the difference between the Greek Cypriot students taking private visual art lessons (M=3.60, Sd=.766) and the Greek Cypriot students who do not take private lessons (M=3.21, Sd=.785), a significant difference was identified regarding the students' opinions on the process dimension of the year eight visual art curriculum ($t=5.894$, $p<0.05$). Similarly, when examining the average points of Greek Cypriot

students who take private visual lessons (M=3.80, Sd=.739) and the average points of those who do not take private lessons (M=3.34, Sd=.841), a significant difference was identified regarding the opinions of students on the product dimension of the year eight visual art curriculum ($t=6.652$, $p<0.05$).

As indicated in **Table 2**, in terms of the product dimension of the year eight visual art curriculum, the opinions of Greek Cypriot students who take private visual art lessons are more positive than the Greek Cypriot students who do not take private lessons. The students who consciously take private visual art lessons outside the school clearly show a higher interest and desire for the field than the students who do not take private lessons. This can also be interpreted as the opinions of students who take private lessons are positively influenced in terms of their opinions on visual art curriculum, compared to the students who do not take private lessons. Another finding identified in the research is that the number of Turkish Cypriot students who take private visual art lesson is extremely lower than the number of Greek Cypriot students who take private lessons. As shown in **Table 2**, from the participating year eight students only 29 Turkish Cypriot students take private visual art lessons whereas 203 Greek Cypriot students take private lessons. In this regard, it is believed that the Greek Cypriot students' interest in art is higher than the interest of Turkish Cypriot students. Furthermore, it is believed that the Greek Cypriot students take private lessons since they want to increase their knowledge on visual art lessons.

DISCUSSION AND CONCLUSION

Once examining the opinions of teachers who implement year eight visual art curriculum, it was found that teachers in both communities had similar views regarding the positive features of the visual art program. In this regard, both the Greek and the Turkish Cypriot teachers expressed a common belief that the visual art lessons developed positive personality traits in students. Moreover, the teachers have also expressed that the visual art lessons had an effect on nurturing sensitivity in individuals toward communal events, establishing personality traits such as empathy and humanism. The findings from similar research support the findings of this research (Chin 2016). Similarly, both Turkish Cypriot and Greek Cypriot teachers argued that the visual art curricula had a positive effect on student psychology. In his research, Vanada (2016), emphasised that visual art lessons had a positive impact on students in terms of their perception and skills, which in turn, acts like a therapy on the students. Furthermore, in their research Navenen et al. (2014), point out that the visual art lessons made positive contributions to individuals such as; overcoming daily issues, gaining aesthetic and ethical values, creating opportunities to express one's self, and develop social skills. In this regard, it is clear that the findings of the literature support the findings of this particular study.

The Greek and Turkish Cypriot teachers who provided their opinions to the research not only pointed out the positive features of the year eight visual art curricula but also pointed out its deficiencies. They stated that the year eight visual art curricula were prepared without taking the readiness levels of students into account and added that this caused them to encounter difficulties while teaching the topics of the lesson. In the research carried out by Mamur (2015), states that the students who had learnt the past topics well were ready to learn the next topic and therefore, had higher levels of success. Thus, the necessity to consider students' readiness levels in the year eight visual art curriculums in Northern and Southern Cyprus is rather significant.

Another issue, which the visual art teachers agree as for shortcoming of the program, is that the content of the visual art curriculum did not go beyond the classical art education. In their study, Leonard and Odutola (2016), draw attention to the need to take students' needs into account and emphasise that the content of the visual art curricula needed to be updated. This research has also revealed that the physical settings in which the Year Eight visual art curricula are implemented in were differing in some respects. The findings related to this issue indicate that the Turkish Cypriot teachers emphasised that the physical environment in which they implement the curriculum was insufficient. On the contrary, an agreement between the Greek Cypriot teachers on the same issue has not been found and their views were found to be varying. While some Greek Cypriot teachers expressed that they implemented the visual art curriculum in an insufficient physical environment; others have expressed that the physical setting in which they implemented the curriculum was fairly sufficient. The Greek Cypriot teachers who had expressed that the physical setting they worked in was sufficient also emphasised that the Ministry of

Education in Southern Cyprus provided the necessary support in this direction. However, once examining the Turkish Cypriot teachers' opinions it was found out that the teachers emphasised the lack of support for the physical setting of visual art lessons from the Ministry of Education in Northern Cyprus. In their research, Atan and Dalkıran (2008), state that the physical setting in which the visual art lessons are conducted play an important role in increasing the teacher and student interactivity. Therefore, it is strongly believed that there is a need to emphasise the importance of physical environments in which the visual art curricula are implemented in Northern Cyprus.

In addition to the above, findings related to opinions of students on the Year Eight visual art curricula were also included in this research show that the views of Greek Cypriot students regarding the program were more positive compared to the views of the Turkish Cypriot students. In this regard, it was found out that both the Turkish Cypriot teacher and students were in a more negative and abstentious mood in comparison to the views of the Greek Cypriot teachers and students. Additionally, the fact that the teachers' and students' opinions show similarities indicates that the research findings are consistent within themselves.

The research also involved examining the statues of students regarding taking private visual art lessons and to evaluate if this status made an influence on their opinions on the visual art curriculum. The findings related to this investigation reveal that Turkish Cypriot students' statuses of taking private lessons did not create a difference on their views regarding the visual art program. However, once considering the Greek Cypriot students, it was found out that their statuses of taking private visual art lessons influenced their opinions on visual art program. In this regard, it can be stated that the students who take private lessons have higher awareness of the visual art program. Moreover, it was found that the number of Greek Cypriot students who take private lessons is higher than the number of Turkish Cypriot students. The fact that not a high number of Turkish Cypriot students take private visual art lessons is believed to be due to financial statuses of their families. In their research, Upitis (2011), point out that students with families of high income participate to out-of-school art activities more than the students who have families with lower income. Therefore, it is clear that the socio-economic status of families is a significant variable in art education.

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On the Cultivation of University Students' Healthy Social Emotion

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ABSTRACT
The cultivation of university students' healthy social emotion is a prerequisite for students to adapt to the new environment of social development, which is conducive to the overall improvement in university students' comprehensive quality. However, study on this subject is insufficient in the current relevant theoretical research which stays in shortcomings analysis, lacking theoretical verification of key means. To further improve the relevant theoretical work, this paper conducts linear regression empirical analysis based on analysis of traditional issues. The conditions influencing cultivation of university students' healthy social emotion was analyzed by regression model, and targeted study was conducted on shaping of students' healthy personality and cultivation of students' moral feelings. The three manifestations of university students' social emotions were then put forward. This paper proposes that efforts should be made to establish targeted cultivation path for university students' healthy social emotion by starting from shaping students' healthy personality and strengthening cultivation of students' moral feelings under the constraints in cultivation conditions of university students' healthy social emotions. In the process of cultivating university students' social emotion, we should integrate humanities education, real social environment, and apply interpersonal communication cultivation method, proceed from shaping students' moral feelings and healthy personality based on the current basic characteristics of university students' social emotion, explore the path to cultivate students' healthy social emotion and ensure healthy development of cultivate students' social emotion.

Keywords: university students, social emotion, manifestation, cultivation conditions, cultivation path

INTRODUCTION

Emotion, as a part of attitude, is consistent with introverted feelings, intentions of attitude as a more complex and stable physiological evaluation and experience of attitude. The so - called social emotion refers to the psychological experience and psychological feelings accompanying the whole social activities of individuals. It belongs to human's high - level emotion which develops from human emotions as a basis and is a unity of emotion and feeling. The human social emotion mainly has two manifestations. The first is the emotional state with a shorter duration, such as excitement, enthusiasm. The other emotional state has a longer duration, such as love, hate, happiness. Healthy social emotion means the state in which individuals can maintain concentration with clear memory, rich association in study, life, work, demonstrating high efficiency in learning and correctly facing life and work. Moreover, individuals in such state have stronger self-control and can correctly evaluate oneself (Beshai, Mcalpine,

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Contribution of this paper to the literature

- The factors affecting cultivation of university students' healthy social emotion are specified through the linear regression model, vague discussion is avoided.
- Targeted solutions to problems are put forward, with specific opinions given from the practical point of view.
- Under the constraint of model data, the path to cultivate university students' healthy social emotion is given, which makes the way of solving the problem more concrete and practical, and provides the theoretical basis for the next research.

Weare, et al. 2016). During study, life and work, they can correctly face setbacks, keep an open mind, regard study, life and work with positive, optimistic, enterprising attitude. Once unhealthy social emotion appears, poor spirit, low self-esteem, depression, pessimism will occur in work, life, study, which is also accompanied by seclusiveness and defects in emotions, personality, interpersonal relations, leading to incapability to adapt to social development environment. In the university campus, the cultivation of university students' healthy social emotion will help university students better integrate into society and seek sustainable development (Hong, Yang, Song, 2016). Start of university life means that students are no longer a simple "natural person", but a "social person" stepping into society, then simple, ideal emotional world will become extraordinary (Leffel, Mueller, Curlin, et al. 2015).

LITERATURE REVIEW

In observation of research status quo in this field, relevant scholars have also carried out preliminary study, achieving stage success, but the study is superficial. For instance, Pan Yewang argues that: At present, China's ideological and political education still has immature understanding of university students' emotional education (Li 2016; Ma, Qi, et al. 2015). However, only analysis of the problem is given without proposal of specific countermeasures. The relevant literature (Min, Jia, 2017) argues that there are mainly two reasons for cultivation of university students' healthy social emotion as an important part of ideological and political education: first, cultivation of moral emotion and value emotion as the main task of ideological and political education including establishment of interpersonal relationships, students' personality shaping is an important part of moral education. Second, social emotions belong to human's high-level emotions which have an important impact on shaping of university students' healthy personality as an indispensable condition for university students to step into and adapt to society. However, this research only analyses the role of shaping of university students' healthy social emotions in ideological and political education, its role in other educational work is not mentioned (Thein, Guise, Sloan, 2015). Therefore, in the development of higher education, to cultivate university students' healthy social emotion, we should make a discussion on the main manifestations of university students' social emotions in our country, and explore the basic conditions for cultivation of university students' social emotion, and finally establish the healthy social emotion cultivation path integrating humanistic education, real social environment, communicative teaching method (Wang, 2015; Wang, 2016).

METHODS

Analysis of the Existing Problems

At present, the social emotion of university students in our country generally has three manifestations of high maturity, idealization and full of passion. Unreasonable control of its development is bound to exert a negative impact on student social development, creating adverse effects on students' social development (Wang, Chai, 2016).

The first is the general increase in maturity. With the continuous broadening of professional knowledge scope of students in contemporary universities, independent analysis ability possessed by students has been further improved, the ability of recognizing right and wrong has also been developed, and their ability to make decisions and solve problems has also been fully cultivated. However, students still have common features of lacking social experience, have insufficient awareness of development law, direction of social things, and have corresponding

irrationality in emotional expression. There are positive and negative emotions. Positive emotions include self-esteem, curiosity, pleasure, empathy, devotion, etc. which can create a mental state conducive to learning for learners, help learners to realize their potential and enhance their learning outcomes. Negative factors such as anxiety, tension, doubt, depression, etc., will bring learners a bad learning effect (Xiao, Wang, 2017).

The second is idealization. Since the first day of entering the campus, university students' role spontaneously changes. Universities mean half of society, then stepping into campus is equivalent to stepping into society, so students' role is changed from "natural person" to "social person", with social emotions gradually growing. Under the effect of frankness, as students step into the university and have access to ubiquitous communications and contacts, they will inevitably have idealized social emotion, have one-sided understanding towards communication between peoples and between people and society, failing to see that they will soon step into the society. With social emotion in the stage of "natural person", they lack understanding of emotional life from a social point of view (Yang, Sun, 2016).

The third is full of passion. Well-known psychologist Hall held that: university students are in transition from ideological "ignorance stage" to "civilized era". With greater ideological fluctuations, students will "go to extremes" in emotion, ideology, behavior. It can be seen that this stage as the critical period for cultivation of students' correct emotions is also important stage for cultivation of students' healthy social emotion. A slight deviation in ideological guidance will lead to unhealthy social emotion in students (Luo, 2017).

Conditions Influencing Cultivation of University Students' Healthy Social Emotion

To cultivate students' healthy social emotion in the ideological and political education of universities, we must refer to the present manifestations, establish the basic conditions for cultivation of students' healthy social emotion, proceed from shaping of students' healthy personality and cultivation of students' moral feelings and lay a good foundation for exploration of cultivation path. It is not difficult to find from the main manifestations of university students' social emotion and prerequisite for shaping of university students' healthy social emotion that the path of cultivating students' social emotion should be based on the integration of multiple aspects of humanistic education, real social environment and interpersonal communication cultivation methods, to provide all-directional impetus to cultivation of students' healthy social emotion.

In this study, the social emotion comprehensive score of the study subjects was selected as the dependent variable y, the personality shaping was selected as x_1, the moral feelings cultivation was selected as x_2, and the theoretical education x_3 was selected as the regression item to study the influence of different factors on social emotion cultivation.

In this study applying multiple linear regression model analysis, the specific formula of the model is as follows:

$$y_i = \beta + \alpha_i x_i \tag{1}$$

The difference between the estimated value and the actual value is expressed by the residual, and the specific formula is as follows:

$$\hat{u}_i = \hat{y}_i - \beta - \alpha_i x_i \tag{2}$$

The model regression coefficient is calculated as follows:

$$RSS = \sum_{i=1}^{N} \hat{u_i^2} = \sum_{i=1}^{N} (y_i - \beta - \alpha_i x_i)^2 \tag{3}$$

The following results are obtained from this model, as shown in **Table 1**:

Table 1. Impact of different factors

Dependent Variable: Y				
Included observations: 500				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-44.3219	0.4532	4. 5643	0.0342
x1	3.4324	0.4345	7.5433	0.4324
x2	6.5433	0.4345	4. 4545	0.2345
x3	0.9323	0.3456	0. 4323	0.5434

As can be seen from **Table 1**, the regression term passes the 5% significance level test, indicating high credibility of the regression results as a whole. The larger regression coefficient indicates the greater influence of regression variable on dependent variable. Hence, it can be seen that shaping of students' healthy personality and cultivation of students' moral feelings have a significant effect on cultivation of social emotion. Both of them have great influence on the final result, while theoretical education factors exert a weak effect on the correlation coefficient.

RESULTS

Pay Attention to the Shaping of Students' Healthy Personality

Cultivation of university students' healthy personality concerns development of students' healthy social emotion. Higher education means an important condition for cultivation of healthy social emotions in the shaping of university students' healthy personality. University students are the pillars of future social development, and personality literacy is the necessary inherent quality and conservation for students. This not only affects university students' internal personality, professional ethics after stepping into society and career, but also affects the development trend of market demand for good talent quality. Shaping of good quality of university students is the key to determine their personal qualities, ethics and professional accomplishment (You, Lin, Leung, 2015). Whether students have sound personality concerns whether students can look at and evaluate the development of things from an objective point of view, and affects whether students can deal with people with healthy attitude.

The main methods of shaping include two aspects: First, start from the interpersonal relationship of students, instruct students on the importance of establishing harmonious interpersonal relationships, add interpersonal interaction links in classroom teaching and practical teaching activities, and change students' unhealthy interaction purpose. Second, emphasize the unity of self-consciousness, instruct students to recognize that objective, fair and correct evaluation of their own contributes to their social development, which is also an important factor for people to maintain good communications, interactions (Zhou, Chen, Wu, et al. 2015). Instruct students to deal with people with sincere feelings, view things with peace, tolerance of mind, so as to improve health degree of students' social emotions. Under the action of such conditions, students will change their view to evaluate social development, look at social development, which helps cultivation of students' healthy social emotion.

Strengthen the Cultivation of Students' Moral Feelings

University students are in the stage of moral conscience generation featuring rich moral feelings. The stage is the most important period for cultivation of students' moral consciousness and moral behavior as healthy moral feelings are gradually shaped. Gradual maturity of students' moral feelings marks the healthy development of students' social emotions (Zhao, Zhang, Du, et al. 2017). Requiring that "ideological and political theory courses should strengthen practice links, establish and improve practice teaching security mechanism and explore long-term mechanism of education through practice." However, the cultivation of university students' healthy social emotion is not just one work content of ideological and political education in universities, but should also be carried out in other educational activities. In strengthening the cultivation of students' moral feelings, we should pay attention to two aspects: First, cultivate students' noble, healthy moral feelings based on campus cultural activities.

Second, by combining professional practice, give guidance to ideological and moral quality, and cultivate students' healthy social emotions from practical participation. Through cultural activities such as campus literature and art awards competition, campus poetry recitation competition, instruct students to experience inner feelings expressed by others, and optimize students' inner feelings through cultural cultivation. At the same time, with professional practice activities as an important carrier, instruct students to recognize the importance of mutual cooperation, mutual support and mutual promotion with practical activities, which helps cultivation and development of students' healthy social emotions.

DISCUSSION

Integrate Humanistic Education

The cultivation of university students' healthy social emotion is an important part of cultivation of qualified talents in higher education. The first step in building the path for cultivating university students' healthy social emotions is to integrate humanistic education. Humanities education plays an important role in modern higher education. The colorful activities will trigger students' thinking, so that they dare to take responsibility and have the courage to act, cultivating their healthy social emotion and training talents with lifelong learning ability and humanistic spirit for sustainable development of society. Whether it is in ideological and political education or other educational activities, teachers' classroom teaching easily ignores cultivation of humanistic spirit, ignores students' emotional needs and value guidance (Ma, Qi, et al. 2015). With the continuously quickening social development process, university students' own social values have also been affected. The idea of realizing self - social value in the infancy stage of adolescence cannot adapt to social development trend, and the maximization of self - interest becomes the core of values. It is generation of this idea that leads to gradual appearance of students' unhealthy social emotions, with purposeful struggle, mutual use, psychological divisive tactics deteriorating and unhealthy social emotions prevailing in the majority of university students. Considering this situation, cultivation of students' healthy social emotions in higher education should be coordinated based on humanities education. It should instruct students to establish a stable social mentality through guidance of excellent humanistic spirit and traditional culture, and then look at social emotion in a responsible mind.

Therefore, in the work of higher education, the method of integrating humanistic education can be explored from two perspectives: First, introduce Chinese traditional culture related contents, nurture students' awareness of self-social responsibility to promote cultivation of students' healthy social emotion. Second, view socialist core values as important content of higher education, take courtesy, integrity, friendliness as the main educational contents, cultivate students' healthy and optimistic social feelings, and optimize students' social emotion. Introduce social responsibility, social morality in traditional Chinese culture, instruct students to correctly understand the relationship between social emotional input and social returns, change their original self interest-centered value concept, and upgrade students' social moral quality. The cultivation and development of sense of social responsibility is a process of gradual accumulation, continuous transformation or reorganization, which has its own law of development. The individual psychology, self - consciousness, thinking level, moral judgment and choice of university students have been matured, but as they are in the active period of value formation, it is necessary to strengthen the education of sense of social responsibility of university students. The connotation of the socialist core values should be widely disseminated in the ideological and political education so that students can realize the importance of social mentality of courtesy, integrity, harmony and friendliness, which can promote emergence of ideology of treating others sincerely, being courteous and sincere cooperation, and help cultivate healthy social emotions.

Integrate Real Social Environment

In the main task of cultivating talents in higher education, extensive cultivation of talents with healthy thinking and good quality should be regarded as the core task, while cultivation of healthy social emotion should be treated as an important content. At present, most university students in our country are the only children with obvious "self-centered" thinking and very serious egoistic psychology who lack cooperation, communication with

others, have poor social communication ability and less cultivated social emotions. In the process of cultivating healthy social emotion of university students, the real social environment should be integrated into the education work in various fields, so that students establish "group-centered" thinking through cultivation by social environment, enhance consciousness of cooperation and exchange with others and promote the cultivation of healthy social emotions.

The main fusion path includes two aspects: First, carry out social practice education activities, cultivate students' social sentiment through high quality cultural life, change students' simple view towards society, instruct students to recognize the temperament necessary for the fierce social competition, upgrading students' inner world. Second, integrate community activities into the higher education system, cultivate university students' team awareness through community activities, and shape university students' enterprising sprit of unremitting struggle, thus controlling the development of their negative emotions. This is an important part of cultivation path construction of university students' healthy social emotion, also the prerequisite for the application of interpersonal communication cultivation method.

Use Interpersonal Communication Cultivation Method

The cultivation of university students' healthy social emotion emphasizes the cultivation of students' self-control to prevent the random development of unhealthy emotions. Whether it is in ideological and political education activities or other educational activities, interpersonal communication cultivation method should be the most important. The social adaptability of university students concerns harmonious development of society and personal development of students. In social transformation, some students have problems to adapt to study, work, psychology, interpersonal communication, etc. The so-called interpersonal communication cultivation method is to instruct students to carry out exchange between people through practical activities, instruct them to establish correct concept of interpersonal communication with the real society as the background, ensure that students look at interpersonal relationships with positive, peaceful and optimistic attitude to achieve the purpose of easy self-emotional control. Where, organization of related exchange activities with community activities, professional practice activities and social welfare activities as the main carrier to express each other's inner feelings and ideas is conducive to cultivation of university students' healthy social emotion. In addition, the use of interpersonal communication cultivation method needs not only feelings but also rationality. Tagore once said that in the process of interpersonal communication, first moving others' heart is a must to arouse people's rational thinking towards interpersonal relationship. In the use of emotional communication cultivation method, we must improve infectivity of the cultivation process, mobilize students' feelings while cultivating their mind, so that students experience interpersonal relationships from the heart with healthy personality shaped, thus able to adapt to various social roles in their posts.

CONCLUSION

In the work of higher education, the cultivation of university students' healthy social emotion concerns whether students can adapt to the needs of society and affects the comprehensive development of students' overall quality. Students' entry into the university campus marks entry into the society with "one foot". Their emotion should not stay in the middle school stage, as they need respect the objective facts in dealing with things and people, get rid of naive, ideal inner thoughts, face study and life with unity, cooperation, mutual promotion in mind. Therefore, in the process of cultivating university students' social emotion, we should start from shaping students' moral feelings and healthy personality based on basic characteristics of university students' social emotion, explore the path to cultivate students' healthy social emotion to ensure healthy development of university students' social emotion.

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Construction Elements and Path of Practical Education Model in Universities

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ABSTRACT
With the promotion and application of high-tech in large-scale manufacturing, aerospace, machinery manufacturing, medical equipment, biotechnology enterprises, enterprises have increasingly growing demand for high-quality skilled personnel, while practical talents are in great shortage, and embarrassing situation of "no recruitable talent" is often a case. Practical education reflects the real demand of national economic development and reform. In-depth analysis of the current development status of practical education model in colleges and universities reveals practical problems such as rigid education system, lack of platform resources and detachment from practical demand. Therefore, it is necessary to build a good practical educational and cultural environment from the three levels of thought, system and teaching. Efforts should be made to improve practice teaching platform, comprehensively enhance "order-oriented" talent training, adhere to the employment-oriented, scientific and practical evaluation system as a guarantee, make comprehensive innovation in practical education model and improve teaching quality. It is necessary to build a strong inner support structure from the aspects of thought, system and teaching, to improve educational and cultural environment from thought, system, teaching, and accelerate the reconstruction of practical educational innovation practice platform. Centering on construction goal of practical teaching model and practical talent training, the practical teaching platform of colleges and universities needs to explore the construction mechanism featuring mutual convergence, mutual cooperation, mutual benefit and win-win of theoretical and social needs, comprehensively highlight practical teaching characteristics, strengthen students' practical ability to lay the foundation for their future career development; conduct "order-oriented" training in line with actual employment needs, provide new ideas and implementation programs for "order-oriented" training, strengthen "order-oriented" teaching effect; strengthen evaluation system practicality within the framework of school-enterprise cooperation.

Keywords: practical education, educational model, cultural environment, order-oriented

INTRODUCTION

In the face of the rapid development of information industry, "made in China 2025" strategic task put forward that all walks of life are in urgent need of management talent, professional and technical personnel, innovative talent and even entrepreneurial talent. For instance, Gao Ming pointed out that the ratio of job vacancies of different technical levels to job seekers is above 1, among which, that for technician, senior technician, senior worker is 2.04, 1.9 and 1.83 (Csaszar, Levinthal, 2016), respectively. These factors have accelerated the innovation and development

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Contribution of this paper to the literature

- A specific analysis is made for the first time on the components of practical education model, which has passed validation.
- Discussion is made on the path to achieve the model by combining the components, with specific approaches given.
- Vague discussions are avoided with theoretical basis provided for the next specific study.

of practical education model in colleges and universities. Efforts should be made to accelerate the construction of practical educational and cultural environment in depth, concentrate outstanding forces of all parties, strengthen and perfect the innovation and practice teaching platform. For instance, Song Xiaojin pointed out that by integration of "production" and "teaching" in the education process, students can receive real experience in this new model, enhance the ability to link theory with practice, so as to fully reverse the practical situation where practical education model in colleges and universities is not up to standard, thus substantially promoting improvement in college graduate employment quality (Duran, Barnes, Corkery, 2015).

LITERATURE REVIEW

From the social point of view, practical education model in colleges and universities is to provide appropriate talents to all walks of life. It emphasizes unity of knowledge and practice, including knowledge objectives, competency objectives and quality objectives. Oriented to the first line senior practical talents in production, construction, management, service, the connotation of objective is: with serving regional development as the purpose, promoting employment and entrepreneurship as the orientation, docking industry demand as a benchmark, meeting job requirements as the basis, and with strengthening professional ability as the basis, focus on complexity and application of knowledge, highlight the cultivation of practical ability and innovative spirit (Liu, Zheng, 2015). However, current awareness of the educational model is still inadequate, mainly including the following states: for example, compared to traditional knowledge education, literature is only understood as more emphasis on students' application of technical skills in actual occupation, plus comprehensive improvement in proportion of practical teaching. That is, relative to academic studies, more focus is given to employment. The literature argues that compared to service, practical education targets at industry, emphasizes fitting in specialty, so that it can take foot in industry characteristics, obtain good employment performance, cooperate closely with local industry, business production, research and development, service, and provide point-to-point professional talent. However, it only proposes solution to problems from the perspective of application, and the awareness is one-sided. The literature only emphasizes technical "specialty talents", integrates technical content of practical education in the traditional knowledge curriculum system, and adds contents of professional characteristics, job responsibilities to achieve effective convergence between university practical education and future employment, which fails to completely depart from the main body of theoretical knowledge (Li, 2017).

METHODS

In order to further validate the elements of practical education model, it is necessary to carry out empirical method design. After replacing the existing non - practical education with the practical educational environment, the factor impact modeling method is as follows:

$$PSA_i = PC_i \cdot SE_i \tag{1}$$

In the above formula, $PSA_{i,t}$ is the practical education correlation intensity of the sample school, PC_i is the judgment variable. If the school adopts the practical teaching method, it indicates that the model has correlation, $PC_i = 1$. Otherwise, $PC_i = 0$. SE_i is correlative background intensity variable of practical education, and five-point rating valuation value is determined according to correlation intensity of teaching means.

Table 1. The correlation test result

Variable	$\Delta WC_{i,t}$	$PSA_{i,t}$	$ALR_{i,t}$	$SIZE_{i,t}$	$AR_{i,t}$	$PT_{i,t}$
$\Delta WC_{i,t}$	1	--	--	--	--	--
$PSA_{i,t}$	0.0125**	1	--	--	--	--
$ALR_{i,t}$	0.0093	-0.0095	1	--	--	--
$SIZE_{i,t}$	0.0198***	0.0098	-0.0099**	1	--	--
$AR_{i,t}$	0.0101	0.0101**	0.0101	0.0101	1	
$PT_{i,t}$	0.0101	-0.0101	0.0101	0.0101**	0.0101	1

Measurement Model for Platform Factor Influencing Degree

The main idea of the model is that the platform influence degree is the linear estimate of practical education, and the influence continuity is measured by acceptance degree converted by platform influence degree. The model expression is:

$$\Delta WC_{i,t} = \alpha_0 + \alpha_1 CFO_{i,t-1} + \alpha_2 CFO_{i,t} + \alpha_3 CFO_{i,t+1} + \varepsilon \quad (2)$$

In the above formula, $\Delta WC_{i,t}$indicates change in the teaching platform, i.e. the number of practical courses taught in the school year t-1 and t of school i/ the total number of courses; $CFO_{i,t-1}$, $CFO_{i,t}$, $CFO_{i,t+1}$ respectively indicates the ratio of participating students in t-1, t, t + 1 school year to the student number with satisfactory feedback (liu, and Tian, 2017).

Talent Impact Modeling

In this study, with the change of talents as dependent variable, students' social adaptability after acceptance of practical teaching as independent variable, student grade, school size, feedback registration, acceptance time, constraint variables are selected as control variables. Due to the large sample size and data size of this study, the model of practical education impact on social adaptability is constructed based on the cross-sectional model, specifically as follows:

$$\Delta WC_{i,t} = \beta_0 + \beta_1 PSA_{i,t} + \beta_2 ALR_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 AR_{i,t} + \beta_5 PT_{i,t} + \beta_6 Industry_{i,t} + \vartheta \quad (3)$$

In the above formula, $\Delta WC_{i,t}$ is a substitute variable for social adaptability, $PSA_{i,t}$ is the talent adaptability, $ALR_{i,t}$ is the negative impact factor of talents, $SIZE_{i,t}$ is the scale of talent, $AR_{i,t}$ is rate of feedback received by school, $PT_{i,t}$ is teaching time, $Industry_{i,t}$ is a dummy variable. β_0 is a constant term, β_i is a variable coefficient, ϑ is a random interference term.

RESULTS

The practical education schools in China are the study objects. In order to avoid impact of collinearity between variables on accuracy of the results, we first carried out correlation test on the variables. The results are shown in **Table 1**.

It can be seen from **Table 1** that there is no significant collinearity between the variables. Social adaptability is related to the teaching environment and is positively related to the platform. According to Model 3, the impact of talent on practical education can be obtained. The results are shown in **Table 2**.

As can be seen from **Table 2**, practical education variable $\Delta WC_{i,t}$ has significant correlation with talent $PSA_{i,t}$ at 1% level, has significant correlation with platform size $SIZE_{i,t}$ at 5% level, indicating that the factor is affected by multiple factors.

Table 2. The regression results of the study

Dependent Variable: $\Delta WC_{i,t}$				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
β_0	8.334	0.545	4. 5433	0.0015
$PSA_{i,t}$	0.0432	0.3568	5.7643	0.0065
$ALR_{i,t}$	0.0043	0.1543	1. 7623	0.6783
$SIZE_{i,t}$	0.6543	0.2964	1. 9875	0.0235
$AR_{i,t}$	0.0044	0.6532	1. 7762	0.0246
$PT_{i,t}$	0.0853	0.0598	2. 5732	0.0255
$Industry_{i,t}$	0.0945	0.2270	2. 6753	0.0360

DISCUSSIONS

Good Practical Campus Education and Cultural Environment

Campus culture environment can achieve educational effects of value leadership, publicity and guidance in a subtle way, but campus culture deposited by different types of colleges and universities is very different, so the potential role of campus culture construction in practical educational model cannot be ignored, which should be designed as an important part of the educational model (Lin, Han, Huang, et al. 2017). In the practical education model, students pay more attention to their own growth, have willing to exchange, want to change, can easily accept information, but do not know how to judge, analyse and use information. However, especially in terms of quality, technology development, production management process demands more personal responsibility, moral quality and professionalism and philosophy from practical personnel. First, the construction of practical education and cultural environment in colleges and universities should adhere to the socialist core values as the guide, fully integrate with the excellent cultural traditions, advanced world thinking, strengthen campus content richness, taste elegance, and adhere to student orientation, create good culture of innovation and humanities, and then form an "encirclement" from the three levels of system, material, spirit, so that students really feel connotation and spirit of practical education concept (Punckt, Bodega, Kaira, et al. 2015). Second, practical education culture is also reflected in quality aspect. Quality awareness, as the fundamental task in development of all walks of life in the whole society, has been deeply rooted, and thus quality culture is also a part of campus education culture. Its core is purpose, stability, that is, what is the purpose of practical education, what is the quality standard of personnel training and what kind of technical indicators can be adopted for explanation. In the course of future development, it is necessary to make constant conclusion, analysis and improvement, thus forming a changing growth path (Şevki, Fidanboy, Kurt, 2016).

Perfect Practical Teaching Practice Platform in Universities

Practical education in colleges and universities has a positive role in meeting the needs of China's social and economic development for high-level, practical talents, and promoting the process of popularization of higher education in China. Different from the research-based education and teaching education, practical education serves local economic and social demands, therefore pays more attention to and urgently needs practice platform to strengthen the coherence of theoretical teaching and practical application. In the face of the increasing number of demand, practical teaching practice platform of colleges and universities should be improved by combining teaching, research and future occupations. In particular, it should focus on practical needs of practice, center on the growth law of practice, learning, re-practice and relearning, fundamentally ensure that students have access to abundant, high-quality practice opportunities, so that students acquire and consolidate theoretical knowledge which are truly understood and innovated in the course of practice (Wei, 2016; Li, 2016). Of course, openness of practical teaching platform is also crucial to stimulation of students' self-initiative to participate in practical activities. After all, despite excellent teaching methods and perfect platform, it is students to complete the activities. Students in the open model can choose, design and deploy resources of practice platform, which not only helps students strengthen their practical ability, but also helps cultivate students' sense of responsibility and cooperation (Wang, Han, 2016).

Employment-Oriented Practical Talents Training

In the face of the serious employment pressure of college students, development of new industries and adjustment of industrial structure, practical education model of colleges and universities must pay close attention to future professional characteristics of students, then innovate the educational model, adjust the professional structure and comprehensively enhance practical talents training quality (Yong, 2017). Aiming at the technical requirements of the national strategic emerging industries and the future career of students: First, strengthen systematicness, solidarity and broadness of students' professional knowledge system, and ensure that students have certain research and innovation capability in the future employment. Education contents should be practical, so that students are competent for a business or social position after completion of each course. Teaching content must be very clear. Meanwhile, pay more attention to the construction of characteristic professional courses, encourage characteristic professional teachers to carry out corresponding practical research, so that curriculum construction is fuller and richer to adapt to and meet needs of characteristic practical talents. Second, ensure hierarchy in practical talent training. The demand for talent knowledge structure, technical capacity, quality and literacy in industrial transformation is more diversified, while personal demand for ideals, job search and development is individualized. Practical training model should be actively optimized to meet the complex two-way demand, protect the future survival and development of college students. Also, students' knowledge, quality and ability characteristics should be optimized with employment-orientation. In particular, enable students to form sensible, rational awareness of future employment, develop sound job concept, so as to improve the matching between talent and occupation, and achieve the ultimate goal of practical teaching model.

CONCLUSION

Improving the Educational and Cultural Environment from Thought, System and Teaching

Good education and cultural environment represents brand connotation of a university. To build practical education "brand effect", strengthen the competitiveness of university education model, efforts should be made to create a strong internal support structure from multiple aspects of thought, system and teaching, eliminate "false, empty" model of practical education in colleges and universities. First is the docking of concept of educational ideas, as idea is the leader of action. In the era of knowledge economy, the most important strategic resource for strategic emerging industry is information, knowledge, science and technology / creativity, so practical talents training demands possession of theoretical basis of professional knowledge, and grasp of inter-disciplinary processional knowledge and technology. Talents of different industries or professions are greatly different in thinking mode, values and even modes of action. Therefore, practical teaching model should gradually give new interpretation to vocabularies of professional, disciplinary, academic concept with vocational guidance as the core. Because there is deep-rooted "time principle" in practical educational model, efforts should be made to cultivate students' ability to produce correct response in the face of professional activities, and then form the teaching idea with knowledge application as the core. Second, establish career-oriented teaching management system. Practical talent training should pay more attention to the use of theoretical knowledge to solve practical problems. The traditional university management system has a bias to academic rigor, theoretical definition, which cannot meet innovation requirements of practical education model. Efforts should be made to promote the shift in university education center with future career, industry development as the core management system. Third is marketization change of teaching model. Emphasis should be given to open, flexible, diverse and diversified pattern of personnel training model. Domestically, there are such main personnel training models as dual certificate system, order-oriented, production and research integration, working and study alternation style, school-enterprise comprehensive implementation of "2 +1". Meanwhile, "double teacher" team construction should be strengthened, so that teachers engage in practical training in workshops. Also, workers and technical staff can be invited to give lectures in university classrooms, forming school-enterprise talent exchange mechanism to create a marketized, industrial new pattern of education, help students build social market awareness, and strengthen students' practical value concept and social adaptability.

Accelerate the Reconstruction of Educational Innovation Practice Platform for Practical Universities

Centering on the construction goal of practical education model and practical talent cultivation, practical teaching platform of colleges and universities needs to explore the construction mechanism featuring mutual convergence, mutual cooperation and mutual benefit between theory and social demand, comprehensively highlight practical teaching characteristics, and strengthen students' practical ability to lay a good foundation for their future career development. First, change practical teaching philosophy, make real-time, dynamic analysis based on the social development situation and future development trend of social environment, effectively manage the relationship between theoretical knowledge, practical ability, comprehensive literacy, so as to ensure consistency with construction thinking, development direction of practical education platform, promote the cultivation of practical talents, create new features of highly dynamic training, ensure the core foothold and development momentum of practice platform reconstruction. Second, cultivate practical ability, literacy of applied teachers, which largely determines the effective operation of innovation practice platform. Teachers' understanding towards professional concept, industry development and professional spirit will directly act on daily practice of teaching process, causing potential impact on students' thoughts and behavior. The practice platform of colleges and universities should implement the talent introduction plan extensively, strengthen actual combat experience of the faculty and gradually move towards diversified development, thus establishing an effective and close relation between practice teaching and practice. Third, innovative practice teaching links. Extracurricular combination has always been an important part of practical teaching model. We must change the past model in which only senior students have the opportunity for participation. Appropriate practical teaching contents should be provided since students are enrolled, with richer technical skills integrated since basic skills to reduce students' difficulty in understanding and adapting to practical education, thus truly reflecting the "going out" teaching idea. Fourth, strengthen mechanism for cooperation of practice platforms among colleges and universities. The biggest difficulty in the construction of college practice platform is the lack of resources, so only "partial" investment is possible. Nevertheless, by regional university cooperation, practice platform can give priority to the development of strengths in accordance with the characteristics of colleges and universities, with weak practice teaching dependent on practice platform of other colleges and universities, thus forming good result of complementary advantages, mutual benefit and common development.

Conduct "Order-Oriented" Training to Meet the Actual Employment Needs

If the college students are defined as "commodity", then satisfaction of "customer" including society, industry, business towards "commodity" will directly reflect the quality of university personnel training. "Order-oriented" practical personnel training idea is put forward in response to the "customer satisfaction" concept. Giving in-depth attention to the customer's multiple demands, it regards enterprise factors as the key to the training of personnel in colleges and universities. From the perspective of functional adaptability, social enterprise demand has more prominent importance, which is an important part of new normal construction of innovation development, sustainable development of modern practical education to conform to the new trend of educational development in the era. First is docking of specialty provision and regional industry. The proposal of regional industrial base provides more effective support to practical education model in colleges and universities, such as cultural industry base, biotechnology industry base, media imaging industry base, etc. which can provide very clear "blueprint" for talent needs characteristics, quantity, technical skills, future development. College education is to provide specialty based on the "blueprint", provide more "order-oriented" talent for various industries, while solving the serious employment pressure and enhancing specialty, flexibility and pertinence in professional teaching. Second, improve the "order-oriented" talent transfer quality monitoring system. Regardless of the changes, college practical education always stresses that personnel training should be very inclusive, while employers pay more attention to pursuit of interests, so students stepping into career will show great changes due to the harsh environment. Quality monitoring is to find a breakthrough, grasp dynamic changes in enterprise requirements, student workplace information, to provide new ideas and implementation programs for "order-oriented" personnel training and strengthen "order-oriented" teaching effect.

Strengthen the Practicality of Evaluation System within the Framework of School-Enterprise Cooperation

Establishment of a scientific, effective and practical evaluation system is an important subject of practical education model in colleges and universities. With the in-depth development of practical education model, the integration of production and education has become the main way of practical education in colleges and universities. The closer and effective cooperation between universities and enterprises brings more effective and practical ideas to the traditional education evaluation system. Based on the cooperation between schools and enterprises, efforts should be made to implement the training standard together, build curriculum system together, undertake practice teaching together, promote graduate employment together, with employer participating in quality evaluation and ultimately achieving seamless docking between graduate employment and industry (trade) development needs. Efforts can be made mainly from the following aspects to improve the evaluation system in the framework of school-enterprise cooperation, and effectively enhance practicality of evaluation effect: First is government level evaluation. As the leader and participant of the school-enterprise cooperation, government departments have an irreplaceable role in practical teaching model of colleges and universities, so the government departments should occupy a certain weight of evaluation mainly in environmental conditions, policy system, supervision and guidance. Second is the evaluation of university itself. As the main body of education and personnel training, colleges and universities occupy higher evaluation weight, with evaluation indexes around specialty type, teacher strength, curriculum content, educational resources and practical training, professional fit and so on. Third is enterprise, industry evaluation. As the employer, business, industry have the most intuitive feelings towards practical talents output by colleges and universities, whose evaluation contents are the most practical and scientific. Hence, the weight of evaluation is consistent with that of colleges and universities. Business, industry evaluation is centered on students' technical skills, professional quality, teamwork, communication, etc. Through the government, university, business evaluation of applied education, practicality of the evaluation system can be improved to better adjust practical education model in colleges and universities. Rapid changes in the socio-economic structure bring more diverse demand levels and specialties for talents. Therefore, to meet the talent needs of all walks of life has become a criteria and goal with key considerations for practical education model in colleges and universities. Starting from practical education and cultural environment, innovation practice platform, efforts should be made to gradually build a job-oriented practical talent training model, effectively enhance internal and external customers' satisfaction towards practical education model of colleges and universities, to strengthen university talent training brand and reputation.

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Stress Experiences and Reactions of University Students Studying in the Education Faculties

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ABSTRACT

The aim of this research is to analyse the reactions of university students in situations where they experience stress in order to create a psychological counselling program with a group based on Rational Emotional, Behavioural, Cognitive and Existential Approaches in order to improve the ability of first year students studying in the Counselling and Psychological Guidance and Preschool Teaching Department to cope with stress. The study examined the behaviours and thoughts of students in the context of these reactions as to the situations in which they experienced and believed to experience stress. In the study, face-to-face interviews were conducted on 45 students in the Counselling and Psychological Guidance and Pre-School Teaching Departments by using the semi-structured interview form developed by the researcher. Data were collected on the perceptions and the stress experienced or believed to be experienced by the interviewed university students, who formed the study group, and their thoughts and behaviours in line with these cases. The data obtained from the interviews were analysed by content analysis. It has been revealed that the first year students in Guidance and Psychological Counselling and Preschool Teaching Departments usually produced negative thoughts against the stress experienced within the university life and their behaviours appeared in the form of falling academic performance and avoidance in social relations.

Keywords: university students, stress, group counselling

INTRODUCTION

Stress is the reaction individuals show against a situation of difficulty that they meet at every stage of their lives. While these reactions may emerge in a variety of situations, stress often manifests itself as a condition that individuals often meet in their daily and school lives. Nowadays, it is seen that every individual encounters the concept of stress and it became a part of their daily life.

The inevitable self-imposed stress at any moment in the individuals' lives can be controlled and managed with developed coping strategies. Stress appears as a part of human life while gradually becoming a difficult situation to survive from within life, but it deeply affects the individuals' lives. Individuals need to raise consciousness at a certain rate towards the concept of stress so that they can continue to live their daily lives better.

While stress is perceived as a negative situation in individuals' daily lives of individuals, Rojas and Kleiner (2000) emphasize that stress should not always be considered negative. Güçlü (2001) describes this situation as the problems brought about by various economic, social and technological changes that the individual faces in everyday life. According to Deniz and Yılmaz (2005), stress is expressed as a concept stemming from the incompatible relationship between individual and environment.

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State of the literature

- The concept of stress is a situation to be encountered by individuals throughout their life and they need to be aware of these stressful situations.
- Thoughts and behaviours of individuals experiencing stress are significant determinants for practitioners.
- Stress is caused by negative thoughts like being unsuccessful, insufficient performance in lectures and uncertainty after graduation, being afraid of inability of finding jobs and lack of professional information.

Contribution of this paper to the literature

- It can be derived from the results that university students experience stress in case of adapting to the university environment, family estrangement and failure to meet expectations from university environment
- Helping university students to coping with stressful situations depends on the implementation of psychological counselling programs
- This research has been conducted in order to determine the variables causing stress in the life of university students.

Stress can be defined as the factors that cause distress, anxiety and tension in individual's life and academic activities for university students. Dyson and Renk (2006) state that the adaptation problems experienced by university students in the daily and academic life put stress on students. As is known, the university period is referred to as a new period in individual's life and is a period of significant development in the process of acquiring many new experiences in many academic, social and personal terms and preparing for a career. In this period, university students are expected to deal with many issues such as adapting to the academic and social environment and meeting academic expectations. In line with these expectations, students will face a certain level of stress while adapting to the new university environment and building new friendships as well as carrying out career planning studies. In this context, university students should be able to cope with the stress situation they face.

As is known, the role of the teacher in the teaching process is highly significant that it cannot be denied. This is because the process of being successful in the educational process depends entirely on the success of the teacher. Therefore, the encountering of students trained to work in the fields of teaching and psychological assistance with the concept of stress does not only threaten their academic success but also their adaptation to their future professional life. Thus, it is highly important that the factors that cause the stress in life are determined at the earliest time and the individuals learn to cope with the stress they experience.

METHODOLOGY

Research Pattern

This research is a qualitative research. In the study, semi-structured interview technique was used as qualitative research methods.

Universe and Sampling

The participants of the research were a total of 45 students studying in the first year of the Guidance and Psychological Counselling (GPC) and Pre-School Teaching (PST) Departments in the Lefke European University in the fall term of the 2016-17 academic year.

Data Collection Tools

Semi-structured interview form developed by the researcher was used as data collection tool in the research. By using forms, the perceptions of the interviewed university students forming the study group about the concept of stress, situations in which stress is experienced and expected to be experienced and information about their thoughts and behaviours related to these situations were collected.

Data Collection Process

The data of the study were gathered through interviews held one day a week in the Lefke European University Faculty of Education in Lefke. In the research, approximately 25 to 45 minute interviews were held with the first-year students studying in the Counselling and Psychological Guidance and Preschool Teaching Departments in order to establish a psychological counselling program with the group to be used in the development of stress-coping skills of university students.

Data Analysis

In the data collection and analysis in the research, three main dimensions have been studied in the form of determining the situations in which students experience stress in school life and their thoughts and behaviours against these situations and the situations in which they expect to experience stress in their future professional life.

The data were collected through interviews and analysed by content analysis. In content analysis, data were analysed within three phases. The data were encoded first, and then, they were divided into specific categories. These categories include the situations in which students experience stress in university life, their related thoughts and behaviours and the situations in which they expect to experience stress in their future professional life.

Findings

The findings regarding the answers of the first-year students in Guidance and Psychological Counselling (GPC) and Pre-School Teaching (PST) Departments, interviewed in order to establish a psychological counselling program with the group to be used to develop stress coping skills in university students in the research, were categorized under the following headings:

1. Findings regarding the situations when the first-year students in GPC and PST Departments experience stress in the university lives.
2. Findings regarding the thoughts of the first-year students in GPC and PST Departments when they experience stress in the university lives.
3. Findings regarding the behaviours of the first-year students in GPC and PST Departments when they experience stress in the university lives.
4. Findings regarding the situations that the first-year students in GPC and PST Departments expect to experience stress in their future professional lives.

Findings Regarding the Situations when the First Year Students in GPC and PST Departments Experience Stress in the University Lives

The research studied 45 participants in the context of determining the situations when the university students experience stress in their university lives. The answers given by students to the question "In which situations do you experience stress in your university life?" are as follows:

1. Adaptation to university environment
2. Family estrangement
3. Failure to find expectations from university environment
4. Abandonment of past habits

The opinions of the participants were determined under the ratios and themes mentioned in **Table 1** and the opinions given were presented. %44 of participants, who are in position of GPC first year students, stated that stress is experienced by them during the adaptation situations to the university environment. "*I miss my high school class a lot. I was very comfortable and peaceful in the high school environment. I used to spend nice and enjoyable time with my classmates in high school. However, I cannot spend such enjoyable time with any of my classmates in university. I cannot*

Table 1. Distribution regarding the situations when the first year students in GPC and PST Departments experience stress in the university lives

	GPC Department		PS T Department		Total
	f	%	F	%	
Adaptation to university environment	10	44%	8	36%	18
Family estrangement	4	17%	2	9%	6
Failure to find expectations from university environment	6	26%	9	41%	15
Abandonment of past habits	3	13%	3	14	6
Total	23	51%	22	49%	45

adapt to the university environment. I think this environment is very cold and frosty." The above opinions were provided by a student from the GPC Department. Having considered these explanation and opinion percentage, it can be commented that situations in which stress is experienced by the GPC first year students is in the foreground. Despite that, 36% of PST first year university students stated that the stress is experienced by them in the adaptation situations to the university environment.

17% of GPC first grade students and 9% of PST students stated that they experience stress in the situations of family estrangement. Regarding the question asked about determination of situations which cause stress in university life, 26% of GPC first year students and 41% of PST first year students indicated that they experience stress in situations such as failure to find expectations from university environment, university environment is very different after the high-school environment and they do not at this environment. Besides, it is seen that 13% of GPC first year students and 14% of PST first year students stated that they experience stress in situations such abandonment of past habits.

It has been found out that there are no differences between the opinions of GPC and PST students, the same view is being shared approximately and the stress is experienced in the situations of adaptation to the university environment, family estrangement, failure to find expectations from university environment and abandonment of past habits.

Findings Regarding the Thoughts of the First Year Students in GPC and PST Departments when They Experience Stress in the University Lives

The research studied 45 participants in the context of determining the situations when the university students experience stress in their university lives. The answers given by students to the question "What are your thoughts regarding the situations in which you experience stress in your university life?" are as follows:

1. Thinking to fail lessons
2. Thinking to be judged as ignorant by classmates and teachers
3. Thinking that the information to be learnt at university will not be useful for the future life

The opinions of the participants were determined under the ratios and themes mentioned in **Table 2** and the opinions given were presented. The students were asked about their opinions regarding the situations in which they experience stress in the university life. 62% of the first-year student participants studying in GPC Department stated that they think they would be judged as ignorant by their classmates and teachers. "*I am afraid of being judged as ignorant while performing an activity in front of my classmates.*" The above opinions were provided by a student from the GPC Department. Despite that, 50% of participants who are in the position of PST first year university students stated that they think they will be judged as ignorant in front of individuals and lecturers. Regarding the question asking the thoughts of the students about the situations in which they experience stress in university life, 38% of PST and 33% of GPC first year students stated that they have negative thoughts that the information to be learnt at university will not be useful for the future life. Besides, 17% of GPC first year students and 5% of PST students think that they will be unsuccessful academically.

Table 2. Distribution regarding the thoughts of the first-year students in GPC and PST Departments when they experience stress in the university lives

	GPC Department		PST Department		Total
	F	%	F	%	
Thinking to fail lessons	1	5%	4	17%	5
Thinking to be judged as ignorant by classmates and teachers	13	62%	12	50%	25
Thinking that the information to be learnt at university will not be useful for the future life	7	33%	8	38%	15
Total	21	47%	24	53%	45

Table 3. Distribution regarding the behaviours of the first-year students in GPC and PST Departments when they experience stress in the university lives

	GPC Department		PST Department		Total
	F	%	F	%	
Lack of desire to enter university environment	11	42%	7	36%	18
Lack of desire to study	4	15%	2	11%	6
Avoiding classes when unsuccessful	2	8%	3	16%	5
Failure to develop social relationships with academics	3	12%	4	21%	7
Failure to make new friends in university environment	6	23%	3	16%	9
Total	26	58%	19	42%	45

No differences have been found between the opinions of GPC and PST students, the same view is being shared approximately and university first year students are afraid of being judged as ignorant in front of other individuals and they think that they will be evaluated as uninformed in minds of teachers.

Findings Regarding the Behaviours of the First Year Students in GPC and PST Departments when They Experience Stress in the University Lives

The research studied 45 participants in the context of determining the situations when the university students experience stress in their university lives. The answers given by students to the question "What are your behaviours regarding the situations in which you experience stress in your university life?" are as follows:

1. Lack of desire to enter university environment
2. Lack of desire to study
3. Avoiding classes
4. Failure to develop social relationships with academics
5. Failure to make new friends in university environment

The opinions of the participants were determined under the ratios and themes mentioned in **Table 3** and the opinions given were presented. 42% of the GPC Department students stated that they exhibit behaviours such as lack of desire to enter the university environment and to avoid environments causing stress. "*I feel bad when I go to the university. I want to return back to my high school. I do not want to go into the university environment, which does not make me feel good. This school is very big and difficult for me. When I enter a crowded social atmosphere, I want to get away from it immediately because I feel very anxious.*"

The above opinions were provided by a student from the GPC Department. It can be said that behaviours of GPC first year students for avoiding environments which cause stress is in the foreground when this explanation and opinion percentage is considered. Despite that, %36 of participants who are in position of PST department first year student stated that they intend to avoid university environment. % 23 of GPC students and %16 of PST students stated that intend to avoid adopting new behaviours, entering into a different circle of friends (cafeteria, photocopy centres, restaurants etc.).

Table 4. Distribution regarding the situations that the first-year students in GPC and PST Departments expect to experience stress in their future professional lives

	GPC Department		PST Department		Total
	F	%	F	%	
Situations in which they have to perform career planning studies	17	63%	6	33%	23
Situations in which they have to fulfil their tasks successfully in the profession	10	37%	12	67%	22
Total	27	60%	18	40%	45

Regarding the question related with determination of behaviours in stressed situations in university life, 15% of GPC department first year students and 11% of PST first year students stated that they do not want to study and demonstrate a behaviour of not fulfilling duties given to them. 8% of PST first year students stated that they avoid classes due to the fact that they do not want to be judged as unsuccessful when they do not complete given homework.

12% of GPC department first year students stated that an internal and external social relationship cannot be developed with lecturers while 21% of PST department first year students have stated that a behaviour of developing relationship with lecturers inside and outside school cannot be demonstrated due to stress which is due to the university environment.

It is seen that no differences have been observed between the opinions of GPC and PST students, the same view is being shared approximately and behaviours such as avoiding the environment due to the stress, not studying, avoiding crowded places, avoiding classes or courses when duties are not fulfilled, inability to develop social relationships with lecturers and inability to make new friendships in the university environment are demonstrated by them in terms of at the determination of situations which the stress is experienced in university life.

Findings Regarding the Situations that the First Year Students in GPC and PST Departments Expect to Experience Stress in their Future Professional Lives

45 participants were included in the study in determining the situations that university students experience stress in the university life. The answers given by students to the question "What are the situations that you expect to experience stress in your future professional life?" are as follows:

1. Situations in which they have to perform career planning studies
2. Situations in which they have to fulfil their tasks successfully in the profession

The opinions of the participants were determined under the ratios and themes mentioned in **Table 4** above and the opinions given were presented. 37% of first-year GPC students and 67% of first-year PST students indicated that they could experience intense stress in situations where they had to successfully accomplish a task in the profession. *"Will I be able to perform my job well when I become a guide or psychological counsellor at a private institute? Will I be successful in my profession? I hope everything goes well. Even thinking about these situations put me under stress.* The above opinions were provided by a student from the PST Department. On the basis of this explanation and opinion percentage, it can be said that the fact that the first-year students studying in the GPC and PST Departments think that they may experience stress in the case of successfully performing their profession as teachers is on the foreground.

Regarding the question on the students' thoughts on the stress to be experienced in the future professional life, 67% of the first-year students in GPC Department and 33% of the first year students in PST Department stated that they could experience stress in case of doing career planning.

Regarding the determination of situations in which the stress will be experienced in their future profession lives, it is understood from the views that there are no differences between views of PGC and PST students, the

same view is being shared approximately and there is a thought that stress can be experienced at the situations like conducting career planning studies and at the situations like there is need for fulling duties successfully at their professions.

RESULTS AND DISCUSSION

In the context of determining the situations in which university students experience stress, no differences have been found among the opinions of the first-year students studying in the Counselling and Psychological Guidance and Preschool Teaching Department, they share similar opinions and they experience stress in case of adapting to the university environment, family estrangement, failure to find expectations from university environment and abandonment of past habits. This finding is similar to the study conducted by Dyson & Renk (2006) on determining the situations in which university students experience stress. Dyson & Renk (2006) indicated that university students experience stress in adapting to the academic life and university and in the social problems they have with family and friends. In this context, it can be said that university students experience stress in case of adapting to the university environment, family estrangement, failure to find expectations from university environment and abandonment of past habits.

In the study of Doğan & Eser (2013), they stated that new university students experience stress when they are expected to perform career planning while trying to adapt to the new environment, to establish new friendships during the family estrangement as well as successfully achieving their degrees and fulfilling their responsibilities as expected from them as a necessity of the university life. Moreover, they explained that students exhibit behaviours such as inability to study, to make friends, to fail modules and to establish relationships with academics.

Along with the finding of determination of thoughts about situations in which stress is experienced and they have negative thoughts like students will be unsuccessful at the courses and assessed as uninformed in front of classmates and lecturers, situations that are thought to cause stress in the future profession lives are determined as conducting profession planning studies and inability of fulfilling duties. In a similar study which was conducted by Aşçı, Hazar, Kılıç & Korkmaz (2015), it was determined that stress is caused by negative thoughts like becoming unsuccessful, the situation that lectures are not sufficient and are not understandable, lack of knowing what to do after graduation, being afraid of inability of finding jobs and lack of professional information.

Ardıç explained in the study conducted in 2009 that is named as effects causing stress and coping behaviours that behaviours such as avoiding school, lack of minding classes and breaking hearts of friends and lecturers are shown by students in situations in which stress is experienced. This result has evoked the findings that GPC and PST students demonstrate behaviours such as lack of desire to enter university environment, avoiding from studying, avoiding courses, lack of developing social relationships with lecturers and inability to make new friendships in the university environment, which have been emphasized in the finding of the determination of behaviours while stress is being experienced in university life.

(Güçlü, 2001; Deniz &Yılmaz 2005; Durna, 2006; Gizir, 2005; Avşaroğlu & Üre 2007) stated that the main sources of stress for university students are adapting to new school, academic and social environment and coping with meeting the expectations while it is unavoidable to experience stress against these situations. At the same time, they explained that the problem that students have experienced about establishing relationships in the new environment to which they intend to adapt leads to stress on students. In this context, it can be said that university students experience stress in adapting to the new university environment and establishing new relationships.

Having examined the obtained findings, it has been found out that new university students experience a certain level of stress in the situations of adapting to new university environment, making new friends, coping with family estrangement and negative thoughts such as failure and making career planning.

This view is observed to be in accordance with the research findings of Akbağ, Sayıner & Sözen (2005. In the research of Akbağ, Sayıner & Sözen (2005), it has been stated that the sources of stress of university students were excessive anxiety, inability to adapt to the environmental conditions, avoiding to establish relationships with

other individuals, avoidance and uncertain fears and thoughts. These findings are observed to be generally in accordance with the findings of other research (Hannigan, Edwardas, Burnard, & Philip, 2004; Keegan, 2003, Bulut, 2005) in the discussion process.

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Separate Exploration on the Development Path of Mixed Ownership System in China's Educational Field

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ABSTRACT
Since the reform and opening-up, China's education has been developing rapidly but facing many systematic problems. In the background of developing mixed ownership system actively, developing the mixed ownership system in educational field has significant realistic value in broadening the source of the educational funds, de-administration in educational field, introducing normative competition mechanism, breaking through the restriction of the public schools' establishment and stimulating vitality of running a school. This paper uses the public theory to analyze the present status of development of mixed ownership in educational field and the problems of all kind of education, and discovery the development path of mixed ownership system, including classifying reform, improving relevant laws and regulations, breaking through the ideological fetter of all-or-none thinking, clearing ownership of property, clarifying the responsibility of each party, strengthening the pilot work and finally realizing the reunification of particularity and universality.

Keywords: education, mixed ownership, public goods

INTRODUCTION

"Education is the basic of a one-hundred-year strategy of a nation". In the 21st century of the era of knowledge economy, education contributes increasing more to material production and social development. Education development and input level is often the main criteria to measure degree of quality and civilization of a country, a nation. With the rapid development of social economy, China's education investment continues to increase. In 2012, China's education spending proportion in GDP reached the international base line of 4% for the first time and maintained between 4% and 5% for five consecutive years, reaching the highest of 4.3% in 2013. However, China's education field still faces many problems, such as unfair distribution of educational resources; lack of funds for pre-school and vocational education, single source of funding, heavy government burden; great gap in education, financial investment between urban and rural areas and between schools; undesirable quality in running vocational education and pre-school education, and lack of outstanding teachers. In this regard, all walks of life is always actively exploring new path for education reform.

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Contribution of this paper to the literature

- Through investigation of current situation of China's education mixed-ownership system, the contemporary development trend was deeply analyzed. Then, through summarizing the research findings, the path forward was initiated.
- This study presented an in-depth analysis of the problems in development of mixed-ownership system of China's higher education and found the causes of the problems, which provide guiding significance for future development.
- This study proposed accurate countermeasures to solve the problems in development of mixed-ownership system of China's higher education. These measures are scientific, which can provide theoretical support for the reform and improvement of mixed-ownership system.

In view of the success of mixed ownership in the economic field, vocational education currently takes the lead in proposing development of vocational education of mixed ownership. From an economic point of view, education is seen as a mixture of goods with multiple ways for provision and production, which provides a basis for the development of mixed ownership education. However, educational products have clear public property, and whether mixed ownership is suitable for education of all levels is still worth exploring. Therefore, this paper attempts to make separate exploration of applicability of mixed ownership in different educational fields in the context of mixed ownership development.

OBJECTS AND METHODS

Promote the Realistic Value of Mixed Ownership in Education Field

Development of mixed ownership in education field means important realistic value for solving and alleviating the existing problems, specifically as follows:

First, it helps broaden the source of education funds and optimize the funding structure. China's education funding mainly comes from the budget, and social capital investment accounts for a small proportion. According to the "China Statistical Yearbook 2016", China's education funding in 2014 totaled 328.1 billion yuan, of which, private school organizers invested only 1.133 billion yuan and social donations only amounted to 7.967 billion yuan. Although China's education spending is increasing with its proportion in GDP reaching international base line of 4% for the first time in 2012, China's investment in education field is still at a low level compared with other developed countries. In particular, private institutions lack financial support and their development is restricted by funds. Because private capital pursues profit, social capital tends to go to education field with strong private property featuring large income and quick results, but reluctant to go to public welfare education. Moreover, social capital in the existing education field lacks effective regulation, and disorderly development is often a case. The property rights of the mixed ownership schools belong to different forms of ownership, including state and non-state ownership. Through the construction of scientific mixed ownership model, public schools can more effectively absorb social idle funds, private schools can receive strong support from state finance, thus forming a financing system integrating state, society and individuals which helps reduce the government's financial burden, optimize the education investment structure and alleviate the problem of insufficient education funding (Su, 2017).

Second, it helps de-administration in education field, thus stimulating school vitality. Education funds mainly rely on finance and management cadres have corresponding administrative level, which determines that schools' important decision has to obey the higher authorities' willing and higher authorities' instructions must be strictly implemented. This is especially demonstrated in administerization in personnel management and management standards. The long-term administrative system leads to lack of school vitality and school autonomy, institutional rigidity, staff redundancy, low work efficiency in schools, especially public schools. The introduction of scientific, standardized mixed ownership can help absorb multi-party investment, inject fresh blood to schools, improve the school governance structure, break through the education administerization barrier, deepen the reform of school system and stimulate school vitality.

Thirdly, it helps introduce standardized market competition mechanism in education field and improve the efficiency of resource allocation. Public schools face the problem of education administerization mainly manifested in the rigidity of personnel management and curriculum setting, which leads to the lack of school autonomy and the disjunction between school curriculum and cultivated talents. The mixed ownership in education field emphasizes use of market mechanisms and market ideas to promote healthy development of education. For example, for public higher vocational education, there lacks innovation motivation, the curriculum setting cannot meet the market needs, education quality is not high, student pool is insufficient, and graduates have difficulties in finding employment and obtaining social recognition. The main reason lies in the absence of school-running enterprise subject and inconsistency between vocational college and market demand (Que, and Pan, 2015). However, private institutions have a strong enthusiasm in new course development, strengthened practice and innovation owing to their profit purposes, but the vicious competition and lack of funds restrict its further development to some extent. The process of mixed ownership school running is in fact a process of readjustment and regularization of the interests of public capital and social capital (Chen, 2017). Education is a mixture of goods. Appropriate market-oriented operation in education field through mixed ownership can achieve complementary advantages of state-owned capital and non-state capital, which can not only ensure sufficient funding sources of schools, but also enhance the liquidity and utilization efficiency of capital through mature market operation mechanism of private institutions, thus improving education quality and enhancing market competitiveness.

Fourth, it helps break the restrictions on the establishment of public institutions to achieve the optimal allocation of teacher resources. Public institutions adopt establishment system in personnel management, and competent authorities responsible for establishment determine the staffing quota and job allocation in accordance with specific circumstances such as school size. However, the manning quota is limited and relatively fixed and staff outside the quota needs to be employed to ensure normal operation of the school. There is a big gap in treatment for staff within and outside the quota. The first issue is different pay for the same work. In the general circumstances, wage of the staff within the quota is higher than that of staff outside the quota, and pension of the staff within the quota is borne by the state, but those outside the quota shall take responsibility for their own pension. However, requirements for the faculty are the same in all aspects. Second, faculty outside the quota can only be promoted after joining the establishment system, and establishment serves as the premise for promotion. Furthermore, establishment features a certain degree of stationarity, excellent teachers preferring economically developed areas are fixed in the locality through establishment, and the lack of liquidity results in regional imbalances in educational resources. Finally, work for staff within the quota means a secure job, while it is relatively unsecure for those outside the quota. The treatment difference between the personnel within and outside the quota has dampened the faculty enthusiasm, and some outstanding teachers have left their jobs due to incapability to join the establishment system, resulting in loss of talents. Development of mixed ownership helps introduce modern personnel management system, practice the principle of matching people to jobs and fair competition, break through the establishment restrictions on teachers in public institutions, thus stimulating the enthusiasm of faculty and retaining talented people.

Development Status of Mixed Ownership in China's Education Field and the Existing Problems

It is generally believed that China's education system is divided into basic education, higher education, vocational and technical education and adult education. The four are not opposed, but have mutual fusions. In this paper, public goods theory is used to analyse development status of mixed ownership and the existing problems in four types of education respectively.

Basic education

Basic education includes pre-school education, nine-year compulsory education and high school education.

1. Pre-school education

Pre-school education means early childhood education, the initial stage of school education. With the development of social economy and improvement of people's living standard, pre-school education has received more and more attention, but there are still problems of insufficient investment, not standardized management, great teacher mobility, uneven regional development. At present, pre-school education has clear mixed ownership characteristic, which includes four different types of kindergartens (Zeng, and Liu, 2016).

Public kindergartens: kindergartens run by the state. With state finance as a support, it pays more attention to equity and increased social welfare, but there are also a number of problems, including: shortage of public pre-school education resources, unfair distribution of quality educational resources; lack of market competition mechanism, insufficient sensitivity to market demand, lack of innovation motivation; with administerization characteristics, lack of autonomy; rigid personnel management system and lack of excellent teachers.

Private kindergartens: kindergartens organized by social capital. With more innovation and vitality than public kindergartens, it sets different courses and teaching standards for different service objects with strong flexibility. In teaching, private kindergartens tend to develop new projects in response to market demand and enhance their competitiveness. However, development of private kindergartens is uneven, there being problems of unlicensed business activity and poor teacher quality issues. Moreover, operators have poor public consciousness and legal awareness, blindly pursuing profit; there is vicious competition to reduce fees, hardware and software facilities are insufficient; government departments lack supervision, failing to provide effective guidance.

Enterprise kindergarten: kindergartens organized by enterprises (generally state-owned enterprises) and belonging to the unit's welfare system. With the vigorous development of GSP kindergarten, enterprise kindergartens are neither public kindergarten nor private kindergartens in pure sense in the context of institutional reform. In a status of embarrassment, they lack stable state financial support. Many enterprise kindergartens face dilemma in financial, management aspects, and lack motivation in innovation such as development of new projects (Wang, 2016).

Transformed kindergarten: mixed ownership schools. Through decomposition of kindergarten property rights, the structure where the state and organizers jointly enjoy ownership is developed (Zeng, and Liu, 2016). Transformed kindergarten is currently in the forms of public kindergarten in balance allocation system, public kindergarten in principal-agent relation, state-owned private kindergarten and joint-stock kindergarten (Yu, 2012). Transformed kindergartens face the following problems in the development process: imperfect relevant laws and regulations; insufficient education funding, absence of government responsibility; unclear property ownership, easy disputes in property rights and benefit distribution.

In 2016, private kindergartens in China totaled 0.1542 million, an increase of 7827 over the previous year, accounting for 53% -54% of the total pre-school education, while private kindergarten children numbered 24.3766 million, an increase of 1.3522 million over the previous year. But in general, China's pre-school education resources are quite insufficient, supply of public pre-school education resources exceeds demand. The gap in regional development level is big especially in rural areas, development of private pre-school education resources is uneven, there are few transformed kindergartens, and pre-school education still lacks inclusive resources (Yang, and Li, 2016). As pre-school education is not compulsory education, its public nature is relatively weak than that of compulsory education. Thus, it enjoys the potential for positive development of mixed ownership education.

2. Compulsory education

Compulsory education refers to education implemented according to law that children, juvenile of school age must accept. Featuring mandatory, free and universal characteristics, it means the rights and obligations of each citizen. From the perspective of public goods, compulsory education is not a mixture of goods, but pure public goods that should be provided by the government free of charge. In reality, although it is provided by the

government free of charge, there is a great gap in amount and quality of compulsory education resources due to the wide gap in development level of various regions. As a result, people compete for excellent educational resources, resulting in competitiveness and exclusivity. There are also some private primary and junior high schools in compulsory education. According to the "China Statistical Yearbook 2016", in 2015, primary schools in China numbered 191,000, 5859 of which were private primary schools, junior high schools in China totaled 52,400, 4876 of which were private junior middle schools. By 2016, private compulsory education schools totaled 11,100, an increase of 325 over the previous year, while students numbered 12.8915 million, an increase of 724,000 over the previous year. Where, the number of private primary schools accounted for 7.4% -7.5% of all primary schools, while private junior high schools accounted for 11.7% of all junior high schools. Private primary schools and private junior high schools are mostly elite schools or aristocratic schools. With small class size, high quality of teaching, focused quality education, their charges are accordingly higher as a whole without inclusiveness. Public schools have bigger class size, some reaching as many as 70 per class, but teachers are relatively stable.

At present, compulsory education faces the following problems in the development process. First, distribution of compulsory education resources is uneven, with big regional gap in quantity and quality; second, there lacks quality compulsory education resources to meet people's needs; third, behavior bias occurs in the process of governance. In the system featuring balanced governance of compulsory education, the three parties of the state, local government and school constitute the complicated principal-agent relation, and information asymmetry due to multiple system barriers results in unconscious behavioral bias in the governance process (Peng, and Zhu, 2017). Then, local government selectively implements policies and the results are often unsatisfactory. In short, as compulsory education is pure public goods, the condition for large-scale development of mixed ownership is not met.

3. High school education

High school education means the education based on pre-school education and 9-year compulsory education to further improve the quality of people and lay the foundation for lifelong development of students. "National Medium and Long-term Education Reform and Development Plan (2010-2020)" mentions the requirement to speed up popularization of high school education, promote diversified development of ordinary high school, promote diversification of school-running system and expand high-quality resources. The contradiction between supply and demand in high school education is the main dilemma of high school education development (Liang, and Chen, 2017). With the establishment of market economic system, China's rapid social and economic development, people have more demand for education. People have increasingly strong voice for popularity of high school education, thus high school education gradually has the nature of compulsory education, with growing public nature.

Higher education

Higher education includes junior college education, undergraduate education, postgraduate education and doctoral education. Seen from the theory of public goods, higher education belongs to quasi-public goods. On the one hand, higher education is an important way to improve quality of people, cultivate high-level talents, drive innovation and promote economic development, thus it has the nature of public goods. On the other hand, who benefit more from higher education are individuals. Individuals receive higher levels of knowledge through higher education, and have more opportunities for better occupations and higher income in the future. In other words, the benefits that individuals derive from higher education are internalized and privatized, and one person's receiving higher education correspondingly lowers other people's opportunity of receiving higher education. Thus, higher education cannot be provided free of charge by the government as defence and law, which also provides a theoretical basis for the development of mixed ownership in higher education.

China's current institutions of higher learning face the following problems. First, public institutions of higher education have single source of funding, heavily dependent on the government; second, private schools generally do not have high school-running quality, with relatively poor quality of students as a whole. With the

large-scale enrolment of public colleges and universities, outstanding students are more inclined to attend public colleges and universities, leading to the lack of outstanding students in private colleges and universities, which exerts a greater impact on school-running quality; third, the social recognition of private schools is not high, there exists discrimination against them, which is also the direct cause leading to the lack of outstanding private students in private institutions of higher learning; fourth, private colleges and universities have insufficient outstanding teachers. Excellent teachers are more inclined to find employment in public institutions offering better treatment, and some private institutions can only rely on external part-time teachers to make up for their insufficiency in teacher resources. The nature of quasi-public goods in higher education provides the potential to further develop mixed ownership.

Vocational and technical education

Vocational and technical education includes secondary vocational and technical education and higher vocational and technical education. Vocational institutions currently include public vocational and technical institutions, private vocational and technical institutions and very few mixed ownership institutions. The current vocational education has not yet fully adapted to the needs of social and economic development, with generally not high school-running quality and not reasonable structure. In June 2014, "State Council decision on accelerating the development of modern vocational education" put forward the requirement to explore the development of joint-stock, mixed ownership in vocational schools, allow capital, knowledge, technology and management factors to participate in school running and enjoy the corresponding rights. The government encourages the organization of mixed ownership institutions, as there are only a few pilot schools of mixed ownership institutions in China, such as Guangxi Institute of Technical.

Vocational education encounters the following problems in the process of exploring mixed ownership school-running. First, property rights are the core of ownership, mixed ownership system involves state-owned capital and non-state capital, explicit ownership of property rights is the basis for mixed ownership school-running, but there is problem of unclear ownership of property rights at the level of practical exploration. As a result, it is difficult to evaluate property rights, as social capital is worried that their own interests cannot be guaranteed, while state-owned capital is worried about losing control of the school and loss of state-owned assets, the two have difficulties to integrate with each other, which restricts the development of mixed ownership vocational and technical education to some extent.

Second, the long-term all-or-none way of thinking is a major obstacle to the development of mixed ownership education in China. China has a late start to explore and practice mixed ownership system in school running, the relevant laws and regulations are not perfect and there is no substantive policy support, which is the origin of unknown school ownership of property rights and unclear legal status in mixed ownership school running.

Third, there is a shortage of funding for education. China's investment in vocational and technical education is lower than that in compulsory education and higher education, plus its incapability to effectively absorb social capital, vocational and technical schools, especially private schools, face the problem of funding shortage, with tuition accounting for a major part of funding. The shortage of teaching funds has led to low treatment of teachers, so excellent teachers cannot be retained, teaching practice lack equipment and facilities and it is difficult to improve quality of education.

Fourth, "double type teacher" resource is in shortage. Different from the academic school, vocational and technical education focuses on training skills applied talents. What vocational and technical institutions need are "double type teachers", which means teachers with academic theory teaching capability and practical teaching quality. However, academic research accounts for a large proportion in teacher evaluation standard in vocational and technical institutions, so that teachers prefer academy over practice, which affects school's school-running quality, and results in inconsistency between trained talents and market demand.

Adult education

Adult education is different from the ordinary full-time teaching, with no age limit characteristics. As a supplement to formal education, adult education can promote popularization and generalization of education, thus making up for its drawbacks to a certain extent (Yang, 2017). Adult education is also a mixture of goods. With relatively strong internality, it has the prerequisite for vigorous development of mixed ownership.

China's current adult education is also facing many problems. First, the purpose and orientation of adult education is not clear enough. Adult education aims to continuously improve the quality of adults so that they meet the needs of social and economic development. The current adult education, however, still resorts to the traditional model, lacks innovation, thus unable to really achieve the purpose of training; second, policy guidance in adult education is not scientific enough. Adult education is a supplement to ordinary formal education, the government and society fail to give enough attention to it, and the investment is far less than that in other types of education. Third, the government and society fail to pay enough attention to adult education, there is a great system vacuum in terms of institutional supply, and the existing system is no longer applicable to further development of adult education.

RESULTS

In view of the general and particular problems reflected above, this paper puts forward the following countermeasures:

First, separately advance mixed ownership reform in education field and steadily achieve reform objectives. Different types of education have different degrees of publicity, so mixed ownership reform should be separately and steadily advanced. In the first place, develop mixed ownership vocational and technical education. State-owned capital and non-state capital can jointly co-sponsor schools. The government can provide funds, school sites, etc., while social capital takes up shares with equipment, capital. In the development of vocational education, strengthen the cooperation between schools and enterprises, encourage outstanding engineers to enroll as part-time teachers to provide practical experience, while enterprises provide practice sites for schools to further improve school-running quality. Vocational and technical institutions can also achieve separation of ownership and management by entrusting professional vocational education group for management. Second, positively develop mixed ownership pre - school education, and actively explore state - owned and social capital cooperation model. Furthermore, vigorously develop adult education mixed ownership. Mixed ownership of adult education is dominated by social capital. The government attracts more social capital through provision of part funds, playing a role of guard reversal. Again, moderately develop higher education mixed ownership. Under the premise of ensuring education fairness, public institutions can introduce social capital to realize diversification of investment subjects. The logistics management of colleges and universities can be outsourced to the society to improve management efficiency. Finally, cautiously explore development of mixed ownership in compulsory education and high school education. Compulsory education is pure public goods, and high school education is more and more public, to ensure public welfare of the two, large-scale development of mixed ownership is not feasible.

Second, improve the laws and regulations to provide institutional basis. Mixed ownership means a new attempt in the field of education, thus supporting laws and regulations are imperfect, mixed ownership school activities lack the relevant legal basis, which is the root cause of many problems. "The decision of the Central Committee of the Communist Party of China on Several Important Issues Concerning Comprehensive Advancement in Rule of Law" mentions that "the socialist market economy is essentially a legal economy. Socialist market economy legal system must be improved with protection of property rights, maintenance of contract, unified market, equal exchange, fair competition, effective supervision as the basic guidance to enable market to play a decisive role in allocation of resources and better give play to the role of government." Mixed ownership aims to achieve healthy development of education with market mechanisms and market management philosophy, applies laws and regulations with market mechanism as the essence, and adheres to fairness and equality. Perfecting laws and regulations is the fundamental guarantee for the development of mixed ownership. In this

regard, it is recommended that the government issues relevant systems and guidance to provide legal basis for the promotion of mixed ownership in education field; revise existing laws and regulations which are old and unable to provide effective guidelines for existing mixed ownership education; strengthen the system classification design, separately and steadily promote mixed ownership reform in education field.

Third, break the all-or-none thinking to achieve diversification of school-running subjects. Mixed ownership is an economic form between public ownership and private ownership, which is demonstrated as diversification of school-running subjects in the field of education, that is, both state capital and social capital are involved and organically integrated. Mixed ownership school running can take the following forms: First, public schools introduce social capital to enable orderly development of social capital; second, state-owned capital invests in private institutions, to solve the problem of insufficient funding in private institutions; third, public and private institutions as well as other social capital jointly invest in school construction; fourth, convert public school assets into shares through assessment of assets, then sell the shares to school staff, so that school staff become the owner of the school, which inspires their work enthusiasm.

Fourth, clarify ownership of property rights, determine responsibility of all parties. Mixed ownership is essentially a joint-stock economy, property rights is its core (Dong, 2016). "Decision of Central Committee of the Communist Party of China on several major issues concerning comprehensive reform" mentions the requirement to "improve the modern property rights system featuring clear ownership, clear rights and responsibilities, strict protection and smooth flow." The essence of mixed ownership system in education is to introduce a number of investment and school-running subjects, transfer part of investment and school management responsibility originally entirely borne by the government to the market, so that each subject can obtain a reasonable proportion of profits, while the property rights subject can freely trade in the property rights trading market. The motivation of social capital to participate in economic activities is economic benefits. Clarification of property rights ownership to protect the legitimate interests of the various investment entities is an important guarantee for sustainable attraction of social capital, healthy operation of social capital and sound development of mixed ownership. Participation of state-owned and social capital is a must for development of mixed ownership education. Otherwise it cannot be referred to as mixed ownership. The government shall perform its functions, strengthen regulation and provide school with sufficient policy and financial support.

Fifth, strengthen pilot work, steadily push forward the reform. Reform is not done overnight, but step by step. Pilot work is experimental work. Steady pilot is needed to timely find problems in the process of exploring mixed ownership school-running. Through timely adjustment of actions of each party, explore the scientific way to develop mixed ownership education, steadily promote mixed ownership reform in vocational education → pre-school education → adult education → higher education → compulsory education and high school education.

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Teaching Reform of Business Statistics in College and University

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ABSTRACT
Business Statistics is an important course for teaching administration and business colleges in colleges and universities. In most colleges and universities, traditional "teaching" mode is till used in course teaching of business Statistics; the mode of interfered realization of course teaching goal in a certain extent. In this essay, current status and characteristics of course teaching of Business Statistics were sorted out with guidance of information age background. The study suggested that there were following problems in course teaching of Business Statistics: defects of teaching position, "teaching-learning" was main mode, connection with practical demands was not close enough and etc. In the study, overall reform framework was proposed through content, method and evaluation of course teaching; "*Practical Business Statistics*" was conducted and used; teaching reform mode with theories and practical teaching was formed which could provide reference for course teaching reform of Business Statistics in colleges and universities.

Keywords: business statistics course, direction of reform, teaching mode

INTRODUCTION

In the 21st century, Business continues developing in China which is becoming a sports power with modernization, informationization and high science technology. As a basement for teaching athletic talents, college and university play an important role in teaching modern athletic talents. Relevant statistics theories will definitely be used in Business exercise, research, software development and other aspects. However, as a newly rising course, Business Statistics has its own problems, like comparatively single teaching form, inaccurate course teaching position and etc. Course teaching of Business Statistics in college and university needs to be explored further.

Business Statistics is a comprehensive course which involves mathematical statistics, Business phenomenon, information technology and other knowledges. It occupied an important position in teaching modern athletic talents. According to Shuxiang ZHAO's "*Practical Business Statistics*" we can see that Business Statistics mainly consists of Research Design, Descriptive Statistics and Inferential Statistics as shown in **Table 1**.

It is not difficult to tell from **Table 1** that course design contents of Business Statistics are comparatively rich, complicated and boring. For students who are not interested in Math, when teaching form is comparatively simple and practicality of teaching is weak, effect of teaching is comparatively poor. There are three problems as follows:

The first is defect of teaching position in Business Statistics. Because of this, students do not have enough understanding on basic theory of Business Statistics and statistical thinking; it is easy for them to learn but difficult for them to memorize; they make mistakes frequently in practice. At one hand, math properties are emphasized in

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Contribution of this paper to the literature

- This article outlines the business statistics teaching difficulties and questions. It gives us how to improve the student's understanding and application in business.
- It is argued that business statistics is an essential tool for students' development in the career. Therefore, the more studying and understanding of statistics, the better they will be.
- Several methods about reforming the business statistics are proposed.

Table 1. Content and classification of Business statistics

Physical Education Statistics	Research Design	Basic Thought and Method of Statistics
		Design and Principle of Statistics Content
		Design of Investigation and Experiment
	Descriptive Statistics	Statistics and Distribution of Frequency
		Sample Statistics and Counting
		Distribution and Description of Normality
	Inferential Statistics	Relevance Analysis
		Regression and Cluster Analysis
		Difference Analysis

Reference: Shuxiang ZHAO, Practical Business Statistics [M], Beijing Sports University Press. 2015, September Edition.

course teaching of Business Statistics in college and university; mathematical formulas and inference are involved in Descriptive Statistics, Sample Statistics, Normality Distribution and other sections. As a result, students focus on learning mathematical formulas and abstract theories; valuing degree of students' accepting theories is increased; teaching of Business Statistics method is emphasized; knowledge of Business Statistics theory is not enough. On the other hand, one-sided pursuit of data accomplishment and logicality exists; there is difference between course teaching and students' practical needs; students know but not the why about statistical method.

The second is that teaching form of Business Statistics in college and university is comparatively single. In recent years, although main body position of student has been emphasized in teaching, "teaching-learning" mode is still used as main teaching form of Business Statistics in most colleges and universities; students do not have enough knowledge of Business Statistics practice; formulas and scores are valued highly, practical application of Business Statistics theory is ignored; students' knowledge range is narrow, their abilities of practicing and comprehensively analyzing are weak, they cannot reach demands of Quality Education.

The third is that connection between course teaching and practical demands of Business Statistics in college and university is not close. Current course teaching of Business Statistics in college and university is limited in to textbook; as a result, connection between teaching and application is not close. In practical learning, students do not have a clear understanding about practicability and operability of Business Statistics; it is believed that there is not enough application of Business Statistics learning in life, therefore, students' positivity and proactivity of learning is low.

KEY ELEMENTS REQUIRED IN COURSE TEACHING REFORM OF Business STATISTICS IN COLLEGE AND UNIVERSITY

Presently, course teaching of still has to face many plights. Especially in today's rapid development of information technology, it is difficult for traditional "teaching-learning" mode to meet demands of social development. Therefore, main body of teaching shall be considered seriously, take demands of students as basis, with the guidance of application of information technology, course teaching mode of Business Statistics can be reformed further, as shown in **Figure 1**.

As shown in **Figure 1**, course teaching reform of Business Statistics in college and university must be guided by demands, development of information technology, science and technology. First of all, it shall be guided by practical demands of students. In college and university, relevant courses of Statistics are not required

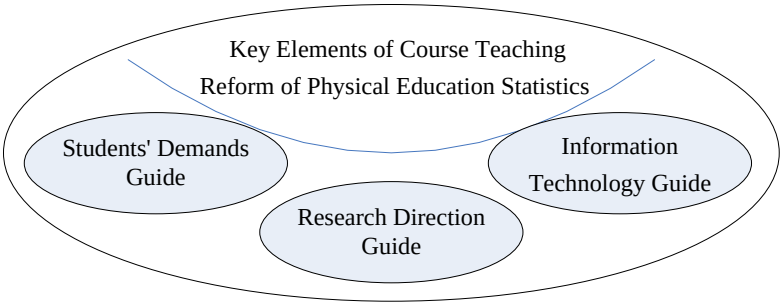

Figure 1. Key of course teaching reform of Business

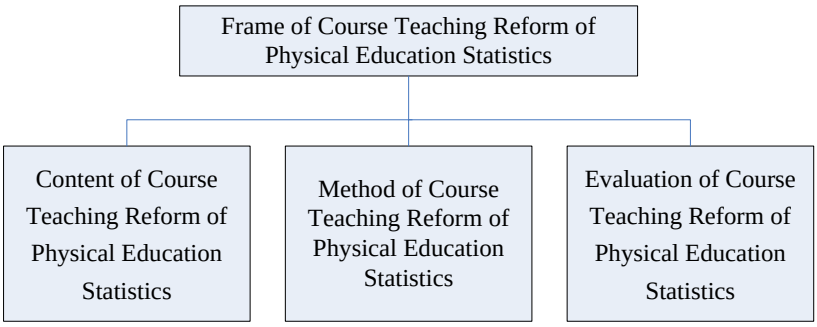

Figure 2. Frame of course teaching reform of Business statistics in college and university

professional courses; especially because most students' math level is not high, so course teaching of Business Statistics must be guided by their practical needs; students' practical receptivity and shall be considered fully, start from practice angle, carry out training of course teaching method of Business Statistics, increase practice experience for students, apply theory in practice and grasp theory through practice; in this way teaching effect can be improved. Secondly, applicability principle is the basis of course teaching method of Business Statistics, teaching work shall be conducted with scientific method. The goal of Business Statistics course is to work for sports and to serve for science and research of Business; therefore, its practicability must be valued, its application in practice needs to be explained more, it shall be connected with scientific research method closely, students will be promoted to realize an organism combination of statistics theory and practice and apply it in practice. Finally, course teaching reform shall be guided by information technology. Complexity of Business accounting is a key to interfere realizing course teaching goal. Most of Business statistics methods are difficult to be spread in Business area; development and application of information technology lower level of difficulty at certain degree; rapid development of statistics software widened developing space for Business Statistics; this is the rule which is the key point in course teaching reform of Business Statistics and must be followed in course teaching.

DESIGN OF COURSE TEACHING REFORM PLAN OF BUSINESS STATISTICS IN COLLEGE AND UNIVERSITY

Frame of Course Teaching Reform of Business Statistics in College and University

Course teaching reform of Business Statistics in college and university is a systematic project which involves every aspect of the course, including course teaching content, teaching method, evaluation of teaching and etc. These aspects constitute main content of course teaching; in creation and reform of teaching mode, connection and scientific reasonability of each section shall be valued highly; systematical frame of course teaching shall be formed like shown in **Figure 2**.

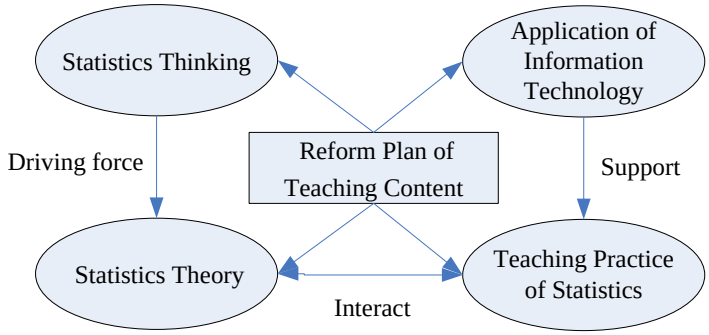

Figure 3. Reforming frame of course teaching content of Business statistics in college and university

Design of Course Teaching Reform Plan of Business Statistics in College and University

Reform of teaching content is the key of course teaching reform of Business Statistics in college and university. In the reform, developing statistics thinking, building statistics consciousness, informationization of statistics teaching and other works shall be valued; create and reform teaching content in selection and application of teaching content. Firstly, statistics thinking is applied in whole process of course teaching, inferring unity, probability statistics and data variation work shall be carried out. Knowledge required in mastering basic statistics knowledge is comparatively easy, but it is still the basis of understanding statistics thinking; only grasping general resource of statistics theory, can students select correct statistics methods in learning, apply them into practice flexibly, get deeper knowledge of concept and meaning of Business statistics content and play its promoting force (as shown in **Figure 3**). Secondly, build statistics consciousness for students. Start with angle of why and what in course teaching, lead students to think and solve relevant problems with statistics consciousness. Integrate a large number of practical examples, train students to discover, analyze, plan and solve problems through Business Statistics cases. Thirdly, conduct teaching by scientifically applying information technology, increase practicability of teaching content. SPSS, Eviews, SAS, EXCEL and other system software can be applied widely in Business Statistics, descriptive statistics analysis, discrete regression analysis, correlation analysis and variance analysis can be conducted through them; their application can largely satisfy teaching demands of Business statistics. Developing teaching of Business through informationizaiton software can not only handle calculating complication of statistics theory and weak practicality, but also can it improve students' mastering Business statistics theory through informationization statistics software and enhance vitality of Business Statistic courses. Finally, master method of combining course theory of Business Statistic and practical teaching. Theory is the basis, only practical work can play its function; in practical teaching, apply theory of Business Statistic in research of Business cases, training and planning scientifically and developing Business software, Business statistics is provided with vitality, students' enthusiasm and initiative can be inspired, teaching effect can be improved in practice, supporting function of practical learning and mastering theory can be played (**Figure 3**). In one word, link of each section shall be highly valued in course teaching of Business Statistics, frame of systematical teaching content reform can be formed, as shown in **Figure 3**.

Reform Plan Design of Course Teaching Method of Business in College and University

At present, single course teaching method of Business Statistics is the key of interfering teaching effect, therefore, it is necessary to conduct a reform of teaching method according to practical demands of students in college and university. Firstly, use modern teaching method and create new teaching form. Traditional "teaching-learning" mode play a role of largely depressing on enthusiasm and initiative of learning and killing creativity of students, this is very different from the goal of Quality Education. In order to suit developing demands of informationization Business in background of globalization, it is necessary to master course teaching rules, apply creative teaching methods and promote development of personality. Most Business majors have short attention

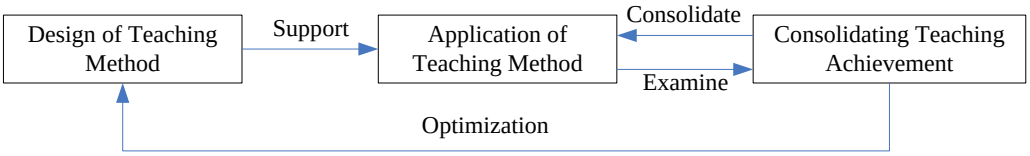

Figure 4. Frame of teaching method reform plan of Business statistics in college and university

span, weak abstract thought and basic theoretical knowledge; therefore, their teachers need to create teaching methods, use instruction method of scene simulation flexibly, personality difference teaching method, layers teaching method and etc., during teaching, they can also apply teaching methods like group discussion, group assignment and tutoring after class; give full play to the initiative of students and role of basic support in the whole system (**Figure 4**). Secondly, construct unified teaching mode of theory and practice teaching. Theory teaching is focused in traditional teaching mode in which students by rote in order to get high scores; although some students do have good understanding of theoretical knowledge, they cannot apply them in practice, therefore, it is impossible for them to master real quality of the theory in future work and to apply theory into science and research of Business. In time of informationization, practical teaching and computer lab can be added in theory teaching in college and university, students' mastering Business statistics theory can be promoted through displaying and individual tutoring, at the same time, degree of mastering can be deepened. Finally, positive learning after class is key section of consolidating knowledge. It is proved that homework is still an important way to improve students' mastering knowledge. College and university can play a role of consolidating and examining in teaching method reform according to their practical needs (**Figure 4**), teachers can divide students into several groups, set analyzing assignment and distribute students clearly; students can design questionnaire, investigate, survey, account and analyze data; group competition can be organized, final achievement will be considered as regular performance of students; students will be promoted to master theory of Business Statistics better. In teaching method reform, build a unified frame of teaching method reform plan: design of teaching method -- application of teaching method -- consolidating of teaching achievement; applying quality of teaching method can be improved through teaching method design and dynamic optimization and teaching achievement can be consolidated through practical teaching, as shown in **Figure 4**.

Design of Course Evaluation Reform Plan of Business Statistics in College and University

As shown in **Figure 2**, teaching evaluation is also an important component of course teaching of Business Statistics in college and university. Grasp basic demand of mastering course teaching, evaluate function and practicability of science in course teaching. Firstly, evaluation system needs to be developed further in college and university according to demands of course teaching; hierarchy and systematicity of choosing index shall be highly valued in design of evaluation system; examine mastering degree of basic theory and comprehensive knowledge through evaluation index system; evaluate capability of applying theory; form evaluation mechanism and evaluate students' performance subjectively. Secondly, combine practical course teaching in college and university and construct "dual" inspection mode of teaching evaluation -- closed book examination of theory (**Figure 5**), examine students' mastering degree through examination paper; for practical learning, computer examination or structuration interview examination can be used; combine examining index and basic situation of teaching, design an examination method in which teacher is lead and student representatives are members; conduct competitive examination mode and form unified evaluating mechanism of theoretical and practical knowledge. Finally, in traditional colleges and universities, closed book examination is mainly used. In time of informationization, colleges and universities shall import practical examination which is based students' practice after class. Teacher sends case of solving practical Business problems to each student through system and leads them to solve problems of case with relevant materials. In short, course teaching of Business Statistics evaluation system consists of design

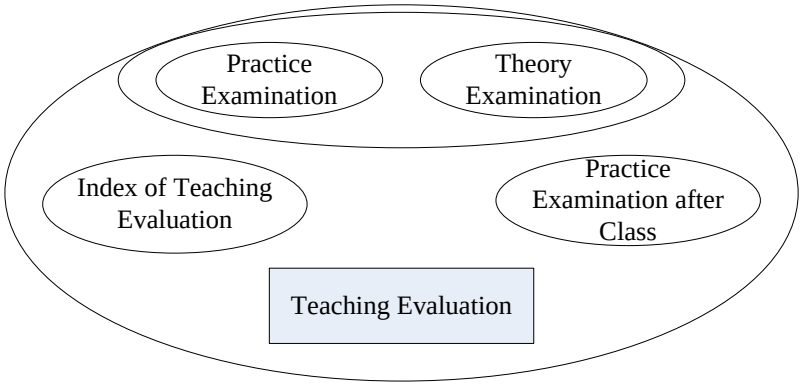

Figure 5. Course teaching evaluation reform plan of Business in college and university

Table 2. Design of course teaching mode of Business statistic in college and university

NO	Key Contents	Teaching Method
1	Basic concepts: Business Statistics, Ensemble, Sample and etc.	Concept explanation is supplement; students explain with samples.
	Obtaining method of science and research data of Business Statistics: Variant, Data Type, Investigating Method, Experiment Method and etc.	List questions; students discuss and learn by themselves; sampling answer questions, teacher explains.
2	Data managing method: SPSS Software, creating data, managing data and making figures and tables.	Teacher explains theoretical knowledge; students practice; students operate to consolidate; teacher sums up and sublimates.
	Descriptive statistics and probability distribution: Variability, average level, probability function and etc.	Teacher explains concepts; students practice; students operate to consolidate; teacher sums up and sublimates.
3	Normality distribution, sampling deviation, hypothesis examining, interval estimation, correlation and regression analysis.	Teacher explains quality; teacher teaches with examples, guide students to participate; students sums up; teacher evaluates; consolidate further; students practice; teacher evaluates further; learn practice after class.
	Design of Experiment: research of case and practical Training after class.	Teacher explains cases of Business Statistic; teachers arrange students to practice in class; students carry out case researches according to teachers arrangement; student hand in researching result of cases; teacher evaluates; students further improve research method; research have high value for Business science and research.

of teaching evaluating index system, practice examination, "dual" theory and practice evaluation mode, as shown in **Figure 5**.

Specific Practical Method of Course Teaching Reform of Business Statistics in College and University

From course teaching reform plan design of Business in College and University, we can see that reform mode which focuses on students as main body and combines theory with practice was constructed, "three-in-one" course teaching mode was formed. The study conducted specific practical method from basic concept to practical exploring from angle of Business statistics and according to demands of teaching and development of informationization. Shuxiang SHEN's "*Practical Business Statistics*" was used as a foundation, management of researching layer in **Table 1** and research mentioned above were combined, practical method was built as shown in **Table 2**. Main body position of students were presented in each section and students' subjectivity was played in positive learning, discussion of learning, operation of learning, live displaying and researching of Businessal topic, specifically show as follows:

CONCLUSION

Since the 21st century, information technology develops rapidly. Various and complicated economical problems can be solved with information technology, this provides a more scientific channel to conduct study on social economy. It is a key that how to release Business Statistics as a course with high applicability from pure mathematical teaching and realize its combination with science and research of Business. The study was based on current status of course teaching of Business Statistics, discussed key elements of reform, put forward overall frame of reform and specific plan, provide certain reference to reform. The main points of the study were: put students in position of main body, construct combination mode of theory and practice teaching.

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Nurturing Learners' Awareness of Littering through Environmental Campaigns: An Action Research Approach

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ABSTRACT

The availability and accessibility of disposable items has contributed immensely to our littering behaviour as humans. People discard plastic containers, paper wrappers and other items by throwing them onto the ground, thus aggravating the problem of littering. This study aims to assist the relevant stakeholders in integrating environmental awareness activities into the school curriculum, to drastically reduce littering in communities. Underpinned by developmental action theory and applied participatory paradigms, the study purports to assess the success of environmental action research campaigns aimed at combatting littering. Fourteen learners from seven classes served as co-researchers, having been randomly selected as participants in this study. Participants' observations and pictures were used to collect data, before resorting to coding and analysis. The results of the study show an improvement in learners' awareness of littering, allowing the authors to conclude that action research, if employed in environmental education, can raise learners' awareness pertaining to littering. A lack of environmental programmes in schools is also to blame for the fact that children often unwittingly litter or pollute their environment.

Keywords: environmental education, action research, developmental action theory, littering

INTRODUCTION

Learners in the case studied school consume different foodstuffs on a daily basis. These foodstuffs are bought at school tuck shop, from fellow learners and vendors, and others bring their lunch bag. Their foodstuffs can be categorised into four, namely, fruits, snacks, drinks, and fast food. Food items bought by learners are covered by plastic bags and that was the reason learners littered on the school premises (Msezane & Mudau, 2014). In addition, the school-feeding scheme has their own menus offered on different days and learners tend to toss food remains on the ground. When the researchers asked some of the learners why they threw food on the ground they indicated as follows, "The food was tasteless", "porridge with fresh milk not edible". Learners who lamented that the food was not properly cooked threw a considerable amount of food away (Silo, 2011). Moreover, learners use obscured parts of school buildings as hideaways for smoking and dropping cigarette butts on the ground, which contributes to littering. The case studied school over the years learner population has increased. This increase most likely did not change learners' littering behaviour.

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State of the literature

- Literature suggests that despite so many countries embarking on environmental campaigns the environmental pollution is far from over.
- Environmental education should be taught at both home and school environment to raise environmental literacy and awareness.
- All schools' stakeholders should take a lead in empowering their learners and staff about the health benefit of learning within a clean environment.

Contribution of this paper to the literature

- Developmental theory has reinforced cooperation, bind people together for a common goal of promoting Environmental Education, and facilitate a relationship of trust to all role players.
- Environmental action research has proven to be a better approach to conduct Environmental Education within a school set up which will then affect learners to consciously take care of their home and communities.
- The study has the potential to inspire other environmental educationists to aspire to embark on action research with their participants, so that littering will be a story of the past and cleanliness will end up being a lifestyle.

As such, the integration of the subject Environmental Education (EE) into the school curriculum is intended to impart environmental knowledge to society at large, starting with school-going children. EE is a cross-curricular discipline which edifies society about the environment and related issues. In turn, members of an environmentally literate society are bound to consider their impact on the environment, prior to taking any action. Budvytyte (2011: 27) states that EE is crucial in shaping an eco-culture amongst youth, because a literate human is a responsible human. However, the availability and accessibility of disposable items has contributed enormously to littering behaviours. Litter is a growing problem in South Africa (Mambinja, 2008: 10) because of modernisation e.g. pollution from industries (Le Grange, 2003). People in particular learners discard plastics, paper or foil wrappers, tins, peels and pips and other items by tossing them onto the ground, thereby polluting their environment.

The following scholars Komane (2005) and, Sethusha and Lumadi (2013), states that much of the environmental degradation that occurs today is primarily a result of failure of our society and educational systems to provide citizens with the basic understanding and skills needed to make informed choices about the interactions and interrelationships with the environment. Owing to the challenge for education systems is how to engage learners so that they become environmentally literate. This study sheds light on a progressive environmental action research (PEAR) campaign which stakeholders can use to integrate activities aimed at combatting littering in their schools.

Over decades, various studies such as Ocansey (2006), Jackson-Tyree (2012) etc. have been conducted to explore the impact of human activities and the effect of natural phenomena on the environment. Littering is one environmental issue that has been researched extensively, yet the phenomenon persists. Home and school education can be used as platforms to address environmental issues such as littering and global warming, the effects of which are felt locally, nationally and internationally. Litter pose threat to plants and animal life because litter contain injurious objects, such as syringes, broken bottles, plastics, metals and broken glasses that can hurt not only children but adults as well (Ajaegbo, Dashit & Akume, 2012). In the race for social and economic development, people typically overlook their social responsibilities and neglect to care for nature. Through such negligence they cause environmental damage and pollution (Hsueh & Su, 2016). Despite numerous studies being conducted in EE, as highlighted below, it appears that environmental campaigns are not yielding the anticipated results in terms of spreading environmental awareness (EA).

Scholars in the field of EE have targeted a variety of aspects of EA: in Vietnam, Hài and Mai (2013) studied EA and the attitudes of Vietnamese consumers towards green purchasing. In Mexico, Jackson-Tyree (2012) undertook a study focusing on the social factors influencing littering in a local urban environment. Coertjens,

Boeve-de Pauw, De Maeyer and Van Petegem (2010) examined whether schools can make a difference in their learners' environmental attitudes and awareness. Maluleke (2015) examined curriculum policy implementation in the South African context, focusing on EE in the natural sciences. In Kenya, Mutisya and Barker (2011) shared the results of their study on learners' EA and knowledge, and proposed a springboard for action in primary schools. Stanišić and Maksić (2014) investigated EE in Serbian primary schools in respect of challenges and changes in the curriculum, pedagogy and teacher training. Silo (2011) conducted the study to probe participation of learners in waste management activities in selected primary schools in Botswana. Her study was conducted in two phases. Firstly, she analysed learner participation in existing waste management activities to identify tensions and contradictions, and secondly, she expanded learning opportunities for action competence. Parkin, Shackletona and Schudel (2006) explored the influence of school-based Arbour week activities on learners' home-based practices regarding tree planting as a means of urban greening. In addition, Lebeloane (2004) conducted exploratory study to evaluate the "beautification of schools" campaign as an environmental management tool.

The aforementioned scholars all belong to national as well as global communities, and have used common instruments or similar approaches to collect data. Despite this, little research has been done in using the action research (AR) approach in EE to examine learners' awareness of littering. With this study the action research practitioners as researchers aim to bridge that gap, by sharing the experiences of practitioners and learners as co-researchers which were gained through implementing PEAR campaigns specifically aimed at combatting the scourge of littering. PEAR campaign refers to environmental activities conducted in collaboration with co-researchers to raise their awareness of littering and to develop action competence.

This ongoing study intends to respond to the following research question: How can action research influence environmental awareness campaigns aimed at teaching learners about littering?

THEORETICAL FRAMEWORK

As proposed by developmental action theory (Scruton, 1987), the interaction between AR practitioners and learners as co-researchers should be built on activities that reinforce cooperation, bind people together in pursuit of a common goal, and facilitate a relationship of trust.

The Value and Application of Developmental Action Theory

Developmental action theory is developed in the 20th century, with industrialised nations representing the most advanced form of society. It categorises other nations in terms of their approximation to this theory. Hence, nations are judged to be either more or less developed, and any efforts made by their respective political, social, educational and economic institutions should be directed towards working their way up the 'development' set goal (Scruton in Bothamley, 2004: 146). South Africa, which is listed among the developing countries, is a member of the BRICS (Brazil, Russia, India, China and South Africa), which is a grouping of emerging economies. It will be the practitioners' acumen as interpretivists to inculcate littering awareness to their learners through participatory paradigms.

Interpretivist and Participatory Paradigms

By reflecting critically on the status of EE in South Africa, intervention strategies can be devised to help co-researchers consider how they can take action in response to the environmental challenges facing their school and community. The kind of intervention that AR suggests is facilitative, because it relies on co-participatory principles – in other words, securing co-researchers involvement. An intervention becomes much more meaningful and empowering if it is not merely instructive: if co-researchers contribute towards finding solutions to challenges and take action, they have a vested interest in the outcome. Hence, an assumption is made that engaging co-researchers in developmental action theory has the potential to improve their understanding of EA in their lived context.

CONCEPTUALISATION

To avoid miscommunication, is it necessary to define or clarify certain terms, and to create a common frame of understanding to make communication more effective (Pudi, 2005). Here, 'littering', 'environmental campaigns' and 'action research' are expanded on.

Littering: In this study, the concept refers to the act of strewing any garbage/waste by discarding and/or misplacing it out in the open; in a field, in the schoolyard or even in a garden. Litter includes food remnants, plastic wrappers, papers and other unwanted items which make a school or home unattractive and untidy. Littered items can pollute the water quality of oceans, rivers, streams, dams and ponds. Many governments are forced to spend huge sums of money to clean contaminated water and polluted land. Litter thus also affects drainage systems as it clogs drains or pipes. Blocked drains system provide excellent breeding grounds for mosquitoes (which spread malaria), besides causing flooding during the monsoon season (Das, 2014). Choked drainage systems cause bad odours which pollute the air and spread disease. Preventing people from littering or controlling litter relies on the effectiveness of both home and school education (Ocansey, 2006).

Environmental campaigns: In a home-based setting, children are exposed to the domestic side of life. To pass on their ecological knowledge to the youth and raise awareness, parents or carers may use hands-on daily activities in combination with different approaches such as stories, proverbs, myths, folktales and rituals (Awuah-Nyamekye, 2014); shopping, cooking, cleaning and gardening (Kara, Aydos & Aydin, 2015: 46); hand washing (Mech & Ojah, 2016); green purchasing (Hài & Mai, 2013); recycling (Barr, Shaw, & Coles, 2011); water saving (Keramitsoglou & Tsagarakis, 2011) and family communication (Dyck, 2012). These approaches are used for the purposes of explaining to people – in particular children – the importance of the environment, and the need to protect and conserve it (Awuah-Nyamekye, 2014: 52). Simsekli (2015) reports that few learners today are unaware of the environmental problems facing the Earth, but their knowledge is limited because teachers emphasise learning 'about', rather than taking action for, the environment (Molapo, Stears & Dempster, 2014). Larijani (2010: 123) found that the majority of teachers had moderate levels of EA, while Bharambe (2013) noted that their knowledge tends to be academic or book-based. Simsekli (2015: 226) found that learners' attention can be caught via practices involving the environmental problems they face (or may still face) in their region.

Action research: AR is a form of collective self-reflective enquiry which participants undertake in a social situation. The aim of AR is to improve the rationality and justice of participants' own social or educational practices, their understanding of these practices, as well as the context in which the practices are carried out. Participating groups can consist of teachers, learners, principals, parents and other community members – any individuals with a shared concern (Kemmis & McTaggart, 1988). AR, as a process, allows participants to examine their own educational practice systematically and carefully, using research techniques (Ferrance, 2000). In this study, AR was used as a means of bringing about radical interventions in the participating school. In addition, empowerment and participation are key components of AR (Dyck, 2012). Participation is a key concept in learning (Silo, 2011) and is a central feature of AR (Le Grange, 2009). Therefore, EE according to the critical paradigm should focus on children's empowerment and action and not on the transference of scientific knowledge about ecological crisis (Tsevreni, 2011: 55).

RESEARCH PROBLEM

Aim of the Study

The aim here was to explore the success of PEAR campaigns on co-researchers' environmental awareness of littering.

Problem Statement

In recent years, South Africa has seen the emergence of various sectors and public initiatives working towards fostering an environmentally conscious society (Mnisi, 2011). Initiatives include the integration of EE in

the education system, an Eco-schools programme, the Bontle ke Botho (Clean and Green) campaign and other programmes which address environmental issues. By focusing on littering, it raises awareness of a social issue which requires urgent attention. South Africa's constitution (Republic of South Africa, 1996) stipulates that every citizen has a right to a healthy environment. As Loubser, Swanepoel and Chacko (2001) point out, a clean and healthy environment is, however, dependent on the level of environmental literacy of a nation.

RESEARCH METHODOLOGY

The research methodology primarily comprises two sections: research design and research methods.

Research Design

This qualitative study reports on findings derived from a single school using the AR approach. This study employed both interpretivist and participatory paradigms to assess the success of a PEAR campaign against littering.

Research Methods

Sampling

The study participants reported on here, were selected based on the researchers' ease of access, through a sampling procedure that is quick to do and cheap to undertake (Maree & Pietersen, 2008): of the five secondary and 12 primary schools in the target area, the researchers selected a single secondary school due to its close proximity, which enabled them to avoid making significant financial outlays. A single school was selected based on the time frame of the study and the research design. From the group of volunteers (i.e., from the learner population in each of seven classes at this school) the researchers selected two learners randomly, irrespective of age, which made for a manageable population. Thus, 14 learners had been selected through convenience sampling were the eventual co-researchers in this study. Therefore, the results of the study can only be generalised to the participating school under the study because sampling technique used adds to bias towards the study itself.

Data collection instruments

In qualitative research, words are descriptive tools through which the researcher undertakes transcription and coding processes. An AR design was chosen to evaluate the effectiveness of a PEAR campaign on co-researchers, as it allowed the researchers to take these co-researchers through the processes of planning, action, observation and reflection.

The specific research instruments were deemed relevant to the study: four research instruments – participant observation (of daily activities), journal writing (to record what was happening throughout the study), questionnaires (to evaluate attitude, awareness, and perceptions) and pictures which capture a particular situation – were used to collect data. The aim was to understand and explore the implications of PEAR campaigns on co-researchers' awareness of littering. The research instruments helped generate and order information through a triangulation technique, used to ensure the legitimacy of the research findings. As the co-researchers were minors, their identities remained anonymous to ensure confidentiality.

RESEARCH FINDINGS BASED ON OBSERVATIONS

The researchers analysed data using tables and coding processes, word processors and spreadsheet programs in Microsoft Office. Using tables helped researchers to analyse observed events and simplify our data analysis.

Table 1 presents observed events of the co-researchers celebrating Arbour Day on 1 September 2016. At school, the celebrations were intended to raise co-researchers' awareness of plants, the environment and littering, by linking indoor and outdoor learning processes. School grounds related activities offered opportunities and

Table 1. Co-researchers celebrating Arbour Day

Coding	Observed	Co-researchers in action	Our opinion/reactions
Environmental day	Over the years it was observed that the school does not celebrate the environment (except for Heritage Day, perhaps).	Co-researchers used spades to dig holes to plant flowers in and outside the school as part of celebrating Arbour Day.	If schools do not celebrate the environment it denies learners an opportunity to link classroom-based knowledge with an outdoor activity.

Table 2. Co-researchers collecting garbage from the kitchen

Coding	Observed	Co-researchers in action	Our opinion/reactions
EA	Learners tend to dump food scraps on the ground. Food handlers also throw out scraps and vegetable waste – there is a dump site on the terrain.	Co-researchers carry boxes containing vegetable waste collected from the school's kitchen. These materials are taken from the kitchen on a daily basis, to make manure for the garden.	The co-researchers seemed to enjoy this activity, which empowered them by teaching them how they could grow vegetables using food scraps as compost.

challenges for constructivist, situated and active learning (Mambinja, 2008: 79). Co-researchers were engaged in active learning processes to stimulate their awareness and thinking process. The majority of co-researchers mentioned that they had never celebrated Arbour Day before, and thanked the researchers for giving them the opportunity to do so. National Arbour Week is potentially a useful vehicle to promote the importance of trees and the benefits that they provide (Parkin et al., 2006: 185) to the co-researchers' awareness and environmental knowledge. One co-researcher mentioned, "The school should encourage learners to bring flowers on this day in order to beautify the school and also this could teach us to know about environmental days". In this school flowers are only planted at administrative block. At this school, it was evident that the focus is on indoor learning, but the outdoor environmental activities seemed to heighten the co-researchers' awareness of environmental issues, amongst them the scourge of litter.

Table 2 presents observed events resulting from co-researchers actions. Co-researchers are engaged PEAR activity to make manure intending to raise their awareness. Comments such as: "besides learning how to make compost I'm also learning ways of saving money as we don't buy manure from the shop but we utilise garbage materials". Another co-researcher stated that "by collecting these waste materials we are also teaching ourselves and food handlers' ways of disposing vegetable waste in an environmentally friendly manner". As it was observed food handlers' throwing waste materials from the kitchen to the dumping site in the schoolyard. This environmental activity aimed to teach the co-researchers about compost making and the three R (recycle, reuse and reduce), showing them how to reduce litter by re-using organic waste.

In **Table 3**, co-researchers and the researchers prepared the dump site in the schoolyard before turning it into a vegetable garden. Spades, forks and a wheelbarrows were used to clear the soil and buried some of the waste that decays to fertilise the soil and to soften the soil first before we start cultivating. The activity of planting and nurturing plants aimed to improve the co-researchers' awareness of the natural environment. Research conducted by Cross (2013) revealed that maintaining a school garden and offering environmental lessons in the garden, if possible, have a positive impact on learners' environmental knowledge, attitude and behaviours. The co-researchers' attitudes were transformed in that they were keen to help design the vegetable garden and by maintaining the garden.

In **Table 4**, co-researchers after the process of turning dump site into vegetable garden. They started planting seedlings and seeds in the furrows after the ground had been prepared for planting. It had taken about three months to prepare and soften the soil because we had to remove hazardous items such as bottles found on this land. The co-researchers showed their interest in and enthusiasm for this fun activity, while nurturing their EA. One co-researcher said that "all teachers and learners must join us, since this garden will contribute more

Table 3. Co-researchers and researcher preparing the dump site

Coding	Observed	Co-researchers in action	Our opinion/reactions
Garden	The school do not have a vegetable garden to engage learners in green activities.	Co-researchers used spades, forks and a wheelbarrows to prepare the dump site into garden.	We observed that engaging co-researchers in such an activity seemed to have conscientise them to utilize dump site for environmental activities.

Table 4. Co-researchers cultivating seed and seedlings

Coding	Observed	Co-researchers in action	Our opinion/reactions
Cultivate	Majority of co-researchers at home they don't have garden, suggesting they do not know how to cultivate.	In the course of cultivation process co-researchers created rows and furrows first in order to cultivate seeds and seedlings.	The process of cultivating seeds and seedlings seemed to have heighten co-researchers knowledge about vegetable garden and types of seeds and seedlings.

Table 5. Co-researcher picking up litter

Coding	Observed	Co-researchers in action	Our opinion/reactions
Campaign	It was observed during breaks and after school learners toss trash on the ground.	Co-researchers cleaned up rubbish and placed inside the rubbish bags and these plastics are put inside the bin.	Litter pick-up activity was successful conducted and it appeared to have effect on other learners as well, as bins were used.

vegetable especially in the school kitchen". Another co-researcher mentioned that "this garden, besides producing vegetables, also makes us to respect the environment and learn how to plant seedlings and seeds because at home some of us don't have vegetable garden". This shows the collaborative nature of the project, and planning for a sustainable future (i.e., there will always be vegetables for use in the kitchen).

In **Table 5**, learners during breaks drops litter on the ground and the food scrap lying on the ground attract birds in the school. Co-researchers engaged in picking up litter to keep the terrain clean and take responsibility for their environment. During this activity co-researcher pointed out that "all teachers and learners should be with us in keeping the school clean and maybe learners will stop littering". The school does not have a duty roster which assigns learners or teachers to pick up litter on the grounds. As a result, learners continue to litter as they see fit. Perhaps degradation was caused by lack of discipline, respect and negligence in schools (Msezane, 2014).

The co-researchers were also engaged in planting trees presented in **Table 6**. The aim here was to conscientise them about the role that trees play on people's lives through gaseous exchange. The trees provide people with oxygen while people provide trees with carbon dioxide. Moreover, trees provide fruit, shade, windbreaks, medicine etc. (Parkin et al., 2006). The trees were donated by a company called Eco-cycle, to celebrate Earth Day on 22 April 2016. Learners showed interest during the plantation as others asked their peers to take pictures while they were planting and observations are logged in my journal. After helping to plant the trees, the co-researchers watered them, using buckets to do so. The emphasis was on saving water and using it responsibly. The co-researchers subsequently gave the trees names, such as 'hug me' and '*ngwana waka*' (my baby), which revealed their love of the trees.

ANALYSIS OF THE QUESTIONNAIRE

Co-researchers completed two sets of the questionnaires at the beginning and end of the study with the intention of comparing outcomes after interventions has taken place to consolidate other data collection methods.

Table 6. Co-researchers nurturing trees

Coding	Observed	Co-researchers in action	Our opinion/reactions
Awareness	Trees were donated to the school to celebrate Earth Day as the school is lacking trees.	Learners used spades to dig holes on the ground to plant the trees and watered the trees afterwards.	Learners were happy to celebrate Earth Day with the teachers and members of the Eco-cycle and their enjoyment implied that their awareness was raised.

Fourteen co-researchers completed first set of the questionnaire and second set the number of co-researchers that completed the questionnaire previously declined to nine due to withdrawals.

School Environmental Policy

On the pre analysis indicated co-researchers response, 28.57% yes; 21.43% no and 50% I do not know. This indicated that the school do not have environmental policy. In the post analysis, all the co-researchers (100%) indicated that the school has an environmental policy. The policy was designed as part of interventions and this is key in any AR project to come up with solutions. Again 57% on the post analysis indicated that the policy is partially practised. This showed improvement as the school now has a policy.

Environmental Awareness

Majority of co-researchers revealed that littering is an environmental problem as indicated on pre analysis (79%) and post analysis (100%). This finding concurs with the following studies, Kärkkäinen, Haukipuro, Rummukainen, Keinonen and Simola (2013) learners highlighted littering as a national and global environmental problem. In addition, Hartley, Thompson and Pahl (2015) found that children recognise that marine litter is an important problem that has a negative impact on the environment, coastal industries, and human health. Additionally, learners from an environmentally polluted area are more aware and have more positive attitudes than their contemporaries from a different area (Olufemi, Mji & Mukhola, 2013). Understandably, awareness of the problem results in attempts to solve the issue and some of the attempts included recycling waste materials to make manure for the garden.

On the pre-analysis (64%) of co-researchers indicated that they would leave littered items on the ground and post-analysis (44%) shows decline and their behaviour seemed to have changed. Interestingly, co-researchers on pre-analysis (79%) and post-analysis (67%) indicated that they do not litter. They put their food wrappers inside litterbins or school bag. This showed good environmental behaviour since visibility of littered items on the ground will be minimal. The ensuing section discusses and summarise PEAR campaigns conducted with co-researchers.

PROGRESSIVE ENVIRONMENTAL ACTION RESEARCH SPIRAL CYCLES

In this section, researchers discuss campaigns conducted in collaboration with co-researchers through cyclic process displayed on **Figure 1**. Several cyclic PEAR campaigns were undertaken with the co-researchers aimed at addressing littering and, along the way, improving co-researchers' EA, so as to effect a change in attitude. The co-researchers were engaged in numerous PEAR campaigns through AR spiral cycles, which included setting up a vegetable garden, planting seedlings and seeds, picking up litter, making manure, planting trees and designing school environmental policy. These campaigns discussed different aspects such as exploration of soil, wastes, and environmental monitoring tools.

On the first campaign, that is cycle one, as illustrated on **Figure 1**, co-researchers were engaged in the exploration of the soil in preparation for vegetable garden and celebration of Arbour Day. The school did not have vegetable garden and dumping site was identified within the schoolyard to start the garden. The land was prepared for months by removing hazardous items and buried other items to fertilise the soil. Afterwards, co-researchers irrigated the land in preparation for cultivation. Co-researchers successfully turned dumpsite into vegetable

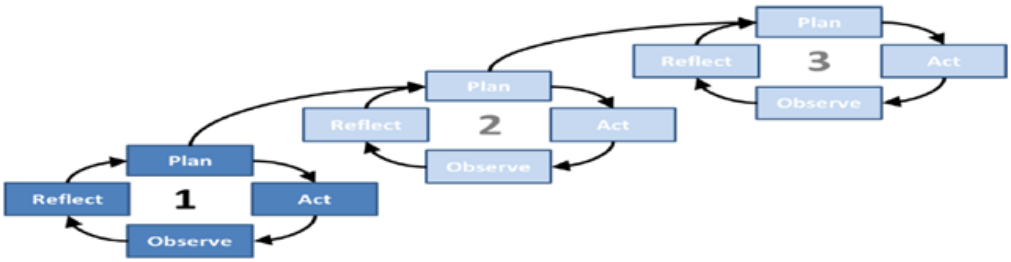

Figure 1. PEAR spiral cycles with co-researchers (adapted from Rose, Spinks & Canhoto 2015)

Table 7. Summarised co-researchers' campaigns per cycle

PEAR CYCLE	CO-RESEACHERS' CAMPAIGNS
Spiral Cycle 1	Soil exploration and Arbour Day celebration
Spiral Cycle 2	Reuse and recycling of waste materials
Spiral Cycle 3	Introduction of environmental monitoring tools

garden. Co-researchers once more celebrated Arbour Day at school by planting flowers. In turn, the initiative beautified the school and raised their awareness of the importance of soil and environmental days.

Figure 1 displayed second PEAR spiral cycle campaign to raise co-researchers' awareness of wastes. In this cycle, co-researchers collected vegetable waste materials from school kitchen to make manure for the garden. This campaign conducted in this cycle raised co-researchers' awareness towards wastes with reference to the success of the activity.

In **Figure 1** cycle three, co-researchers introduced environmental monitoring tools which included litter pick up campaign to encourage their peers to keep the school clean. Subsequently, co-researchers wrote the school environmental policy since the school did not have one. The policy intended to put into action of tackling littering in the school. **Table 7** summarises co-researchers' campaigns per spiral cycle, which is developed from **Figure 1**.

These outdoor environmental campaigns promoted environmental learning opportunities for co-researchers because classroom activities limit learners' environmental learning (Sehlola, 2007). This hands-on approach is vital to any AR undertaking and infused action competence. Action competence emphasised learner-led activities mediated by deliberative co-engagement that highlight respect for difference (plural dispositions) in democratic societies (O'Donoghue, 2007: 147). This approach increased learning opportunities of co-researchers throughout as they were not mere participating but taking action to curb littering in the school through collaborative engagement including planning, acting, observing and reflecting. Competence approach points to democratic, participatory and action-oriented teaching–learning that can help learners develop their ability, motivation and desire to play an active role in finding democratic solutions to problems and issues connected to sustainable development (Mogensen & Schnack, 2010).

Co-researchers were provided with opportunities to take action to influence real life environmental issues that they were confronted with daily, as part of their action-oriented activities. Hence, by engaging co-researchers in identifying problems and coming up with action-oriented solutions, they became co-catalysts for change in the school environment (Silo & Mswela, 2016).

DISCUSSION AND RESULTS

Littering is an environmental issue which involves the misplacing of items or the deliberate discarding of objects once they are no longer useful. In many instances such items (papers, plastics and cans) can be recycled. As it was indicated above by the learners that "food is tasteless" hence discard it on the ground polluting the general aesthetic of the school. As a result, co-researchers addressed discarding of such items on the ground through litter

campaign and turning waste materials into manure to conscientise learners towards littering. Thus, in turn reduce littering in the school.

Msezane and Mudau (2014) study found that learners continued to litter even after participation in EE as an extra mural activities. This suggests that activities that were conducted with learners infused knowledge based hence had minimal impact on the learners. The effectiveness of EE campaigns/activities should incorporate knowledge based and action orientated to conscientise learners towards littering. As in this study, co-researchers were engaged in exploration of soil, wastes, and environmental monitoring tools. These campaigns infused both knowledge and action.

Furthermore, this study noted that a lack of environmental programmes in the school is also to blame for the fact that children often unwittingly litter or pollute their environment. Consequently, school environmental policy was designed as part of environmental tools to control learner littering behaviour in the school. This improved co-researchers' awareness of littering as it was indicated on the questionnaire that littering is an environmental issue and they put garbage in the litterbins or their school bags. A co-researcher further indicated, "I used to litter school ground but since we have started with campaigns I am no longer littering". This was indication that PEAR campaigns had impact on the co-researchers' awareness of littering. Our fragile Earth is threatened by, amongst others, littering and many other harmful human actions. Activities which have a positive impact on the environment include throwing garbage in garbage cans or recycling recyclables. Through environmentally sound activities, such as picking up litter and establishing vegetable gardens, we can protect our fragile environment.

Moreover, Dyck (2012) study found that involvement in the program led participants to engage in environmentally responsible action and helped them to identify areas that they wished to take action on in the future. In this case studied school co-researchers recycled waste materials to make manure with the intention of reducing littering. Utilisation of waste materials had impact on the co-researchers as indicated above that they learnt ways to save money and environmentally friendly ways of disposing wastes. Cross (2013: 2) states that one way to connect young people to the environment may be to create a school garden, where learners may be responsible for designing, planting, maintaining and harvesting vegetables. Exposing them to gardening at school might be one avenue through which to cultivate future generations of environmental stewards. Children cherish hands-on activities, which they may remember for the rest of their lives. Kolb (1985: 267) attests that we tend to understand that which we are involved in.

Outdoor learning activities promote hands-on tasks such as planting flowers and recycling organic material. Hands-on activities make learning fun for children and increase their interest the subject at hand. During plantation of trees celebrating Arbour Day, co-researchers indicated that school must encourage learners to bring flowers to beautify the school and another co-researcher indicated, "It was refreshing to engage in this activity and being away from the classroom. I wish the school could continue to celebrate environmental days". This was indication that a PEAR campaign has effect on co-researchers. Therefore, learners' interest in, and excitement about, what they are learning are two of the most important factors in education (Woolfolk, 2010: 394).

This scholar Silo (2011) conducted her study in two phases. The first phase of the study revealed that participation of learners in waste management activities was largely teacher-directed. Second phase, the study showed that if learners' participation is taken seriously, and if opportunities for dialogue exist between teachers and learner, positive changes for a healthier environment can be created in schools. In this study, co-researchers were in the centre of the campaigns addressing litter issue in the school in collaboration with the researchers. This process mediated teacher-centred approach to co-researchers-researchers engagement. Co-researchers identified littering as an environmental issue in turn provided solutions to the problem such as designing school environmental policy. Subsequently, the action model that evolved through this research proved to be a tool for children to develop their participatory capacities and, especially, to gain self-confidence about their perceptions of their environment and understandings of the local issues facing them as children and adults in the future (Tsevreni, 2011).

CONCLUSION

Teachers and learners could use PEAR campaigns to address environmental issues such as littering. PEAR campaigns could start in the classroom, with learners taking turns to sweep the class or pick up litter. However, teachers should monitor all activities. The conclusion drawn here is that AR can be used as a tool to raise learners' awareness of the environment. As Cross (2013) found, the use of a school garden for environmental lessons proved effective in raising awareness amongst learners.

A dirty or litter-strewn environment encourages learners to litter and portrays a negative image of the school (Makonya, 2004). Schools with a poor, unwelcoming exterior promote neither attendance nor attachment, because children and teachers want to learn and work in clean surroundings (Doan & Jablonski, 2012).

Most schools in this country punish misbehaving learners by forcing them to clean the terrain (Msezane, 2014; Sehlola, 2007); hence, learners have a negative attitude towards keeping their environment clean because grounds staff and volunteers will clean up after them. The sooner this practice stops, of punishing learners by making them do manual labour, the sooner learners' EA activities will be taken seriously and will flow from a willingness to keep their surroundings clean.

The aim of this study was to engage co-researchers, through AR circular activities of observation, planning, action and reflection of their daily activities, to raise an awareness of littering. Daily hands-on environmental activities and/or practices at home or at school could be the answer in addressing the problem of littering, provided activities are implemented through AR. Activities such as picking up papers could be utilised to conscientise learners and raise awareness of the harmful effects of littering. Eventually, small acts will work together to improve everyone's environmental literacy.

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The Effect of Attachment Styles on Perfectionism in Romantic Relationships

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ABSTRACT

The aim of this study was to examine the effect of attachment styles on perfectionism in romantic relationships among university students. 136 university students participated in this study. The data collection tools were "Perfectionism in Romantic Relationships Scale" and "Relationships Scale". The ANOVA analysis system was used to define the differences, if any, in points related to the participants' and their partners' gender, birth-sequence, the state of their relationships, and attachment. A correlation analysis to with age was carried out to determine differences, if any, to do with age and a t-test analysis was used to determine differences, if any, to do with gender. The findings showed that there was no difference in terms of gender in both perfectionism type scores. In addition, while there were no differences in self-perfectionism scores according to their birth-sequence, there are reasonable differences when romantic relationships are at stake. A post-hoc study showed that these differences are seen among the participants with no past experience, but have newly started a relationship. When points related to a partner's perfectionism is considered, it is seen that there are no differences to do with birth-sequence and romantic relationships. A negative correlation, at a reasonable level, has been seen between age and partner-oriented perfectionism. Finally, there seemed no differences between self-perfectionism and partner's perfectionism points in attachment styles.

Keywords: perfectionism, attachment styles, university students, relationships

INTRODUCTION

For many individuals, having a close, positive and effective relationship means happiness, enjoying life and feeling confident. For Sternberg (1986), maintaining long-lasting friendship and self-development without any problems shows mutual communication and understanding which form emotional attachment between couples. Gizir (2012) points out that the quality of intimacy among individuals affects their mental development, self-respect, success and social adaptation. Romantic relationships in the scope of close relationships are defined as a relationship as a result of attachment and passion and is considered as the most important psychological development in puberty age (Sternberg (1986; Erikson, 1968).

Like other intimate relationships, romantic relationships affect individuals' social, emotional and personal development as well as forming the quality of the relationship between families and friends (Gizir, 2012). Intimate relationships are more important compared to other stages for young adults because at this stage they try to develop their roles. Furman (2002) points out that romantic relationships at university years help them in choosing their spouses as well as the quality of other relationships.

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State of the literature

- When the studies on the subject-matter is considered, it is strongly emphasized that university students consult most frequently to the Psychological Guidance Centers with problems and disagreements they experience in their relationships (Tütküm, Kızıltaş and Sarıyer, 2004; Creasy and Ladd, 2004; Küçükarslan, 2011).
- Whereas in national and international literature, it is noted that married individuals focus on their beliefs in relationships (Küçükarslan, 2011; Hazan & Shaver, 1994).

Contribution of this paper to the literature

- It will contribute to the literature on perfectionism in romantic relationships.
- It will provide suggestions for solving the current issues of university students' lives.
- It will contribute to the literature of the studies carried out in small countries.

Research studies show that, first romantic experiences at young ages play a great role in the development of intimate relationships at later ages (Q'sullivan, Cheng, Harris and Brooks-Gunn, 2007; Davies, 2006; Raley and Sullivan, 2010). Particularly research on romantic relationships among university students show that such relationships occupy a great time in their lives (Demir, 2008) and an average of %65 of them experience a romantic relationship at least once at university years (Collins, 2003).

The concept of perfectionism and parent-child relationship (Flett, Hewitt, Oliver& McDonalds, 2002; Kenny Benson & Pomerantz, 2005), mutual relationships among individuals (Besharat, 2004; Larijani & Besharat, 2010; Stoeber, 2013) and romantic relationships (Flett, Hewitt, Shapiro & Rayman, 2001; Makinnon, Sherry, Antony, Stewart & Sherry, 2012; Stoeber, 2012) have been dealt with in many studies. Although the researchers did not agree on a clear definition of the concept of perfectionism, in many resources it is assumed that it is the major focus on an individual's efforts in specifying high personal standards and perfectionism (Frost, Marten, Lahart & Rosenblate, 1990; Flett & Hewitt, 2002).

In their studies, Hewitt and Flett (1991) looked at perfectionism through various angles among groups and individuals and specified it as based on "self-oriented", "others-oriented", and "social oriented". At this point, perfectionism was examined according to what was expected from others (Flett & Hewitt, 2002). In self-related perfectionism, the bases of one's behaviors are the individual himself/herself. In this regard, the individual sets unrealistic high standards for himself/herself, criticizes weaknesses heavily and tries to generalize his thoughts to his behaviors. On the other hand, in perfectionism to do with others, various elements were dealt with and it was seen that the individual sets unrealistic standards, exhibits excessive evaluating approaches, and refrains from failure, but even at this point, the focus is on others. Finally, in the case of social perfectionism, individuals are preoccupied with the idea that others set high standards and evaluate them in the light of those standards (Hewitt & Flett, 1991).

Flett et al. (2001) developed a model in which they studied perfectionism in romantic relationships in two dimensions; perfectionism towards others – developing strict standards towards the partner and perfectionism for oneself – strict standards towards self-behavior. Similarly, Wiebe and McCabe (2002) examined the same issue in two dimensions; over-strict standards for oneself and partner's conception of over-strict standards and developed the scale of perfectionism in relationships. Stoeber, (2012), too, examined the issue in two dimensions; self over-strict standards and over-strict standards perceived from partners. In their study on the Turkish adaptation of perfectionism in individual romantic relationship, Özteke, Büyükbayraktar and Kesici (2015) explained perfectionism as self-oriented perfectionism and perfectionism towards partners. This present study deals with these dimensions in perfectionism in romantic relationships.

In studies and literature related to relationships between people, the concept of "attachment" was considered to be the one of the effective theory (Kuyumcu, 2011). In the theory of attachment behavior in babies, John Bowlby points out the theory as a strong bond by people towards the others they consider as important (Bowlby, 1969). Bowlby (1982) and Ainsworth (1989) classified attachment styles in babies in three different styles

as safe, unsafe-anxious, and unsafe- side-step attachment. Later, Bartholomew and Horowitz (1991), based on these studies, divided attachment among grown-ups into four styles; safe-attachment, dismissive avoidant-attachment, preoccupied-attachment, and insecure-attachment. In the light of these points, attachment styles are effective roles in individuals 'intimate behaviors, the degree of influence they face in, the rate of satisfaction, and overcoming such situations in relationships (Gonzaga, 2001).

Secure-attachment style is defined as a positive ego and values, which includes low rate anxiety and low rate avoidance. Individuals in this style have a positive ego conception and they are comfortable in close relationships. Even more, such individuals see others as reliable, easy to reach, supportive and good willing and they have both the feeling of positive ego and self-appreciation. Therefore, individuals with the ability of secure-attachment are both autonomous and can establish long-lasting positive relationships with others (Bartholomew, 1994).

In preoccupied-attachment styles, while others are perceived positively, one's ego is perceived negatively and in such a style, anxiety level is high and avoidance level is low. In the case of such a style, the individuals lack self-esteem, feel insignificant, look at others positively and exhibit high efforts to prove themselves. Even more, in intimate relationships they have unrealistic expectations and reflect preoccupied behaviors (Bartholomew, 1994).

In an insecure-attachment style, one perceives both himself and others negatively. In this style, anxiety and avoidance rates are high. These individuals have negative expectations from others and try to refrain from being refused and being the loser (Griffin & Bartholomew, 1994). Such individuals do not only blame their spouses for not being sincere, but they focus on them and develop an ongoing control mechanism over their spouses.

Finally, in a dismissive avoidant attachment style, one perceives his ego positively, but perceives others negatively. In such a situation, both, high anxiety and avoidance level is at stake. Because such individuals have negative expectations, they refrain from establishing good relationships. They emphasize the importance of freedom and adapt a feeling of autonomy, ignoring the possibility of being on their own. They do not trust their spouses in their romantic relationships (Feeny, 2002). Therefore, they try to minimize the rate of their feelings and intimacy in their relationships (Riggs, Jacobvitz & Hazen, 2002).

In studies dealing with romantic relationships, it has been noticed that the utmost attention was on non-functional beliefs and their effects on romantic relationships (Epstein, 1986; Eidelson and Epstein, 1982). According to this, as the non-functional beliefs increase, individuals focus more on the negative sides of their spouses, which may put an end to their romantic relationships (Medora, Larson, Hortaçsu, and Dave, 2002; James, Hunsley and Hemsworth, 2002).

Sherry, Sherry, Mcneil, Smith and Mackinnon (2014) studied clashes and perfectionism in romantic relationships and emphasized that self or partner-oriented perfectionism was a factor in clashes. Similarly, Makkinon et al. (2012) argued that perfectionist thoughts underlined clashes and depression symptoms. In another study by Stoeber (2012), partner-oriented perfectionism has a negative effect on self-satisfaction in relationships and long-lasting attachment. All these findings indicate that perfectionism in romantic relationships plays a great role on the quality of relationship, satisfaction and some psychological symptoms.

Studies carried out show that there is a connection between attachment-styles, psychological symptoms and mental functions. For example, Lippe Von der Eilersten, Hartmann and Kille (2010), point out that children from secure-attachment-style mothers develop the same style and their mental functions are affected positively. On the other hand, according to Cabeldue and Boswell (2012), timid and anxious styles affect individuals in their self-efficiency beliefs negatively. In another study carried out in Turkey, Vatan (2015), examined the relation between preoccupied and compulsive indications and found out that attachment dimensions constrained preoccupied beliefs.

METHODS

Research Design

This is a descriptive study in which relationships are researched. The dependent variable of the study is perfectionism and the independent variables are secure-attachment, insecure-attachment, dismissive avoidant-attachment, and preoccupied-attachment with gender, age, birth-sequence, and the state of romantic relationships.

Participants

This study extends its scope to university students, 136 of whom were picked through random sampling as participants.

Data Collection Tools

Perfectionism in romantic relationships scale

A scale was developed by Matte and LaFontaine (2012) to specify the participants' perfectionism in romantic relationships. A Turkish version of the form, adapted in a study in 2015 by Özteke, Girgin, Büyükbayraktar, and Kesici, was used in this study. Both forms, Turkish and English, were used in a two-week interval and the translation was found to match the original. The participants were those university students with a romantic relationship for more than 12 months. The reliability level of both forms (Turkish and English) was high ($r=91$, $p<0.01$). Although the scale consisted of 14 items according to the result of the confirming factor analysis, it came out in two items as in the original form as; self-oriented perfectionism (1, 2, 3, 4, 5, 6, and 7) and partner-oriented perfectionism (8, 9, 10, 11, 12, 13, and 14). Item 6, 10, 11, and 13 were marked reversely. Any high point in the lower dimension refers high level perfectionism. The correlation of total items is between 30 and 70 which equals to 76 in Cronbach alpha value.

Relationship scales questionnaire

Attachment styles of the participants were defined through a 30-item relationship- scale questionnaire (RSQ) developed by Griffin and Bartholomew (1994). The relationship scales were composed of Hazan's and Shaver's (1987) attachment-scale paragraphs and from Bartholomew's and Horowitz's (1990) items they used in relationship questionnaires. 18 items were used in this study. Attachment styles were specified with the points from 18 items related to four attachment-styles (Güngör, 2000).The participants evaluated on a seven-step scale (1= It doesn't define me; 7= It clearly defines me). Secure (3, 7, 8, 10, 17) and dismissive avoidant (2, 5, 12, 13, 16) attachment-styles were evaluated in four items; preoccupied (6, 11, 15, 18) and insecure- attachment (1, 4, 9, 14) styles were evaluated in four items. The participants' replacement in one of the four attachment styles was based on their highest scores.

In the translation of the scale into Turkish, a translation – retranslation method was used (Sümer & Güngör, 1999). The English version of the form was translated into Turkish by four experts in the field. The Turkish form agreed on was translated into English. The scale was finalized after some comparisons were done. In their study on the reliability and validity of the Turkish sampling, Sümer and Güngör (1991) referred to psychometric features of the Relationship Scales questionnaire. It was noted in the study that the coefficiency inter-validity of the Scales varied between .27 and .61 (Sümer & Güngör, 1999).

Personal information form

In the Personal Information form, developed by the researcher, the participants were asked to state their gender, age, and birth-sequence and the state of their relationships.

Table 1. Demographic peculiarities of the participants

	Frequency		Percentage	
Gender				
Female	75		55.1	
Male	61		44.9	
Birth sequence				
First child	57		41.9	
Second child	41		30.1	
Third child	15		11.0	
Fourth and later	23		16.9	
The state of romantic relationship				
I had never experienced it before, but now I am experiencing it	27		19.9	
I had experienced before it, but I am not experiencing it now	43		31.6	
I had experienced before and I am experiencing it now	36		26.5	
I have never experienced it	30		22.1	
Perfectionism				
Self-oriented perfectionism	97		71.3	
Partner-oriented perfectionism	39		28.7	
Attachment styles				
Secure	35		25.7	
Dismissive avoidant	64		47.1	
Preoccupied	27		19.9	
Insecure	10		7.4	
	Minimum	Maximum	Average	SD
Age	19	34	22.52	2.5

Data Analysis and Procedure

After getting the permission from the University Administration to carry out the study, the data was collected while the participants were in class. The data collected was overviewed for any mistakes and unanswered questions. Then the analysis was done on fully completed data sets. Data analysis was carried out through the 20th version of the SPSS program. A t-test was applied to define the effect of gender on the perfectionism in romantic relationships and ANOVA analysis, a correlation analysis was applied to examine the relation between age and perfectionism, and, once more, ANOVA analysis was applied to examine the relation between perfectionism and attachment-styles in romantic relationships.

FINDINGS AND DISCUSSIONS

All demographic information about the subject-matter in question is shown in **Table 1**. According to the findings, 75 (55.1%) of the participants in 22.52 (SD=2.5) age-average are female and 61 (44.1%) male. When their birth-sequence is considered, 41.9% of them are the first child, 30.1% are the second, 11% are the third, and 16.9% are the fourth or later. In the case of romantic relationships, it was found out that 19.9% of the participants had never experienced a relationship before, but at present they are experiencing it. On the other hand, 31.6% of them had experienced a relationship before, but at present they are without it. Even more, 26.5% of the participants had experienced a relationship before and they are still experiencing it at present. Finally, 22.1% of them have never experienced a relationship up to the present.

From the perfectionism scores, it is noted that 71.3% of the participants are in self-oriented, and 28.7% of them are in partner-oriented classification. In addition, 25.7% are in secure style, 47.1% are dismissive avoidant, 19.9% are in preoccupied, and 7.4% are insecure-attachment style. A t-test was applied to define any differences by

Table 2. T-test table showing the differences by gender in the level of perfectionism

	N	Average	t	df	p
Self-oriented perfectionism					
Female	75	32.61	-.651	134	.516
Male	61	33.40			
Partner-oriented perfectionism					
Female	75	28.44	.232	134	.817
Male	61	28.22			

Table 3. Correlation analysis results related to the relation between age and perfectionism scores

	r	P
Self-oriented perfectionism	-.023	.795
Partner-oriented perfectionism	-.180	.036*

Table 4. ANOVA analysis results to define differences (if any) in perfectionism scores related to attachment styles

	Sum of Squares	df	Mean Squares	F	P
Self-oriented perfectionism					
Between groups	31.89	3	10.63	208	.891
Within groups	6737.99	132	51.04		
Partner-oriented perfectionism					
Between groups	143.70	3	47.90	1.766	.157
Within groups	3581.05	132	27.12		

gender on either self-oriented or partner-oriented perfectionism scores. **Table 2** shows that there are no differences in perfectionism scores by gender ($p<0.05$).

ANOVA analyses were done to identify the effect of birth- sequence and the state of relationship of the participants on perfectionism points (**Table 3**). The results of the analysis showed that, while there were no differences in self-oriented perfectionism scores related to birth-sequence ($F(3, 132) = .805$, $p<0.05$), there were reasonable differences in romantic relationships ($F(3, 132) = 6.899$, $p<0.001$). In order to see the reasonable differences between types of relationships, a post-hoc test was applied.

The result of the test showed that, the difference was between participants with no previous experience and the ones experiencing a relationship now ($p<0.001$). Even more, participants with no previous experience, but experiencing it now have higher self-oriented perfectionism scores compared to the other group. According to these values, in the results with Cohen's d value 1.088, the effect rate was 0.47. When partner-oriented perfectionism scores were examined, there seemed no differences related to birth-sequence ($F(3, 132) = 1.478$; $p<0.05$) and the state of romantic relationships ($F(3,132) = 2.480$, $p<0.05$).

A final ANOVA analysis was done to define differences (if any) between perfectionism scores and attachment styles (See **Table 4**). The analysis showed that there were no differences between self-oriented perfectionism scores ($F(3,132)=.208$, $p<0.05$) and partner-oriented perfectionism scores ($F(3,132)=1.766$,$p<0.05$) (**Table 4**).

CONCLUSION AND SUGGESTIONS

The aim of this study was to define the effect of attachment styles on perfectionism in romantic relationships among university students. The findings show that there are no differences in self-oriented or partner-oriented scores related to gender. This is an indication that gender does not have any effect on perfectionism in romantic relationships.

Moreover, while there are no differences in scores related to self-oriented perfectionism according to birth-sequence, there seemed reasonable differences when romantic relationships are at stake. A post-hoc test showed that this difference seemed between individuals with no romantic relationship in the apast, but experiencing it now which indicates a lower level of self-oriented perfectionism between inexperienced individuals and individuals experiencing it now. This can be interpreted as that individuals' expectations are high in their self-oriented romantic relationships.

It is also noted that, there is a reasonable difference between birth-sequence and the state of relationship when partner-oriented perfectionism scores are examined.

Finally, differences were noted in self-oriented and partner-oriented perfectionism scores according to attachment styles. However, these findings do not match with previous research findings. For example, Vatan (2015) investigated the relation between preoccupied and compulsive signs related to attachment styles and found out that attachment styles dimensions affected preoccupied beliefs. The present study deals only with perfectionism in romantic relationships and attachment styles are considered as ineffective factors. If a future study on the same subject is done with a larger sample, findings will be more comprehensible.

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Guiding Role of Professional Concept in Higher Educational Reform

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ABSTRACT

As a basic quality requirement for students entering into the workplace and the key to construction of characteristic high schools, professional concepts can help universities reshape the concept of talent cultivation. Starting from the connotation of professional concept as well as optimizing and innovating the curriculum system setting, we should pay attention to students' subjective initiative in the process of cultivation for professional concept. Focusing on the change of students' professional position in future and the concept of lifelong education, the reform of higher education should actively explore the professional concept. Based on employment standard in social enterprises and evaluation feedback, we should comprehensively use service of personalized education to drive and strengthen the students' professional concept. We should also carry out education of traditional Chinese moral, spiritual of the times and citizens' moral to effectively solve the problems that whom the university students should serve for and how to serve; university students should be cultivated to combine "occupation dream" with university education to correctly handle the relationship between personal career dream and profession. Through systematic vocational education, students can choose contents of professional education according to their own interests, abilities and needs of enterprises and establish their own professional development planning to love what they do and try their best to be expert in their fields so that they can comprehensively strengthen occupation identity. Combining with the professional concept, curriculum system in higher education can deepen the comprehension of university students to what they have learned, make what they have learned stereoscopical, stimulate the students' occupation enthusiasm, encourage students to follow the path of professional awareness, career identity, and professional personality as well as realize the change from university students to career man. In order to establish occupation identity, university students should actively establish their plan for career, understand the relevant information on work outside the enterprise and establish their own career aims to reduce confusion and bewilderment after graduation and at last, they can grasp the opportunity in the workplace to get occupation power beyond the other people.

Keywords: professional concept, curriculum system, higher education, lifelong education

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Contribution of this paper to the literature

- New enrollments should be carefully guided, allowing students to understand their own personal characteristics-including their own personality and ability to work, to clearly comprehend their own interests and values, to make career planning clear and to strengthen professional development goals.
- Students are guided carefully when graduating from university. It is required that students should have a clear self-realization and analysis before graduation and understanding of the objective and subject factors.
- The construction of ideological politics must be strengthened. In the new period of the cultivation for students' professional quality, in addition to expanding the educational space and resources outside the classroom, the basic role of traditional ideological politics cannot be ignored. It is necessary to excavate, integrate, explore and update the teaching ideology and method in ideological politics to realize advance with the times and common development and meet the demand of society for "career man".

INTRODUCTION

The rapid economic change promotes university students facing a tough job market at any time. Because of subjecting to traditional working concepts, students are more likely to push themselves to the stable income and decent work (Duan, Wang, and Jia, 2015). Therefore, state-owned enterprises and public institutions become their initial choice. It is difficult for students to meet the employment standards of enterprises due to the passive professional concept (Li,2015). The criterion of employment and selection in modern enterprises has changed in original grades, professional knowledge, education and other aspects, thus, individual comprehensive qualities such as view of employment, dream, dedication, responsibility, loyalty, innovation consciousness and team cooperation etc. have become the key factors. Based on superior professional talent cultivation and emphasizing knowledge and skill, the reform of higher education will put professional concept in the first place of education. In virtue of professional concept, it will realize talents change from "quantity" to "quality" to meet the job requirements and assessment standards of modern enterprises. Starting from the change of students' major responding to the demands of future occupation, we should gradually cultivate the concept of lifelong education; taking employment criterion of enterprises as guidance for cultivating professional concept to build co-operational platform between universities and enterprises and enhance students' comprehensive occupation quality. At the same time, we should closely centre on the feedback system of professional concept to provide students with individualized vocational guidance service (Mi, Yuan, and Jia, 2015).

REVIEW OF RESEARCH STATUS

By strengthening the close connection with social reality, grasping the changing characteristics of future career is the foundation of constructing reasonable expectation for career planning. Students are in the stage of changing for concept and the ideal occupation as well as environmental change will transform students' thoughts and ideal occupation. These objective factors should be considered in planning for occupation to further create characteristic professional development plan for each student and make career plan for future development (Liu, 2017).

The interaction with the environment allows people to accumulate knowledge and experience and the practice of integrating with the real environment are more likely to stimulate students' desire for knowledge, and to speed up the understanding and internalization of knowledge. The application of professional concept in higher education must have some basic characteristics to deepen the students' understanding of the connotation of professional concept and transform it into their own professional quality. Firstly, the authenticity of occupation practice must be paid attention to: real work environment can help students understand their professional life and the connection between their major and work to gradually transform, optimize and deepen the knowledge system (Roux, Kingsford, and Mccool, 2015). Secondly, the diversity of knowledge and skill needed by modern occupation and elaboration of social division put people in extremely complex network, thus, we need to establish educational dialogue, communication and cooperation. Among them, students can fully understand themselves and know others: knowing themselves is a comprehensive and multi-angled understanding, including their own personality,

hobbies, outlook on life and values and so on to understand and master work expectations and abilities of others; students should recognize the strengths of others to compensate for their weaknesses to further show the value of their occupation to the society and to be used by society and enterprises (Sun, 2016). Thirdly, the challenge goals predetermined by professional education and limit factors must be clear to mobilize students' learning initiative and promote students' rational development. Professional teachers should actively make use of various teaching methods to introduce students into the situation of professional practice and ensure that teachers are in the real working atmosphere so as to fully study, sample and comprehend (Liu, 2016).

METHODS

After graduation, university students should base themselves on the society, adapt themselves to the society and realize themselves, which is the common demand for individuals and society. During four years' learning and life, higher education must insist on starting from the view of occupation and letting students take the demands of future occupation as guidance to gradually create a correct view of professional concept and to cultivate students' abilities of cognition, work, living and viability. It also has professional dream, occupation moral, work groups and occupation career in mind (Cai, 2015). At first, for the decision-making ability, higher education should see the nature of things, set up long-term and short-term goals, constantly come up with new ideas at working, be good at innovation and dare to put forward new ideas. When facing problems, it can quickly see the essence of things and seize the key to problems quickly and accurately; Secondly, for the ability of adaption, when facing rapid changes in economy and technology, students must fast renew their own occupation skills and grasp knowledge and technology in the specific professional fields to cultivate their own compound skills, ability of self-study and innovative spirit as well as quickly adapt to the future social change; Thirdly, during the process of team development, students need to be good at communication and cooperation with others, play a leading role in the team and effectively promote the completion of work with persuasion when talking. Excellent career man in the team must be able to express their own views, have a good adaptability and ability to listen and have clear thinking and coordination (Ying, 2015); finally, for the aspect of professional teachers, teachers are the key to the implementation of education. In the application of professional concept to higher education, teachers should be eager to innovate education, effectively enhance the ability of self education, adhere to lifelong learning and improve knowledge of self professional education to create a unique teaching style (Huo, 2015).

Construction of Cointegration Model

It is assumed that in the process of higher education reform, the mean, variance and covariance related to the random variable V_t are fixed and for any sample t, m, n:

$$\begin{cases} E(V_t) = E(V_{t+m}) \\ Var(V_t) = Var(V_{t+m}) \\ Cov(V_t) = Cov(V_{t+m+n}) \end{cases} \quad (1)$$

It is believed that the process of higher education reform is stable and for all values , m, n , the sequence of educational reform is steady, thus, it can be recorded as $V_t: I(0)$. Under the guidance of the professional concept, the unstable sequence of educational reform does not have this characteristic and the current value of the sequence will also be affected by a numerical change a long time ago. The unstable data sequence of educational reform is integration, which can be noted as $V_t: I(1)$. When it is fully differentiated, it can be stable. Similarly, the stability of data for whole educational reform also needs to be tested and when the unstable data is differentiated, it will be made stationary (Muller, 2015).

After the multiple stationary sequences are processed by linear regression, we cannot get the expected stationary sequence, but under the condition that goodness of fit in the new sequence R^2 is higher and statistics DW is relatively low, the stability of sequence variable is firstly determined when constructing the cointegration model of higher education reform (Snoen, and Waale, 2015). After determining the data stationarity of variable, it is assumed that there are variables of time sequence Y_t and X_t among professional concept of higher education. If they are stable, the relative regression model is:

$$y_t = a + \alpha x_t + u_t \quad (2)$$

When regressively analyse the relative relationship between them, the unstable time sequence of professional concept and higher education reform needed to be turned into stable time sequence. It is a hypothesis that the variables $X_{1t}, X_{2t}, H, X_{it} (i \geq 2)$ in the process of educational reform are a set of sequences $I(k)$, and there are relative real numbers $\beta_1, \beta_2, H, \beta_i$, which are not all zero. If it meets the relationship of linear combination βX is $I(k-p)(p>0)$, the sequence (k, p) can be called cointegration. β can be called relative cointegrated vector, among which $X = (X_{1t}, X_{2t}, \ldots, X_{it})$,and $\beta = (\beta_1, \beta_2, \ldots, \beta_i)$. A sequence cointegration can be used to explain that the stable relationship lies between variables of the higher educational reform for a long time and if the sequence (k, p) is cointegrated, variables are not far apart from each other. They are not affected by some changes within a long time, even if they are affected, they will return to stable mean in the short term.

RESULTS

Before analyzing the effect of higher educational reform guided by professional concept, the method of Pearson correlation coefficient is used to determine the relevance between them. The absolute value of Pearson correlation is closer to 1, and the correlation between them is stronger. The statistical analysis software-Eviews7.2 is utilized to calculate the correlation coefficients, and the results are shown in **Table 1**:

Table 1. Correlation Coefficients between Logistics and the Development of Commercial Circulation

	LNCEVA	**LNLEVA**
LNCEVA	1	0.9156
LNLEVA	0.9378	1

From **Table 1**, it is shown that the Pearson correlation coefficient between professional concept and higher educational reform >0.8, which indicates a higher correlation and a stronger dependence between them. It can be further analysed by virtue of cointegration regression.

The cointegration test is adapted in the sequences CEVA and LEVA and the results are shown in **Table 2**:

Table 2. Cointegration Test of LNCEVA and LNLEEVA

Variable	**Coefficient**	**Std.Error**	**t-StatisticProb.**	**Std.Errort**
c	0.0914	0.0183	2.5501	0.0129
LEVA	0.6147	0.1028	5.5721	0.0203
LLI	0.5143	0.1127	2.8791	0.0000
NLPE	0.4291	0.0581	1.9611	0.0701
R^2	0.4960	F-statistic	6.9845	/
Durbin-Watsonsta	1.78	/	/	/

According to the results of cointegration test for LNCEVA and LNLEEVA, regression model can be shown as follows:

$$\begin{aligned} lnCEVA &= 0.0914 + 0.6147 lnLEVA \\ &\quad +0.5143 lnLLI + 0.4291 lnNLPE \\ &\quad -0.1211 E_{T-1} \\ t &= 2.55 \quad (5.57) \quad (2.87) \quad (1.96) \\ R^2 &= 0.4960 \quad F = 6.9845 \quad DW = 1.78 \end{aligned}$$

According to the results of cointegration regression test, 1% increase in each educational concept will cause 0.6147% increase in results of educational reform. Because of remarkable short-term adjustment coefficient, it is assumed that the fluctuation of students' career concept in short period is not consistent with the long-term equilibrium state, which will pull it back to the corresponding equilibrium state with 12.11% of adjustment tension. The match value of the above-mentioned values is shown in **Figure 1**, where the fitting effect is relatively good.

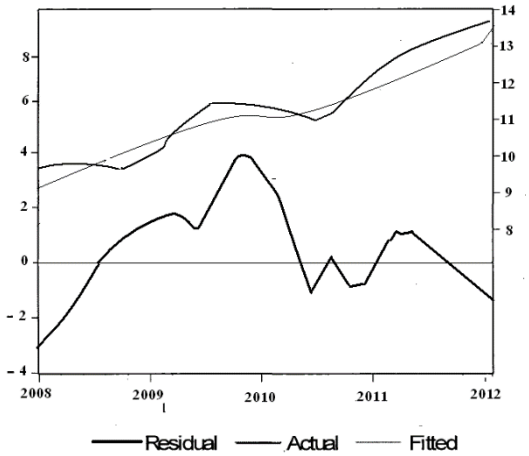

Figure 1. Match Figure of Professional Concept and Educational Reform

The professional concept is a concept and realm of career man, reflecting the rational cognition, pursuit of dream and maintenance of human's educational idea. The professional concept is an important force for university education and higher education should have special features, entelechy and vitality. It also should start local, face the world and study market to accurately grasp the guiding role of professional concept. A variety of ways of running schools should adapt to professional concept to adjust strategic reform direction of talent training and establish diverse and comprehensive higher education.

DISCUSSION

Higher education has a certain limits in cultivation of professional concept. When students enter into the hustle and bustle of social competition from the quiet campus, university students have to face a huge psychological gap and the concept of lifelong education can make up the gap, which is in line with the future direction of educational development. Universities should actively cooperate with the national macro strategy, combining with adult education, pre-career education, continuing education, social communities and enterprise to construct multi-level professional education system, realize connection and communication for students admission to society from the campus, meet the increasing learning needs and gradually adapt to the rapid development and reform of social economy.

At present, the system of professional lifelong education in China has narrow professional training and less training objects, which will seriously affect the rapid development and popularization of the concept of professional lifelong education. Lifelong education system should adhere to the principle of diversity and universality, from the perspective of openness, science and pertinence to strengthen the prediction about the demand for talents. To adapt to professional change under structure changes of social economy, the system should gradually optimize the teaching policy and professional settings and timely increase new teaching content. It should be beneficial to the sustainable development of students' career, deepen reform concept and adapt to the requirements of lifelong education.

CONCLUSION

The development of enterprises must improve professional level, professional morals and human cultivation of career men. As the "source" of enterprise's talents, during the educational reform, through deepening professional concept and constant self improvement and development, universities follow the strategic goals of talent training to strive to cultivate students' professional quality and help students to set up accurate sense of occupation and values, ensuring the match of university students with enterprise standards and laying a

foundation for entering the society, and at the same time, helping students to understand the lifelong development planning as well as gradually growing into a talent of country and society.

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Comparative Advantages between China and Britain in the Construction of Higher Educational Security System

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ABSTRACT
It is a common sense in the field of world educational theory that the development of higher education is promoted and the participation of talents into practice of training for technical education is encouraged. All countries have taken active measures to encourage and promote the development of higher education in their own countries. With deepening of reform and opening up, talent shortage has become the bottleneck of social and economic development in China's higher education. In order to meet the needs of professional and technical talents in economic development, China's vocational higher education has established the goal of training talents to meet the needs of social and economic development. In educational practice, talent training is related to job gap in social technology. Under the guidance of this goal, the batch of market-oriented training model for qualified personnel has become the mainstream. As a result, China's higher educational system can alleviate the "thirst for talent" in the market and provide a strong support for sustained and healthy development of economy. The mode of Chinese higher educational system and "dual system" of British educational model constitute a different form of personnel training. The UK higher education pays more attention to ability training, which has significant tendency. It is beneficial to individual development, while Chinese higher educational system supported by university system will not only offer the talents systematic knowledge, but also timely adjust the teaching content according to the change of market demand and enhance the social applicability of higher education. In the reform of optimizing Chinese higher educational system, we should actively refer to experiences of higher education in Britain to build higher educational system with Chinese characteristics: strengthening basic construction of law system and top-level construction of vocational education; carrying out quality certification and encouraging enterprises to participate in practice of vocational education system; regulating the connotative construction of contents and model in higher education to improve the quality of vocational education.

Keywords: university module of educational system; dual system; higher education; social adaptability

INTRODUCTION

Dual system is a vocational training model originated from the United Kingdom. Dual refers to vocational training, requiring that the personnel who take part in vocational training must go through trainings from two places (Alas, Aarna, 2015). As a vocational school, the main function of unitary system is to teach professional knowledge related to occupation; unitary system is the training venues outside enterprise or public institutions, whose major function

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Contribution of this paper to the literature

- Analysis of the comparative model for developing higher educational security system in China and Britain and specification of the content of data research;
- Around Chinese and British higher education, obtaining innovated educational mode by virtue of logic analysis and comparative integration;
- Laying the foundation for future research through deep analysis of educational characteristics of China and Britain.

is to allow students to receive professional training in enterprises. Higher education means the school focusing on higher skill training and promotion of employment level of labor force, which is the product of the school's running model with Chinese characteristics. Through technical training at university, students can have strong competitiveness in job market and if they pass the skill assessment, they will obtain vocational qualifications and certificates recognized by the country (Gao, Ma, 2016). At present, the university system is the most important educational form in China's higher education system. Most of the vocational and technical personnel in China have the educational experience at universities. The university system supports the development of higher education in China (Hou, Ince, Tsai, et, al., 2015).

Under the higher educational system of "cooperation between schools and enterprises and cooperation in running schools" in Britain, most of enterprises accepting students will cover expenses of higher education (Li, 2017). British higher educational model of "dual system" has made enterprises the major social organizations to provide subsidies for students. Internship units arrange special funds to equip with qualified training instructors for students, provide professional skills training facilities and training venues as well as provide the corresponding apprentice wages for students who participate in the occupation training (Ma, Wang, Shen, et, al. 2016).

From the current educational practice, through financial subsides and tuition remission for students, China promotes the development of higher education. (Maassen, Potman, 2017). Through the number of enrollments in technical schools and enrollment scale, China's government issues the financial subsidies. The government's subsidies are directly applied to improve students' learning environment and students can also get scholarships and grants during the study period, which greatly enhance the enthusiasm of students to participate in study in vocational schools (Liang, and Yu, 2017).

REVIEW OF RESEARCH STATUS

Under dual system of vocational education, the development mode of British higher education has obvious practical characteristics. The school's basic education for theory and knowledge and practical education in enterprises, institutions and other places together constitute the process of education for learners'. The dual system of "learning theory at school and improving skill in training places" enables learners to practice and verify the theoretical knowledge that they have learned in training places (Price, 2015; Shen; 2016.; Sun, 2015). The campus basic theory study complements site training, which forms the educational model of talent theoretic knowledge resources and cultivation of practical ability.

Foreign scholars pointed out that comparing with Chinese higher educational system, Britain's "dual system" pays more attention to the improvement of students' practical ability. In training place, students are completely in authentic industrial environment. What they see, hear and learn are all from front-line production practices, having high practical value. In training places, the role of students is not only learners, but also direct participants (Serrano, Llamazares, Otamendi, 2015). In the authentic working environment, the operational skills formed by students can be applied directly to production practice. Therefore, higher education in Britain has a strong practical orientation, and the trained talents are quite outstanding in their practical ability and personal skills.

The study at home shows that the cultivation of technical personnel training in China has obvious advantages: first, the whole process of personnel training is carried out in full-time schools, where professional teachers and excellent technical staff can cultivate batch of standard talents by compiling textbooks and arranging teaching contents (Wang, Fu, Yi, 2015). The school can adjust the direction of talent training according to the change of market personnel demand. Second, during learning at systematic and disciplinary school, students can systematically and comprehensively recognize business theory. Perfect subject construction and standardized teaching content will help students construct relatively perfect and comprehensive industrial cognition and technological development in the course of study. Comprehensive and systematic knowledge is helpful for technical personnel to realize self improvement and self perfection. Through training at university, one can clearly understand the development of the industry and the basic situation of the whole industry (Yeap, Ramayah, Soto-Acosta, 2016). It has important practical significance in deep ploughing industry and pursuit of cutting edge of technology.

Domestic scholars have pointed out that through years of development, the higher educational security system in China and Britain has its own unique mode of higher education. Talents cultivated by Chinese universities have significant advantages with comprehensive theoretical knowledge and systematic knowledge structure; while talents cultivated by British universities have general professional spirit and high professional quality because of active participation in first-line enterprises under the British higher education (Zhang, Zhang, Cui, et, al. 2015). In the practice of deepening the reform of China's higher educational system, we should refer to useful experience of the British higher educational model and bring it into the higher educational system of China.

METHODS

Under the concept of higher education, higher education in Britain has a strong professional spirit and the technical personnel have superior technical ability and excellent occupational spirit, so that the British skilled workers win the title of "craftsman spirit". Higher education in China always emphasizes the market applicability of talent training and social applicability of talent quality. The demand for human resource market determines the development of higher education in China (Zhang, 2015, Zhan, 2016). The practice of higher education in China has always centered on human resource market, and has adjusted its educational activities according to the change of market demands.

Comparative Modeling Analysis of Dominant Factors in the Development of Higher Educational Security System in China and Britain

For the comparison of dominant factors in the development of higher educational security system in China and Britain, a fuzzy evaluation method based on fuzzy set theory is adopted. First, this paper constructs the fuzzy factors unit $U = \{u_1, u_2, \ldots\ldots, u_n\}$, influencing the development of the advantages of higher educational security system, among which, evaluation set is $S = \{s_1, s_2, \ldots\ldots, s_n\}$, weight set is $W = \{w_1, w_2, \ldots\ldots, w_n\}$. It meets $\sum_{i=1}^{n} w_i = 1$, where w_i is weight corresponding to factor i.

Take λ_{ij} as fuzzy membership that is used to judge whether it affects advantages of higher educational security system in China and Britain, ie. the degree that effect factor u_i is subordinate to evaluation unit s_i, $(i = 1,2,3, \ldots\ldots n)$. Therefore, the membership matrix λ can be expressed as:

$$\lambda = \begin{Bmatrix} \lambda_{11} & \lambda_{12} & \ldots & \lambda_{1m} \\ \lambda_{21} & \lambda_{22} & \ldots & \lambda_{2m} \\ \ldots & \ldots & \ldots & \ldots \\ \lambda_{n1} & \lambda_{n2} & \ldots & \lambda_{nm} \end{Bmatrix} \quad (1)$$

If matrix B is fuzzy comprehensive comparison corresponding to specific advantage, matrix $B = \{b_1, b_2, \ldots\ldots, b_n\}$ can be expressed as:

$$B = W \cdot \lambda \quad (2)$$

Then, total comparison value η can be expressed as:

$$\eta = B^* \cdot C^T \quad (3)$$

Comparative model of advantageous factors qualitatively analyzes the development of Chinese and British higher educational security system and then quantifies each factor after qualitative analysis and obtains the total comparison value of each factor in Chinese and British higher educational security system.

Advantageous Comparison of Higher Educational Security System between China and Britain

The difference between educational model and educational system makes the development of higher educational system in China and Britain different from each other. The main motive of developing British higher education is "dual system", and enterprises undertake the function of teaching and cultivating talents. In Britain, enterprises participating in the practice of higher education need to obtain quality certification and approval of relevant education authorities. Enterprises will arrange special funds and personnel to normally manage students who participate in training. British enterprises are keen on participating in the practice of training for higher education: for one thing, enterprises carry on social responsibility of making corresponding contribution to social development; for another thing, enterprises can discover excellent technical staff with development potential through professional training to enrich the technical backbone of the team. For the enterprise itself, it is also a considerable return.

The motive of developing Chinese higher education, to some extent, comes from the support of government. In the environment of socialist market economy, the government can guide the development of social economy through powerful macro-control measures. In view of change in talent demand, the government can also lead the development of higher education, and then realize the adjustment of talent supply. The government greatly supports the development of higher education with financial subsidy, policy encouragement and financial appropriation. In recent years, the rapid development of higher education in China has benefited from the government's strong support.

RESULTS

The training model, development achievements, problems and countermeasures of British "dual system" have an important reference value in promoting the reform and development of vocational education in China. At present, the personnel training of vocational education in China faces such problems as nonstandard training mode, unbalanced supply and demand vocational personnel, low quality of graduates' employment, inadequate supervision and unsmooth operation mechanism. In order to improve the quality of Chinese higher education and strengthen the system construction of higher education, we should actively learn from British experiences to strengthen the top-level design of higher educational system. To advance the top-level design of our higher education and to strengthen the legal process of higher education system in China: first, actively learn from legislation of British higher education and bring higher educational system into the construction of legal system. The legislature of National People's Congress and education authorities should actively promote the legislation of higher education to allow the higher education in China to follow. Second, strengthening scientificity of policy-making by educational authorities on higher education to form a good system of experts managing higher education. Experts are allowed to carry out the formulation and top-level design of education.

Teaching contents of higher education should be standardized and professional construction should be strengthened. First, we should organize professional personnel to strengthen the investigation of industrial technological development to promote full-time teachers understanding and grasping the latest and cutting-edge developments in technology. Ensure that students learn the latest and most advanced technologies. Second, it is necessary to strengthen the professionalism and practical awareness of learners, and establish the concept of talents with practical ability as king. The theoretical knowledge studied by learners can be effectively applied to practice. It is the only way to promote the healthy development of higher education by promoting the connotation of higher education and strengthening the quality of higher education.

DISCUSSION

In the view of professionalism, there are two important features in talent cultivation of British higher education: firstly, when choosing occupation, the learners participating in the practice of higher education are chosen who have professional dream of technical personnel. They choose to engage in higher education training for their own interests and hobbies, so that they can concentrate on industrial technical learning. Second, the inheritance of excellent spirit and culture for "made in Britain" regards "spirit of craftsman" as the goal of higher education. Influenced by the refined and dedicated British "spirit of craftsman", students involved in higher education develop professionalism and excellence in their technical and professional spirit.

Edified by British professionalism, higher education realizes self-improved and self-promoted transition from technology transfer to the technical staff. From the perspective of professionalism, British higher education cultivates modern career men with freedom and responsibility, breed and propagate green industrial culture and explore the theory of practical logic connecting with technology. The development of higher education deepens the cognition of technological philosophy and plays a profound and lasting role in construction of talents' professionalism.

CONCLUSION

It is the important way to promote the reform of higher education by learning from the experiences of British higher education, improving the level and quality of China's higher vocational education and actively building China's higher vocational education brand. Advantages of higher education should be maintained and at the same time, China should actively make reference to advantages of British higher education mode, attracting active participation of the majority of enterprises to strengthen the connection of Chinese higher education with social practice, enhance students' practical skills and lay a strong foundation for the students' career development.

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Students' Perceptions on Teaching Styles within Public International Law Curriculum: a Case of Russia

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ABSTRACT

The topicality of the research is stipulated by the challenges the legal education faces due to the controversial trends toward globalization and national legal system preservation, toward comprehensive legal training on the one hand, and the market increasing demand for narrow-field practitioners. The aims of the research are to study law students' perceptions regarding teaching/learning formats of studies in progress, to follow the development of students' perceptions regarding their legal studies at different levels of higher education. The research methods included theoretical analysis, law students' survey, statistics data processing. The empirical studies included two surveys: the entry survey of second year students of LLB and the same students' survey when they have moved to the second year of their master studies. The research enhances the awareness of the specific characteristics of public international law teaching within national system of legal culture and its values. The empirical data contributes to teachers' understanding of students' needs and raises awareness of learner-centered education within legal domain. The article had both theoretical and practical value as the theoretical background and the proposed methodology can be applied to developing training courses for legal faculty.

Keywords: legal education, public international law, learner-centered education, interactive training

INTRODUCTION

The modern legal education is traditionally considered as an important factor of the nation development within both national and international contexts. Currently this domain of higher education faces debates and disputes regarding the scope and contents, the recommended formats of training, applied of theoretical focus in training, skill-based versus fundamental knowledge-based training, pragmatic or humanistic approach to professional values of lawyer-to-be.

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Contribution of this paper to the literature

- The research provides fresh empirical data on law students perceptions regarding their preferred styles of learning at different stages of their education. New educational field is in the focus, covering the issues of legal education.
- The research allowed for distinguishing the students' attitudes to learning formats with regard to the students' learning experience and type of their academic program. The experiment confirmed that the more experience students get in their field of studies the more demanding they become regarding interactive learning formats related to the profession real settings.
- The study made it possible to specify students' perceptions regarding concrete forms of training, including lectures, colloquia, Socratic dialogues, problem solving, simulations, creative tasks, mooting. The empirical analysis also allowed for identifying benefits that the above forms bring to different stages of university-based legal education. The research results reveal the ways to balance various learning formats and tailor the legal studies curriculum to BA or MA students' needs.

Meanwhile, the shifts and moves within the above multidimensional environment can lead to rather different outcomes in legal training regarding the level of professional expertise, its self- perception by the law school graduate, and his or her future activities.

Further, it is really important to develop students' reflection skills on their studies in general, and law students' reflection skills, taking into account the role of reflection in legal profession (Leering, 2014).

Moreover, the above issues come across confronting voices over globalization of law and national legal systems specifics rooted in the long standing historical traditions of nations.

Against the mentioned background there are statements that international law training formats are globally spread and the same across countries, universities, levels of higher legal education (Nowrot, 2004).

The main goal of this paper is to explore law students' perceptions regarding teaching/learning formats of studies in dynamics, i.e. to trace the development of students' perceptions regarding their legal studies at different levels of higher education, namely LLB and LLM programs.

The goal is expected to be reached through the following tasks: literature analysis on legal training practices and prospects, law students' surveys on their preferred formats of studies with additional explanations on the reasons for expressed preference, analysis of variables significance regarding students' opinions.

LITERATURE REVIEW

The modern higher education strives to develop the personality of a student, his/her individual abilities; to assist the learners to get diverse knowledge, skills and know-how necessary for their prospective realization in the future professional (Hüfner et al., 1997).

Legal education has become one of specific issues within the Higher education studies due to it high profile impact on modern society development and future generations life (Reed, 1999, Webb, 1998). The above has led to specific legal documents regarding legal education (RF President Decree, 2014).

Scholars underline the importance for legal education to contribute to promoting intellectual development, spiritual growth or the broadening of one's horizon in general and argue for a combination of various approaches and forms of delivering and shaping students' legal knowledge (Van Klink & de Vries 2013; Sommerlad et al., 2015).

Stakeholder underline that special attention should be paid to development and use of such methods and tools that could motivate students, enhance their self-reliance, promote creative approach to learning, develop practical skills, as well as in the ability to anticipate a real situation of professional activity.

Current research on legal education specifies the importance of the constructivism philosophy (Vanderstraeten, 2002) and humanism principles application, competence-based approach (Sturm & Guinier, 2007), learner-centered interactive training (Barton & Westwood, 2011).

Scholars underline the importance of search for integrated techniques to teach law, appreciate experimental teaching to weight and compare divers teaching/learning practices (Qafisheh, 2016).

Legal educators insist on the importance of Legal Theory and Methodology issues in the legal education contents (Sokhi-Bulley, 2016), agree on the importance of the students' engagement in empirical research (Hutchinson, 2016), underline the need for comparative approach to studies (Germain, 2016), argue for visualization and performance through case studies (Del Mar, 2016).

Researchers on legal education agree on the importance to combine various formats of studies. Educators outline the following widely accepted teaching/learning forms within the curriculum:

1) lecture; and it seems importance to mention the difference between traditional versus engaging lectures, that are also called broken or interactive lectures, in the course of which students are given short periods of "breaks that can consist of short papers, problem sets, brainstorming sessions, or open discussion (Miller et al., 2013, p. 347-348); moreover, it seems reasonable to distinguish also quest lectures by internationally recognized visiting professors and practitioners from international intergovernmental organizations;
2) various types of seminars, including
   - colloquia seminars with the view to estimating the level of theoretical knowledge in addressing specific problems and tasks (Sokhi-Bulley, 2016); this kind of seminar offers students a wide range of sources is offered for seminar preparation;
   - seminars using Socratic dialogue format that in the form of questions, answers and debates provides the opportunity for sharing theoretical knowledge requires a deep immersion in the problematic aspects of a particular problem with the mastery of a vast theoretical material, primarily of a doctrinal nature. This allows comparing the doctrinal positions of various schools of international law on the most controversial issues and, if possible, developing individual point of view based on the appropriate legal argumentation (Areeda, 1996);
   - problem-solving seminars in an interactive form when subgroups of students are offered only one specific international legal problem for consideration in an interactive form as the above problem solution can be reached by using different approaches (Menkel-Meadow, 2001);
   - professional simulations, i.e. simulation of meetings or negotiations within various international judicial bodies when students are assigned various roles, which implies the most accurate performance of the functions of a particular specialist (Barton et al., 2007);
   - creative tasks with critical thinking focus within the seminar; for instance, such tasks can include an analysis of the provisions of a specific treaty, systematic assessment of the arguments of the parties to the dispute from the position of the judge with the use of various methods of interpreting the provisions of law (Menkel-Meadow, 2001, Montgomery, 2007).
3) mooting (as part of extracurricular activities) include organization and preparation of the university team to participate in the international legal competitions; the above activities imply that a student team is set up to elaborate legal positions and their further presentation in the international court; legal educators underline that is a really specific form of assessment in legal education (Lynch, 1996).

The literature review paved the way to students' surveys design and implementation.

MATERIALS AND METHODS

The research followed qualitative approach to analysis and incorporated theoretical and empirical activities. Materials for theoretical analysis involved research papers on the issues under study. Their critical investigation paved the way to identify the research problem and elaborate on the methodology for empirical activities that included several stages, including the empirical research overall scheme development, target audiences' identification and preliminary explanations to enhance students' understanding purposeful engagement in the experiment, the open-ended questionnaire drafting, students' survey, and the results thereof processing, as well.

The empirical analysis was a kind of longitudinal study as it encompassed law student cohort opinions during the learners' studies on their second-year studies on BA program on International Law, and then, during their second-year studies on the MA program on the International Law.

Thus, empirical analysis aimed to evaluate the target audience' perceptions at two different time periods, with two-year long gap.

The empirical analysis took place at the Law Institute of Peoples' Friendship University of Russia (Moscow) that is really international university and enrolls annually students from over 150 countries.

The survey engaged three flows of students that totally amounted to 103 participants, first during their being second year BA students, and then, second year MA students.

The open-ended questionnaire was practically the same for both surveys. It listed the formats of studies mentioned in the section of Literature review. Students were asked to answer the following questions:

- Do you consider this format of study useful? (yes/no) Why? (Answer in free style)
- Think of the percentage distribution of training time among these formats (if possible give reasons for your choice).

The factor analysis was used to specify students' perceptions on the teaching/learning process at different periods of their studies at different stages of higher education (bachelor and master levels). The t-test was applied to explore the importance of different variables.

The survey took into account the gender, age, year of studies, cultural background (respondent's affiliation to eastern/western culture), geographical origin (small towns/industrial cities). The variables have been identified with reference to existing data on the grounds for student perceptions' diversity (Astin, 1993; Li, 2012). SPSS was used for data procession.

RESULTS AND DISCUSSION

The research revealed that university students prefer to integrate theoretical and applied training and value interactive formats though at different stages of their education students view the relevance of a concrete format differently.

Figure 1 shows BA students' opinions and **Figure 2** reveals MA students' attitudes. The diagrams provide average percentage that students related to the share of each training form within the overall course of international law subjects.

The comparative analysis of data proved that students' learning and overall social maturity lead to the significant changes in their perceptions of the learning formats students need for further professional activities. Along the move from BA to MA level students consider lectures, colloquia seminars, and isolated problem solving as less suitable. The statistics confirms over three-fold decrease from 30% to 8%, nearly two-fold decrease from 15% to 9%, and one third decrease from 15% to 10% indicating the relevance of the training formats, respectively. The figures prove that students when growing require more interactive formats related to the profession real settings.

The factor analysis helped to understand reasons for the above changes.

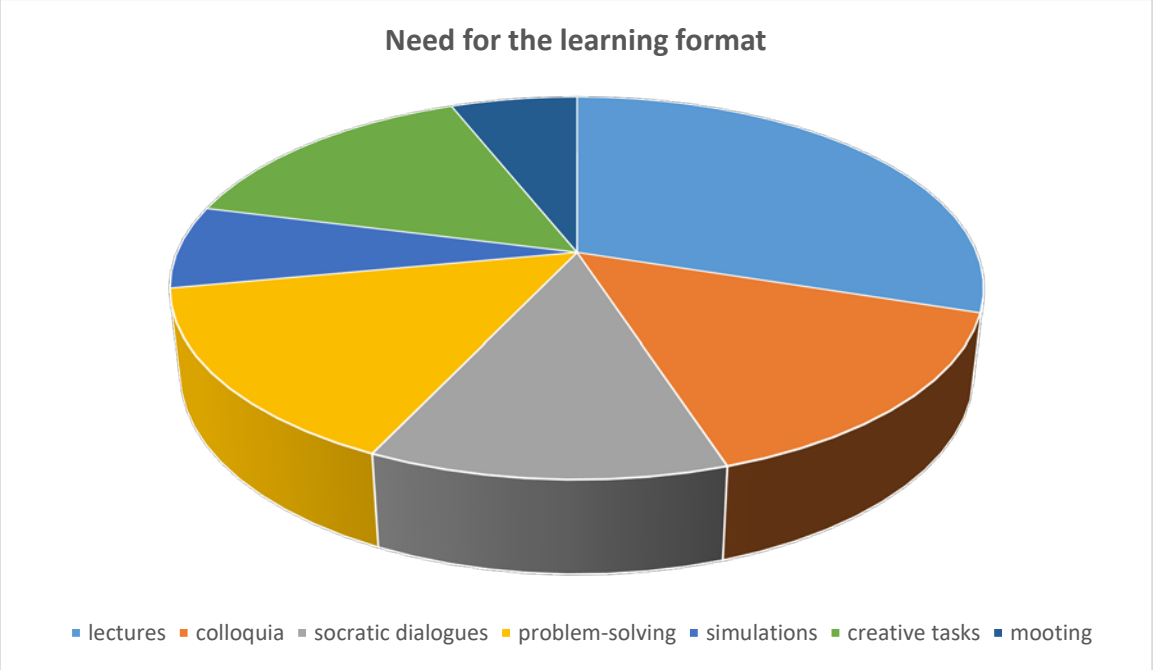

Figure 1. BA students' opinions

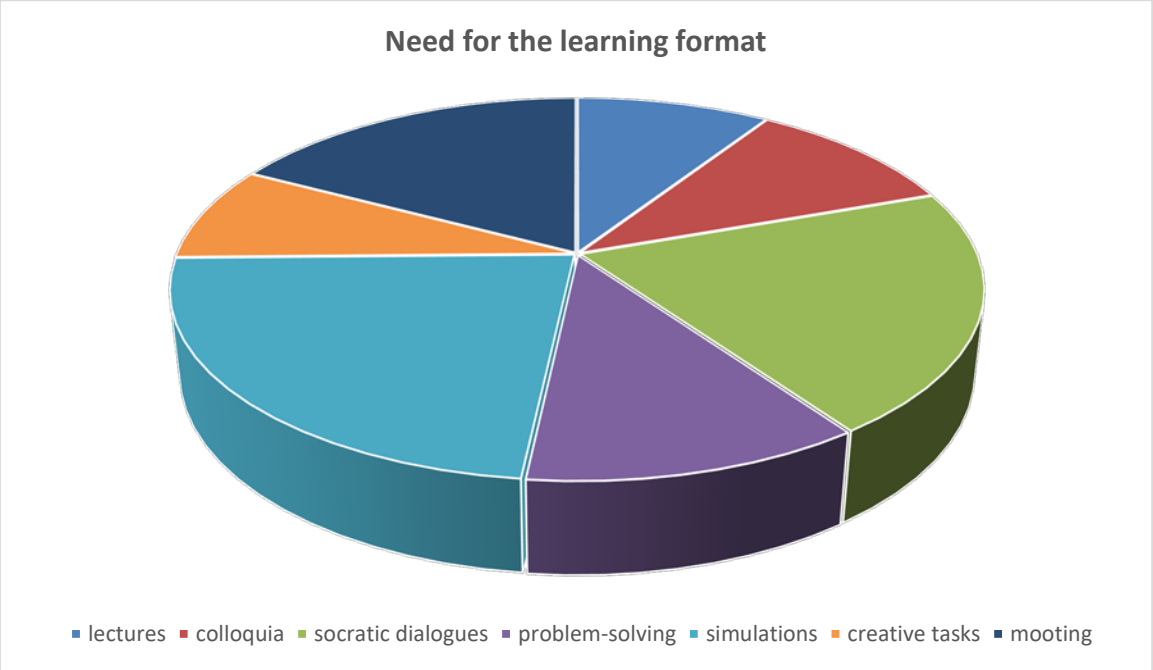

Figure 2. MA students' attitudes

Integrated analysis of students' responses during their studies at BA and MA levels confirms that agreed that the lecture and colloquia help to detailed, deep and systemic understanding of normative sources (international treaties and other international legal acts), and doctrinal sources, the preference is given to textbooks and monographs in various foreign languages. Moreover, the respondents underlined that the above formats of

learning highlight the most important aspects of the problems, and put complex and controversial questions requiring a certain level of independent analysis based on systematic nature of the already acquired knowledge. Meanwhile, respondents have stressed that such kind of knowledge is not the top goal of MA students who strive to engage in real professional settings; the item was mentioned by 87% of the respondents. Moreover, the above percentage of students specified the importance of interactive lectures conducted by guest professors and officers from international institutions. This can be explained by the assumption that such activities enhance students' awareness of the legal profession international environment.

Nonetheless, the discriminant analysis identified as statistically significant ($\lambda = 0{,}243$, $\chi 2 = 4{,}65$, $p < 0{,}01$) respondent cultural affiliation to the eastern/ western culture. Fewer students who affiliated themselves with the western culture mentioned the need for lectures and colloquia in the curriculum.

On the other hand, the data confirmed students get even more interested in learning in the settings that mirror real world of legal profession in diverse contexts.

When going up from BA to MA programs students start strongly appreciating and vote for simulations, mooting, Socratic dialogues, and retain their interest towards creating tasks, as well. The comparative analysis of the first and second diagrams figures reveal nearly three-fold increase from 7% to 20%, over two-fold increase from 6% to 15%, and 30% increase from 12 to 18 meaning, regarding the mentioned formats of training, relevance, respectively.

The factor analysis explained the grounds for the above state of affairs.

This form of training allows students to master the skills of working with sources, time management for elaborating the position and highlighting the key and most significant arguments. The factor was mentioned by 83% of the respondents.

While preparing the task, students are advised to use materials in the original languages: Acts of international and regional intergovernmental organizations, the practice of different states, international judicial bodies and others. This also enhances students' practical experience; the item was mentioned by 81% of the respondents.

As for simulations, they assume a comprehensive analysis of normative and other materials, as well as viewing the video and audio materials of various hearings of a particular organization. This work allows students to master the skills of working in the courtroom, being immersed in the real practical settings. This item was mentioned by 78 % of the respondents. As an example, students mentioned their participation in simulation of the Dispute Settlement Body within the World Trade Organization.

Another example mentioned by the students concerned the simulation of international negotiations with a view to drawing up and concluding an international agreement. The experimental data confirms the research team preliminary assumption that simulations allow for developing the creative potential of students, their ability to activate their skills of team work for negotiating and balancing diverse positions.

Nonetheless, again the discriminant analysis identified as statistically significant ($\lambda = 0{,}221$, $\chi 2 = 4{,}07$, $p < 0{,}001$) respondents' cultural affiliation to the eastern/ western culture.

Less percentage of the students who affiliated themselves with the eastern culture mentioned the need for interactive formats, including simulations, mooting, Socratic in the curriculum.

The discriminant analysis data goes in line with theoretical assumptions that have been outlined in previous research (Dent, 2005). The data requires further research and draws law teachers' attention to the culturally sensitive formats of legal training.

CONCLUSION

The research data elaborated one law students' perceptions regarding teaching/learning formats of studies in dynamic paradigm, allowed for associating the change in the mentioned perceptions with students' studies at different levels of higher education, students' educational values from a cultural perspective. The findings helped to understand students' priorities with the view to learning formats and styles.

The research findings contribute to enhancing the concept of interactive teaching of international law. The domain of training will gain if various methods of educational and cognitive activities are combined through integrating verbal and performance methods (narrative story, dispute, explanation, etc.), theoretical and applied training (lecture and practical tasks), deductive and inductive methods, research-led training with various level of investigation (from concrete search towards full-scale research), etc.

The university-based teaching on Public International Law takes into account internationally recognized standard forms of training and assumes that a qualified lawyer should reach civil maturity and follow national specifics of professional legal ethics, of legal and psychological culture. Curriculum design of academic programs on Public International Law requires careful understanding of peculiarities related to the teaching subject, target audiences, educational and professional contexts.

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Developing New Learning Resources for the Linguistic Mediators' Training in Modern Social Environment

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ABSTRACT

The topicality of the research is stipulated by the challenges of bringing the educational content and learning materials in line with the needs that young translators and interpreters have entering the labour market in modern fast developing society. The article aims to analyze from students' perspective the practical value and effectiveness of the learning materials for language mediators' training developed on the basis of the new content-focused technology in comparison to learning materials developed within the framework of the traditional approach. The methodology of the research included survey based experiment as well as the method of statistic data processing. The experiment involved the students doing their master degree course on Public Service Interpreting and Translation (total number of the participants is 30 students). The experiment was conducted in several stages including two surveys: the entry survey focused on obtaining the students' feedback on their general satisfaction with traditional learning materials, students' assessment of the materials' effectiveness for training as well as identifying particular areas of professional interest and respective needs; the second survey elicited students' responses concerning the effectiveness of the proposed new materials. The research enhances the awareness of the specific characteristics of the public services setting for training lingo cultural mediators. Practical learning materials were worked out and implemented into practice. The correlated training of interpreting and translation skills was proved. Based on the results obtained in the course of the experiment the authors propose new content focused approach to developing learning materials which constitutes practical outcomes of the research. The article had both theoretical and practical value as the theoretical background and the proposed methodology can be applied to developing training courses on translation and interpreting in various professional domains.

Keywords: lingo cultural mediation, translation, interpreting, training skills, learning materials, public services, specific setting

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Contribution of this paper to the literature

- Within the frames of the constructivism approach the new way of selecting learning materials for training interpreters and translators for public services is suggested.
- The not standard methodology of using the learning materials in teaching practice is identified.
- The correlation of the efficiency of the linguistic mediators' training and the learning resources used is proved.

INTRODUCTION

The modern international situation and the social environment increase the role of lingo cultural mediators. The interpreters and translators' activity has become crucial. The importance of this activity is determined by the following factors: multilateral cooperation in all scientific, technical and research domains, professional and academic mobility, migration crisis. Very often the lack of any communicative skills in a foreign language or of any cultural awareness cause many problems in the interpersonal interaction. Moreover, because of language barriers people cannot get medical or legal assistance, provide education for themselves and for the children. Under these circumstances the specialists in translation and interpreting i.e. lingo mediators are in great demand.

Professional training of translators and interpreters has been in the focus of practical teachers, researchers and educators for decades. Many higher educational institutions realized such programmers. Traditionally the curricula of these institutions concentrated on the foreign languages for communicative purposes e.g. General English and did not take into consideration the specific settings of the mediation activity. Apparently, nowadays when the social environment has changed the translators and interpreters teaching and training should be carried out in accordance with modern lingo didactic approaches, technologies and aids. It should be correlated not only with various domains but also with diverse discourse inside the domains.

The Goals and Objectives of the Research

The main goal of this paper is to determine the correlation of the efficiency of the linguistic mediators' training and the learning resources used. The objectives of the study are to examine the materials for training interpreters and translators; to study various discourses in public services setting; to report on the learners' assessment of different aspect of their professional training as mediators and provide the recommendations for further development of the methodology of the linguistic mediators training.

Peoples' Friendship University of Russia (RUDN University) runs the master's program "Public Service interpreting and Translation". Program graduates are expected to provide linguistic mediation services primarily in judicial and medical settings. The specificity of interpreter assisted communication in these settings directly affects the choice of study materials used for interpreters' and translators training.

LITERATURE REVIEW

Studying the theoretical resources and lingo didactic literature of the last decade one can say that modern researchers and practitioners have always shown their interest to the problems of translation and interpreting and the ways, approaches, technologies and tools of training the appropriate skills.

The following issues of translation and interpreting development have been examined recently: training translation and interpreting skills in law setting (Atabekova, 2011); the issues of specific characteristics of public service interpreters' activity and the challenges of translators' and interpreters training including the lack of well qualified trainers and learning materials (Corsellis, 2008); methodology of training translators (Kiraly, 2000; Masalimova et al., 2016); general concepts, evolution and prospect of interpreting development (Pöchhacker, 2016); the issues of curriculum building in interpreters' training (Sawyer, 2004); the role of translation and interpreting

for public services in modern multicultural environment (Valero-Garcés & Atabekova, 2013; Grigoryeva et al., 2015); the importance of ICT resources for training language and culture mediation skills (Atabekova, 2017).

M. Vargas-Urpi (2017) describes the use of datasets in studies of public service interpreting focusing on its linguistic aspect. A. Remael & M. Carroll (2015) consider the interpreting as a dialogue with the participation of an interpreter who helps the transfer of verbal and/or non-verbal communication in a real time period.

B. J. Robinson, C. I. López Rodríguez & M. I. Tercedor Sánchez (2009) examine the significance of the students' responsibility and the self-assessment of the output of their studies in their professional training as interpreters.

Two approaches to training interpreting, in particular, flipped learning across disciplines with more interactive activities and the traditional flipped model are compared in the research made by D. Kim (2017).

Translation Studies as an academic subject has been characterized by some challenges for the last decades, these issues are review by R. A. Valdeón (2017).

Very often interpreters who work in public service (community) settings can face many problems with cross-cultural differences and diverse cultural background of the interlocutors. S. Hale (2014) identified the output of the study on the ways how interpreters in legal setting anticipate the potential cross-cultural differences.

Various aspects of translator and interpreter's training are discussed by L. Meister (2017), I. S. Robert, A. Remael & J.J.J. Ureel (2017), J. Huh (2017), and C. Rico (2017). The correlation between training interpreting skills and note taking is studied by S. Chen (Chen, 2017). The integrated approach of translation and interpreting training with other subjects is the key topic of the research by S. Colina & C.V. Angelelli (2015).

Translation and interpreting are realized in various settings which have certain characteristics that modern linguistic mediators should be aware of. Apparently, each setting assumes the use of specific terminology and extensive knowledge of a particular discourse. The following researches can provide more information about legal/ court interpreting (Mikkelson, 2000) and translation (Millán & Bartrina, 2013); medical/healthcare interpreting (Nicodemus & Metzger, 2014) etc.

Practical handbooks and teachers' guides focused on the development of translators' and interpreters' professional skills are of crucial importance. The authors examined various aspects of teaching and training linguistic mediators from the point of view of the main problem of this research that is the correlation of the mediators' training and materials used for the purpose.

In "A Practical Guide for Translators" G. Samuelsson-Brown (2004) traces a number of the sources of reference that can be used by a translator in his practical work. The author reports on the importance of mono and bilingual on-line and paper dictionaries, encyclopedias, standards, reference books and past translations, research papers and monographs, database applications for translators, however he does not reveal the way how to use them in professional training.

'Interpretation: Techniques and Exercises' by J. Nolan (2005) provides an overview of didactic assignments mainly focused on linguistic challenges. J. Nolan sets examples only from the political and economic discourses. Considering the economic discourse the author suggests that interpreting should be trained on the materials of business section of The New York Times or in such mass media papers or on line sites as The Economist, The Wall Street Journal, The Financial Times. But no materials are mentioned as far as the political discourse is concerned.

Training professional translators and interpreters in Russia has deep roots. It is evoked from the research of Y.I. Retsker (2010), V.Y. Rosenzweig (1972), A.D. Shveytser (1988), L. S. Barkhudarov (1975), V.N. Komissarov (1970), and others. Now traditional approaches of Russian lingo didactics are realized in the use of materials compiled by (1) Russian authors like students books by I. Alekseyeva (2001) or S. Fomin (2006) or (2) authentic resources implied for teaching English for specific purposes e.g. "Professional English in Use Medicine" by E. Glendinning & R. Howard (2007) or "Professional English in Use Law" by G. D. Brown & S. Rice (2007).

However these materials have failed to match the contemporary educational environment and learners' needs. The former have few assignments for training mediators' skills, the tasks do not reflect the current situation in the word and are not focused on any special setting, whereas the latter contain much information on the subject, are written in an authentic language but do not include any tasks for translators' and interpreters' skills development. Moreover, authentic students' and course books for studying English in educational or culture settings are not available.

Apparently, the different sources and theoretical studies have been compared. In our opinion, neither of these materials can serve as the bases for training professional skills of translator and interpreters in a specific setting.

MATERIALS AND METHODS

The experiment was held in the Institute of Law, RUDN University. The participants of the experiment were the learners studying at the Master program "Interpreter and Translator for Public Services and Institutions" run by the Department of Foreign Languages of the Institute mentioned above. All students (30) were included in the focus group.

To obtain accurate and reliable data of the experiment the following methods of investigation were used (the classification of research methods is given in accordance with the online resource "Wikibooks" (Research Methods, 2017]:

- Qualitative methods including various methods of collecting analyzing and interpreting information, in this case it was related to the examination of lingo didactic researchers' theories and approaches as well as learning materials; browsing, comparing and selecting new sources of information that could be implemented in the pedagogical practice; identifying and presenting the output of the teaching experiment.
- Quantitative methods related to all kinds of recording and data statistics. In the experiment presented in this paper these methods were used when reporting on the results of the observation, surveys, interviews and questionnaires that expressed the respondents' opinions and assessment.
- To observe and explain the findings of the research the methods of statistical analysis and the method of specific theoretical perspectives were used.

The lack of appropriate learning materials for training linguistic mediators in a specific setting (e.g. public services) determined the course of the experiment. Prior to analyzing the resources that could be used for training purposes, the professional interests of the participants were studied. The course books and other learning materials used in practice of training translation and interpreting skills were examined. Apparently, translation and interpreting skill should be trained in all discourses, but the students' interests differ greatly. They prefer to concentrate on a certain discourse and to pay less time and attention to the others. So the aim of the first stage was to learn the professional interests of the participants of the experiment. For this purpose a survey was held, it consisted of the following questions:

1. Are you generally satisfied with the learning materials? Why? (Yes/No)
2. What setting would you like to work at? (Educational, law, medical, others)
3. What do you expect your learning materials would be? Put the characteristics (authentic, interesting, up-to-date, useful for work) from more important to less important.

After the summarizing the data obtained, the search for the learning materials and resources was carried out. The hypothesis that translation skills can be trained in the cohesion with the interpreting skills provided the lingo didactic technology of the practical use of the selected materials and supplementary resources. As the basis for the experiment there were selected the free on line materials of the European Commission of Directorate-General (DG) for Education and Culture; DG for Health and Food Safety; Service Department Legal Service; DG

for Justice and Consumers etc. (https://ec.europa.eu/info/departments_en); and such sites as the official European Union website (https://europa.eu/european-union) etc.

The central stage of the experiment was carried out in accordance with the constructivism approach and implied an active involvement of the students in the process of teaching and learning. Browsing the appropriate sites the learners chose the materials to study. Then the files were divided into equal parts suitable for home work translation and in class activities. As a homework the students were to translate the appropriate part and distinguish the key words or chunks in two languages. In the class the interactive work was realized. Changing the languages one student voiced the lexical unit another one interpreted it, then they changed over. In the same way the students checked the translation made at home reading aloud the fragments of the text for further interpreting. So the consecutive interpreting was simulated. Later, interpreting the YouTube files and film fragments was integrated in the class activities.

In the follow-up phase of the teaching experiment, the students were asked to assess the efficiency of the suggested technology and respond to the questions:

1. Are you generally satisfied with the learning materials? (Yes/No)
2. Does the way of training translation skills match you expectations? (Yes/No)
3. Does the way of training interpreting skills match you expectations? (Yes/No)
4. Which type of training (a traditional or an experimental one) meets your prospective professional goals better and why?

Finally, their opinions were generalized and recommendations for further practice of mediators' skills development were put forward.

RESULTS

The experiment presented in the paper consisted of several stages, so the results of each stage should be reported. As it was mentioned above public service translation and interpreting touches upon various discourses such as educational, legal, medical etc.

As mentioned in the literature review, various aspects of mediators' (translators' and interpreters') professional training are of utmost importance. These problems are studied by lingo didactic researchers and practitioners involved in teaching and training specialists in higher education institutions. One of the acute issues of the current methodology of training linguistic mediators is the choice of learning materials and the integration of the new materials in the teaching practice. The present study proved the fact that the learning materials should be chosen taking into consideration the professional interests and perspectives of the translators- and interpreters-to be.

The pre experiment survey was aimed at assessing the students' opinion on the traditional learning materials used in their professional training. The output of the survey is presented in **Table 1**.

The results of the survey indicated that only less than one third (9) respondents thought that the course books used were quite interesting and worth studying. The other part of the respondents (21) were sure that the materials they study should be more modern and related to the setting they were going to work at. Consequently, they supposed that the materials should be changed.

As the domain of public services includes various settings, it was important to find out what setting the participants of the experiment would prefer for their professional activity. The results obtained show that the majority of respondents (15) would like to connect their career with the law setting, about one third of the students (9) intended to work as translators and interpreters in medicine, and one fifth of the survey participants (6) supposed that studying the issues of education and culture were the most topical.

Table 1. The students' opinion before the pre experiment

Issue of the Survey	Positive response	Negative response
Satisfied with the learning materials	9	21
Professional setting including:	30	-
Law	15	
Medical	9	
Educational	6	
Requirements to the learning materials:	30	-
useful for work	30	
up-to-date	28	
authentic	27	
interesting	19	

Table 2. The students' opinion after the experiment

Issue of the Survey	Positive response	Negative response
Are you generally satisfied with the learning materials?	28	2
Does the way of training translation skills match you expectations?	28	2
Does the way of training interpreting skills match you expectations?	28	2
Which type of training meets your prospective professional goals better?	30	1
traditional	3	27
experimental	27	3

The students expected that the new learning materials should be, first, useful for work (100% of respondents); then, up-to-date (95%) and authentic (92%). More than a half of the participants (63%) supported the idea that the learning materials should be interesting.

On completion of the training with the use of the recently selected learning materials a post experimental survey was held. **Table 2** shows the output of the post experimental survey.

Though the first question was similar to the one of the pre experimental survey, the response differed greatly. 28 students answered that they were satisfied with the learning materials. The same number of the survey participants were sure that the experimental way of training translator's and interpreter's skills is much more effective for their professional career. 27 respondents expressed their positive opinion to the way the translating and interpreting skills were trained on the basis of the up-to-date learning materials.

As a result of the experiment the learning materials for practical training translation and interpreting skills were selected; the assignments for training and assessing the appropriate skills were worked out; the English – Russian glossary of the terms for the public services setting was compiled.

DISCUSSION

Nowadays the role of a linguistic mediator especially of a translator and interpreter in a specific setting is crucial. Training the appropriate professional skills in translation and interpreting is the goal of various educational institutions and programs. Modern educational environment is characterized by the diversity of curricula and learning materials. The development of translation and interpreting professional skills should be correlated with the learning materials. The latter should have a certain number of characteristics and, first of all, match the learners' professional expectation and requirements.

One of the educational approaches applied in the modern education is constructivism, which implies the involvement of the students in the process of education. We can assume that the students can participate in selecting

the materials for learning, as they realize what material can be useful for their professional career. Their professional interest in a certain setting determines the choice of the learning materials. Moreover, using the samples and the teacher's recommendations, the students can also prepare the tasks and assignments for training definite skills in translation and interpreting. The students with a high level of language proficiency can also assess the correctness of their fellows' output in translation and interpretation.

Mediation along with speaking, listening, reading and writing is considered to be a language activity (Common European Framework of Reference for Languages, 2004). The development of speaking, listening, reading and writing skills is interdependent as speaking and listening are oral forms of language activities whereas reading and writing are the written forms. On the other hand, speaking and writing are productive forms and listening and reading are the perceptive ones. The experiment described above demonstrated that the translation and interpreting skills can be trained in cohesion on the basis of the same learning materials but with different tasks.

The experiment also included two surveys, the pre experiment survey observed the aspects to choose the learning materials, whereas the post experiment survey proved the efficiency of the technology suggested. Among the benefits of the experimental training its participants emphasized:

- the learning materials that were chosen by the students during the experiment correspond to the up-to-date real practice;
- the materials studied could be used when writing research papers and graduation thesis;
- the experimental training helped to prepare to the pre-thesis internship;
- the students felt more confident and comfortable in their translating and interpreting activities.

The examination of the literature review proved the fact that the lingo didactic approach to training translation and interpreting skills has not been previously described. The findings of the current study proved the efficiency of the applied lingo didactic technology; demonstrated the enhancement of the translation and interpreting skills of the students. Doing the translation and interpreting tasks the students enhanced the speed of the use of the professional vocabulary, improved the professional reaction in interpreting; reached more adequate translation. The students were motivated to use appropriate on line resources including on line reference materials, dictionaries, encyclopedias and official sites of relevant agencies.

At the same time despite these promising results, further research in various settings and with a greater number of participants is required.

CONCLUSION

Much attention has been paid to the development of the mediator's professional skills i.e. the skills of translating and interpreting. This issue has been studied from various angles but still there are some unsolved problems left. The literature review showed that such issues as the choice of the learning materials as well as their importance for training skills in translation and interpreting was not studied yet.

The research held by the authors highlighted the importance of the correlation of the learning materials with the specific domain of the students' perspective professional activity. The experimental findings that include the output of the teaching experiment and the statistical data supported the authors' outlook on the issue.

In course of the research diverse learning materials for training interpreters and translators were examined; various discourses in public services setting were studied; the learners' assessment of different aspect of their professional training as mediators was reported. The trajectory for further evolution of the methodology of the linguistic mediators' training was provided taking into account the ideas of constructivism and the interrelated development of all kinds of language activity.

The current research is limited by the lack of information from other specific settings and by a small size of the experiment participants. So further theoretical examination and teaching experiments are strongly recommended.

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Cooperation Learning of Flip teaching style on the MBA Mathematics Education Efficiency

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ABSTRACT

This study aims to discuss the effects of flipped teaching supported cooperative learning on MBA students' learning achievement, attitudes toward technology, cooperative learning attitudes, and course satisfaction in the mathematics and science education. By applying quasi-experimental research, 120 MBA students of a national university in China are selected as the research objects. Two classes are randomly sampled for a class as the experiment group (N = 75) and the other class as the control group (N = 45). The students in the experiment group apply flipped teaching supported cooperative learning, while those in the control group adopt traditional didactic cooperative learning. Both the experiment group and the control group are paired with heterogeneous cognitive styles for the 4-week (16 sessions) teaching experiment. The research results reveal that the flipped teaching supported cooperative learning could actually enhance students' learning achievement, course satisfaction, and cooperative learning attitudes in the science education. However, there is no significant effect between learning achievement, course satisfaction and cooperative learning attitudes. On the other hand, web-based learning self-efficacy would influence students' learning achievement and course satisfaction in the mathematics and science education.

Keywords: flipped teaching, science education, learning achievement, course satisfaction

INTRODUCTION

Group teaching, as the most traditional and common teaching model currently, focuses on one-way instruction of a teacher. Under such teaching environment, students often lack for actively thinking of lesson contents and have to synchronously accept knowledge in the classroom. A teacher therefore could not take care of students with various levels to result in student differences in absorption and comprehension. Some students even consider that

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Contribution of this paper to the literature

- To change such a dilemma, common lesson preparation among teachers might be an effective method. Having teachers with the same subject discuss with each other and mutually support and record the teaching films could largely reduce the time for lesson preparation.
- To have students actually watch films on the teaching platform before the course, teachers have to think of the reward and confirmation mechanism, e.g. answering questions after watching teaching films or writing opinions on the teaching platform, to effectively achieve flipped teaching.
- The application of flipped teaching supported cooperative learning in this study allows students watching teaching films on the teaching platform before the course and then preceding cooperative learning in the classroom.

they have learned concepts in the course but find out that they do not really comprehend such concepts when doing assignments at home. Unfortunately, they have nobody to immediately provide assistance. When dividing learning processes into "delivery of knowledge" and "absorption and internalization of knowledge", group teaching simply stresses on the delivery of knowledge but ignores the knowledge absorption and internalization of students. To improve group teaching, flipped classroom, a teaching model proposed recently, has been popular in the education circle. The concept refers to flipping over the traditional teaching process of "lecturing in class, doing assignments at home". Students have to complete the knowledge learning before the class and precede cooperative learning with teachers and classmates in the school (Jensen, Kummer & Godoy, 2015; O'Flaherty & Phillips, 2015). A classroom therefore becomes the place for the interaction between teachers and students as well as among students. Different from traditional teaching models, a flipped classroom allows students selecting adaptive and individualized education, according to personal preference, to acquire knowledge through self-learning and enhancing the learning interests through the cooperative learning among classmates in the classroom to enhance the knowledge absorption and internalization (Baker, 2000; Wong, Ip, Lopes & Rajagopalan, 2014). The cooperation among students not only improves the passive learning in traditional group teaching but also promotes students' thinking ability to enhance the learning interests (Chu, Hwang, Tsai, & Tseng, 2010).

A flipped classroom is based on constructivism and social-learning theory (Moraros, Islam, Yu, Banow & Schindelka, 2015) as it allows and encourages students regarding learning as an activity and the process of socialization to construct knowledge through self-learning before the course and in-depth discussion in the classroom. In terms of social-learning theory, self-efficacy is a primary factor in learning. Bandura (1997) regarded self-efficacy as individual belief in being able to complete specific tasks. Besides, self-efficacy could affect the intensity of individual belief to cause specific results that a learner had to analyze and reflect the learning tasks, judge the balance between the ability and the learning objectives, and further self-evaluate the requirement for achieving the objectives (Shea & Bidjerano, 2010). Teachers, in a flipped classroom, used to provide materials like textbooks, traditional handouts, or audio presentation (PPT) for students' watching or learning to complete the course preparation before the class (Wu and Tai, 2016). However, the prevalence of online e-teaching, particularly the assistance of MOOCs, has a flipped classroom develop into the new trend of digital learning. With changing information technology, multimedia digital teaching is constantly impacting original teaching styles; multiple knowledge are presented through texts, pictures, and clear audio with sound and light effects; and, even learning environments and learning materials are simulated to induce students' learning interests and enhance the teaching effect (Wu and Tai, 2016). Flipped teaching could be regarded as a transformation of mixed teaching model, but online e-teaching and classroom teaching covered in the mixed teaching model are practiced based on traditional teaching orders. Flipped teaching practices actual teaching activity, with online e-teaching, before classroom teaching which then does not focus on teaching but on common discussion, problem solving, or guiding further thinking. Although flipped teaching simply "flips over" the teaching order, the core value is to give the learning initiative to students that a teacher's role or task in classroom teaching is not to teach, but to discuss or dialogue with students (Kong, 2014).

Research Focus

The content of science education lies in the cultivation of scientific concepts. The science deduction process allows deducing and understanding the development process of new technology and actually researching and developing scientific products in the course to cultivate specific R&D experiences. Since the science education in higher education stresses more on life-related mathematics & science, science & technology innovation, and the sustainable operation of energy saving and environmental protection, MBA mathematics & science teaching emphasizes on cultivating students' "thinking" ability. Moreover, the design of MBA course outline definitely indicates that problem solving is the key design of mathematics & science teaching and the processes of logic, practice, and application are emphasized. Especially, most MBA students, with in-service education, join in the course to learn new knowledge and skills that the requirements for learning mathematics & science does not simply "do wonderfully", but "solve skillfully" to actually solve the tasks and problems assigned by the teachers. Nevertheless, such a learning process can hardly be reached in other courses that it is the specialty of the mathematics & science course. To cultivate students' future competitiveness, it is necessary to have students effectively learn professional knowledge and skills through efficient learning and to think of new teaching approaches and strategies (Zakaria, Chin, & Daud, 2010). For this reason, well applying the mathematics & science course matched with the guidance of perfectly designed materials and the flipped teaching strategy would effectively develop students' multiple abilities and promote the technology learning interests. This study intends to enhance MBA students' learning outcome in the mathematics & science course with flipped teaching supported cooperative learning by effectively applying the teaching films recorded by the teacher before the class and combining the function of web-based teaching platform in e-class for the 4-week (12 sessions) teaching experiment to further understand the effects of flipped teaching on MBA students' learning achievement, attitudes toward technology, cooperative learning attitudes, and course satisfaction in the mathematics & science course. Specifically speaking, this study intends to discuss 1.the effects of different teaching strategies on learning achievement, cooperative learning attitudes, and course satisfaction in mathematics and science education, 2.the effects of learning participation in flipped teaching supported cooperative learning on learning achievement, cooperative learning attitudes, and course satisfaction in mathematics and science education, and 3.the effects of web-based learning self-efficacy in flipped teaching supported cooperative learning on learning achievement, cooperative learning attitudes, and course satisfaction in mathematics and science education.

LITERATURE REVIEW

Flipped Teaching

Flipped teaching is not a new idea, but the development of digital technology allows students ubiquitously receiving information and contacting with peers so that flipped teaching is re-emphasized. In the digital era, flipped teaching contains mixed learning design that digital technology has the passively delivered learning knowledge exceed formal curricula, while students in formal curricula more actively construct learning concepts through active learning (Davies et al., 2013; Flumerfelt & Green, 2013). Students in flipped teaching are positioned as being able to control the learning speed and schedule and establish individually required learning steps. Teachers in flipped teaching could achieve meaningful learning, without restrictions, through observation, guidance, comments, and assistance (Flumerfelt & Green, 2013).

After the popularity of computer, network, and cloud technologies, classrooms are no longer the sole field for "teaching" and "learning". Flipped teaching presents distinct perceived learning effect of students, but students generally show positive reaction to flipped teaching. Students favor watching teaching videos by themselves, but prefer interactive learning activities in classrooms (Wong et al., 2014; Moraros et al., 2015). Day and Foley (2006) discovered that, under same topics, assignments, and time, students in the experiment group who watched films outside the classroom but participated in interactive learning in the classroom outperformed the control group on the assignments, projects, and examinations. Kong (2014) discovered that flipped teaching could significantly promote students' information literacy and critical thinking ability. Besides, teachers and students had more team discussion time to enhance the students' information sharing and peer discussion before and after the classroom

learning activity. Several studies indicated that flipped teaching could enhance students' learning outcome and provide more team discussion time to enhance the development of multiple abilities. Nonetheless, most research was preceded in universities, but seldom applied to MBA education. Moreover, it was mostly applied to general courses, but seldom to mathematics & science education. For this reason, this study intends to promote MBA students' learning outcome in mathematics & science education by utilizing flipped teaching supported cooperative learning.

Learning Participation

Participation is a part of learning (Wenger, 1998). Past research pointed out participation as individual voluntary actions and the invested resources and commitment in the process. The degree of participation is the observable degree of involvement and the invested efforts in the process. Internet-based learning environment allows teaching not being restricted to space and time that students could learn at any places and flexibly arrange the learning time to really achieve the situation of learning anytime and classrooms everywhere (Chu et al., 2010). In addition to not being restricted to time and space, Internet-based learning could automatically record students' learning activities on the web-based learning platform to the system. Moreover, teachers could understand students' learning conditions and performance through the learning participation records. Flipped teaching stresses on practicing actual teaching activity, through online e-teaching, before the classroom teaching. Students' degree of online participation therefore becomes primary. The time of students logging in the web-based teaching platform for reading materials is applied to evaluate the learning participation.

Self-Efficacy

Individual self-efficacy refers to individual belief, under special situations, in evaluating the ability to complete specific objectives and tasks. Such a belief is the ability judgment of a person completing certain behaviors that it would influence the person's ideas and actions, the efforts and persistence in encountering problems or obstacles, and the selection of tasks and the performance (Bandura, 1997; Wang, Shannon & Ross, 2013). Internet-based learning (IBL) self-efficacy describes individuals being confident and believing that they are capable of mastering the online course or web-based learning activity (Yukselturk & Bulut, 2007; Chu et al., 2010). According to IBL self-efficacy, Cheng and Tsai (2011) proposed web-based learning self-efficacy (WLSE), which referred to students' opinions and self-confidence in being able to complete online courses and participating in and completing online courses with the Internet and computer skills. With the use of digital technology, flipped teaching has the passively delivered learning knowledge exceed formal curricula. In this case, web-based learning self-efficacy might be a key success factor in flipped teaching.

METHODOLOGY OF RESEARCH

Research Model Development

Quasi-experimental research is applied in this study to discuss the effects of applying flipped teaching supported cooperative learning and traditional didactic cooperative learning to mathematics and science education on learning achievement, attitudes toward technology, cooperative learning attitudes, and course satisfaction. The research structure in this study is shown as **Figure 1**.

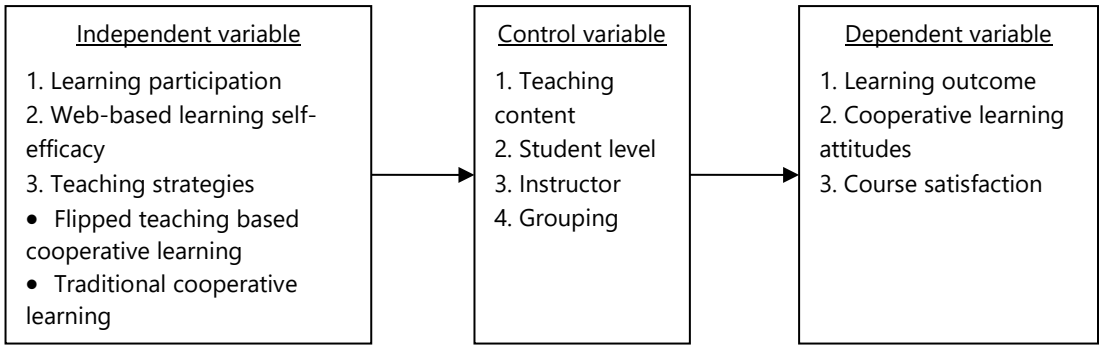

Figure 1. Research model

Independent variable

Learning participation: Learning participation in this study calculates the total time of the experiment group from the teaching experiment to the material reading on the Internet-based teaching platform. Web-based learning self-efficacy: Web-based learning self-efficacy in this study refers to students' test score of the web-based learning self-efficacy scale. The scale refers to Cheng and Tsai (2011), and the Cronbach's α appears 0.93. Teaching strategy: According to the teaching strategy, students in this study are divided into the experiment group (EG) with "flipped teaching supported cooperative learning" and the control group (CG) with "traditional didactic cooperative learning".

Control variable

Teaching content: Based on current MOOCs platform, the teacher designs 5-unit mathematics and science courses and records relevant teaching films before the course on the web-based teaching platform. Both the experiment group and the control group use the same teaching films. Student level: MBA students of a national university in China are selected as the research objects, who have studied basic mathematics before, for the teaching experiment. The student level therefore does not appear large differences. Instructor: Both the experiment group and the control group has the same instructor, who graduated from a graduate school of mathematics in a famous university in China and has 12-year teaching experiences in MBA mathematics and science education. Grouping: Heterogeneous grouping is applied to this study. All participants precede the cognitive style scale before the experiment. Based on the pretest scores, top 50% students are in the high-score group, and the rest are in the low-score group. A cooperative learning team is separately selected from the high-score group and the low-score group, which are paired by heterogeneous grouping with cognitive styles.

Dependent variable

Course learning achievement: The course learning achievement in this study refers to students' evaluation performance after the course. Cooperative learning attitudes: The cooperative learning attitudes in this study refers to students' test scores on the cooperative learning attitude scale. The scale refers to Nam and Zellner (2011), and the Cronbach's α is 0.93. Course satisfaction: It refers to students' scores on the course satisfaction scale, which is referred to Frey, Faul and Yankelov (2003) and shows the Cronbach's α 0.97.

Participants of Research

Two classes of (120) MBA students of a national university in China who are studying "Statistical mathematics" are selected as the research objects in this study. With random grouping, a class is set as the experiment group (75 students) and the other class is the control group (45 students). Students in the experiment group apply flipped teaching supported cooperative learning, and those in the control group adopt traditional didactic cooperative learning.

Table 1. Analysis of Variance of cooperative learning attitudes under the teaching strategy

	Teaching strategy group	No. of people	M	SD	Adjusted Mean	F	*p*
Cooperative learning attitudes	EG	75	61.12	5.33	60.97	8.287	.01
	CG	45	54.78	5.26	55.18		

Procedures

Three sessions (3hrs) before the formal course are used for the course explanation and the brief introduction of the web-based teaching platform as well as for completing the pretests of cognitive style scale, web-based learning self-efficacy scale, attitudes toward technology scale, and cooperative learning attitude scale. Based on the cognitive style scale, the students are paired with heterogeneous grouping. Since most students have not used the mathematics and science education platform, the teacher, using 6 sessions in a week, has all students understand the basic use of the mathematics platform. Furthermore, all students learn to operate the evaluation through assignments. In the following 4 weeks (16 sessions), students in the experiment group have to watch the teaching films assigned by the teacher before the class. To effectively control the students completing the films before the class, the teacher request the students to answer 1~3 questions on the web-based teaching platform after watching the films. In the classroom, the teacher simply solves problems, but not lecturing, and the students precede group discussion and complete the assignments. Students in the control group, in the classroom, are lectured the teaching films on the web-based teaching platform by the teacher and then answer the same questions as those for the experiment group on the web-based teaching platform. The students further precede group discussion and complete the assignments. After completing the assignments, the teacher collects qualitative data with open-ended questionnaire aiming at the assignment contents and the technology practice. When all courses are completed, the last session is utilized for the course satisfaction and cooperative learning attitude scales.

RESULTS OF RESEARCH

Effects of Different Teaching Strategies on Mathematics and Science Education

Independent-sample t Test is used for testing the learning achievement in mathematics and science education between the control group and the experiment group. The analyses find out the mean assignments score 83.792 of the experiment group and 77.875 of the control group as well as the t-test result -4.900 (p<.001) with significant differences. It reveals that the assignment evaluation of students in the experiment group outperforms those in the control group. Accordingly, the application of flipped teaching supported cooperative learning could indeed enhance students' learning achievement in mathematics and science education. It also discovers that the mean course satisfaction score of students in the experiment group appears 103.417, but 91.691 in the control group, and the t-test result shows -4.855 (p< .001) with significant differences. It presents that students in the experiment group outperform those in the control group on course satisfaction. Accordingly, applying flipped teaching supported cooperative learning could actually promote students' course satisfaction. In this study, the cooperative learning attitude pretest score is the covariance, the teaching strategy grouping is the independent variable, and the cooperative learning attitude posttest score is the dependent variable for the in-group regression coefficient homogeneity test. The homogeneity test p of the teaching strategy grouping and the cooperative learning attitude pretest does not achieve the significance that One-factor Analysis of Covariance (ANCOVA) could be continuously preceded. After excluding the effect of the cooperative learning attitude pretest, the cooperative learning attitudes of students in the experiment group is remarkably higher than those in the control group (F=6.858 and p<.01). Apparently, flipped teaching supported cooperative learning could notably promote students' cooperative learning attitudes (see **Table 1**).

Table 2. Analysis of course satisfaction under web-based learning self-efficacy

	Teaching strategy group	No. of people	M	SD	F	*p*	Post hoc
Course satisfaction	High	25	115.23	12.52	30.701	<.001	High > Medium
	Medium	25	104.97	11.46			
	Low	25	99.52	11.71			High > Low

Table 3. Analysis of Variance of cooperative learning attitudes under learning participation

	Teaching strategy group	No. of people	M	SD	Adjusted Mean	F	*p*
Cooperative learning attitudes	High	25	59.41	6.58	58.97	0.579	.687
	Medium	25	58.77	7.87	58.33		
	Low	25	58.13	8.15	59.49		

Effects of Learning Participation on Mathematics and Science Education

This study intends to understand the effects of learning participation in flipped teaching supported cooperative learning on learning achievement in cooperative learning attitudes and course satisfaction in mathematics and science education. According to the learning time on the web-based teaching platform, 75 students in the experiment group are divided into high-learning participation (top 1/3 of total learning time), medium-learning participation (middle 1/3 of total learning time), and low-learning participation (last 1/3 of total learning time) for the test of homogeneity of variance. When it does not reach the significance, it does not violate the assumption of homogeneity of variance that One-factor Analysis of Variance (ANOVA) could be further preceded. When One-factor ANOVA reaches the significant difference, a posteriori comparison is proceeded. The posteriori comparison analysis discovers that ones with high-learning participation outperform those with medium- and low-learning participation on course satisfaction ($F=30.701$ and $p<.001$). The research results show that learning participation in flipped teaching would remarkably affect satisfaction in mathematics and science education and watching online films at free time in advance could actually enhance learning satisfaction. Research also finds out no significant difference of learning participation in flipped teaching supported cooperative learning to cooperative learning attitudes ($F=0.579$ and $p>.687$) (see **Tables 2** and **3**).

Effects of Web-Based Learning Self-Efficacy on Mathematics and Science Education

According to the scores in the web-based learning self-efficacy scale, 75 students in the experiment group are divided into high, medium, and low self-efficacy groups for the analysis. The analysis results reveal notable differences of web-based learning self-efficacy in learning achievement in mathematics & science education ($F=8.167$ and $p<.001$). The posteriori comparisons show that ones with high web-based learning self-efficacy remarkably outperform those with medium and low web-based learning self-efficacy on course satisfaction, and ones with high web-based learning self-efficacy notably outperform those with low web-based learning self-efficacy on course satisfaction. Apparently, web-based learning self-efficacy in flipped teaching would significantly influence learning achievement in mathematics and science education, and students with high web-based learning self-efficacy present better learning achievement than those with low web-based learning self-efficacy. Furthermore, it is also discovered that ones with high web-based learning self-efficacy outperform those with medium and low web-based learning self-efficacy on learning satisfaction ($F=23.11$ and $p<.001$). In other words, web-based learning self-efficacy in flipped teaching would notably affect students' course satisfaction. Web-based learning self-efficacy in flipped teaching supported cooperative learning does not appear significant difference in cooperative learning attitudes that distinct web-based learning self-efficacy would not affect cooperative learning attitudes (see **Table 4**).

Table 4. Analysis of course satisfaction under web-based learning self-efficacy

	Teaching strategies group	No. of people	M	SD	F	*p*	Post hoc
Course satisfaction	High	25	117.15	8.78	23.11	<.001	High > Medium High > Low Medium > Low
	Medium	25	105.87	10.14			
	Low	25	101.18	10.52			

DISCUSSION

Independent-sample t Test and One-factor Analysis of Covariance are utilized in this study. The analyses show that students in the experiment group with "flipped teaching supported cooperative learning" outperform those in the control group with "traditional didactic cooperative learning" on learning achievement, course satisfaction, and cooperative learning attitudes in mathematics and science education. From students' qualitative data, it is discovered that students watching teaching films in advance and proceeding team discussion in the classroom present deeper discussion of questions because of more discussion time. Besides, they could better experience the importance of team cooperation due to more interaction time. What is more, they have more time to think of technology knowledge, as they watch teaching films in advance, that the application of flipped teaching to mathematics and science education could indeed significantly promote learning achievement, course satisfaction, and cooperative learning attitudes. Such a research result corresponds to various studies. Flipped teaching contains the mixed learning design that the use of digital technology has the passively delivered learning knowledge exceed formal curricula and students in formal curricula more actively construct learning concepts through active learning (Davies et al., 2013; Flumerfelt & Green, 2013). Flipped teaching provides students with adequate time for discussion and learning and assist students in more interaction with the companions (Chao et al., 2015). Students could control the learning speed and schedule and establish individually required learning steps. Teachers, on the other hand, could achieve the meaningful learning through observation, guidance, comments, and assistance, without any restrictions (Flumerfelt & Green; Fulton, 2012).

The advance of technology enhances the effect and practicability of flipped classrooms, which present better learning effect than simulated basic training, could induce learning motivation, and take larger learning differences into account. Students present positive reaction to flipped teaching; they favor watching teaching videos on their own, but prefer interactive learning activities in the classroom. The teaching films established for flipped teaching could effectively have students appear learning motivation on the material. Besides, when students feel that the films are useful and easy to follow and could help them comprehend new materials, the learning achievement and satisfaction would be enhanced (Day & Foley, 2006; Kay & Kletskin, 2012; Wong et al., 2014; Wu & Tai, 2016). Furthermore, the analysis results reveal that students with high-learning participation in the experiment group with "flipped teaching supported cooperative learning" outperform those with low-learning participation on learning achievement and course satisfaction in mathematics and science education. However, there is no significant difference in cooperative learning attitudes, possibly because students with high-learning participation often watch teaching films and have more understanding and comprehension of the course that they could quickly complete the assignments in the classroom discussion and present higher sense of achievement. The learning achievement and course satisfaction therefore remarkably outperform those with low-learning participation. The research results correspond to the notable effects of Internet-based learning records, e.g. "course use time" and "material reading time", on learners' learning outcome and learning technology (Prinsen, Volman, Terwel & Van den Eeden, 2009). Students have the same time for cooperative learning and problem solving that cooperative learning attitudes are not influenced by learning participation.

Finally, students with high web-based learning self-efficacy outperform those with low web-based learning participation on learning achievement and course satisfaction in mathematics and science education, while cooperative learning attitudes do not appear significant differences. It is considered that students with high web-based learning self-efficacy present the opinions and self-confidence to complete online courses and are confident in participating and completing online courses with the Internet and computer skills. They therefore have better

self-confidence and consider that they are capable of completing relevant assignments to show higher sense of achievement. As a result, the learning achievement and course satisfaction are obviously better than those with low web-based learning self-efficacy. This research result corresponds to that students with higher motivation on online courses would strengthen the self-efficacy and course satisfaction, and students with higher technology self-efficacy and course satisfaction would eventually show better performance (Wang et al., 2013). All students in this course would receive the same course contents and learn new science knowledge; besides, all students have same time for cooperative learning and problem solving in the course that cooperative learning attitudes would not be affected by web-based learning self-efficacy.

CONCLUSIONS

Flipped teaching is a popular teaching strategy currently; however, it takes a lot of time and manpower to have online materials or online films able to delivery course points. Such restrictions have current teachers focus on course data or instructional PPT collection, but not provide teaching films recorded aiming at the course. To change such a dilemma, common lesson preparation among teachers might be an effective method. Having teachers with the same subject discuss with each other and mutually support and record the teaching films could largely reduce the time for lesson preparation. Besides, to have students actually watch films on the teaching platform before the course, teachers have to think of the reward and confirmation mechanism, e.g. answering questions after watching teaching films or writing opinions on the teaching platform, to effectively achieve flipped teaching. What is more, although the Internet is popular, few students do not have fast Internet access at home to watch teaching films. Consequently, a teacher should understand all students' conditions before applying flipped teaching so as to smoothly precede the teaching activity. The application of flipped teaching supported cooperative learning in this study allows students watching teaching films on the teaching platform before the course and then preceding cooperative learning in the classroom. Future researchers could apply online cooperative learning to continuously discuss the relationship between flipped teaching and learning outcome.

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Influence of Mobile Media Application on University Students' Psychological Health Education

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ABSTRACT
The emergence of mobile media has brought new opportunities and severe tests to the ideological and political education in universities. In order to improve and implement the effectiveness of ideological and political education of university students, we must fully realize that mobile media has become a new domain of ideological and political education. Ideological and political workers should strengthen the ideological and political education of university students under the influence of mobile media. This article takes the mobile phone media as a clue, and leads to the reflection of university students' mental health education. It aims to promote the benign development of mobile media, and calls on the community to pay more attention to the psychological health education of university students. The multiple linear regression model is applied to study the influence of mobile phone media application on mental health education of university students, the positive and negative influence of mobile phone media on university students' psychological health education in university students' cognitive ability, communicative ability, life and emotion regulation ability and other aspects are obtained, and the improvement strategies are proposed.

Keywords: mobile media, university students, psychological health education

INTRODUCTION

With the rapid development of modern information technology, the new media based on mobile phones have begun to interfere with people's lives and have a profound and extensive impact on people's lives (Apouey, Clark, 2015). Mobile media is the highest form of media coverage in new media, and has gradually become a necessary tool in people's lives, which has also increased the possibility of mobile media selection (Li, 2017). At the same time, as a mobile phone can transfer and access to information of high quality media platform, so that consumers understand the major events in each region whenever and wherever possible, which broadens people's access to information channels, also facilitates the exchange and communication between people (Bowers, 2015; Chen, 2016).

Mobile phones have a significant impact on university students' learning and life, and even more influence the development of university students' mental health (Dai, 2016; Gilhuly, 2015). In the process of using and innovating mobile media, people can deeply feel the benefits of mobile media to consumers, but the inherent lack

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Contribution of this paper to the literature

- Multiple linear regression model is used to study the impact of mobile media applications on university students' mental health education, data analysis and the results are reliable.
- Independent variables are certificated by reliability and validity analysis, and the results are reasonable and strong.
- The author puts forward some countermeasures for the university students' mental health education under the application of mobile media.

of mobile media also makes experts and scholars worried (Guan, Chen, 2015). Students can not only browse more "positive energy" essays through the circle of friends, but also may not recognize the subtly malicious with full conspiracy theory, therefore, it needs to face the influence of mobile phone application on university students' psychological health. As a typical representative of new era high-tech, mobile phone new media not only breaks the rigid mode of information dissemination in traditional media, but also makes up for the disadvantages of traditional media which is not carrying or moving.

REVIEW OF RESEARCH STATUS

Domestic Research Status

In China, the mobile media not only shocked the traditional media, but also impacted the traditional mode of ideological and political education of university students. Bad interpersonal relationship will increase university students' sense of frustration, stimulate internal conflicts, and lead to a series of adverse emotional reactions, affecting physical and mental health (Hu, Chen, 2015). "Introduction of Mobile Phone Media" edited by Kuang Wenbo is the first teaching book to study mobile phone media in China, in which a theory model of mobile phone media research was introduced. Other books also study the mobile media and ideological and political education from different angles and different branches. In related papers, from 2000 to 2016, 588299 articles about mobile phone media in China were published. Obviously, in the rapidly changing social environment and cultural atmosphere, the mobile media has received more and more attention from domestic political researchers (Higgins, et, al., 2015).

Foreign Research Status

In foreign country, there are many researches on mobile phones and new media, mostly in the form of books. Meyrowitz, an American communications scientist, believes that the electronic media have contributed to the consolidation of many old situations (Kim, et, al., 2015). With the popularity of electronic media, he says, the situation is changing because of the simplicity of their code of communication. Text, pictures, audio, video and other forms of media content can be obtained from the mobile phone, with integrated information dissemination advantages. Paul Levinson also expounds the importance of mobile media in his book. "There are two basic ways of human communication: speaking and walking." Unfortunately, since the birth of mankind, these two functions began to split, until the mobile phone turned out, the two relative functions are integrated, and set in one. Mobile phones alone make people talking with walking and texting with walking. As a result, people liberated from the machine and confined room, into nature, roaming the world. The unlimited two-way communication potential of wireless mobile make mobile phones to become the most media of information dissemination." (Lee, 2015; Nolte, 2016).

METHOD

The rich network culture of mobile phone media makes students having a new life experience, but also promoting the innovation of university students' thinking mode, it is an important way to improve their cognitive ability, social and cultural life of the (Wang, 2015). But the widespread use of mobile phones has also made the potential weaknesses of the network rapidly expanding. Simply use the mobile phone media will make students

Table 1. Reliability analysis of influencing factors of university students' mental health education

	Cronbach α coefficient	α coefficient after removal of the item
University students' psychological health education	0.755	
X_1		0.745
X_2		0.756
X_3		0.675

Table 2. Validity analysis of influencing factors of university students' mental health education

	Factors	Factor loading	KMO value	Sig value
Financial organization learning ability	X_1	0.646	0.745	0.000
	X_2	0.632		
	X_3	0.545		

have psychological dependence on the frequent contact, mobile phone media will also make their cognitive level and self-control ability decreased rapidly, even tempered, anxiety, and lack of morbid psychological security (Wang, Yu, 2016).

In this paper, university students' psychological health education is taken as a dependent variable y, university students' cognitive ability x_1, university students' communicative competence x_2 and the students' emotion regulation ability x_3 are taken as independent variables. First of all, the reliability of this model application scale is shown in **Table 1**.

The Cronbach α coefficient of the scale is higher than 0.7 through the previous table, and the α coefficient will not be significantly improved after the deletion of any item, indicating that the scale is tested by reliability. The validity of this scale is shown in **Table 2**.

As shown in **Table 1** and **Table 2**, KMO value is larger than 0.7, each factor load is larger than 0.5, and through the significance test, the data is valid.

This paper uses multiple linear regression model to study the impact of mobile media application on university students' mental health education, and the specific formula of multiple linear regression model is as follows:

$$y_t = x_t\beta_t + \mu_t \tag{1}$$

where, $t = 1,2,\dots,N$.

In formula (1), the dependent variable y_t is the mental health education of university students. The independent variable x_t is the variable of mobile media application, β_t is the independent variable coefficient, and μ_t is the column vector of interference term (Li, 2017).

Formula (1) is written in matrix form as:

$$\begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_N \end{pmatrix} = \begin{pmatrix} x_1 & 0 & \cdots & 0 \\ 0 & x_2 & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \cdots & 0 & x_N \end{pmatrix} \begin{pmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_N \end{pmatrix} + \begin{pmatrix} \mu_1 \\ \mu_2 \\ \vdots \\ \mu_N \end{pmatrix} \tag{2}$$

The formula for estimating the independent variable coefficients using the maximum likelihood estimation method is as follows:

$$Q = \sum_{i=1}^{n} \hat{u_i}^2 = \hat{u}'\hat{u} = (Y - Xb)'(Y - Xb) \tag{3}$$

When the normal equations are established, the coefficients of the out variables can be estimated, and the formula is as follows:

$$b = (X'X)^{-1}X'Y \tag{4}$$

The residual formula for dependent variables is as follows:

$$RSS = \sum_{i=1}^{N} \hat{u_i^2} = \sum_{i=1}^{N} \left(y_i - \hat{y_i}\right)^2 = \sum_{i=1}^{N} (y_i - \mu_0 - \beta_i x_i)^2 \tag{5}$$

It can be seen from the above formula calculation that the use of mobile phone media by students can help to improve the cognitive ability, help students deal with emotional problems, and improve the effectiveness of mental health education. But at the same time, mobile phone media applications will have a negative impact on university students, it will take disorder cognitive, low mental health education ability, reducing communication lags behind the development of mobile phone media etc.

RESULTS

Mobile Media Applications have a Positive Impact on University Students

To promote the development of cognitive ability of university students. Compared with traditional media, mobile media has broadened the channels of information sources for university students and improved their cognitive ability. Mobile media can overcome the obstacles of information dissemination in time and space, and enable students to accept various kinds of information easily and happily anytime, anywhere. The information on the one hand increase the students' information storage capacity, on the other hand, it can shorten the time to get information and use effective information for students, the learning efficiency is greatly improved (Yu, Wang, 2017). The application of mobile media to university students can deepen their perception of the external things, and help to establish a sound psychological mechanism.

To broaden the channels of emotion regulation. The use of mobile media for university students provides a channel for their emotional adjustment and expression, and to a certain extent, reduces the possibility of university students' abnormal emotions and their lost status. The one-way communication model in traditional communication tools has long been unable to meet the needs of contemporary university students (Zhou, Chen, 2015). Today, the integration of traditional and new media produced a typical media - mobile phone media, it not only has the function of mass media, and the media has changed the traditional one-way linear mode of transmission, for university students it opens a new emotional communication and emotional release place and broaden the interpersonal communication mode university students.

To improve the effectiveness of mental health education. The widespread popularity of mobile media has changed the traditional face-to-face teaching mode between teachers and students. Mobile phone network can conveniently and quickly spread the mode of education such as "one to many" and "many to many", saving resources, but also optimizing the allocation of resources and the efficiency of teaching education is improved, in addition, the activities space of mental health education workers and teachers is broaden, to strengthen the students' attention on their own the mental health education, and facilitate mental health education work smoothly. For example, the Fudan University has established a WeChat open public platform for mental health education, in which students can browse the healing picture, accept mental health video and film recommendation, It is more helpful for students to receive primary mental health counseling than the traditional face-to-face model.

The Negative Impact of Mobile Media Applications on University Students

The dissemination of bad information results in cognitive confusion. The spread of good and bad mixed information can easily lead to cognitive confusion among university students. In the virtual world, the curiosity and the different psychology of university students have been satisfied, but if things go on like this, it easy to have a strong sense of alienation and the sense of exclusion of real life. Excessive dependence on the virtual network in

the world, will eventually lead to a loss of trust in real life, and the students' cognitive will be disorder. Similarly, the quick way to get the information you need will also make university students less willing to think and reject deep-seated questions. mobile phone media opens channel for information transmission, the channel is the channel of students to get the information, also to earn petty profits by some bad businesses, who get the convenience to cheat students. It is difficult for university students to trust again after they are cheated, and these phenomena can lead to the lack of social identity, which leads to the morbid psychology of university students.

To reduce students' communicative competence. Excessive use of mobile media by university students will make their emotions indifferent and their interpersonal skills declined. First of all, mobile phone media breaks the boundaries of reality and the virtual world, many university students cannot extricate themselves in mobile phone games and entertainment software, and limit them in the mobile phone to communicate with the outside. Secondly, the handset network has the concealment and the virtuality. University students often do not know each other's identity and appearance when they are engaged in social interaction, and this way of information communication can also make interpersonal communication untrue. Finally, the study found that excessive use of mobile media can make university students apathetic, which is not conducive to their physical and mental health development.

Mental health education lags behind the development of mobile media. The development of mobile media technology has brought great difficulties to the smooth progress of university students' mental health education. The pace of development of psychological health education work lags far behind the mobile phone media, but students have used the mobile phone media hundreds of times, the development of students' mental health education is extremely unfavorable. The traditional mode of education and the old-fashioned way of communication are no longer adapt to the new media under the impact of mobile phone media age, mental health education in university class does not keep pace with the times, so that university mental health education faces new challenges.

DISCUSSION

Countermeasures for promoting psychological health education of university students under mobile media environment:

To carry out media literacy education for university students. In view of contemporary university students' cognition of mobile phone media is still in the surface, Before the psychological health education for university students of which mobile media is as the carrier, it is necessary to start the media quality education, to improve cognitive ability and judgment ability of university students, so that the resistance of students to the negative impact of the mobile phone media has been further improved. At the same time, universities can also open some psychological communication classroom based on mobile phone network, encourage university students and teachers to take full advantage of this platform to solve their own psychological problems, help students correctly recognize the advantages and disadvantages of using mobile media, and persuade them to moderate and rational use of mobile media.

To strengthen the construction and management of mobile phone network culture, and create a favorable mobile phone network environment. For young university students whose self-control is weak, it is necessary to establish an appropriate network supervision and management system. The school should strengthen the standardization degree of using mobile phone media in university students' life and learning process, difficulties and doubts can also be paid attention to students through the campus network in campus life encounter, so as to timely help break through difficult points smoothly, and create favorable conditions for them to set up correct views. Only by strengthening the supervision and management of campus mobile phone network cultural information can we create a relatively suitable environment for university students to correctly use mobile media.

CONCLUSION

Mobile media not only affects the learning behavior and reading habits of university students, but also deeply influences the psychological health education of university students. The concealment and virtuality of mobile media itself have aroused the concern of scholars and researchers. Based on the analysis of the features of mobile phone media and mental health education, this paper focuses on the analysis of the psychological health education of university students under the influence of mobile phone media, and strives to develop more comprehensive and effective coping strategies, to enhance students' sense of responsibility and media ethics, and achieve true social value.

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Analysis of the Role of New Media in University Students' Mental Health Education System

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ABSTRACT

The emergence and development of new media has a great influence on people's life, study, thought and mental health, especially the psychological impact on contemporary university students. The rapid development of the network brings not only new opportunities to the university students' mental health education, but also a severe challenge to the traditional methods and content of the work. In order to improve the negative influence of the new media, in this paper, the development of new media is taken as the starting point, and combined with the characteristics of psychological development of contemporary young university students, the double influence of new media development on the development of university students' mental health is expounded. Then, the data analysis is used to verify the results, and corresponding solving measures are proposed, to promote "one to many" mode of education, even more to achieve the education development model of "many to many", realizing effective utilization and reasonable allocation of resources. At the same time, to create a virtual educational exchanges network environment makes the young university students forgetting the identity barriers between teachers and students, which is more conducive to the students in the process of psychological counseling, improves the timeliness and pertinence of mental health education of university students.

Keywords: new media, university students, mental health, education system

INTRODUCTION

With the rapid development of information technology, new media, which are different from traditional media, are getting involved in people's lives. It is based on the digital information, and with the network media as the carrier, has broken the traditional rigid media dissemination way, broken through the communication between people in time and space limitations, and the advantages of interactive communication and strong have attracted people's eyes (Bouris, Hill, 2017). Among them, university students become the largest and most lively crowd in the use of new media. Education departments and institutions of higher learning have done a great deal of work in promoting and strengthening the mental health education of university students. They have made active exploration and achieved some successful experiences and obvious results. But on the whole, the mental health education of university students cannot adapt to the development of the situation, especially the need of promoting quality education in an all-round way. And after the new media is involved in our daily life, the mental health education faces new opportunities and challenges (Choi, et, al., 2016). The Internet, as a tool for information transmission and communication, has begun to penetrate into every corner of our lives. As an information intensive place, the

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Contribution of this paper to the literature

- This paper analyzes the negative influence of the new media environment on university students' mental health education, and puts forward corresponding strategies from the practical point of view.
- It is innovative to use data analysis of the related problems of university students' mental health education.
- Principal components in data are analyzed by factor analysis to validate the reliability of the data studied in this paper.

information globalization has brought many new situations, problems and new phenomena to the mental health education in universities. It also provides a wider space for mental health education in universities. For young university students, it is not only a learning tool for communication, but also a kind of sustenance of the soul, thus, a series of social problems also surfaced, the mental health of university students has become the most concerned issue of all walks of life (Chen, Yang, 2017). In the course of its spread and development, new media has helped university students develop their horizons and communicate with each other. At the same time, it also seriously affects the healthy development of university students' mind and body (Chen, Qin, 2016). The value judgment and moral judgment on the quantitative change caused the students' understanding and thinking way of qualitative change, once to the extreme, it is bound to cause many negative effects, is likely to lead to a variety of mental illness, while the number of students who obsessed with online and dropped out of school increased year by year. How to meet the challenges of the internet age and do a good job in the mental health education of university students is a major task for the mental health educators in universities (Hu, Chen, 2015).

REVIEW OF RESEARCH STATUS

Domestic Research Status

In China, some university students' mental health educators have been involved in the study of related fields, and there have been some findings about the application of the network to university students' mental health education. Researchers from different angles, analyzed the impact of various Internet on university students' mental health education, and put forward the following opinions: the one is the new changes in the content of university mental health education (Kim, et al., 2015). The researchers believe that in the network, the representation of the content of mental health education has from the plane to the three-dimensional, from static to dynamic, from the real-time to hyperspace. The content of the mental health education of university students has become richer and more comprehensive, and it has greater observability and more selectivity. The content of culture and science and technology in educational content has been greatly improved (Liu, 2016; Mosesnunley, 2015). The other one is that the development of the network brings new challenges to the university students' mental health education. They think that the Internet is a double-edged sword, brings the rare opportunity for university students' mental health education at the same time, it also leads to the serious challenges, the traditional concepts and methods of mental health education of university students are obviously lagging behind etc.. In short, whether it is in the theory research level by combining the mental health education of university students and computer network, or in the practice operation of university students' mental health education research, "the problem of university students' mental health education under the network environment" needs to be more in-depth research (Pei, 2015; Steele, 2015).

Foreign Research Status

At present, some foreign countries have made some substantial progress in using the network to develop students' mental health education. In the United States, for example, many educators use the Internet to learn about the learning, life and work conditions of students. Tens of thousands of teachers are using this Internet to effectively develop the psychological education of Internet users. The Internet is changing the relationship between students, teachers and parents in a radical way. Parents and teachers can always keep in touch by e-mail (Trigylidas, et, al., 2016). Those students who have bad grades and poor psychological qualities are only stressed by Internet users,

but on the other hand, they are no longer hiding or deceiving between them and their parents. This helps to be honest with each other because your parents have mastered all the facts (Tasmania, 2015; Wu, 2016). This combination of family education and school education is more conducive to the students needed to receive education, and improve their self-care quality. These countries have carried out the practice of students' mental health education on the internet, which has provided valuable experience for the development of mental health education for university students in the internet age (Wang, Yu, 2016).

METHODS

Today, the new media development faster and faster, the effect on young university students' daily life and psychology healthy development is also growing. The extensive use of new media affects the information cognition itself on the effectiveness and correctness of young university students (Yu, Wang, 2017). But the development of the new media has both advantages and disadvantages. For contemporary university students, it has a negative impact on university students' psychological and life, at the same time, we must also face the positive effects of it. The new media is a platform for contemporary university students to better understand the society and realize their socialization (Zhang, et, al., 2017).

This paper uses data analysis method to analyze the effect of new media on university students' mental health education. University students' socialization, network dependence, communicative competence are expressed as p_c, p_s and p_r. γ is the coefficient. The τ probability of the positive function of new media in university students' mental health education subjects to binomial distribution, which can be expressed as:

$$\tau = p_c(1-\gamma) + p_s\gamma + p_r \tag{1}$$

However, in real life, for who does not form a stable world outlook, outlook on life and values, young university students extensive access to the Internet is extremely unfavorable. The negative function η of new media in university students' mental health education can be expressed as:

$$\eta = \frac{1}{\lambda p_r Q_m}\begin{pmatrix}\lambda p_r Q_m e^{I_1 T} - p_r D - \\ p_s \int_0^Q f(x)dx - p_s \\ \int_L^Q f(x)dx\end{pmatrix} \tag{2}$$

In order to integrate the mental health education of young university students into the new media activities and realize the win-win situation between the development of new media and the development of university students' mental health, it is necessary to satisfy the following conditional function $f^{-1\emptyset}(\cdot)$:

$$f^{-1\emptyset}(x) = \begin{cases}-\infty, x < 0 \\ f^{-1}(x), x \in [0,1] \\ +\infty, x > 1\end{cases} \tag{3}$$

Make ζ as the best value of mental health education for university students, p_a is the average of p_c, p_s and p_r, $p_{\max}$ is the maximum, $p_{\min}$ is the minimum, and the best value is ζ, three:

$$\zeta = \frac{p_{max} - p_{min}}{p_a} \tag{4}$$

In order to further verify the validity of the principal component in the above formula, the principal component is analyzed by factor analysis. If the factor load is less than or equal to 0.5, the data is valid. As shown in **Table 1**:

Table 1. Factor analysis of university students' mental health education

Total variance			
Components	**Characteristic value**		
	Total	**Variance %**	accumulate %
p_c	2.24	73.221	73.221
p_s	0.651	11.5	90.462
p_r	0.705	8.022	100.000

Table 1 shows that the three factors of mental health education of university students are all greater than 0.5 by principal component analysis, which shows that the scale is tested by principal component analysis.

RESULTS

The Negative Influence of New Media on the Development of University Students' Mental Health

The information in Internet is not screening information stored in database, as well as the most effective and rapid amplifier for public opinion. Widespread exposure to the Internet is extremely detrimental to young university students who have not yet formed a stable outlook on the world, outlook on life, and values. The influence of the multi-information network environment easily causes the youth university student's psychology to fall into the perplexed condition. University students are in the network virtual environment for a long time, and they are easily affected by all kinds of psychological impact. The low level of interesting, pornographic information and violent pictures in the network are likely to cause university students' cognitive bias. So, although the relevance of the new media to strengthen university students and society, promote the socialization of university students, the contemporary young university students are still in the immature stage, in the face of the fish in the network information, the students lack the ability of rational judgment. Coupled with its relatively strong curiosity, they are unable to accurately determine the network information, and easy to be induced by a lot of negative information in the network, resulting in Three Outlooks affected, and making some contrary to the social and moral behavior, which seriously affects the correctness and effectiveness of university students' cognitive information.

In addition, the pace of social, economic and cultural development is accelerating, and the time for university students to contact new media is greatly advanced. The new media represented by the Internet is a silent way to affect university students' life style, value orientation, learning habits, behavior, hobbies and mental health, which has great influence for university students on fostering good behavior and understanding the world. At present, university students are in an acceptance of new things and the most important period in shaping their own views. For the new things on the outside, they always have an eager impulse. At this time, in the face of online events, they may not think of every hue to the depth, simply believe that online speech, and depend on the use of new media to broaden their knowledge and vision. The fast storage information content of new media is not conducive to young university students to overcome their inertia, to study and explore. Indulge in the virtual world can easily make young students close ourselves, reduce their contacts with the outside world frequency, and the communication ability. The emergence of the eccentric, interpersonal indifference and other psychological alienation increase the incidence of young university students' anxiety, depression and other psychological problems.

In addition, as a tool for communication and learning, with the development of new media, it has permeated all aspects of daily life of university students. For a long time in the network virtual environment, it also increases the incidence of mental illness among young university students. The "communication" of young university students with new media is far more than with her friends and family. A majority of young university students will make their own thoughts, emotional sustenance in the Internet and other new media, which leads to that some students feel confused about life, indulge in the network to ease the minds of feelings of depression, but in real life in the wordless, indifferent performance of interpersonal relationship. On the other hand, the fast and convenient way of information transmission in new media makes it difficult for young university students to accept

the information they have gained, so they can easily accept it and increase their psychological burden. Therefore, the inappropriate use of new media is extremely detrimental to the physical and mental health of young university students. If the new media is allowed to develop at will, it will cause university students to rely more and more on it, so that it will be far from the real life and lead to morbid psychology.

The Positive Influence of New Media on the Development of University Students' Mental Health

In the life of modern university students, the advantages of new media relative to traditional media have become more and more obvious. The development of new media breaks the traditional information transmission mode of "one to one", and more is "one to many" or "many to many" forms of communication. During the period of university, young university students are in the best study period to train good character and psychological quality. It is far from enough to help people to develop by themselves. At this point, the rapid and convenient new media has provided a wide range of knowledge for the society, and it has also brought rich life information to university students. University students can use the new media to obtain the information at any time as quickly as possible, and analyze and organize them to help them make the right choice. The rapid development of new media technology can also help students grasp the life and learning skills, broaden the students' communicative field, so that it is not by its own constraints, strengthen their interpersonal ability, to help them find the self-confidence and self-esteem missing in reality life, reshape their own self-confidence, alleviate the psychological pressure of young university students, and use new media to promote the development of mental health.

In addition, the new media provides an outlet for students to vent negative emotions, relieve the feelings of depression in real life of young university students. The rapid delivery of new media provides sufficient time for young university students to broaden their horizons and greatly encourages the learning, development and psychological needs of young university students. For young students, learning in school time in the face of all the pressure is enormous, and the Internet, the mobile phone as the representative of the new media at this time has become a choice to relieve the depressed in the hearts. It does not require you to adjust their mood, don't need you with any pressure, it can let the young students in a relaxed, pleasant atmosphere to complain, to cultivate emotional stability. The development of new media can help university students enhance mental endurance to a great extent, cultivate their strong and decisive character.

In addition, the development of new media can meet the desire for knowledge of young university students, and has a positive effect on university students' understanding external things and the promotion of their own mental health. With the development of economy and culture, people's pace of life is speeding up. For young university students entering into higher education institutions, it has become a necessity for daily learning to use new media to obtain the information they need. The giant information capacity of the new media, the characteristics of rapid dissemination of information, matched with the contemporary young university students full of curiosity about the outside information. in the virtual space of new media construction, university students can be bound to abandon the traditional ideology, freedom express their views, grasp the text, sound, and make them to experience between people and social justice, which meet their desire to maintain their rights and be respected psychology. In such a space of independent thinking and open environment, the young university students can become the dominant person in the world, the development of new media provides a fair exchange with others and the opportunity of opening mind for university students. New media, this indispensable important link of a society, is to promote the development of its powerful charm for youth mental health of university students.

DISCUSSION

Countermeasures to promote the mental health education of university Students under the new media environment:

The development of the new media popularity is a "double-edged sword" for the young university students, and brings convenience to the study, psychological needs, spiritual help of contemporary university

students, at the same time, the information in the virtual network environment also has brought adverse effects on the students' physical and mental health development. In view of the negative influence of the development and popularization of new media on the mental health of young university students, we should start with all aspects to minimize the adverse effects.

Facing the conflict between the development of new media and the development of contemporary university students, we can adopt the following strategies to guide the development of university students' psychological health education: first, governments should be able to pay attention to the impact of new media for university students. The government should to block the websites, WeChat public number who spread bad information, but also respond to the popularity of young university students' self-understanding, deepen self-experience and self-control to maintain their mental health, and promote the healthy development of young university students. The government should properly guide the healthy development of the new media, so that students avoid excessive reliance on new media, or indulge network to create a virtual environment, resulting in physical and psychological development unbalanced, etc.

Secondly, in the face of the impact of new media development on contemporary university students, the major universities should improve their work, and strive to adapt to the impact of the media on the mental health education of university students. In the construction of university students' mental health education propaganda platform, it should increase investment in the construction of new media, making that the campus becomes able to provide convenient services for the learning of contemporary university students. According to the characteristics of school education, the relevant contents of university students' mental health education should be loaded on the campus new media website, so as to create new media with campus characteristics.

CONCLUSION

As a far-reaching technological revolution, the Internet is a new weapon and a new means of understanding the world and transforming the world under the modern conditions. The combination of Internet and university students' mental health education will bring about the innovation of university Students' mental health education and make the mental health education of university students get all kinds of new opportunities. At the same time, the computer network will bring many new situations and new problems to the university students' mental health education. With the rapid development of new media forms, it requires the education workers to improve occupation quality, media quality, to adapt to the construction of the quality in the new media environment, and make them learn to carry out psychological education for contemporary university students using the new media, to implement the win-win situation in mental health education of university students.

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Analysis of the Impact of New Media Era on Traditional Computer Education

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ABSTRACT
With the continuous popularization of Internet, the influence of new media permeates all fields and levels of society. The arrival of the new media era has brought great influence to the traditional computer education. On the one hand, it provides opportunities for computer teachers to improve their teaching ability and knowledge level, and on the other hand, they bring a certain impact. For computer teachers, how to seize the opportunities brought about by the new media era, and meet the challenges, has become a new topic. All computer teachers should attach great importance to the impact of the new media era, raise the level of computer teaching, and maintains a certain self-control, moral awareness and legal awareness, so that the new media can be used rationally. This paper firstly analyzes the existing traditional computer education under the new media era of the problem, and then elaborates on the positive impact and negative effects of the new media era on the traditional computer education. In addition, the regression model and the factors of negative impact of new media on traditional computer education are analyzed. Finally, it points out that: on the one hand, the computer teacher should speed up the learning of new technologies, explore new teaching methods, change teaching ideas, master the concept and basic knowledge of new media, the use of new media, and the understanding of new media environment, as well as the ethics and safety awareness of new media. On the other hand, new media literacy should be introduced into the computer class. Teachers and students should strengthen the new media literacy, and let students actively participate in activities, to maintain and improve the knowledge of computer. Only in this way can we improve the quality of computer teaching, make better use of new media for computer learning, and make the traditional computer education glowing with new vitality.

Keywords: new media era, computer education, impact

INTRODUCTION

With the continuous development of computer technology and network technology, human society has entered a new era of media. New media is a new form of media, information dissemination mainly depends on the network technology. The popularization of Internet makes the new media's influence has penetrated into the society in various fields and levels (Bao, 2016). The new media is a form of media accompanied by network technology, which is relative to the traditional media such as newspapers, radio and television (Fu, 2017). The reform of computer teaching has always been a hot issue in the field of education and computer enthusiasts. With the advent of the new media era, more and more people begin to use the impact of the new media era on traditional computer education as a new research topic (Curini, Lacus, Canova, 2015).

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Contribution of this paper to the literature

- Using linear regression model to analyze the correlation of each variable and the factor coefficients, and drawing the conclusions of data research;
- First of all, the traditional computer education problems are studied; secondly, according to the problems, in-depth analysis of influencing factors is carried out, and corresponding improvement strategy are given;
- Around the era of new media, traditional computer education, multi-angle narrative is performed, which has reference value.

In the new media, the traditional computer teaching methods will be greatly affected. First of all, multimedia assisted instruction has become the development trend of computer teaching, and various new teaching methods have emerged at the same time as the new media era, such as micro class teaching method (Cheng, Wang, 2015). And students' enthusiasm for computer learning is also bound up with the teaching methods of computers. The traditional teaching methods have certain advantages, but compared to the new media era, the teaching methods still have a lot of shortcomings, resulting in that the computer teaching effect is not satisfactory. In this case, the vast number of computer workers should adapt to the trend of the times, and constantly improve the ability to use new media (Huang, 2016; Juan, 2015).

The current research on the impact of the new media era on traditional computer education is mainly reflected in the following three aspects: first, the role of new media technology in traditional computer education, and the existing advantages of the new media era compared to classroom teaching form; second, the influence of new media era on self-regulated learning computer knowledge of students; third, application of new teaching methods in the emergence of new media era in computer teaching. The above research results have promoted the impact of the new media era on computer education to a great extent (Huang, et, al., 2016). However, there are few studies on the change of traditional computer education in the new media era. Therefore, changes of computer teachers based on the new media era is the focus of the study, and that the computer teachers should be teaching in the new era is pointed out; on the other hand, role change and self – positioning should be done again, to strengthen the quality of new media (Liu, 2016; Liu, 2017). Only in this way can we adapt to the impact of the new media era on traditional computer education, so as to improve the level of computer education.

REVIEW OF RESEARCH STATUS

The domestic scholars found that, at present, the traditional computer education mainly has the following problems: first, the problems existing in the computer knowledge; second, computer teachers lack sufficient preparation in the psychological level. In order to adapt to the new requirements of traditional computer education in the new media era, the traditional reform of computer teaching is imperative. This reform will be a comprehensive and thorough innovation. The content of the reform is the various aspects involved in computer teaching, with emphasis on computer knowledge, teaching methods and other aspects of innovation (Pusaksrikit, Kang, 2016). At the same time, from the aspect of computer teachers, the construction of computer teachers should take the form and the present situation of the new media era into consideration and understand the problems faced in computer education as a breakthrough and a foothold. First of all, from the aspect of computer teachers, there are many computer teachers who stick to the traditional methods of computer teaching and don't want to change it. The teaching philosophy needs to be improved (Patchen, Smithenry, 2015). Although the reform of the traditional teaching of the computer work has been ongoing, there are still a lot of computer teacher understanding of computer teaching reform is not in place, many domestic scholars believe that such reform is specious writing which cannot solve the deeper problems, therefore, it also need to attract enough attention in the mind (Rubera et al. 2016). Some computer teachers do not pay attention to conform to the current era of new media, still follow the traditional teaching method of computer teaching, for example, network teaching cannot be effectively used, some teachers even never use new media teaching methods in computer teaching, leading to the fact of that the teaching effect of traditional classroom is serious stereotype and cannot effectively mobilize the students' activities (Rehm et al., 2015). Although some teachers have used multimedia teaching means to do the teaching of computer, the

range is very limited; And some only use simple music or video teaching, new teaching methods do not give full play to the role of new media. At the same time, many foreign scholars believe that many computer teachers need to change their roles. In the traditional computer teaching mode, teachers act as the role of a knowledge initiator. In this teaching mode, the computer teacher is the source of all computer knowledge for students, and also the judge of the accuracy of all computer knowledge. They play a leading role in the classroom. Computer teachers grow up in the traditional teaching mode, so in the era of new media, it is often difficult to integrate their role positioning with the new media era, which makes computer teachers' knowledge level to determine the quality of teaching. If the teacher's teaching level is higher, then his computer teaching effect is higher and vice versa (Zhong, et, al., 2016).

METHODS

The Influence of New Media Era on Traditional Computer Education

The positive influence of the new media era on traditional computer education. The rapid development of new media has profoundly changed the traditional mode of computer teaching and the atmosphere of computer teaching class. In the course of teaching, teachers can keep abreast of the progress of teaching, change teaching means, and control the progress of teaching according to each student's learning situation (Zhao, 2016). For example, in the computer teaching methods, teachers can use WeChat, QQ group, send the focus of the knowledge to students' mobile phone, let students learn targeted. By using micro-blog, WeChat and QQ group, teachers can carry out real-time communication with students, so that when students encounter difficult problems, they can solved them in time; the teacher can also push computer knowledge to every student's mobile phone through the creation of WeChat public number, and let students expand their knowledge. In short, as long as we make full use of the new teaching methods in the new media era, we can effectively improve the quality of computer teaching and improve students' interest in learning computers.

The negative influence of the new media era on traditional computer education. The new media in computer teaching also has a negative side, first of all, in the computer classroom teaching, many students will play with mobile phones, tablet computers and so on. The teacher is in the class, but students will secretly use mobile phone or tablet computer to play games, Internet, chat and so on (Zhu et al., 2017). The learning process of the computer need to concentrate, if students wander in the study, it is difficult to guarantee the computer learning effect; secondly, after class, the teacher arranges some tasks, students will depend too much on the network, it will make a lot of knowledge is not strong, even there will be watching forget, which reduces the computer learning effect; thirdly, many students rely too heavily on the use of electronic products and electronic products, play games, chat, Internet and so on, it will be a long time with Internet addiction.

The Negative Influence Factors of New Media on Traditional Computer Education

To some extent, the negative effects of the new media era on traditional computing education are due to the lack of education aimed at new media literacy. The lack of new media literacy in traditional computer education has led to the lack of new media literacy among computer majors. To maintain a certain self-control, moral awareness and legal awareness are the key to a person's rational use of new media.

In this study, multiple linear regression model is applied to analyze the negative impact of new media on traditional computer education:

$$y_i = \beta + \alpha_i x_i \tag{1}$$

The difference between the estimate and the actual value is expressed as residuals, and the exact formula is as follows:

$$\hat{u}_i = \hat{y}_i - \beta - \alpha_i x_i \tag{2}$$

Table 1. Coefficient of correlation of variables

γ	x_1	x_2	x_3	y
x_1	1	0.2351	0.4354	0.4613
x_2		1	0.1450	0.4619
x_3			1	0.8465
y				1

Table 2. Negative impact of new media on traditional computer education

Dependent Variable: Y				
Included observations: 500				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-102.4561	0.7032	5.5803	0.0010
x_1	2.4356	0.5658	6.4381	0.0484
x_2	12.2023	0.5475	1.5680	0.0137
x_3	9.9552	0.0676	2.5682	0.0547

The regression coefficients of the model are calculated as follows:

$$RSS = \sum_{i=1}^{N} \hat{u_i^2} = \sum_{i=1}^{N} (y_i - \beta - \alpha_i x_i)^2 \tag{3}$$

Based on this model, this research chooses three indexes to construct the negative impact of new media on traditional computer education factors, which reflect the students' understanding of new media. Where, x_1 reflects the students' understanding of new media, x_2 reflects school computer education, and x_3 reflects the quality of computer teachers. In this paper, the correlation coefficient between variables is calculated by correlation analysis, and the formula is as follows:

$$\gamma = \frac{L_{ij}}{\sqrt{L_{ii}}\sqrt{L_{jj}}} \tag{4}$$

In formula (4), L_{ij} is the sum of squares of discrete differences between variables. The correlation coefficients between the variables obtained are shown in **Table 1**.

According to the coefficient of correlation between variables in **Table 1**, the regression coefficients of multiple regression equations are calculated:

$$\hat{y} = 512 - 24x_1 + 79x_2 + 10x_3 - 72x_4 + 8x_5 \tag{5}$$

According to equation (5), it can be calculated the comprehensive score of negative effects factors of new media on traditional computer education. Taking into account the needs to handle large amounts of data in this study, the comprehensive score of negative influence factors in traditional computer education is made rounding, so as to do computer simulation regression.

According to the above formula, the results shown in **Table 2** can be obtained.

As can be seen from **Table 2**, the regression items have basically passed the significant level test of 5%, indicating that the regression results are high in reliability as a whole. The greater the regression coefficient of regression variables on the dependent variables is, the greater the impact is. It can be seen that the negative impact of new media on traditional computer education is large, the estimated value, the actual value and the residuals of the dependent variable are as shown in **Figure 1**.

From the research results we can see that our traditional computer education in new media literacy is still at a low level. By enhancing students' understanding of new media, school computer education and strengthening new media contacts of computer teachers, it has played a significant role in improving the quality of students' new media.

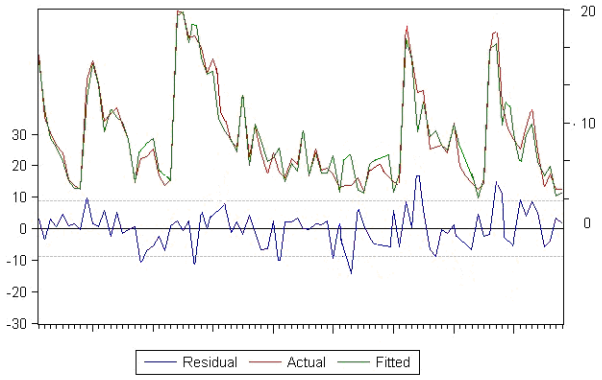

Figure 1. Sketch map of actual value, estimated value and residual of the dependent variable

RESULTS

The Reasons for the Negative Impact of New Media on Traditional Computer Education

At present, computer science major in most schools of China has established the campus network or LAN, and the computer network teaching is basically realized, however, school education is mainly to improve their computer skills, while ignoring the new media literacy education of students, because students lack of new media literacy, which cannot correctly use new media. Some school campus network cannot play its due role, it is just simply used to transfer files, do computerized office, and search information on Internet, which lacks of computer knowledge, so it is difficult to attract more students, and unable to guide students to improve the quality of new media. Therefore, students have a lot of blindness in the use of new media, and cannot accurately locate new media, resulting in students' wrong understanding of new media, and therefore using the new media incorrectly.

Secondly, as the computer teachers themselves, their behavior will have a profound impact on students, many school computer teachers usually have very little contact with new media, do not know how to use new media, and do not innovate computer teaching methods through the new media. For the students' confusion and doubt in the new media era, many computer teachers are not able to solve them accurately. Some computer teachers will have a negative impact on students, and students are unable to be correctly guided in the use of new media.

The Countermeasures for the Negative Impact of New Media on Traditional Computer Education

According to the current development of new media, the computer major of each school should gradually improve the school rules and discipline, especially strict the classroom discipline in computer teaching, such as in the computer class or the examination, students are not allowed to carry mobile phone. In students' computer students' life, strict restrictions should be placed on the time of students contacting new media, so that both wired and wireless networks can be effectively controlled. In the process of using new media, teachers should take full control of classroom discipline, communicate with students and make use of new media to stimulate students' initiative and enthusiasm in learning computers. Computer teachers should also continue to explore new media under the new teaching methods, and change the passive to active. New media is as a new channel for students to acquire knowledge.

In the computer class, if the students are found deserted, the teacher should correct and remind in time, and make reasonable punishment when necessary, so as to keep the students' attention and interest in learning. In spare time, it should make full use of the new media to set up a learning platform, such as micro-blog, WeChat or QQ group, and held some computer activities, which should be some ideas to attract students attention, and let students actively participate in activities, to maintain and improve the knowledge of computer in the interest.

Teachers should strive to do the following in the new media era: the first is to understand the new changes of computer education under the new media environment, and comprehensively grasp the characteristics of Computer Science in new media; the second is to understand the development trend of new media, grasp the latest development results, for better servicing computer education; the third is to explore the combination of new media and computer education, continue to explore the appropriate countermeasures, actively use the advantages of new media, and constantly improve the quality of computer education.

DISCUSSION

The traditional computer education in China lacks the content of new media literacy. At present, the important content of computer education in China is the courses of computer basic knowledge and knowledge of the network, so the ideological content of new media is very weak, which makes the computer course has been stuck in the computer basic education and skills and unable to meet the requirements of the new media era. Most schools offer new media literacy courses only in the media profession, while there is no new media literacy in the computer profession. The characteristics of China's traditional examination oriented education determines the students too dependent on school education, so it is difficult to rely on their own initiative to strengthen new media literacy, and the lack of schools in this area also causes students to face the confusion in new media era.

Over time, the impact of the new media on the traditional computer education is more and more big, to this end, we must continue to explore corresponding countermeasures, so as to reduce the negative influence of the new media era. The new media literacy education should be introduced into traditional computer teaching. New media literacy education should include the following contents: mastering the new media concept, basic knowledge and the application of new media, understanding of the new media environment, and grasping the moral quality and safety awareness of the new media master etc.. Only by improving the new media literacy of teachers and students can we make better use of new media for computer learning.

CONCLUSION

The continuous development of new media has a great influence on the traditional computer education, both positive and negative effects. As the teacher and student are in new media era, it is necessary to improve the knowledge of new media, but also has the new media literacy. Only by constantly innovating the teaching methods of computer and giving full play to the role of new media, can we adapt to the development requirements of the new media era and bring new vitality to the traditional computer education.

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Current Status and Development Strategies of Ideological and Political Education on Cultivating Innovation & Enterprise Ability of University Students

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ABSTRACT
The ideological and political education plays a crucial role in shaping the entrepreneurial concept of university students because it influences their life outlook, value outlook and world outlook. Therefore, the education has a significant influence on shaping the entrepreneurial ability of university students. The ideological and political education precedes the entrepreneurial spirit in practice. It starts from the entrepreneurial spirit of university students and gradually establishes the students' entrepreneurial consciousness through the later cultivation. The cultivation of enough entrepreneurial consciousness could drive the entrepreneurial behavior. Moreover, the entrepreneurial capability could not be described by single parameters, and it requires a comprehensive evaluation including professional ability, communication ability, decision-making ability, mental ability, vocational ability, management ability, values, etc. The ideological and political education involves multiple factors including the entrepreneurial capability. It is intended to cultivate students in terms of thought, experience, management, market, etc., analyze the comprehensive performance of students' entrepreneurial capability thoroughly and put forward specific guidance. The innovation and entrepreneurship education could give play to its positive guidance, conversion and standardization by fusing the elements of the ideological and political education. It constantly motivates the fighting wills of university students as well as their courage to overcome difficulties in the entrepreneurial process, and promotes the core competitiveness of university students in the future employment, entrepreneurship and career. By conducting a systematic analysis of the entrepreneurial situation and policies released by the Chinese government and combining the entrepreneurial mental health education with the service teaching, the educational concept of the innovation thought is quickly established, the discovery ability of entrepreneurial capability among students is emphasized, and the vertical entrepreneurial education progressive mode is established in which university students are guided to firmly and calmly carry out the entrepreneurial study and practice in the ideological and political education.

Keywords: ideological and political education, entrepreneurial education, entrepreneurial capability, service

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Contribution of this paper to the literature

- The prediction model is constructed to predict university students' innovation and entrepreneurial ability, avoiding impractical conjectures and discussion.
- This paper analyzes the influences of the ideological and political education on university students' innovation and entrepreneurial ability in an all-around way. Moreover, it provides specific advice from a professional perspective.
- This paper lists several effective means for university students to start up their businesses, and it makes the solutions more specific and practical, laying foundations for further study. The prediction model is constructed to predict university students' innovation and entrepreneurial ability, avoiding impractical conjectures and discussion.

INTRODUCTION

As a comprehensive and practical subject system, the ideological and political education has been receiving great concerns from China and the Chinese society. In the new period, the characteristics of the times are adhered to, hot social topics are centered on, and the functions of the ideological and political education are fully achieved to solve the actual problems of the Chinese society, colleges and universities and university students in the ideological and political education (Wang, 2015).

The increasingly severe employment situation has turned the innovation and entrepreneurial education into an important course of the university education. The innovation and entrepreneurial education is intended to cultivate and enhance the basic quality of students' entrepreneurship and their entrepreneurial capability, preparing fully qualified entrepreneurial talents for China (Yang, 2016). The cultivation of innovational and entrepreneurial talents is driven to better serve the Chinese entrepreneurial development strategies by keeping up with the times and fusing itself with the entrepreneurial education. Based on the current development status of the entrepreneurial education, the ideological and political education starts from the entrepreneurial concept and enthusiasm of university students, helping students to clean the impractical entrepreneurial thoughts and concepts. Meanwhile, it also guides the students to see entrepreneurship with correct values and entrepreneurial views (Zhang, 2016). The inner relationship between the ideological and political education and the entrepreneurial education is found to construct the thought and concept of the innovation and entrepreneurial education and provide a comprehensive analysis of the entrepreneurial ability for university students (Cui, 2016)). The ideological and political education starts from the analysis and interpretation of the current situation and policy, focuses on cultivating the comprehensive entrepreneurial quality of university students, and realizes its rapid innovation in combination with mental health education and service education concepts. It has been a major drive to cultivate the entrepreneurial ability of university students through its full integration into the entrepreneurial education (Yan, 2016).

REVIEW ON CURRENT RESEARCH

Song and Jia (2015) mentioned that two extremes were likely to exist in the entrepreneurial education process of university students: indifferent disposal and wild enthusiasm. These are also two common reactions to the entrepreneurship and can be ascribed to the entrepreneurial enthusiasm. Investigations have been conducted on university students who have the entrepreneurial enthusiasm and these investigations show that: the expressed entrepreneurial enthusiasm of university students is seen as the impractical fantasy without understanding the market and the basic entrepreneurial knowledge in the entrepreneurial education. The university students rely on successful cases and entrepreneurial speeches to judge whether they are suitable for the entrepreneurship. Such impractical and blind entrepreneurial enthusiasm will greatly reduce the success rate of the entrepreneurship (Ding, 2015).

The ideological education should focus on changing the thinking habits of university students, guide university students to stick to their ideals and beliefs, motivate the consciousness of their responsibility and honesty

instead of resting on the initial educational functions. It should make university students realize their own responsibility shouldered in the entrepreneurial activities and help them to develop the persistent entrepreneurial spirit. These factors are subjective conditions for university students to develop the positive entrepreneurial consciousness and helps university students to know better about the entrepreneurship. Entrepreneurs establish a comprehensive entrepreneurial concept and shift from the passive entrepreneurship to the active entrepreneurship (Tang, 2015). University students are guided to interpret their entrepreneurial concepts at a higher level and combine their entrepreneurial dreams with the Chinese dream. The entrepreneurial chemical reactions are constructed in a broad environment, exerting a positive influence on the entrepreneurial education as well as the ideological and political education and promoting the entrepreneurial consciousness and ability of university students (Xie, 2017).

METHODS

Positively Guide University Students to Make Steady Progress with Ideological and Political Education

No entrepreneurial process is without ups and downs. Unpredicted difficulties and challenges of the entrepreneurial ideals and plans may come up in each link of the entrepreneurial process. Entrepreneurs could go farther only with firm entrepreneurial beliefs and the same entrepreneurial drive all the way (Gao, 2016). Firstly, the ideological and political education should give full play to its positive guidance function, helping university students to develop the entrepreneurial spirit that is featured by brave striving and innovation so that university students could turn their outstanding qualities into the sources of power on the way to entrepreneurship (Lei, 2016). Secondly, the sense of social responsibility of university students is cultivated in the education, in which university students are guided to correctly see and dispose the relationship between themselves and the society, and the students become creators to propel the social development by combining their entrepreneurial dreams with the social development. Thirdly, the ultimate goal of the entrepreneurial education should target at helping entrepreneurs to realize their self-fulfillment to the maximum. Only in this way can the fostered university students become free masters without being separated from the society (Zhu, and Wang, 2016). Fourthly, university students are guided to be rooted in the grassroots level, start from practice and bring out the best performance along with a wide coverage of the ideological and political education (Lin, 2015).

Construction of Innovation and Entrepreneurial Ability Prediction Model for University Students

In terms of the predicting method, some theories are based on university students' innovation and entrepreneurial ability for prediction, while an unpredicted model is adopted to predict the innovation and entrepreneurial ability of a single university student (Zhang, and University, 2017). The prediction process is as follows:

Supposed T_{it} is the entrepreneurial ability of a university student i in the ideological and political education t, C_i is the interference of the entrepreneurial ability under other influencing factors, and E_i is the innovation ability of a university student at school. The following equation could be obtained:

$$T_{it} = E_i - C_i \tag{1}$$

If the public company i plans to predict the degree of earnings management at the threshold value α, the threshold value α is seen as the starting point and the surplus distribution function is divided into multiple sections. If the following conditions are met, it can be proved that the function of the entrepreneurial ability for university students is smooth at the threshold value α, namely, it does not require re-treatment at the threshold value α.

$$n_1 = \frac{n_{-1} + n_2}{2} \tag{2}$$

Table 1. Analysis of university students' innovation and entrepreneurial ability

α	-2	-1	0	1	2
n_{-1}	-0.01413	-0.01486	0.04301	-0.04587	-0.03815
n_1	-0.00205	-0.04217	0.01309	-0.02131	-0.00686
n_2	0.0257	-0.01979	0.01074	-0.00321	-0.00519
η	0.02582	0.0205	0.01784	0.01589	0.01619

Suppose η is a statistic at the threshold value α in the function that is used to judge the entrepreneurial ability of university students, η can be expressed as:

$$\eta = \frac{n_1 - \frac{n_{-1} + n_2}{2}}{\sqrt{\kappa^2}} \tag{3}$$

It can be analyzed from the data of **Table 1** that: On the one hand, entrepreneurial university students must have stronger desires for entrepreneurship well beyond the reality than common university students, and this is the cornerstone for entrepreneurial talents to break away from conventions and realize their life ideals. On the other hand, entrepreneurs must have a stronger endurance than common people because starting up businesses requires unbearable efforts and the endurance of challenges and hardships are important parameters for the entrepreneurial ability.

RESULTS

The combination of the ideological and political education with the innovation and entrepreneurial education helps university students to develop the ideological morality and psychological quality required in the rational entrepreneurship by guiding the cognition and regularizing behavior. Then, university students are guided to think and study independently so that they can develop correct views on employment and entrepreneurship. After motivating the entrepreneurial consciousness and enlightening the entrepreneurial dreams, the education could teach university students to clearly understand the entrepreneurial goals and form suitable entrepreneurial emotions and cognitive attitudes. With the discovery ability of university students' innovation and entrepreneurship gradually promoted, university students could motivate the independent entrepreneurial behavior to win the development advantage and initiative.

The ideological and political education guides university students to develop good entrepreneurial qualities and personalities, which is the source of strong mind power for the entrepreneurship as well as the forerunner conditions to form the entrepreneurial power. Facing the frustrations in the entrepreneurial process, university students could keep calm and rapidly recognize their advantages and disadvantages so that they can seize good opportunities for better development. Facing the entrepreneurial success, they can keep sober-minded without a swelled head. These all reflect good psychological qualities of university students. The mental health of university student must be thoroughly considered in the entrepreneurial process because they must have strong endurance and subsistence against adversity to keep going in the entrepreneurship. Firstly, university students seek psychological counseling mostly from university counselors at the present stage. However, limited by the professional characteristics, university counselors are not highly professional in the psychological education. The psychological counseling of the entrepreneurship is technical so the ideological and political educators must enhance the ability of the mental health education in the field of entrepreneurship. Meanwhile, relevant professional trainings should be organized to help the ideological and political educators to grasp better mental education methods. An accurate understanding of common mental problems in university students' entrepreneurship could improve the pertinence and effectiveness of the entrepreneurial education in colleges and universities. Secondly, the mental education support should be enhanced in the entrepreneurial process. According to the summary of most entrepreneurs, they often ascribe the entrepreneurial hardships to such factors as the government, the society, the environment, etc. This has a large influence on university students, who may come up with various excuses when facing entrepreneurial problems or frustrations. The ideological and political education should cover the following aspects: strengthening psychological counseling and emotional comfort in the

entrepreneurial process of university students, encouraging university students to view the dilemma correctly, communicating with partners, teachers and friends, taking others' advice with an open mind, and developing the entrepreneurial of self-reliance, self-improvement and self-independence. Thirdly, a comprehensive investigation of university students' mental health should be conducted in terms of time nodes and groups so that the targeted mental counseling could be offered. Moreover, the necessary and rapid mental health education could be provided to solve psychological problems, particularly specific psychological problems of university students in the entrepreneurial process, promote the promptness of the ideological and political education, and ensure the steadiness and smoothness of university students' entrepreneurial process in the future.

DISCUSSION

It has been an important development mode to combine the ideological and political education with the entrepreneurial education in modern university education. Meanwhile, it is also an educational reform thinking necessary for the development of the times. Moreover, the educational content and educational patterns keep exploring and innovating. This study is intended to gradually enrich the ideological and political education of colleges and universities and improve the entrepreneurial education system in terms of research objects, research content and research theories.

Firstly, the ideological and political education must keep closely with the society, the economy and the technology. It gives full play to the fundamental functions including talent cultivation, scientific research and society service. With the strategic planning of "promoting employment with entrepreneurship" as the basis in China, the education explores the fusion point and the breakthrough point between itself and the entrepreneurial cultivation. Meanwhile, the fusion and mechanism is constructed to strengthen the entrepreneurial spirit, consciousness and ability in the talent cultivation as well as to meet the needs of the Chinese economic and social development in the new period.

Secondly, the education concept about the integrated development of entrepreneurial talents is deepened and the main entrepreneurial force is established. The entrepreneurial education helps university students to construct the entrepreneurial ability system, intensify the entrepreneurial cognitive attitude of university students, and make the entrepreneurial goals so that university students can have independent entrepreneurial behavior. The personalized entrepreneurial quality training program is formulated from the perspectives of ideological morality and psychological quality in the ideological and political education, guiding university students to purse the truth and uphold true knowledge. The mutual synergistic effect lays a solid foundation for the formation of university students' entrepreneurial ability and improves the comprehensive entrepreneurial competitiveness of university students by enlarging the coverage and depth of the university education.

Thirdly, both the innovation and entrepreneurial education and the ideological and political education fulfill the educational purposes by means of practice, and they are complementary to each other in terms of the teaching means. Meanwhile, the innovation and entrepreneurial education is the expansion of the practice from the ideological and political education. The innovation and entrepreneurial education should attach importance to practice, establish the practice-oriented cultivation system and serve as the inheritance and expansion of the ideological and political education means.

CONCLUSION

The ideological and political education is the first step of university students' entrepreneurial education and serves as a precondition for entrepreneurial behavior. Only with correct ideological concepts can university students go farther in the correct direction on the way to entrepreneurship. The educational functions of the ideological and political education should be dug to the maximum, and the required ideological morality and psychological qualities of university students should be firmly cultivated, guiding university students to adhering to the innovative ideological concepts and perfect personalities in the entrepreneurial process and making students reveal their entrepreneurial ability to the maximum in starting up their businesses.

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Role of Media in the Popularization of Physique Education in Higher School

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ABSTRACT
With the rise and development of various media, more and more people have become the audience affected by the media. The influence of media on people's life is more and more extensive, especially for young people, the influence is more profound and lasting. At present, the multimedia technology has been applied to the vast majority of college teaching, but the application in the teaching of physical education is still in the exploration and practice stage. This paper analyzes the significance of multimedia technology applied in college sports teaching from different aspects, and it believes that the application of multimedia technology in college sports teaching not only helps to improve teaching quality and cultivate students interested in sports, but also improve teachers' occupation accomplishment. We should use the influential of media platform, to arouse public concern on the situation of college sports, to improve the students' enthusiasm for sports, and promote the college sports education and the healthy development of Chinese adolescents.

Keywords: media, physical education, higher school

INTRODUCTION

The rapid development of modern science and technology has had an unprecedented impact on sports, so that modern sports entered into a booming scientific era (Liu, 2016). With the development of science and technology, modern teaching methods are becoming more and more advanced. People can effectively improve the quality of teaching by means of modern teaching equipment (Chen, 2016). Therefore, the application of media technology to optimize teaching methods is an important feature of modern teaching methods. At present, the promotion of computer assisted instruction and network teaching makes the interactive mode of teaching diversified and provides a new development space for modern teaching methods (You, et, al., 2016). Since the traditional teaching methods are affected by many factors, how to effectively solve these problems in the actual teaching has become the key to the reform of Physical Education (Wang, 2017). When sports teacher acts and cannot display the details of the action and the action key place, it can use the film, video and television, computer demonstration and other means to deepen students' understanding of the action, to help them master the acceleration action (Bin, Wei, 2017). As a modern teaching means, multimedia teaching is a vivid and visualized teaching, which enriches the teaching methods, and its advantages are much more than the role of visual aids (Rutten, Boen, Seghers, 2012). With the rich material level, modern teaching methods have become simple and easy.

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Contribution of this paper to the literature

- By constructing the model, we get the specific role of the media in the popularization of sports education in Higher school, and avoid vague discussions.
- The multiple functions of the media are analyzed from several perspectives, and specific opinions are given from the practical point of view.
- According to the role of the media in the university sports education, the concrete method of solving the problem is given, which provides the theoretical basis for the next research.

REVIEW OF CURRENT RESEARCHERS

Physical education in higher school not only includes teaching, but also includes courses, management, teachers, students and other aspects. In order to achieve the goal of educating people, physical education needs active cooperation in these aspects (Chen, et, al., 2014). As an advanced means of education, multimedia technology can only promote the development of physical education in higher school when it is applied to all aspects of physical education (Yang, Ma, 2017). But at present, the research on media education technology and physical education in higher school mainly concentrated in sports teaching, and research on media education technology and physical education, sports management, sports teachers are scattered and superficial (Spessato, Gabbard, Valentini, 2013). For example, (Pan, 2014) believed that the positive development and application of media technology in education will play an important role in promoting the reform of physical education in higher school. The construction of excellent courses must use media education techniques, methods and means to fully embody the media education theory in curriculum management and curriculum teaching. (Wang, 2014) believes that the use of media technology can improve the effectiveness of sports work, improve the teaching and research level of sports higher school, and also improve the quality of administrative management. Through the practice of multimedia technology teaching in Wushu theory course, Huang Shan thought that it could receive good results (Shen, et, al., 2016).

After 1990s, the maturity and development of computer technology, multimedia technology and network communication technology of modern information technology, make the education get unprecedented development (Kpaza Daniel, her, Attiklem, 2015). Foreign scholars believe that popularizing modern educational technology in physical education is the inevitable result of the rapid development of modern science and technology and the development of modern education (Okada, et, al., 2015). The application of modern educational technology plays an important role in improving the quality of physical education and improving the teaching level and surface. For PE teachers, it is necessary to use modern educational technology; the Teaching Department of physical education should gradually improve the construction of the hardware and software environment of modern educational technology, make full use of multimedia and network technology to create a good learning environment for students, and help to improve students' ability to understand and analyze problems. Multimedia and network technology are the future development, but also a strong assistant in the development of modern sports education.

METHODS

Because there is no specific national policy support, sports venues and sports facilities are insufficient, development level of sporting club hotel, the level of teachers and the enthusiasm of college students to participate in sports are not high, China's college students' sports is still in decline. At the same time, it also caused some other obstacles to the healthy development of college students, such as the mental health problems of college students and the decline of resistance. It can be said that the proper sports is the key to promote the healthy development of college students.

Table 1. The parameters of the media on the sports education in higher school

Media categories	The number of people	Contact media time	Percentage of people/%
Television	97	30min~1h	16.1
Newspapers	56	<30min	9.3
Magazines	61	30min~1h	10.2
Mobile phone	214	1h~3h	35.7
Computer	172	>3h	28.7

First of all, to determine the model expression formula of the two relations, the specific form of realization is as follows:

$$Y = C + L + G + (EX - IM) \tag{1}$$

In the formula (1), Y is the effect of popularity of college sports education; C is representative of the use of media in higher school; L is acceptance of college students; E is the using situation of media by college teachers; M is outside interference factor; I is random error in calculating value.

Secondly, through the formula 1, we can get the primary effect of media effects on college sports education, the results can scientifically predict the popularity of college sports education, and in the case of higher number of college students, it provides reliable reference for the structural adjustment of sports system and the management of sports system in higher school.

Effective data are obtained by **Table 1**, and the estimation result model can be obtained by bringing into formula 1:

$$C = \frac{1}{Y}\sum_{i=1}^{N}(x_i - n)\,(x_i - n)^T \tag{2}$$

$$Y_2 = C + L + G + NEX + TR - TA \tag{3}$$

According to formula 3, we can get the parameters of the media on the university sports education, and these parameters can reflect the results of this relational model.

RESULTS

All kinds of media should integrate existing resources and promote the popularization and development of physical education in higher school. Under the impetus of the widespread dissemination of modern information technology, it is the most important thing to use media technology and its own advantages to popularize the sports knowledge among college teachers and students, and fundamentally solve the problem from the development of sports. The understanding of sports among college students influences their participation in sports activities to a great extent. "sports information environment" formed by all kinds of media provides an equal learning and exchange platform to the college students who are not in-depth understanding of the sports knowledge, which has had a profound and extensive impact on college students. College students can get any sports information they need through the media platform, continue to deepen their understanding of sports, but also it is conducive to college students' understanding of the nature of sports to change their old ideas, and strengthen their own sports development, to promote the healthy development of China's sports common progress of college students.

To increase the sports situation in higher school broadcast efforts by media, will inevitably cause widespread concern in the whole society, and boost the development of college students' sports. All kinds of media communication can extend the social value, also can make college students as the main body of sports population to be greatly expanded, making sports for college students, which is not only a simple outdoor sports, but also a free exchange and mutual learning opportunities. At the same time, strong media reports will inevitably arouse widespread concern about the development of sports in higher school, which will lead to the introspection of the whole society. Young people are the main population in the future to promote the development of society. Only when they have good physical and psychological qualities can they shoulder the important task of developing the

motherland and realize the great rejuvenation dream of the Chinese nation. The widespread appeal of the media platform, while attracting social attention, can promote the rapid development of sports in higher school in China.

Using media platforms, we can expand the social influence of sports education in Higher school. Media sports can not only affect the audience's attitude towards sports, the degree of cognition, but also affect the audience's enthusiasm for sports. Especially, the youth is easy to accept new things, when using the media publicity platform, the early sports concept of China's college students will formed, to promote the rapid development of university sports in China. With its huge information capacity and immeasurable social influence, the media quickly spread the concept, connotation, behavior, spirit and influence of sports throughout China. If it wants to expand the influence of sports education in higher school, it is necessary to achieve through the media platform.

DISCUSSION

A large number of media sports on the university sports situation, is conducive to training college students' sense of identity in sports. At present, the popularity of college Students' sports knowledge is generally low, which is not conducive to the participation of college students in sports. The media can give more publicity to college students who have little knowledge of sports activities, aiming at improving the popularity of college students' sports knowledge and promoting the development of physical education in higher school. When the university students' world outlook, outlook on life and values are not stable, the content of information will have a profound impact on them. The popularization of sports related knowledge in higher school by media will inevitably deepen their understanding of sports. Media promotion in promoting the development of sports at the same time, it is also conducive to training college students' sense of identity in sports.

Media attention to sports in higher school, can enhance the attention of people from all walks of life to the status of sports in higher school. At present, from the current situation of sports activities of college students in China, the future of sports development in higher school is not optimistic. To improve this situation, we must use the influential media, the development of unique advantages and characteristics of media and China's college sports are combined to aroused widespread concern in the vast information market. When the university sports evolved into the national sports exhibition, it became a great undertaking of the whole nation to promote the development of physical education in China. The players who fight this protracted war are no longer just teachers and students of universities and colleges, and the wide participation of the whole society will inevitably push forward the great development of sports in China.

Media outreach can increase college students' enthusiasm for sports. Our college students in primary school and middle school to participate in sports consciousness is relatively weak, coupled with no corresponding national policy support, the school sports facilities and education level is limited, these factors seriously hindered the enthusiasm of our college students participate in sports. While parents only pay attention to children's learning situation, students on the concept of sports is also very vague, only the use of various media to carry out publicity and education, to make students realize the importance of physical exercise for their stable development and national development. The proper use of the media, not only can influence people's way of thinking, and even guiding the public opinion and influence the audience life, especially for the college students' sports awareness and sports knowledge popularization, it is has great influence. The media broadcasts all kinds of wonderful sports events, news, and conveys a series of national policies on sports, which can increase the students' enthusiasm for sports participation in a subtle atmosphere.

Media teaching has a certain negative impact on the health of students. Media sports resources are rich, the content is brilliant, there are a large number of timely and accurate sports information, there are many popular sports reviews, many exciting events pictures and clips. These contents are the main contents that meet the needs of students' sports appreciation in daily life. These "media fast food culture" in bringing the enjoyment to contemporary college students at the same time, but also created a number of weak physical "pseudo sports population." Such students show great interest in sports for many or individual sports, but they do not like to participate in sports in person.

The new mode of teaching does not depend entirely on the advantages of media teaching, but on the basis of the reform of physical education mode and so on. It has a positive impact on students. The application of media education technology has brought about the condition for the reform of PE teaching, and has produced its recessive function through this new teaching mode. The evaluation of a sports teaching model requires multi - directional and multi - angle. In this paper, the evaluation of sports teaching in the media environment is not comprehensive enough, and perhaps there is still a lack of scientific. This is also the field which needs further study.

CONCLUSION

The above discussions is only a preliminary rational thinking on the scientific physical education evaluation system, and the index system is only a rough framework. This framework can only further refinement for the physical education evaluation service, so there are a lot of theoretical and practical problems need further research.

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Application Strategy of Modern Network Technology in Higher Vocational Teaching Activities

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ABSTRACT

The pace of the development of contemporary science and technology is accelerating, and the multimedia assisted instruction technology with computer as the core has become an indispensable teaching means in higher vocational colleges (HVCs), and also an important mark of educational reform in HVCs in China. The development of modern network technology provides a strong impetus to the teaching reform in HVCs. This paper analyzes the research status of modern network technology application in domestic and overseas higher vocational education (HVE). It was found that the research on the application of modern network technology in HVE in China has a certain gap with that in overseas countries, especially the developed countries. Meanwhile, problems also exist that multimedia technology is too backward, the quality of CAI courseware cannot be guaranteed, and the interaction between teachers and students lacks, etc. Focusing on these problems, we suggest the following measures. First, vigorously strengthening the construction of campus information environment, establishing strict introduction and management systems of network facilities, strengthening the construction requirements of software teachers, and enhancing the propaganda of modern network technology. Second, integrating information technology with curriculum teaching, focusing on the inspection and verification of theoretical knowledge and application results, and improving the effect of students' knowledge acquisition. Third, enhancing the modernization of teaching technology in HVE, improving the memory effect of students' knowledge, thus arousing the enthusiasm of learning and teaching enthusiasm, and solving the lack of interaction between teachers and students, through the service function provided by network information technology. The starting point of optimizing the atmosphere of teaching activities in HVC is from these three aspects. Improve the application level of modern network technology in higher vocational teaching activities in China, and establish the application strategy of modern network technology in higher vocational teaching activities.

Keywords: teaching reform, modern network technology, application strategy

INTRODUCTION

Facing 21th Century, China has already paid attention to the integration of science, technology and education, and higher vocational colleges (HVCs) have made great efforts to build a modern teaching environment. Modern network technology has become an integral part of higher vocational teaching activities (HVTA), and the effect of network technology has a direct impact on the quality of teaching activities (Cheng, 2015). The rapid development of digital media technology has changed the information dissemination and acceptance habits of young students, which requires changing teaching ideas and teaching methods in education (Collins, Burke, Martindale, et al. 2015).

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Contribution of this paper to the literature

- The content of the current research was clearly explained, the collection and collation of research materials of domestic and overseas literature were relatively comprehensive;
- Concrete improvement strategies were presented for the problems of modern network technology in HVTA;
- The analysis of the problem was in-depth, and summarization was pertinent.

Research on the application of modern network technology in higher vocational education (HVE) in China has a certain gap with that in overseas countries, especially the developed countries. The application of multimedia technology only stays at the display level of teaching content, and it can seldom display the full content of teaching activities through the function of multimedia teaching technology. In the current teaching activities in HVCs, there are still many quality problems in the design and manufacture of CAI courseware, and just the basic theoretical knowledge is presented to the students in a way of presentation. Such CAI courseware is just a kind of writing with new pictures on the blackboard, with very little inspiration for students. The teaching function of courseware is very difficult to be displayed in front of students and teachers. In the process of using modern network technology to carry out teaching activities, there are still serious problems of lacking interaction between teachers and students. Modern network technology has not created the teaching atmosphere of mutual aid, and the educational function of modern network technology has not been fully demonstrated. Focusing on these problems, this study provided detailed solutions (Curran, Matthews, Fleet, et al. 2017; Connell, 2015).

REVIEW OF CURRENT RESEARCH

Domestic Related Research Status

With the arrival of the 21th Century, the Ministry of education took the lead in putting forward "the application of modern educational technology in the field of vocational education", and universities across the country have responded positively. In 2006, the project "the application of modern information technology in the cultivation of students' autonomous learning ability" was established by the Henan Provincial Department of Education. Career Technical College in Heilongjiang, Daqing, has undertaken the research project "the application and development of modern educational technology in the construction of teaching materials for vocational education". These projects analyzed the application direction of modern network technology in HVC teaching activities from several perspectives, and laid a solid theoretical foundation for the reform of HVE and modernization (Chen, 2017; Gai, 2015; Cui, 2015).

Liping Yu carried out related research on the impact of modern network technology in HVE, and considered that the application of modern network technology would have double influences in the fields of HVE, scientific research and management, with both advantages and drawbacks, and the drawbacks lied in that the modern network technology was too backward (Luque, Marcenaro-Gutiérrez, López-Agudo, 2015). Hong Qin carried out related research from the aspects of teaching organization and teaching methods, and believed that the application of modern network technology could improve the flexibility and diversity of teaching activities, but the content of the teaching structure was too simple. Peikang Zhu focused on the application of modern network technology in teaching activities in HVC and conducted systematic research, and it was considered that although the teaching technology had been applied, there was still a sense of distance between students and teachers, pointing out a new direction for the application of modern network technology in HVC in China (Chen, Sun, Chai, et al. 2016).

General Situation of Foreign Research

The United States was the first country in the world to use information technology in education. As early as the late 90s of the last century, it had been worked out the plan "Prepare every student in the United States for the coming twenty-first Century: meet the challenge of information literacy", and developed a series of reforms for the education of software, hardware, connectivity, professional integration. Back in the early 90s of the last century,

Table 1. Regression equation fitting

Model	R	R-Square	Adjusted R-Square	Deviation of standard estimate
1	0.872a	0.85	0.913	0.3074

Kenneth C. Green of Clement University put forward the viewpoint of the development of campus informatization, and established the Campus Computing Project. The research of this project has become the focus of world attention, and has provided an important theoretical reference for other countries to apply modern network technology in education (Kaymak, Winemiller, Akin, et al. 2015). Mr. Mery, Pamela M took San Francisco Institute as the studied object, and carried out research on the integration of modern network technology and student service system and how to correctly apply modern network technology. In the research results, three major measures were proposed. First, the development of education must be supported by powerful hardware. Second, more modern network technology application opportunities should be provided to students and teachers. Third, modern educational technology should build a sustainable planning system. These research results provided a good theoretical reference for the application of modern network technology in teaching activities in HVCs in China (Liu, Zhang, Shi, et al. 2015).

METHODOLOGIES

Comparing the application of modern network technology in the teaching activities of HVCs in China with the results of foreign research, the multimedia technology lags behind. These problems will directly lead to the difficulties in playing the educational value and educational role in HVC teaching activities for modern network technology. In this study, linear regression model was adopted for analysis.

Let ζ be the education quality of HVCs, p_a represent multimedia technology is too backward, $p_{\max}$ represent the quality of CAI courseware cannot be guaranteed, and $p_{\min}$ represent the lack of interaction between teachers and students is serious. The correlation index can be obtained.

$$\zeta = \frac{p_{max} - p_{min}}{p_a} \tag{1}$$

Therefore, the application model of modern network technology in HVTA can be concluded:

$$\lambda \leq \frac{p_r F^{-1}\left(\frac{b}{\gamma}\right) + p_v \int_L^Q f(x)dx - p_h \int_L^Q f(x)dx}{p_r Q_m (e^{I_1 T} - \eta)} \tag{2}$$

According to the above formula, and through statistical software SPSS18.0 regression analysis, the key factors for influence the teaching quality in HVCs as well as quantitative analysis were obtained, shapge the multiple regression model of the teaching quality in HVCs, shown as **Table 1**.

In **Table 1**, R represents the negative correlation coefficient between the explained variable and the explanatory variable, R-Square describes the judgment coefficient, Adjusted R-Square describes the adjusted judgment coefficient, and the last column represents the prediction error coefficient of the regression equation. The goodness of fit test can be reflected by **Table 1**, since the adjusted judgment coefficient is 0.913, which is closed to 1, Model 1 has relatively high fitting goodness, and the explanatory variable has a relatively large part that can be explained. The main problems of application of modern network technology in HVCs are:

Multimedia Technology is too Backward

It can be found from the above study that in teaching activities in HVCs in China, the most obvious problem in the application of modern network technology is that the multimedia technology is too backward. The application of multimedia technology only stays at the display level of teaching contents, and the content of teaching activities can rarely be fully displayed through the function of multimedia teaching technology. In this way, modern network technology can only be used as an alternative to traditional blackboard teaching, and it is difficult to achieve the purpose of modern educational technology, i.e., serving students, serving teachers and

serving the classroom. The modernization of classroom teaching in HVCs can only be regarded as a superficial phenomenon, and substantial progress is difficult to be made (Wang, Wang, and Tian, 2015).

The Quality of CAI Courseware is not Guaranteed

CAI courseware is an important means to carry out multimedia teaching activities in HVCs. Many teachers believe that the novelty of the interface can improve the teaching effect in the design and production of CAI courseware. The content structure of the produced courseware is very simple, with basic theoretical knowledge presented to the students in a way of presentation. This kind of CAI courseware is only a blackboard writing with new pictures, and it has little enlightenment for students. It is difficult to arouse the enthusiasm of students to participate in classroom teaching activities (Yu, He, Zhong, et al. 2015). Therefore, modern network technology in classroom teaching activities in HVCs has not been substantially applied.

Lack of Interaction between Teachers and Students is Serious

In view of the research results of the application of modern network technology in teaching activities of HVCs in China, in the process of using modern network technology to carry out teaching activities, there are still serious problems of lacking interaction between teachers and students. Modern network technology has not created the teaching atmosphere of mutual aid, and the educational function of modern network technology has not been fully demonstrated. There is no obvious difference between the effect of current teaching activities and traditional teaching methods.

RESULTS

Facing the main problems in the application of modern network technology in teaching activities in HVCs, the solution mainly depends on the following three aspects. Set perfect application strategy of modern network technology. By exerting the educational function of modern network technology, the application value of teaching activities is improved.

Vigorously Strengthen the Construction of Campus Information Environment

Today, with the rapid development of network information technology, HVCs should make great efforts to apply modern network technology to teaching activities, and vigorously strengthen the construction of campus network environment. The following three aspects should be emphasized.

First, establish a strict introduction and management system for network facilities. In the aspect of the management system of network facilities, for the responsibility system of the maintenance and upgrade of facilities, the responsibility is fulfilled to a special person in charge, so that the network facilities are able to operate in real time, and the modern educational media can be more timely upgrade, solving the problem of backward modern educational media equipment in teaching activities.

Second, strengthen the construction of software teachers. In facing of the current problems in the application of modern educational technology in HVCs, the construction of the campus network environment should be strengthened so as to improve the construction of software teachers, and train a batch of teachers who can master the application of network technology, making the network resources able to be shared and utilized in teaching activities (Zhang, Zhu, Rong et al. 2015).

Third, enhance the propaganda of modern network technology. The propaganda of modern network technology can be carried out in three ways, namely, centered learning of leaders and teachers, inviting experts from the field to make special reports, and carrying out modern network technology training. Through the three ways, centralized exploration, expert guidance, special training, the leaders and teachers of HVCs are guilded to recognize the future of the application of modern network technology, providing an ideal environment for the better application of network information technology in teaching.

Integrating Information Technology with Curriculum Teaching

The reason why the quality of CAI courseware in HVCs is not high is that teachers do not have a profound understanding of the essence of multimedia courseware, with only superficial understanding that courseware is made with just a few pictures or music, making courseware a means of teaching instead of writing on the blackboard. The teaching function of multimedia courseware is rarely recognized by teachers.

Upgrading the Modern Level of Teaching Technology in HVE

In the teaching activities of theoretical courses in HVCs, multimedia courseware teaching techniques are mainly selected. Through the multi-sensory stimulation the students' acquisition efficiency and teachers' knowledge transfer efficiency are improved, ensuring that students' eyes, ears, mouth and hands can participate in teaching activities, enhancing students' understanding, analysis and memory ability. Video teaching, picture teaching and audio teaching in multimedia courseware are combined with each other. Students perceive new knowledge at the same time through the two sensory systems of vision and hearing, which greatly improves the memory effect of the students' knowledge, and then promotes the enthusiasm of students' learning and teachers' teaching.

DISCUSSION

Modern network technology has been applied to different levels in HVCs, with endless effects, showing that modern network technology is irreplaceable in teaching activities to varying extents. The reason why modern network technology has the very good development prospect in the HVTA mainly lies in that the relationship between students and teachers can be close due to the transmission of network information and extensive information resources. The rich resources of teaching activities can meet the needs of students' in job practice, serving the whole link of the students' "learning" and the teachers' "teaching". In classroom teaching activities in HVCs, the application of network technology means not only to multimedia courseware, but the network information resource base is also an important modern network technology means. Through the rational application of network information resources, we can provide students with learning resources of more knowledge and knowledge fields, satisfing students' curiosity in their study activities. There is a cooperative relationship of knowledge acquisition and knowledge guidance between teachers and students. In this way, students and teachers can maintain more interactive process. This is the most direct method for HVCs to solve the problem of lacking interaction between teachers and students in the application of network technology in HVTA, and is the most ideal means to shorten the distance between teachers and students in teaching activities. Through the service function provided by the network information technology, the atmosphere of teaching activities in HVCs can be optimized.

CONCLUSION

In a word, we must take the construction of campus network environment as the first step in strengthening the application of modern network technology in HVTA, in order to create a good atmosphere for the application of modern network technology in teaching activities. As the application level of modern network technology is continuously strengthened, the educational function and value of the modern network technology should be exerted to provide good service for teaching activities.

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Education Strategy of Professional Physical Education Talents' Practical Ability Cultivation under the New Situation

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ABSTRACT
Objective: Education undergoes constantly reform and school education also constantly makes progress, however, presently many schools have omissions in fostering students' practical ability, causing extremes in polarization of theory and practice after graduating. Practical ability is an important ability in physical education major, and so its cultivation study is very necessary. Research method: in this paper, literature consultation, questionnaire survey, mathematical statistics, logistic analysis and interviewing are applied to investigate systematically on fostering our school's physical education major students' practical ability from Grade 2013 to 2016. Research process: Finding issues in students' cultivation process through parsing how school fosters practical ability of students in physical education major, what about students' mastering level on practical ability, and then making analysis of the issues and putting forward suggestions. Result shows that students in physical education major are weak in practical ability, with a main reflection of general practical ability, physical education ability, sports race organization ability, extracurricular activity ability, sports training ability and scientific research ability. Suggestions: We should strengthen sports knowledge and skills' practical teaching, organization on sports race, construction of external-campus practice base, guidance on working out thesis; school should make proper adjustment on physical education talents cultivation plan in accordance with realistic social conditions.

Keywords: physical education, practice ability cultivation, teaching method, training channel, education strategy

INTRODUCTION

Education undergoes constantly reform and school education also constantly makes progress, however, presently many schools have omissions in fostering students' practical ability, causing extremes in polarization of theory and practice after graduating and they couldn't enter the work state very well and very quickly. Sports are a special discipline, and one should firstly possess good sports technology and teaching ability to become a qualified sports teacher (Zhou et al., 2012). However, there are many problems in many physical education normal college graduates' practical ability, for instance, some students have rich theoretical knowledge but their sports skills are weak, they are speakers rather than doers; some students have good sports skills but lack of theoretical knowledge reservation, they are doers rather than speakers (Li et al., 2016). With regard to this, how to well organize students and foster their practical ability has become an important topic in social research.

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Contribution of this paper to the literature

- This paper, from schools' talents cultivation plan, studies on current status of students' practical ability. Through analysis, it puts forwards relevant suggestions and conclusions to improve students' practical ability step by step and go deeper into studying.
- Students in physical education major shows an increasing trend in various practical ability as they upgrades, from which they have higher physical education ability, exercise training ability and organizing ability of sports race, lower organization and management ability and extracurricular activity organization in the terms of general practical ability, and they should improve scientific research ability.
- Undergraduate students' practical ability should be promoted from four aspects, such as fostering students' practical ability in sports knowledge and sports skill teaching, organization ability of sports race, construction of external-campus practice base and guidance on scientific and research ability.

With increasingly development of society and reform of economy and politics, modern society has become a society of talents competition, whereas the key to the competition lies on that of practical ability. So does sports. As one of the ancient courses in sports history, physical education, focus on stronger practical ability. Research on fostering practical ability is very necessary (Chen & Zhang, 2016).

i) Practical ability is one of important abilities in physical education, and physical education course has specialty –"practice" that other disciplines don't possess, so it becomes crucial. However, it shows weak and has many shortcomings in many physical education major's students now.

ii) Presently, rarely and even no scholars have put forward specific plans to improve students' practical ability. In this paper, it takes physical institutes as examples, starts from talents cultivation plan thereof, researches on students' practical ability status and puts forward relative suggestions and conclusions step by step and goes into deeper studying by analysis.

iii) There is a long history in school physical education. Taking schools with most rich teaching experiences as examples, we parse how present physical education institute fosters practical ability of students in physical education major and explore more typical and referential cultivation of students' practical ability.

RESEARCH STATUS SUMMARIES

Relevant Research on Education Practical Ability

In Marxist Philosophy, it defines practical ability as "ability that individual may or can fulfill special practical activities". Weili Fu and Lei Liu defined practical ability as the total sum of these physiological and psychological characteristics that individual possesses to handle with practical problems smoothly using existing knowledge and skills (Zhang & Peng, 2017). As far as students are concerned, the ability refers to students adapt to social life with knowledge that they learnt and solve problems so that facilitate personal growth, which cannot be measured by test paper scores but evaluated by practical abilities. In Discussing on strengthening the importance of fostering university students' professional practical ability", Feifei Hao suggested that professional practical ability referred to the scope of abilities that using relevant theoretical knowledge to solve a special problem consciously, purposely and systematically based on special subjects in some studies, including ability of analyzing information, logical thinking, information handling, exploration and research, etc. Yongcheng Tao, Ye Peng, Bangyao Zhou thought that professional practical ability indeed was to let university students to take some personal activities as observation, learning, investigation and operation when they engaged in industries relevant to their major after graduation. To sum up, practical ability refers to "ability that individual can solve practical problems" for short (Zhang & Qin, 2016).

Constitute Research of Physical Education Practical Ability

As a future sports teacher, students in physical education major's practical ability directly related to quality of education in the future. What on earth parts compose of practical ability was explored deeply by Chinese researchers (Zhang, 2017).

Regarding the problem of which parts essentially compose of practical ability of students in physical education major, there are various opinions. Kuang Li and other scholars thought that their practical ability could be divided into general ability and special ability. Among them, general ability contains operability, language organization ability and intelligence so on, while special ability contains education ability, interpersonal communication ability and students' management ability and so on. Zuoyun Zhou etc. suggested that practical ability of physical education students could be divided into education ability, teaching ability and ability of creating good situation. Among them, education ability covers appeal to students in class, individualized education ability and ability of handling with students' emotions. Teaching talents contain ability of organizing and using textbooks, language expression ability and classroom organization ability so on. Analyzing from psychology, practical ability of students in physical education major is composed of general ability and special ability, from which special ability contains classroom teaching ability, class management ability, and classroom supervising ability and ability that is conductive to promote personal cognitive level and teaching practices as well as innovative ability and so on. Students in physical education major are practitioners that really engage in teaching practices in teaching sites, instead of observers or listeners. It is very necessary to effectively train and promote teaching practicability of students in physical education major (Li et al., 2017). Ru Wan and Zhenming Mao thought that sports practical ability covered four aspects, capable of exercising, able to appreciate sports, working hard in physical exercises, and taking relaxation activity by applying sports. As future sports teachers, students in physical education major should firstly master relevant theoretical knowledge, and then be capable of teaching. Next they should formulate effective and proper training plan and organize and judge a competition in accordance with students' basic information and social environment; and finally they should possess scientific research ability and so on (Liu, 2013). Deng Yun thought that as future sports teachers, students in physical education major should not only possess common ability as other disciplinary teachers, but also be capable of organizing extracurricular activities since the activities are important parts of students' school life, occupying rather larger time. As future sports teachers, students in physical education major should firstly have firm devoting spirit and sense of social responsibility; secondly, they should be able to give a good physical education lesson; and then they should do a good job in school sports activities, finally they should impart knowledge and educate people, taking care of students' sound growth in an all-around way (Zhang & QIN, 2012). Shigao Chen ranked sports professionals' abilities according to importance, he suppose that a sports teacher should firstly possess teaching ability, next is ability of organizing sports training and handling with interpersonal communication. Besides, they should master ability of class management and language expression as well as innovation.

To sum up, we can conclude that practical ability of students in physical education major should contain teaching ability, expression ability, class management ability, scientific research ability, lifelong learning ability and so on. All of these abilities are essential for future sports teachers, students in physical education major.

Cultivation Mode of Physical Education Practical Ability

Through consulting China CNKI a great deal, Wanfang database and Baibu Baike's treatise, we learnt that scholars mainly studies physical education practical ability cultivation from concept and classification of cultivation mode and improvement mechanism of practical ability cultivation mode.

Firstly, there are studies on cultivation mode's concept and classification as follows:

Yajun Shi thought that cultivation mode referred to cultivation plan that school drew up in talents cultivation process in accordance with social environment, conditions and education policies. Wenju Cai pointed out that cultivation mode was specific expression form and realization mean of cultivation objective. It was a system project, including implementation of teaching concept, design of course and specific mean of teaching and so on.

However, there was drawback in Chinese universities' mode of students' cultivation. For instance, cultivation objective on students was single, various schools showed the same cultivation mode, causing no individualism in Chinese universities' talents cultivation that may not satisfy various social demands (Zhang, 2008). This led to talents expansion in single aspect and deficient in diversified aspects. Yue Zhang thought that there were two cultivation modes, one was previous set cultivation method and mode, the other is management in cultivation process etc.

There were studies on improved mechanism of practical ability's cultivation mode:

Ailian Fang put forward mode of "whole process practical teaching", pointed out that fostering students' practical ability should be integrated into the entire teaching. Four-year University system was divided into eight terms. Then, from the 1st to 5th term, when teaching students' theory, we should also focus on exercises of practical ability, integrating practice into classroom, letting students' theoretical practice to develop together. Starting from the 6th term, we should lay more emphasis on fostering students' practical ability, as students' theoretical level arrived at certain requirements by the theoretical learning in the former five terms. At this time, we should let students walk out school and take practical exercises from multiple aspects, for instance taking trial teaching and so on. Starting from the 7th term, we should let students to teach independently, that is carrying out teaching practice. The key in the 8th term is to write thesis. In this way, students can be exercises theoretically and timely in every time frame, instead of concentrating knowledge cultivation of practical ability on one time frame. Hongge Wu put forward in the mode of practical ability cultivation of students in physical education major：firstly school should make reasonable allocation on courses, formulate reasonable teaching objectives; secondly, students should make clear tasks and objectives of learning during learning, and then school should organize students to perform internship inside and outside school as much as possible in every term, participate in more professional teachers' open courses; besides, they should encourage students to take initiative in sports fitness activities; and school should make preparation of internship completely and do a good job in summarization and examination of internship.

Knowledge is not the sum of fact and rules by a kind of dynamic establishment and organization, and meanwhile it should be ability of individual coordinating behaviors and adapting to dynamic changes and developed environment. Students in physical education major of normal colleges should not only learn to take in knowledge but also promote individual practicability.

Fostering students' practical ability is a huge and complicated project and should run through the whole teaching process. School should constantly optimize teaching contents, pursue and explore new knowledge in accordance with social demands. Besides, it should also make reformation and innovation on the previous teaching methods and means, constantly improve theoretical level and practical ability. The school should lay emphasis on classroom teaching practice, go deeper into concept of connecting theory with practice, guiding students to apply learnt knowledge to solve realistic problems smoothly, combining inside with outside classroom and extending function of classroom teaching; besides, they should establish perfect education internship mechanism so that foster students' practical ability. They should adopt strict and effective examination system.

RESEARCH OBJECTS AND METHODS

Research Objects

Students in school physical education major in Grade 2013 to 2016.

Table 1. Table of questionnaire releasing situation

Total released questionnaire	Recovered questionnaire	Recovering rate of questionnaire	Valid rate of questionnaire
200 pieces	186 pieces	93%	93%

Research Methods

Literature consultation

According to defined research objects, tasks and purposes in this paper, we collect and read a lot of relevant treatise through CNKI, Wanfang database, Baidu Baike and so on, sort out and analyze all consulted documents to provide firm theoretical basis for the development of the research.

Questionnaire Survey

In this paper, questionnaire of "Questionnaire survey on students' practical ability cultivation status" was designed, 50 students were taken at random from all grades in physical education major from Grade 2013 to 2016 and released, that investigation was made to 200 students. Details can be referred to **Table 1** as follows.

Questionnaire validity test: four experts were invited to carry out validity and structural test to ensure effectiveness of questionnaire. Results are three experts think that setting of the questionnaire is very reasonable, while the other thought it reasonable. This suggests the attached research questionnaire is valid.

Questionnaire reliability test: Firstly sample ten classmates to fill out questionnaire at random before releasing questionnaire in a big scale to ensure reliability of questionnaire. After ten days, these ten classmates were arranged to fill in the same questionnaire again. We found that the filling situation was roughly similar in two questionnaire, students relevant coefficient was R=0.87, indicating the questionnaire had higher reliability.

Mathematical statistics

Make statistics of investigation data through Excel in computer.

Logistic analysis

Carry out logical analysis of students' practical ability status and cultivation mode constitute of physical education talents in accordance with the demands of investigation result, striving for providing references for fostering practical ability of physical education major.

Interview method

Perform interviewing with partial students and teachers in physical education major on relevant problems according to requirement of investigation, so that acquire certain information to create certain practical value for the research.

CULTIVATION MODE OF STUDENTS' PRACTICAL ABILITY

Teaching Plan

Professional training objective and requirements

Physical education institute fosters integrated talents, who are equipped with modern education and physical education's basic theoretical knowledge, capable of working in physical education, extracurricular sports training and competition arrangement, physical education science studying, school sports management and of creative spirits.

Table 2. Constitute of class hour and credit in various courses

Type of courses		Total class hour and credit	Due total credit - Proportion of due total credit %
General education course		**656+2weeks /42**	**26.75%**
Professional basic course	Professional basic theoretical course	606.8/39.3	25.04%
	Professional basic experimental course	311.2/18.7	11.91%
Professional course	Profession-oriented theory course	464/29	18.47%
	Profession-oriented experimental course	192/12	7.64%
Practice link		26week/16	10.19%

Students in physical education major mainly learn basic theory and knowledge in school physical education, accept essential sports skill training as a sports teacher, and master basic ability of physical education, training, competition and scientific research.

Study duration, graduate credit and degrees conferred

Undergraduate in physical education major of physical education institute basically takes four year learning, and is allowed to graduate only get full 157 credits as required. In case that he conforms to conditions of degree when graduating, he would be conferred with bachelor degree.

Curriculum setting

According to talents cultivation plan, total disciplines of courses in physical education are 59, from which there are 14 general courses, 18 required courses, 9 major courses and 28 elective courses. This indicates wider coverage of course in institute with a variety of forms. The institute attaches great attention to various aspects of students, and performs overall development on students' theory and practice.

In school's cultivation of students in physical education major, it highlights fostering students' stronger physical education practical ability. This indicates school focuses on students' practical ability cultivation. As shown in **Table 2**, credit in theory accounts for 70.26% of the total credit, and that in practical accounts for 29.72%. This reflects that school relatively focuses on students' practical ability cultivation, which not only reflects in credit, but also in theoretical course as theoretical course builds foundation for practical course. With certain basic theory, practice could be implemented with facility.

STUDENTS' PRACTICAL ABILITY STATUS

Students' General Practical Ability Status

Statistical data shows that students' social practical ability and adaptability are increasingly enhancing with continuous learning, however, they don't show a significant increase in the improvement of other aspects. As students constant learn from kindergarten to university, they are rather satisfied with personal learning ability and expressions.

On a whole, students show higher satisfaction with their social practical ability in Grade 13 to Grade 16. They have improved adaptability as time goes by. However, there is a long way to go to develop their abilities in other aspects, especially the cultural and artistic ability and organization management ability that hasn't changed in four learning years of University.

Status of Sports Teaching Ability of Students in Physical Education Major

From statistical data, there is an increase in students' various ability on a whole as time goes by, from which the most significant increase lies in junior and senior year, especially reflecting in their ability of making teaching plans and applying textbooks. Reasons for that are school arranges students to take trial teaching and substitute teaching since junior year, and students in senior year would greatly improve their ability due to

implementation of internship. However, the students should improve their resilience and ability of electronic education. Through interviewing and investigation, we found that our students haven't fully mastered physical and psychological characteristics of teaching objects in the stage of internship, leading to their poor handling with emergency. By observation and interviewing, we found that in the investigation on students' attitude towards internship, 41% of them thought that internship was very important, 35% of them thought it important, while 20% students just wanted to fulfill internship, and even 4% ones thought internship was just getting through formality and not important. This suggested that most of the students stressed on internship. Students showed an overall good internship performance in school, they took enough internship class in the whole process; 25% students reflected that they lacked of teachers' guidance in the internship process, most of them started to take over teaching in several classes after viewing and emulating teachers' lecturing for two weeks; in teaching, they just gave a lesson with personal feeling, lacking of guidance on lecturing. 10% students reflected that their internship position didn't conform to their future work; some students didn't plan to teach but still took internship practice that was of no help. Some students planned to teach in middle school after graduation, but they took internship in primary school, there were certain gaps. Some students even expressed that they could not teach when started teaching in real situation, might not organize a physical education course, though they initially thought teaching was easy. They didn't know how to give a good lesson even though they were equipped with teaching skills and ability.

Status of Sports Competition Organization Ability of Student in Physical Education Major

From statistical data, freshman was weak in various abilities of sports competition since they just got into the school, and ability was under 20%. With increasingly learning, improvement was made in diversified abilities, from which referee ability was most significant, while others were less and even the ability of summarizing competition accounted for the minimum. Investigation found that most causes of students' sports competition organization ability's improvement were because of participation in examination of national referee grade and engagement in referee, and such participation was for future development. On a whole, students' sports competition organization ability improved at various levels as time goes by. This is a good tendency.

Status of Extracurricular Activity Ability of Students in Physical Education Major

From statistical data, students have improved extracurricular activity ability at various levels as time goes by and shown an overall increase trend, especially the most increasing amplitude in organizing class leagues. This suggested that students have learnt a lot in extracurricular activity ability, basically applied what they learnt.

Status of Sports Training Ability of Students in Physical Education Major

From statistical data, having learnt a series of sports knowledge and professional skills, students have improved sports training ability in all aspects. Especially, junior and senior students' ability is generally superior to that of freshman and sophomore. There are improvement of ability "application of sports training methods and means" in sophomore and junior year at various degrees, while the improvement is not significant in senior year.

By investigation, many students only simply learn skills but ignore importance of theory in skill course; they may not well combine theory with practice and further lead to mistakes in future teaching.

Status of Scientific Research Ability of Students in Physical Education Major

By questionnaire survey, it shows scientific research ability contains ability of selecting topics, ability of document retrieval, ability of scientific research method, ability of writing thesis, ability of finding problems. Among students in physical education institute, generally only senior students possess scientific research ability, with an exception of less junior students, whereas freshman, sophomore and most of junior students haven't got involved in thesis, and they are weak in scientific research ability. Carry out questionnaire survey on senior students, found that 9% students realized the important of thesis and would write it in earnest, 23% ones thought it important, 55% ones regarded it as general and just wanted to fulfill thesis defense, even 13% ones thought it not

important and no more than a form. It is clear that students don't pay enough attention to thesis comparing to internship. Through investigation on thesis advisers, students by interviewing and problems in students thesis preparation process, we found that 70% students supposed that they lacked of scientific research theoretical knowledge, not knowing how to writer personal thesis, 55% ones thought they lacked of teachers' guidance in writing process as the teachers were too busy to spend enough time in guiding their writing. The opening time of students' thesis generally starts from the beginning of the 7th term summary vacation to the starting of the 8th term. However, due to topic selection starts in vacation, students are not available to access to CNKI to consult data, they lack of learning enthusiasm as in school and don't select it. While they should start internship right now since school starts, they basically have no time to write thesis. In addition, they tend to forget relevant thesis research problems after internship, together with tight job hunting period during the second time of senior year, they lack of writing duration and guidance.

From the above status of six practical abilities, from students' practical ability status investigation result, we learnt that freshman was slightly poor in practical ability of all aspects as they just enter into school. Sophomore has some improvement in abilities through around one year's learning, but their abilities are not mature. Junior students have improved various abilities after over two years' university life, their ability in various aspects are overall nearly similar to that of senior students, whereas the senior students have somewhat improvement in the mature degree through education internship by comparing. Therefore, status of senior students' practical ability can be a good reflection of current students' practical ability cultivation status in physical education major.

CONCLUSIONS

Research on status of practical ability cultivation of students in physical education major and get three conclusions as follows:

i) Cultivation mode of undergraduate includes teaching plan, management system, comprehensive evaluation, practical teaching. In teaching plan of physical education, students' practical ability cultivation was fully represented; Students' practical teaching covers sports theoretical knowledge and skill practical teaching, cultivation of extracurricular activities' practical ability, internship practice and thesis.

ii) There are two main braches and six parts in evaluation indicators of practical ability of undergraduate in physical education major, such as general practical ability and special practical ability, the later one includes sports knowledge and skill, sports training ability, sports competition organization ability, extracurricular activities' organization ability and scientific research ability. Students major in physical education have shown a rising trend in various practical abilities as they upgrade, from which they have higher grasping of sports teaching ability, sports training ability and sports competition organization ability, whereas they are weak in general practical ability, such as organization management ability, sports competition organization ability and extracurricular activities' organization. They should improve scientific research ability. They show an overall good internship situation, but lack of theoretical knowledge in writing thesis and teachers' guidance.

iii) The undergraduate major in physical education could improve their practical ability from four aspects: strengthening their practical ability in sports knowledge and sports skill teaching, sports competition organization ability, external-campus practice base's construction as well as guidance on scientific research ability.

SUGGESTIONS AND STRATEGIES

Strengthen Physical Education Knowledge and Skills' Practical Ability Teaching

In current Chinese university students' cultivation process, there are two parts of students in school-attending a class and extracurricular activities. Among them, most of the students' professional knowledge learning

still bases on class learning. As far as students in physical education major, there are two parts in physical education major's teaching, one is teaching of sports knowledge, the other is classroom teaching of sports skills. Thus, teaching of sports knowledge and skills cover a great part in the overall students' professional learning. It is crucial to promote sports knowledge and skills' practical ability teaching.

Firstly, in the regard of sports knowledge teaching, sports exercises are closely related to sports teaching in many theoretical courses of sports. When preaching theoretical knowledge, the teacher should teach theory and also combine the theoretical knowledge with practical sports. In teaching, teachers should play the guiding role, center on students, guide students to initiatively find problems, think problems and further solve them. They should apply more discussion teaching to arouse students' learning interests.

Secondly, in the process of teaching sports skill course, teacher would instruct students' skill movements to enable them to master movement skills basically, but also enable them to master how to teach the skill movements. In class, they should train students' teaching ability, let students to carry out warm-up or skill movements' revision in turn, or assign them certain teaching tasks, let students to complete simulation teaching in one class independently. And in skill examination, teacher should not only examine students' skill movements, but also get involved in examining students' grasping of theoretical knowledge and their practical teaching.

Strengthen Organization of Sports Competitions

In investigation on status of practical ability of students in physical education major, we found that they have great deficiency in the ability of organizing sports competitions. Every year, physical education institute organizes some sports competition activities to improve students' sports ability and competition ability, such as organizing sports meeting, Huanggang Normal College's Cup, football league and so on. Through exchanging with students, we found that most of them focused on these competitions, consciously organized training before competition to enhance sports skills.

Organization on these competitions, however, is far from enough by comparing. We should properly increase students' participation times in sports competitions to enhance their ability of sports competition. Above all, changes in quality results from that in quantity.

Strengthen Construction of External-campus Practice Base

External-campus practice base is precondition of students' practical teaching. Only with stable external-campus practice base, the schools' implementation of practical teaching could then be ensured. School should make use of social resources, and optimize them. Generally, students would go to work after graduation. The construction of practice base not only can give guidance on society and school regarding the demands of talents, but also offer a real job for students who would graduate, letting them to get into society in advance and adapt to the society. Internship is an examination on students' knowledge and skills and also a performance in working ahead of time. For students in physical education major, they are mainly working as a teacher in school after graduation. In selecting external-campus practice base, there should firstly be equipped with practice bases with high quality, stable and fixed amounts. At present, due to lack of practice bases, many universities would arrange over 10 students in one practice base. The scale of practice base school is fixed with enough formal teachers, students would have nothing to do and lack of practicing opportunity if too many ones are assigned to one practice base. Besides, school should strengthen communication with practice base, guarantee for students' exercising opportunities during internship and increase guidance on students' internship so on.

Strengthen Guidance on Ability of Writing Thesis

For cultivation of ability of writing thesis, physical education institute has attached great important. It issued various documents on thesis management; there were normalized management from students' thesis subject selection to defence. However, in the real implementation process, many people think scientific research ability is

not so important for students; thesis is just a form as required. As students confront with an important task as finding a job after graduation, they don't focus on writing a thesis and some of them copy thesis.

For students' thesis, both schools and advisors should attach great emphasis, they could increase cultivation of students' scientific research ability from freshman to junior year, for instance, reinforcing researching lectures, organizing more subject researches, encouraging students to positively participate in and so on. Guiding on thesis could also follow master's advisor system, thesis advisors would be assigned to students after starting school for a while. The advisers could guide students in certain time and duration every term. We also suggest that school to make proper adjustment on physical education talents cultivation plan in accordance with social realistic conditions.

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Influence Factors and Strategies of Teacher-Student Interactive Behaviors in Sports Class Teaching

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ABSTRACT
Good interaction between the teacher and students in class is crucial for giving a good lesson. Only the teacher and students could well interact with each other than teaching quality could be better promoted. In this paper, literature consultation, mathematical analysis, questionnaire survey etc. are applied to study on teacher-student interactive behaviors in sports class at Chengdu municipal experimental primary school. Results indicated that there are four types of teacher-student interaction at Chengdu municipal experimental primary school, from which group interaction between the teacher and students were most frequent. Investigation finds that problems in interaction of the school were formalized class, ineffectiveness and unequal interaction. Whereas main influence factors of interactive behaviors cover teacher factor, student factor, teaching contents, teaching media, teaching environment etc., from which teach factor is the main part. Moreover, it acquired some promotion strategies to improve present situation that provided evidence for better interaction between the teacher and students in sports class.

Keywords: sports teaching, school sports, physical education, teaching reform, teacher-student interaction

INTRODUCTION

Relationships between the teacher and students have always attracted great attention since the term 'education' emerged, while Good interaction between the teacher and students in sports class is crucial for giving a good lesson. Only the teacher and students could well interact with each other than teaching quality could be better promoted. In this paper, influence factors of teacher-student interaction in sports class at Chengdu municipal experimental primary school was analysed and studied, and some suggestions were put forward. This provided foundation for better interaction and communication in the school's sports class in future (Liu, 2013). Recently, there emerged serious teachers' moral decay phenomena, such as "Professor Scandal in Xiamen University and Sichuan Academy of Fine Arts" as well as unimaginable teacher abuse phenomena, such as "Splashing incident in East China University of Political Science and Law", "Young master incident", which resulted from poor handling with teacher-student interaction problems (Lin, 2012). These negative phenomena have attracted great attention and response in the whole society, making people realized that there are serious problems in relationships between the teacher and students in the new era. With regard to this, it is urgent to find out the 'source of the disease' and

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Contribution of this paper to the literature

- To study interactive behavior in class at its source, we should firstly make clear what on earth the interactive behavior itself is and then we may carry out subsequently further study. Indeed, interaction between the teacher and students always plays an important role in sports class.
- Interactive teaching in sports class not only covers one-way teachers' interaction, but also interaction between the teacher and students so that teaching can become entire.
- Main influence factors of interactive behaviors include teacher factor, student factor, teaching contents, teaching media, and teaching environment and so on, from which teachers is the main part.

pursue a magic instrument to guide good development of teacher-student relationships. Based on this, the paper went deeper into studying good interaction development of teacher-student relationships (Chen & Zhang, 2016).

Interaction is interaction between one and another or several people and even groups as traditionally explained. This is its literal meaning, however. Actually from the deeper level, it can be summarized as the effects of one on others' life or values on the precondition of conducting interaction mode with others (Li et al., 2016). In the term of pedagogy, experts think that interaction is a precondition to achieve teaching goal, on which a lesson makes full use of all positive factors in class to make good interaction finally formed. This is a continuous developing and integrating process (Zhang et al., 2012). On the precondition of class teaching, we utilize positive class factors in all aspects to gradually form into harmonious good interactive community.

Studies on interactive types between the teacher and students are as follows: interaction between a teacher and a student, interaction among a teacher and a crowd of students, and interaction among a teacher and a group of students that are divided on the basis of the teacher and students' roles in sports class. Among them, the first type refers to teacher coach one student targeted at one event or motion in sports class; the second one refers to teachers' practice of face-to-face teaching in one sports lesson, which mainly faces to a crowd of students. The third one refers to teacher divides students into groups and teaching them in a certain teaching environment. Through studying on the three types, we could acquire certain teaching methods that would provide evidence for sports class teaching (Liu & Zhang, 2008).

Some scholars thought that teacher-student interaction in sports class had its unique characteristics. On one hand, teacher-student relations are different from other social relations; on the other hand, they are also complicated, beyond human's will and possess uniqueness. In terms of culture, development of teacher-student relationships is higher than that of cultural education. The relationships are therefore characterized as nature of culture and comprehensiveness (Zhang & Qin, 2012).

Other researchers think that both the teacher and students' interaction have their characteristics in primary school's sports teaching, from which teachers are characterized as instructive and theoretical. In some books, teacher-student interaction in sports class is described as two-way, teacher-led and students-cantered. Even some people think that teacher-student interaction in universities is mutual and complementary. Among them, training on student's ability and interests of learning is crucial for interaction.

Experts suggest that teacher's teaching behaviors in class should be affected by the Western countries. Effects of teaching situation, personal factor, customs or cultural value on sports class could be classified as external factors, whereas individual body peculiarity such as body structures, potential, physique etc. as internal factors (Zhang & Peng, 2017). Bin Zuo thought that main influence factors in teacher-student interaction in class were class factor, teacher concept factor and so on, which caused obvious changes in the interaction.

In the opinion of this study, the present study has made considerable achievements in teacher-student interactive behavior, whereas foreign countries, in particular, have shown certain maturity. To study interactive behavior in classroom teaching at its source, however, should firstly make clear what on earth the behavior itself it and then could go deeper into subsequent study. Indeed, teacher-student interaction has always played important

roles in sports class. Sports class interaction should have both sports teachers' one-way interaction and also students' interaction to form teaching into an entirety.

RESEARCH OBJECTS AND METHODS

Research Objects

All teachers and students in Class Seven to Nine, Grade Three at Chengdu municipal experimental primary school are research objects.

Research Methods

Questionnaire survey

Conduct questionnaire survey among pupils in Class 7 to 9, Grade 3 at Chengdu municipal experimental primary school, release 200 pieces of questionnaires to students and 20 ones to teachers, receive 186 pieces of students' response, from which 178 ones are effective, the effective rate is 89%; meanwhile, receive 19 pieces of teachers' response, from which 18 ones are effective, the effective rate is 90%.

Observation method

Carry out in-situ observation on sports class situation in Class 7, 8 and 9, Grade 3 at experimental primary school, and analyze the three specific lecturing situations.

Literature consultation

Literature consultation is applied to collect research results in recent years' teacher-student interaction at Chengdu municipal experimental primary school, analysis is then made to research situation of the school's teacher-student interaction and conclusion is finally got. In addition, suggestion is put forward for future development of the school.

Mathematical analysis method

Data analysis is made on research results using mathematical analysis method, hidden questions behind the data are found so that constructive suggestions could be put forward targeted at the questions accordingly.

RESULTS AND ANALYSES

Types of Teacher-Student Interaction

By questionnaire survey on teachers and students respectively, we obtain different teacher-student interaction types as follows **Table 1**:

Table 1. Table of Chengdu municipal primary school teacher-student interaction types (from the perspective of teachers) N=18

Type	Number of people	Percentage	Ranking
Interaction among the teacher and a crowd of students' interaction	7	38.8%	First
Interaction among students	4	22.2%	Third
Interaction between the teacher and individual student	2	11.1%	Fourth
Interaction among the teacher and a group of students	5	27.9%	Second

Table 2. Table of Chengdu municipal primary school teacher-student interaction types (from the perspective of students) N=178

Type	Number of people	Percentage	Ranking
Interaction among the teacher and a crowd of students' interaction	78	43.8	First
Interaction among students	32	17.7	Third
Interaction between the teacher and individual student	27	15.7	Fourth
Interaction among the teacher and a group of students	41	22.8	Second

Table 1 and **Table 2** suggest that teacher-student interaction in primary school's sports classroom teaching are divided into four types, those are interaction among the teacher and a crowd of students, interaction among the teacher and a group of students, interaction between the teacher and individual student and interaction among students, respectively. It is clear that the proportion of interaction among the teacher and a crowd of students are the largest one that is common in sports class, the subsequent order in successive are interaction among the teacher and a group of students, interaction between the teacher and individual student, and interaction among students. Therefore, teacher-student interaction is obviously insufficient in normal sports class teaching. The teacher should take measures to impel teacher-student positive interaction.

Interaction between the teacher and individual student

In sports teaching class, the teacher exchanges with individual student to change teaching procedure and improve teaching quality. This type of interaction refers to a teacher's practice as teaching instructor to a student. For example, a teacher specially corrects wrong movement of one student in playing basketball; while interaction among the teacher and a crowd of students prescribes a mutual exchange process among a teacher and a crowd of students.

Interaction among students

The essence here is students themselves exchanging and getting some conclusions in accordance with an assigned scope of teachers' well-planned lesson contents. Facts prove that interaction among students in class is of an important significance in promoting students' learning initiative and positivity, could strengthen students' ability of collecting and analyzing information, and also plays an important role in enhancing students' spirit of solidarity and innovation. It is necessary to reinforce students' interaction contents in classroom teaching so as to carry out quality-oriented education in an all-around way. Students' individual interaction refers to one student exchanging with the other on the precondition that the teacher doesn't engage in discussion. For instance, two students discuss after class with previous contents and make mutual progress; groups of students' interaction, similarly refers to a group of students implement fiercely discussing with other groups without teachers participation. Such as a group of students take volleyball attack and defines exercises.

Problems in Chengdu Municipal Experimental Primary School's Sports Class Interactive Behaviors

In sports class teaching, sports teacher takes initiative to change communication way with students, doesn't force them to accept new concepts of course. This is the precondition that sports class may run in a normal way. In doing so, sports teacher passes on knowledge and skills to students, students take initiative to complete them. This requires that the teacher to treat with every student democratically, properly encourage them and affirm their performance. In this ways, students would understand what they should do to acquire better knowledge and then make progress. There are fewer sports teachers still don't understand the way, however. And there are more

Table 3. Table of problems in Chengdu municipal experimental primary schools' sports class interactive behaviors N=178

Problem	Number of people	Percentage	Ranking
Formalized	77	43.3%	First
Ineffectiveness	59	33.1%	Second
Inequality	42	23.6%	Third

Table 4. Statistical table of investigation on sports teachers' form of teaching N=18

Variation form	Continue to teach	Timely adjust	Perfunctory	Free activity
Number of people	4	10	2	2
Percentage	22.2%	55.6%	11.1%	11.1%

serious problems in Chengdu municipal experimental primary school's sports class interactive behaviors. Various analyses are carried out targeted at problems seen in **Table 3**.

Formalized Chengdu municipal experimental primary school's sports class interactive behaviors

According to investigation, interaction among the teacher and students in Chengdu municipal experimental primary school's sports class is a formalized interaction, its duration is short and most of the students don't participate in while only fewer students could be concentrated in interaction with the teacher. The formalized interaction and participation situation makes many students neglected and further estrange them. They therefore look around or don't know what to do-just are spectators. Moreover, investigation on a small part of teachers suggests that these interactions only remain in the superficial layer. This is not positive interaction, which in turn is a waste of a lot of time. Some sports teachers simply regardless of students, and students don't follow teachers' method, a vicious circle is therefore formed.

Having observed sports class of three classes in Chengdu municipal experimental primary school, sports teachers' changes in teaching way in case students lose interests in sports class (see **Table 4**).

Statistics shown in **Table 4** suggest that in primary school's sports class, when students don't take time to learn what teacher teaches, 55.6% teacher would make timely adjustment. Whereas 11% teachers would handle with it in a perfunctory way or don't manage them but let them to take free activities, 22.2% teachers would continue to give a lesson because they know that both the two parties should make common interaction and be mutual recognized in the interaction process. In teacher-dominant teaching, teacher deprives students' due rights of what they should do, which is bad for their growth in future.

Ineffectiveness or negative effects of Chengdu municipal experimental primary school's sports class

Observation finds that Chengdu municipal experimental primary school's most sports classes have shown no proactive teacher-student interaction and teacher paying no attention to students. No matter how optimized and advanced teaching environment would be, there always a great part of students are unwilling to go in for interactive process. No matter how teachers create teaching environment and care for students in sports class, there always occur to students' collusion. However, the students with no big discrepancy, common interests and hobbies, similar characters would be more willing to exchange and learn. These different factors impede realization of teacher-student interaction and also restrict in the scope of students' positive interaction.

As shown in **Table 5**, most of students' interaction in sports class is effective, however, there are small parts of students think it is ineffective or negative to organize activities from the following aspects. Primary school's teachers should proactively find out the causes and correct them.

Table 5. Statistical table of investigation on ineffectiveness and negative effects of primary school's sports class interaction N=178

Item	Number of people	Percentage	Ranking
Set up groups, independent learn	51	28.7%	Second
Encourage students to learn	86	48.4%	First
Students learn from each other	30	16.8%	Third
Students learn in harmonious atmosphere	11	6.1%	Fourth

Table 6. Investigation table of degree of coincidence in students and sports teachers' interactive exchange N=178

Class	Number of people	Percentage	Degree of coincidence	Ranking
Class Seven	70	39.4%	Quite coincide	First
Class Eight	65	36.5%	Rather coincide	Second
Class Nine	43	24.1%	Coincide	Third

Table 7. Sports teacher's influence factors N=178

Aspect	Number of people	Percentage	Ranking
Teacher's professional proficiency	94	52.8%	First
Teacher's teaching concept	61	34.3%	Second
Teacher's teaching behavior	23	12.9%	Third

Inequality of interactive opportunities in Chengdu municipal experimental primary school's sports class

Observation finds that sports teacher tend to restrict development of students' thinking and compel them to perform their order. This belongs to compliance interaction. Less teacher and students and students themselves carry out diversified interaction, the whole sports class teaching lacks of feeling of freshness. Even many sports teachers naturally follow traditional authority of teachers in class. By observing interactive behaviors in sports class, it suggests there is inequality of interactive opportunities in sports class teacher-student interaction that is mainly presented as sports teachers select different interactive objects in different sports events. For example, in a basketball class, sports teachers tend to choose students with good basketball skills to interact. Thus, it is easier to find that sports teachers often choose students with stronger athletic ability as interactive objects, as **Table 6**.

Sports Class Interactive Behavior's Influence Factors

Analysis of Chengdu municipal experimental primary school's sports class interactive behaviors' influence factors finds out major influence factors, including teacher factor, student factor, teaching environment factor, teaching content factor and teaching media factor. In the following, it makes specific analysis of the five factors.

Sports teacher's factor

As shown in above **Table 7**, in terms of sports teacher's influence factors, sports teacher's professional proficiency becomes an important indicator to measure teacher-student interaction and is a major reflection. Whereas sports teacher's teaching concept and sports teaching behavior respectively rank the second and the third. Therefore, in sports class teaching, sports teachers should constantly reinforce personal profession. Detailed introduction about sports teacher's teaching concept, teacher's professional proficiency and their teaching behaviors are as follows.

(1) Sports teacher's teaching concept: Teaching concept is an overall recognition of sports teacher on the course. Among them, it covers his recognition on himself, a long-term expected sports environment, his own instructed students, the students' personality and their learning performance. These reflect a sports teacher's view of education, knowledge and students. Usually, sports teachers like interacting with clever students and constantly encourage them. To make sports class an effective class, the sports

teacher should firstly change the way of teaching, for instance, they should constantly lay emphasis on students' knowledge and skills, sports teaching process, and specially becomes the guider and instructor of students in sports class. Meanwhile, sports teachers should be creative in teaching. In sports class interaction, a sports teacher should create certain teaching situation and form into personal teaching style.

(2) Sports teacher's professional proficiency: In the development of sports teaching, many difficulties would occur to teacher-student interactive process. To realize interaction in a real sense, a sports teacher should firstly possess very solid professional foundation. Secondly, they should look for solutions. In class interactive process, the teacher should correctly judge what students like and what they want. On this basis, he adjusts teaching activities to promote students to learn more effectively; He should not only make good preparation before class, but also continues to think about and adjust. This is also a process to facilitate the teacher getting along well with students. By realizing the goal, the teacher shines the class with vitality. During the process, the teacher is required to use their teaching tact-applying his intelligence on the basis of previous teaching experiences, paying close attention to students' changes in classroom teaching, forming an overall knowledge on today's lesson and making overall arrangements. To do so, the teacher should possess stronger basic theory and knowledge, and meanwhile master practical experience I sports classroom teaching and different cultural knowledge. Only in this way could realize deepen interaction in sports class.

(3) Sports teacher's teaching behavior: In the class interactive process, a sport teacher has various teaching behaviors. The teacher's verbal behavior includes explanation of skilled movement, assessment on students' performance verbally and so on. Non-verbal behavior refers to other ways, for instance, the teacher stops students' action with his eyes or affirms his action by nodding. These are supplements of teaching that making teachers' wording more convincing. Some think that eyes are the windows to the soul; teacher-student relations are somewhat established and maintained by all eyes. Teacher's attention to students could also be transmitted by eyes. And meanwhile students would make more reaction when they feel it. Actually, students' gesture could disclose whether they understand what the teacher teaches; and the teacher could use gesture to express something what they want. This also occurs to sports class interaction. Such as sports teacher can issue instructions on students by nodding, shaking, gestures and others instead of natural language, this may also let students to pay attention. In the sports classroom teaching, many skills should be completed by teacher's demonstration, giving students a great impression. In common class, the teacher uses gesture or nodding to show students' skills as supplement after illustrating knowledge. The method provides evidence for better interaction in class.

(4) Student factor: Investigation finds that sports classroom teaching's teacher-student interaction teaching influential factors covers student factor, including teaching contents, load of exercise, favorability of sports class, favorability of sports teacher and peer pressure. These five factors exert main effects.

The following **Table 8** indicates that Chengdu municipal experimental primary school's pupils' favorability on sports class accounts for larger share. Therefore, we should reinforce characteristics and diversity of sports class in the teaching process. Next is peer pressure and favorability of sports teacher, the two are also important reference and school leaders and teachers at all levels should take full consideration of them in school sports teaching.

Table 8. Students' factors in teacher-student interaction teaching N=178

Type	Number of people	Percentage	Ranking
Teaching contents	54	30.3%	First
Load of exercise	41	23%	Second
Favorability of sports class	33	18.5%	Third
Favorability of sports teacher	31	17.5%	Fourth
Peer pressure	19	10.7%	Fifth

Students' favorability of sports class

A larger part of students' favorability of sports class lies in students' motivation of learning and interests. Motivation of learning refers to reason why students learn the course. There is strength that supports students to learn at the back, for instance the teacher describes what learning contents are and then tells students that they could be rewarded if they could master the contents earlier, stimulating students to learn in this way. In general, the level of motivation increases, efficiencies of learning would therefore promote. Interest is one of learning motivation constitute factors, students' interest in learning one item would arouse their learning motivation. This is also a good way to develop students' intelligence. Wide interests contribute to students' good psychological status and enable them to generate a potential impetus. In this way, students will keep a good mood in learning process. Some students have nature of self-abasement and closed, they have no interest in sports class and are not proactive in class, completely ignore what teacher asks. This may affect their improvement on sports skills.

Students' favorability of teacher

Teacher has been an example for students to learn from since the ancient times. If a student prefer to the teacher, he would surely prefer to the lesson and also good interact with the teacher. This is the starting point and also foundation. Interaction simultaneously carries out between the teacher and student without order and it is two-way. Fully arouse enthusiasm and initiative of the two could make class atmosphere alive and realize teaching goal. In the view of laws of learning, it is useless for teacher compelling students to learn. Only in case that student himself realizes he should change, then could he be very committed to learn and accept teacher's guidance and make efforts so as to realize the goal of improving teaching efficiency.

Peer pressure

Interaction among students is an important form in sports class interaction. When teacher gives a lesson, there are students of better acceptance ability and the teacher likes them, whereas a part of students of poor learning ability that often drag down. The part of students is bullied, and they would echo others' view when peer pressure occurs. As far as primary and secondary school students are concerned, relations between classmates would be complicated as they grow. Everyone would expect to be keen on and accepted. Many students tend to go against their inner thoughts and feelings instead of doing things in a correct way as they think to catch up with peers. Youth behaves as community-oriented convergence because of peer pressure. In this way, a vicious circle would be formed. If a class is collaborated and united, the whole class would have higher positivity in class interaction, on the contrary, the class would be distracted and few students would take initiative to go in for class interaction.

Teaching contents and load of exercise

In normal teaching, the results of teacher-student interaction is up to students' understanding level on teacher's teaching contents. Thus, the teacher should transform teaching contents in teaching to make students understand and master them. In terms of load of exercise, it may not be too much. Teaching should carry out step by step in accordance with principle of differentiation and finally achieve teaching goals and teacher-student interaction.

Sports Teaching Content Factor

What teacher teaches in a class directly relates to the effects of the class. The teacher's teaching contents exert huge and profound impacts on sports class interaction. Besides, how sports teacher handle with class would also affect class atmosphere. Curiosity is source power of learning enthusiasm. For students, only unknown contents are appealing; students would like to learn the content and the class would come alive; on the contrary, students would dislike the course and class would be dull. If teaching contents is too simple, the students would be boring; if teacher's explanation is too complicated, students may not master them. Thus, teaching contents had better be moderate, challenging students' mind. That is to say, students would generate positive inner experience in learning process only by striving to understand and master knowledge. Sports teacher should properly master difficulty of instructed knowledge and highlight the important points and difficulties, so that enable students to get some achievement in every lesson's learning. In this way, students would have good moods in the whole class. At the same time, students should be treated in different ways so that teaching plans could be fulfilled. Choice of teaching contents should start from the perspective of students and create good teaching environment.

Teaching Media Factor

Site and instrument are preconditions for teachers passing on knowledge to students and also essential in sports teaching and also the essentials. The teacher should utilize sites in a scientific and reasonable manner. When the size of class is too big and the amount of people is too many, teacher could lead students to such as larger location as playground or track-and-field ground to implement teaching. As the number of class increases, students would be impetuous. Every student has different characters. In this case, teacher should make good arrangement in class-creating mutual favorable situation and adopting various teaching methods. For example, when two students common use one instrument, teacher could arrange the use order to avoid class problems.

Teaching Environment Factor

Relations among students in a class also have impacts on teacher-student interaction. Research finds that harmonious students' relations would contribute to better teacher-student interaction. The class with stronger sense of class honor would easier to promote more people to participate in teacher-student interaction; on the contrary, some people would regard the classmates that positive participate in teacher-student interaction as getting favor from the teacher. The remark and thought may not appear in a class with good interpersonal relationships. In the view of psychology, emotion is also interactive, only a teacher bears a good thought then could the students have a good one. Sports teacher's positive emotion would make students refreshed while negative emotion would surely suffocate vitality of class. Thus, classroom atmosphere should be focused on to make students love class. Good student-teacher interaction would create a relaxed and happy learning environment; and the compact teacher-student interaction would contribute to establishment of an orderly learning environment. Teachers therefore should positively create a harmonious and friendly class atmosphere from the beginning of a new term.

Promotion Strategies of Chengdu Municipal Experimental Primary School's Sports Class Interactive Behaviors

It is necessary to find a solution to the above problems and factors. Improvement is mainly through teacher and student-increasing interactive frequency between the teacher and students through a series of measures so that improving the quality of sports class teaching.

Teacher should enhance teaching understanding and change teaching concept

Leaders teachers at all levels of school and those of teaching and researching institute should play leading roles in constantly changing teaching concept about students. Only with the improvement and transformation, teacher could do a better job at school and so give its calling role into play to impel more teachers to improve their teaching understanding and change their concept. Teachers should form the concept of lifelong learning, work hard

to improve sports teaching, be student-centered, learn the new curriculum standard, grasp the spiritual essence of the standard and realize improvement of their own teaching understanding and transformation of teaching concept.

Make clear and reasonably establish teaching goals

Teaching goals are guidance to teaching. So, no matter teachers or leaders should set teaching goals in advance in sports class. Sports teacher, in particular, should know why he should teach and what to teach. It is an essential theoretical preparation for a lesson. Whether give a good lesson or not depends on the teacher's teaching goals, therefore the goal should be set clearly and reasonably. In some sports classes, there is inconsistency in teacher's teaching plan and actual lessons. This is a reflection of unclear teaching goals that exerts a serious impact on subsequent lecturing. Besides, teaching goals should be reasonable. In some sports classes, teachers' teaching plan is completely inconsistent with students' ability, making implementation impossible. This is bad for the growth of students (Li, 2017).

Giving teacher's leading role into play and paying attention to students' subjective role

Teaching and learning is a process that teacher and students simultaneously make progress. Students are the main character, they are subjects of learning. Students could promote their ability in the way that they understand what teacher teaches in sports class, and transform these basic knowledge and skills into comprehensive ability. General speaking, students would have a good learning result in case that teacher gives a good lesson. Teacher exerts an impact on students to a great level. In sports class, both subject role of the two should be given into full play; combination should be made on the way. That is to give students' subjective initiative of learning into full play on the precondition that teacher plays his leading role. The two supplement each other-in teaching, the teacher plays its leading role fully, students' positivity and initiative would be easier to arouse; and students in turn plays their subject role fully, students' leading role would be better reflected. The combination of the two is beneficial to improve teaching quality in an all-around way and promote students' quality.

Absorbing other's experience and promoting self-cultivation

No matter in school or at home, teacher should learn from excellent people around to perfect himself. Above all, learning excellent experience is not just copying but absorbing its thought. Learning from excellent teachers should absorb the essence. The teacher should read more books and go in for more researches, keep learning and making progress at ordinary. In this way, he could improve himself and be excellent.

Promotion strategies of students' learning

i) Enrich sports class and create diversified choices: Enrich sports class using multi-media teaching. Students just want to enjoy the class beyond cultural course in a sports class. The aim of sports class therefore is to have fun. Multi-media, a kind of modern science and technology, therefore could well make up for the dullness of sports class. Except for basic sports technological and theoretical knowledge, it could present students real sports image. Thus, strengthen application of multi-media could better integrate students into the class.

ii) Properly adopt system of reward and punishment to improve students' positivity of learning: In class teaching, teacher must adopt different teaching methods as students are different. This required the teacher to adopt system of reward and punishment to improve students' positivity. When comparison occurs to students, the teacher should take the advantage to promote students to conduct self-attribution and form them into positive interactive mode.

Supporting strategies of school teaching environment

i) Perfect sports teaching management system: a school may not run normally without reasonable teaching management system. A scientific and reasonable school management system is essential for a school. All teaching modes have their own advantages. The common point of their success is teacher paying attention to class and caring for students, while students also follow teacher's instruction. The teacher should handle with emergency in class correctly- guiding students' behaviors correctly and helping them to set up good code of conduct, as well as developing student's good habits of learning. At present, excellent schools possess these conditions. They fact to all students , improve students quality in an all-around way, aim to cultivate modern students, take student as subject, develop students and themselves and form into positive class atmosphere.

ii) Strengthen construction of sports teachers: every school should spend more time and vigor to strengthen construction of sports teachers. In every school with solid excellent teachers, under the background of strong theory, teachers may spend more time in students, they would create more teaching methods to promote schools and students development and form into positive interaction. They make efforts in both hardware and software and create a good environment.

CONCLUSIONS

Set types of experimental primary school's sports class interaction by investigation and study: interaction between the teacher and individual student, interaction among the teacher and a crowd of students, students' individual interaction, and interaction between the teacher and a group of students; Investigation on Chengdu municipal experimental school's sports class suggests that the teacher are not proactive in teacher-student interaction. And meanwhile, students dislike learning and teacher doesn't care; all interaction types have their characteristics. In students' interaction, students lack of vitality, just copy the teacher assigned task, don't fulfill the task down to earth but only go through the motions.

In the form of primary school's sports class, teacher mainly explain with verbal interactive behavior, while students passively answer or make no response; In the term of verbal guidance, sports teachers are different in gender; there are also differences in students' verbal interactive behaviors in different grades. In primary school's sports class, teachers are used to present the movement, and students just take exercise. On a whole, the way is rather single; it is a long way to go to form a real interactive mode.

There occurred formalized and unequal problems in primary school's sports class interaction. This is only a reflection from a side. It suggests that teacher could find out more issues in sports teaching. It is more important to solve these issues in present education background.

In Chengdu municipal experimental primary school' sports teaching, teacher's concept exerts a great impact on teaching and further on students' learning motivation and interests. And teaching behavior of sports teacher decides the whole quality of teaching. Concept of teaching in the school's sports teachers is generally old-fashioned without innovation, which impedes students' development.

In terms of promoting effectiveness of school's sports class interaction, teachers and school should jointly establish a reasonable teaching mode, update teaching system, and speed up the transformation of teaching methods. By doing so, both school and students could make common progress.

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Developing and Application of Mobile Game Based Learning (M-GBL) for High School Students Performance in Chemistry

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ABSTRACT
This study aims to develop and understand the effect of a mobile game based learning (M-GBL) implementation on student learning outcomes associated with student learning independence. The research was conducted in three schools at 58 Jakarta High School, 77 Jakarta High School, and 78 Jakarta High School in the academic year 2016/2017. The research method used was quasi-experiment with two ways Anava research design (treatment by level 2x2). A total of 40 students, as a sample of the study, were selected using a simple random sampling technique. In the experimental class, the learning process used M-GBL media which has been validated by experts and tested against students and teachers. While students in the control class, the learning process used traditional media. The conclusions are: M-GBL media is feasible to be used as chemistry learning media which is practical, fun, interesting, can be used anywhere, and in accordance with facilities owned by learners. M-GBL media has a positive effect on students chemical learning outcomes when applied to groups of students who have high learning independence; in groups of students who have low learning independence, students' academic achievement when taught using M-GBL media were lower than students taught using traditional media owing to the factor of learning independence.

Keywords: mobile game based learning, learning outcomes, learning independence, chemistry

INTRODUCTION

Teaching and learning activities are effective when using media that is integrated with technology to help enhance students' understanding as well as their interest in the topic. Through the Internet, information technology is a way for the world to generate the multiplier effect of learning (Wu & Tai, 2016). Technology is a complementary tool for enhancing innovative instructional models and, due to the prevalence of technology in our society, especially for students, many educators strive to make its integration into education a reality (Ekmekci & Gulacar,2015). Game

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Contribution of this paper to the literature

- The characteristics of the effective use of M-GBL media on student learning: the use of books replaced by RAM with learning that can be arranged and connected. Mobile games do not require many pages of books and can be incorporated into the handset so they can be carried easily. Learning is designed for use on mobile devices. Mobile games can be used on any mobile phone provided that the appropriate operating system base is installed. M-GBL media can be learned anywhere, any time by the students to enable them to obtain and explore the subject matter more effectively.
- The results of the effectiveness test of using M-GBL media in chemistry learning. The using of M-GBL media will have a positive effect on students' chemical learning outcomes when applied to groups of students who have high learning independence. In groups of students who have low learning independence, the use of M-GBL media is lower than that of students taught using traditional media.

based learning, on mobile devices, is an alternative learning media being developed by researchers to create fun learning that is easy to understand and accessible to students.

Learning on mobile devices leads to the use of mobile phones as a learning media. Learning based on mobile devices (mobile game based learning) is an alternative learning service which can be implemented anywhere and anytime (Darmawan, 2012). Mobile game based learning is a game that contains a summary of the lesson topic, is constructed by different levels of education, is adjusted to the prevailing curriculum and is able to run on mobile devices. Because electronic games play such a prominent role in young people's lives, researchers and educators, hope to combine the intrinsic motivation that students show towards electronic games that contain a summary of the topic of the lesson and objectives, to make learning more fun and enjoyable (Marina Papastergiou, 2009a).

M-GBL has now become a new trend in education as most mobile devices, especially smartphones and tablets, can run user-friendly mobile applications. Mobile games based learning developed for chemical materials, among other uses, is the application OCRA (Organic Chemistry Reaction Application) being developed by Talib (2014). In OCRA, the users can explicitly form and break the chemical bond between atoms. Users can use the touch screen feature to explicitly demonstrate the organic reaction mechanism, explicitly through an electron moving technique, which is used to conceptually visualize the mechanistic steps in the organic reaction mechanism. A Multimedia Based maze game integrated with a scientific approach being developed by Setiawan (2016) has enhanced student learning outcomes. Based on this study, the scientific approach to learning by using a multimedia based labyrinth game can improve the quality of learning and increase student understanding. The examples provided here are practical examples where a mobile application has been innovatively designed to enhance the value of e-learning in an educational context. However, there is a need to develop more learning tools that specifically optimize the use of mobile applications to include other chemistry topics.

Mobile games based learning, in the form of a quiz which contains a summary of the material and practice questions for chemistry material, is operated with the help of a mobile phone that has an Android operating system. Chemistry material presented as a mobile game will make students more interested and facilitate their understanding of the description of a chemical reaction. Gaming activities are a good source of engagement and bring fun into learning by providing an instant appraisal for players when tasks are completed successful, thereby motivating them to reach higher stages in the gameplay (Mathrani, Christian & Ponder-Sutton, 2016). Problem-based learning, contained in the game on mobile devices, uses various ways to help students understand concepts and resolve various issues. Some researchers believe that teaching materials and techniques are not as good as having children learn via games by having fun and being happy (Norman, 1981). Games are easily accepted and used by students (Kafai, 1995). Furthermore, games can help students develop problem-solving skills (Seonju, 2002; Chuang & Chen, 2009; Lee & Chen, 2009; Blumberg, Rosenthal, & Randall, 2008; Shih, Shih, Shih, Su, & Chuang, 2010). Media M-GBL is presented as an alternative to help students understand chemistry by using games on mobile devices.

Table 1. Two Ways Anova Research Design (Treatment by Level 2x2)

Learning Independence (B)	Media learning (A)	
	Mobile game based learning (M-GBL) (A_1)	Traditional Media (A_2)
Higher Learning Independence (B_1)	A_1B_1	A_2B_1
Low Learning Independence (B_2)	A_1B_2	A_2B_2

The use of M-GBL media in learning relates to students' learning independence. Student learning independence is one of the internal factors in a person that will lead to a sense of responsibility and confidence to achieve. Learning independence is very important for students to have because with this attitude students can discipline themselves to be responsible for the learning process. The learning environment with M-GBL media provides a means by which students can manage their learning (Chen, 2008).

METHODOLOGY

The research was conducted in three schools during the 2016/2017 academic year at: 58 Jakarta High School, 77 Jakarta High School, and 78 Jakarta High School. A quasi experimental method was used with Two-Way Anova research design (treatment by level 2x2). Two-Way Anova research design (treatment by level 2x2) in this study can be seen in **Table 1**.

The sample in this study, consisting of 40 students from class X, was taken using a simple random sampling technique. Students in the study used M-GBL media that has been validated by experts and has been tested by students and teachers. The students in the control class used traditional media in the learning process. Data collection was is done using a test technique and questionnaire, that is, a learning results test and a self-study learning questionnaire. The test used approximately 20 multiple choice items with 5 choices. The multiple-choice test of validity was calculated using the "biserial point" analysis technique, while the reality was calculated using Kuder Richardson-20 (KR-20). In the test, the validity description was calculated using Karl Pearson's "correlational product moment" analysis technique, while the reality was calculated using Alpha Cronbach. The type of self-learning instrument used was a questionnaire in the form of statements totaling 28 items which calculated the validity using Karl Pearson's "correlational product moment" analysis technique, while the realities was calculated using Alpha Cronbach.

Before being analyzed, the student's score was tested for normality and homogeneity. In this study, a normality test was done using the Liliefors test, while homogeneity test was done using the Fisher test and Bartlett Test. There are four hypotheses tested in this study. The first hypothesis (main effect) and the second (interaction effect) were tested using techniques of analysis of variance (ANOVA) two ways, while the third and fourth hypothesis (simple effect) were tested using the Tukey test.

RESULTS AND DISCUSSION

The product of mobile game based learning (M-GBL) development on reaction rate material is validated by media experts, chemistry concepts experts, and linguists. Furthermore, trials were conducted with students and teachers. Reaction rate materials are presented in the form of books, websites, slides or handouts. The effectiveness of M-GBL media was tested using the Two-Ways ANOVA test (treatment by level 2x2).

The Evaluation Product M-GBL Media by Validation Expert

Validation of the test stage aims to take into account the judgments, criticisms, and suggestions from experts on M-GBL media so as to developed and produce media of good quality. Expert validation testing stage has been done by material and language experts as well as by media experts.

Table 2. Results of media M-GBL Assessment by content experts and linguists

Aspects	Question Number Item	Average Feasibility Percentage	Criteria
The relevance of content substance to the competencies that must be achieved by students	1, 2 and 3	86%	Very good
Problem and Discussion	4, 5, 6, 7, 8, 9 and 10	90%	Very good
Language	11 and 12	83%	Very good
Average Overall Media Assessment		86%	Very good

Table 3. Results of M-GBL Assessment from media expert

Aspects	Question Number Item	Average Feasibility Percentage	Criteria
Audio and Visual Display	1, 2, 3, 4, 5, 6, 7, 8, and 9	82%	Very good
Software implementation and engineering	10, 11, 12, and 13	98%	Very good
Average Overall Media Assessment		90%	Very good

Validation test by expert on chemistry concepts and language

Six lecturers as experts on chemistry concepts and language. The feasibility test instrument, given to by the material and language experts, consisted of 12 questions covering several aspects, namely the relevance of the content to the competencies to be achieved by students; questions and discussion; and the language used in the media.

Based on **Table 1**, the average feasibility assessment of M-GBL media by content experts, and linguists as a whole, is 86% with very good criteria. Also, based on the calculation of reliability between rater, it can be seen that the reliability value obtained for 0.67 with good criteria. These results indicate that the instrument used is reliable, and the quality of M-GBL media material is good. Information obtained from material and linguistic instruments is known that M-GBL media has met the criteria of quality media regarding validity, accuracy, conformity, and coverage proposed by Elissavet and Economides (2000).

Validation test by media experts

The validation test by media experts aims to know the feasibility of M-GBL media developed. The feasibility test phase by the media experts in this research involved six respondents, four of which are media learning design experts, and two IT experts. The instruments used by the media experts consisted of 13 questions covering visual display aspects as well as software implementation and engineering.

Table 3 shows that the average of the overall M-GBL media assessment result is 90% with very good criteria. Also, based on the results of the assessment using reliability between rater, it can be seen that the results obtained reliability value of 0.62 with good criteria. These results indicate that the instrument used is reliable, feasible to use, and the quality of M-GBL media is good. Based on the information obtained from the results of the instrument and the test of reality, it can be concluded that the resulting learning media meets the technical quality criteria proposed by Walker and Hess (Arsyad, 2011).

The Evaluation Product M-GBL Media by Trial Test on Students and Teachers

Results of product testing by student in small group

In the trials, undertaken by by a small group of students, participants were given an application to install on their mobile phone using data transfer. The trial was conducted by distributing questionnaires to 20 students in

Table 4. Assessment test of M-GBL as learning media by a small group of students

Aspects	Question Number Item	Average Feasibility Percentage	Criteria
Questions and discussion	1, 2, 3, 4 and 5	76%	Good
Language	6 and 7	77%	Good
Audio and Visual Display	8, 9, 10, 11, 12, 13, 14, and 15	78%	Good
Software Implementation and Engineering	16, 17, 18, 19 and 20	76%	Good
Benefits	21, 22, 23, and 24	83%	Very Good
Average Overall Media Assessment		78%	Good

the second grade of high school in Jakarta. The instrument used for these media trials consisted of a 26 item of questionaire covering several aspects as stated in **Table 4**. This small-scaled student test phase aimed to find out what the students' assessment of the developed M-GBL media was, as well as to hear the criticism and suggestions from the students for improve the media so that it could inform the larger scale study. In the experiments conducted by students on the media produced, problems were identified and discussion points raised, such as, language used, audio and visual appearance, and software implementation and engineering and expediency. Here is a table of student test results on a small scale:

Table 4 shows that in the aspect of expenditure, the highest percentage of average feasibility is highest compared to another aspect that is 83% with very good criteria. The indicator of this aspect of expediency concerns students' interest in chemistry after using M-GBL media. Two questions cover the reasons for learning using the game being more interesting and fun and the interest of students wanting to learn chemistry further after using M-GBL media. Based on the instruments distributed to 20 students, 85% of them stated that learning by using M-GBL media is more interesting and fun, and 90% of students were interested in studying chemistry further after using M-GBL media. Some students commented on the use of M-GBL media, one of which stateed that rather than using a mobile phone for game play, it would be better to try the M-GBL media as it is easy to operate.

Based on the results of the small-scale use of M-GBL media assessment by students, it can be claimed that the M-GBL media is well made and acceptable to the students. This is indicated by the average result of the overall media assessment that has an assessment percentage of 78% with good criteria. The suggestions from students about the media, namely, the use of a background that is too crowded and the addition of music. These suggestions were used to improve the media for subsequent large-scale trials.

Results of product testing by students in large group

After trialing the media with the small-scale student group and improving the media, the next phase of the research was to conduct media large-scale trials. This stage was done by distributing questionnaires to 100 students in the second grade of high school in Jakarta. The medium test instrument used was the same as the questionnaire used for the small-scale trial; 26 questions consisting of several aspects in **Table 5**. The large-scale student trial stage aimed to reveal the students' assessment of mobile learning media developed after the small-scale trial and following the improvements made. Below is a table of results of meditation of the large-scale trials.

Table 5. Results of M-GBL Media Trial Assays by Students of Large Scale

Aspects	Question Number Item	Average Feasibility Percentage	Criteria
Questions and discussion	1, 2, 3, 4 and 5	86%	Very Good
Language	6 and 7	81%	Very Good
Audio and Visual Display	8, 9, 10, 11, 12, 13, 14, and 15	81%	Very Good
Software Implementation and Engineering	16, 17, 18, 19 and 20	84%	Very Good
Benefits	21, 22, 23, and 24	91%	Very Good
Average Overall Media Assessment		85%	Very Good

Table 6. Trial Results of M-GBL Media by Teacher

Aspects	Question Number Item	Average Feasibility Percentage	Criteria
The relevance of content substance to the competencies that must be achieved by students	1 and 2	100%	Very Good
Questions and discussion	3, 4, 5, 6 and 7	88%	Very Good
Language	8 and 9	88%	Very Good
Audio and Visual Display	10, 11, 12, 13, 14, 15, 16, 17 and 18	89%	Very Good
Software Implementation and Engineering	19, 20, 21 and 22	88%	Very Good
Benefits	23	100%	Very Good
Average Overall Media Assessment		91%	Very Good

Based on the results of M-GBL medium-scale & large-scale trial assessments, all aspects of the assessment increased compared to the M-GBL media outcome assessment results by the small-scale trial asesment, where the average overall media outcome assessment on the large-scale trial asessment has a percentage Assessment of 85% with very good criteria. This indicates that the M-GBL media is a feasible tool to be used as an alternative learning medium with high school students in the year 11 chemistry classrooms in the concept of Rate Reaction. Presentation of material in the form of mobile learning media that has not been so developed cause the material presented more interesting than in other forms. Another reason that makes students interested in M-GBL media is that the developed M-GBL media is made using an off / on form so it can be used anywhere and anytime without any time constraints, even if there is no internet connection.

Results of product testing by teachers

The media was tested by giving the application to 10 chemistry teachers to be installed on their owned mobile phone by using data transfer. The instrument for teacher media trials consisted of 23 questions consisting of several aspects as stated in **Table 6**. The following is a table of media test results by teachers:

Based on the results of the teacher media trials, as collated in the table above, it can be seen that the average assessment of M-GBL media, as a whole, is 91% with very good criteria. Based on the results of the media trials by teachers it can be said that the resulting M-GBL media is feasible to be used as an alternative tool for learning chemistry.

The M-GBL media product has advantages over other learning media, such as, the process of installing the media is very easy; the operation of the media is very easy, like operating a mobile phone in general; the medium can be used repeatedly without the need to use the internet, making it more economical; the material presented consists of several sub-items that are easy to understand; how to operate "touch and scroll" makes the display more interesting and simple; media can be operated anywhere and anytime according to the needs of learners;

Table 7. Hypothesis Testing Results Using Two Ways Anova

Variants	Degree of Freedom (Db)	The sum of squares (JK)	Average Number of Squares (RJK)	F_{count}	F_{table} (α=0.05)	Conclusion
Between A_1 and A_2	1	336.40	336.40	13.20	4.10	H_0 rejected
Interaction A X B	1	1742.40	1742.40	68.34	4.10	H_0 rejected
In Group	36	917.80	25.49	-		
Total (T)	40	245624.00	-	-		

media can be used as a learning medium for learners in high school; problems can be contained in the quiz accompanied by discussion; the sequence of questions in the quiz menu is randomly created each time the quiz menu opens so learners cannot memorize quiz answers.

The Application of M-GBL Media on Student Learning

The application of M-GBL media in the study of chemistry learning, studying the effect of M-GBL media used on students' learning outcomes is related to learner independence. In this study, four hypotheses were tested.

The effect of M-GBL media on student learning outcomes

Based on the result of hypothesis testing (**Table 7**), the value of Fcount (Fc) is 13.20. Meanwhile, the Ftable value at the level of significance (α) = 0.05 of 4.10. Therefore, the value Fcount> Ftable, then H_0 is rejected so it can be concluded that student learning outcomes, taught by using M-GBL media, are higher than students taught by using traditional media. Research can provide such results because, in the medium of mobile, game based learning, (M-GBL) has an advantage, that is, the use of books is replaced with RAM. Mobile games can readily incorporate content into the handset so they can be carried easily; learning is designed for use on mobile devices. Mobile games can be used on any mobile phone provided that the appropriate operating system is installed; and M-GBL media can be learned anywhere at any time by students enabling them to obtain and explore the subject matter more easily. Research conducted by Hwang et. al. (2013), suggests that mobile learning media is very promising in improving student achievement and student interest. Jabbour (2013) concurs that the use of mobile learning has a positive effect on student performance. It also affects the interaction between students and teachers in the learning process and has the impact of learning becoming more active. Based on the research, it is considered that students taught by using mobile learning media can learn independently anytime and anywhere to increase their knowledge. Thus, in this way the use of mobile games can impact on the high student's learning outcomes as they develop a deeper understanding of the subject matter. As proposed by Tømte and Olsen (2013), technology contributes to the increase in student learning outcomes in higher education.

In the study with students taught by using traditional media, the subject matter was delivered, in the classroom, by direct instruction using PowerPoint media. The students recorded the subject matter delivered by the teacher, causing the students to be dependent on the teacher and less independent. Based on this explanation, learning using traditional media becomes less effective because it is controlled by the teacher delivering the learning material rather than involving the students in in-depth learning activities.

Interaction between M-GBL Media (A) and Learning Independence (B) on student learning outcomes

Based on the hypothesis test result (**Table 7**), obtained value of Fcount (Fc) equal to 68.34. Meanwhile, the Ftable value at the level of significance (α) = 0.05 of 4.10. Therefore, the value of Fcount> Ftable, then H_0 is rejected so it can be concluded that there is an interaction effect between learning media and learning independence of student learning outcomes. In this case, the media learning in question is M-GBL media and traditional media. The existence of interaction proves that each of media learning has a different influence on student learning outcomes

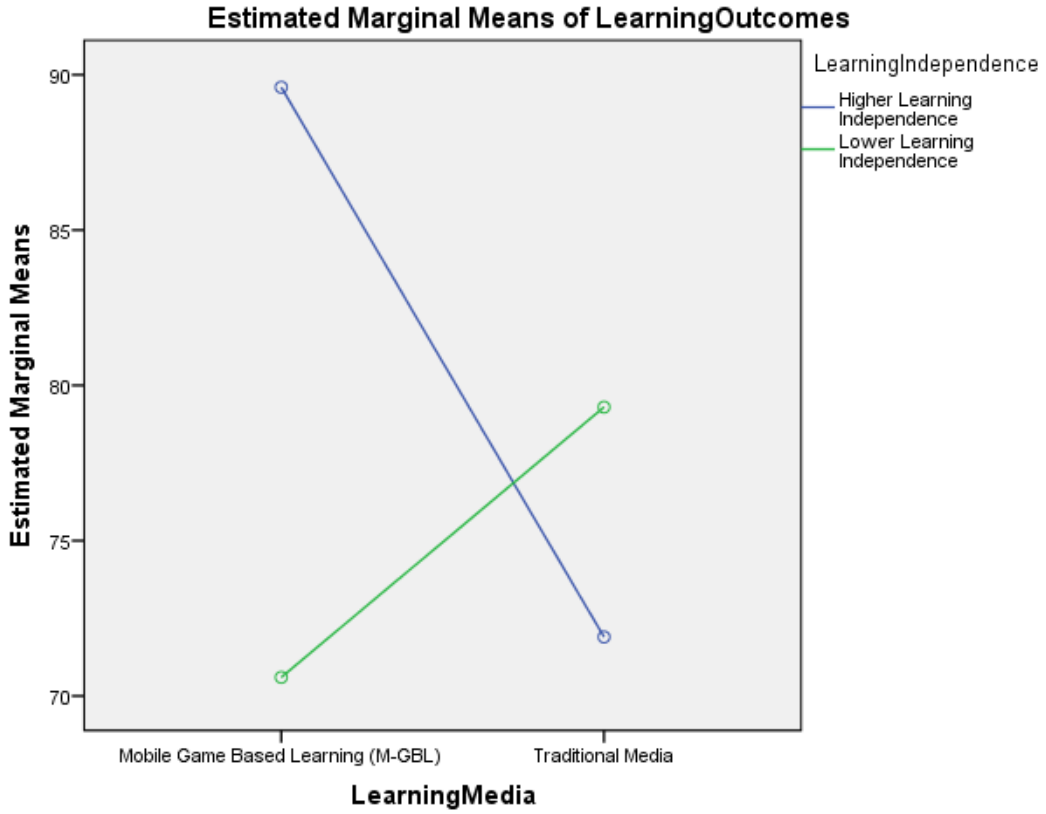

Figure 1. Graph Influence Interaction between Learning Media and Learning Independence of Student Learning Outcomes

if used with a group of students having different degrees of learning independence. The results show that M-GBL media is more effective if used with students who have high learning independence. Meanwhile, traditional media is more effective if used with students who have low learning independence. The influence of interaction between independent variables (learning media and learning independence) to the dependent variable (learning result) can be seen in **Figure 1**.

To improve student learning outcomes, by encouraging students to be independent learners, requires students who support a learning process that is fully optimized. The students' learning independence is essential so that they become responsible for the learning process. Implementation of independent learner attributes is demonstrated in the learning process where students do not only rely on books or teacher explanations as the main learning resources but they also engage in a mutual learning process. Based on the description above, it can be concluded there is an interaction between learning media and learning independence on student learning outcomes.

Differences in student learning outcomes between groups A_1B_1 and A_2B_1

Based on the result of hypothesis testing (**Table 8**), the value of Q_{count} is 11.90. Meanwhile, the value of Q_{table} at the level of significance (α) = 0.05 of 4.33. Therefore, the value of $Q_{count} > Q_{table}$, then H_0 is rejected so that it can be concluded that student learning outcomes taught by using mobile game based learning (M-GBL) are higher than students taught by using traditional media in groups of students who have high learning independence. The

Table 8. Hypothesis Testing Results Using Tukey Test

Groups	Q_{count}	Q_{table}	Conclusion
A_1B_1 & A_2B_1	11.90	4.33	H_0 rejected
A_1B_2 & A_2B_2	4.63	4.33	H_0 rejected

results also show that mobile media based learning (M-GBL) is more effective than traditional media, if used with groups of students who have high learning independence.

A person who is an independent learner often prefers to work alone, determine and choose how to work by his conscience. He attaches importance to autonomy in acting, decision making, and in the selection of activities in achieving goals. Learner independence is linked to the media used in the learning process by the main characteristics of M-GBL media that can be studied anywhere, anytime and by anyone who can help students to learn independently. Students who have to learn independence point out that the use of M-GBL media is more helpful and beneficial in acquiring the subject matter. Liu (2014) concludes that the use of e-learning media affects student independence and motivation in a way that increases student academic achievement.

Differences in student learning outcomes between groups A_1B_2 and A_2B_2

Based on the result of hypothesis testing (**Table 8**), obtained the Q_{count} value of 4.63. Meanwhile, the value of Qtabel at the level of significance (α) = 0.05 of 4.33. Therefore, the value of $Q_{count} > Q_{table}$, then H_0 is rejected so that it can be concluded that the results of student learning, taught by using M-GBL media, are lower than students taught by using traditional media in groups of students who have low learning independence. The results also show that traditional media are more effective than M-GBL media if used with groups of students who have low learning independence. Broadbant and Poon (2015) support this claim that one-way-based learning, using mobile media, can improve learning independence, time management, and critical thinking that can all have a positive impact on student learning outcomes.

Students who have low learning independence tends to become passive learners who follow the learning process as it is delivered so students who have this attitude may find it easier to master lessons than the students who do not have learner independence. The learning materials are structured and systematically delivered by the teacher. The process of learning with traditional media (PowerPoint) appears to be more advantageous for students who have low learner independence. Therefore, using M-GBL media with students who have low learner independence is not recommended due to the low motivation.

CONCLUSION

Based on the results of the research, it can be concluded that the test results validation by experts and the testing of students and teachers, M-GBL media has very good overall criteria. Thus that M-GBL media, developed in this research, is a feasible media to be used for learning chemistry that is practical, fun, interesting, can be used anywhere, and in accordance with the facilities owned by learners.

In the process of learning chemistry, the use of M-GBL media has a positive effect in improving student performance, in this case, improving student learning outcomes. Students are not bound by time and space. They can learn not only in the classroom but they can also study outside the classroom depending on the student's individual conditions. The learning material contained in M-GBL is interesting as it comes with games, animations, and learning videos.

The use of M-GBL media in the learning process must pay attention to indicator of student learning independence. Based on the results obtained, the use of M-GBL media will have a positive effect on student learning outcomes, when applied to groups of students who have high learning independence. By contrast, in groups of students with low learning independence, student learning outcomes, taught using M-GBL media, were lower than those taught using traditional media.

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Internet News Dissemination on Ideological and Moral Cultivation in Higher School

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ABSTRACT
Mass media television, radio and Internet have a profound influence and change people's way of thinking, values and behaviors, especially for new media heavy users of university students, the influence of the media is more obvious and profound. In order to play the guiding thought of Ideological and political education in the complex media environment, we must combine the theory and the practice of communication into the academic research and practice activities, broaden the ideological and political education discipline field, and improve the effectiveness of Ideological and political education. The network news communication has both positive and negative influences on the ideological and moral education of university students. Firstly, this paper analyzes the characteristics of network news communication, and points out that network news dissemination has selectivity and position. The characteristics of Internet news communication make it bring about two influences on the ideological and moral education of university students, that is, positive influence and negative influence. Finally, the author puts forward his own views on how to deal with the negative influence and how to deal with the negative influence of network news communication on the ideological and moral quality of university students.

Keywords: network news, communication, ideological morality

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Contribution of this paper to the literature

- Through stepwise regression empirical algorithm, the relationship model is established. The influence of network news communication on the ideological and moral cultivation of higher school is made specific analysis, to avoid the vague talk about traditional methods.
- Relationship between the network news dissemination and the ideological and moral education in Higher school is analyzed, and it has certain persuasive power.
- Using data to solve problems is highly practical.

INTRODUCTION

Network news is a kind of news form developed with network technology at the same time. With the popularity of the Internet (Shi, et, al., 2016), the network news has gradually demonstrated strong news communication ability and public opinion influence (Wang, 2015). This is because in the network, anyone can freely spread all kinds of news, the news information due to the lack of the correct guidance of public opinion, often mixed with a lot of bad news information (Ye, 2016), therefore, the network news media have great influence on every aspect in the society. Among them, to the ideological and moral cultivation of higher school, it has greater impact. This is because university students are the most active group of thought, the network has a natural attraction for university students (Wang, 2016), and the opportunity for university students to contact the network is the most frequent (Deng, 2017). Students can correct ideological and moral formation of the concept of right reason in the network news under the guidance; also can be in error of irrational network news under the guidance of the formation of wrong ideological morality (Tian, Yi-Nan, Wang, 2017). Therefore, how to deal with the impact of network news media on university students' ideological and moral cultivation, and take reasonable measures to respond to these effects, has become the current hot research topic.

REVIEW OF CURRENT RESEARCH

There a lot of literature about the effect of the selective network news reported on university students (Zhang, 2016), mostly in discussing the influence of network news media on youth from the macroscopic angle, and is mainly discussed some aspects of university students' moral quality, value orientation etc.. (Li, et, al, 2017) analyzed the effect of network news media on university students' Three Outlooks and interpersonal skills and ways of life; (Zhu, Ma, 2017) analyzed the positive guidance and reverse misleading of the network news media on university students' Three Outlooks. These discussions are of reference significance to the study of this paper. Most of the research on countermeasures is focused on the measures to deal with the negative impact of network news communication on university students from a macro perspective. (Zheng, et, al., 2016) pointed out that "to effectively deal with the negative impact of the network negative news on the value orientation of university students, we must strengthen the network news supervision, improve individual moral self-discipline, and strengthen the education and guidance of university students." The countermeasures to deal with the impact of network news communication are mainly aimed at a certain point, for example, Wang Shuwei just put forward countermeasures from the point of view of professional ethics of media practitioners. Thus, the research in this area is relatively weak and should be strengthened.

There are still many expositions in foreign writings which give inspiration to the author. (Han, Zhu, Marxism, 2016) pointed out that "when the news spread to some critical figures or events, in order to maintain the balance of network news, it must find the relevant person, and provides an equal opportunity to rebut statements". The American scholar (Barnett, Öz HCM, 2017) proposed "fishpound" concept, he believes that "the media in any specific social environment are shouldering the social control function, and this kind of control is often a subtle and imperceptible process, summed up is: "fishpound" (Kirby, Michaelson, 2015). the audience in the "fishpound" (Schäfer, 2015), their understanding of the objective reality and the environment monitoring are all based on the "symbolic reality" provided media, and is affected by it unconsciously." These researches have certain reference significance for the writing of this paper.

METHODS

The Selectivity of Network News Communication

News communication is a report of recent events in society. Through news communication, people can understand the changes of the world. Only true news dissemination can provide accurate basis for people to understand the world, and thus guide correct public opinion. Therefore, authenticity is the basic requirement of news communication. News communication should also report news events in the light of true, accurate and objective principles. As a new media of news dissemination, network media is more liberal and effective than traditional media such as newspapers and broadcasting (Yan, Chao, 2015). However, the characteristics of network news communication also make the authenticity and objectivity of network news suffer great challenge. When major emergencies occur, most of the news in the network tends to "selective reporting".

News communication inevitably has a certain tendency. This tendency is caused by the position, viewpoint, interest of the news producer. Therefore, the news will inevitably reflect the value of communicators in the process of communication, and make the news communication stand and subjectivity. In the network news dissemination, this kind of standpoint mainly has the following three aspects to manifest: first, the news event has the subjective selectivity. Second, in the representation of network news, the news producer is limited by its own knowledge level, identity and other conditions, to inevitable make the stand in the process of news with producers, this position is exemplified by the network news media; third, in the process of network news commentary, users who hold different positions will make different conclusions of a news event, leading to that it difficult to believe that which is right and which is wrong.

In this paper, a stepwise regression empirical algorithm is used to establish relationship model for the two party. First of all, WINDOWS.STATA13.10 software is used to establish the relation of data function, and the specific function relation is expressed as follows:

$$Y_t = Q_t^{(\Sigma_{i=1,2,3\cdots n}^{100}\alpha_{e^{i\theta}}\beta_{e^{i\theta}})} E_t^{(\Sigma_{i=1.2.3\cdots n}^{100}\chi_{e^{i\theta}}\delta_{e^{i\theta}})} e^{i\theta} \quad (1)$$

In the formula, Y_t represents the stimulate rate of network news media to the university ideological and moral culture at time t; Q_t is the transmission rate of network news; E_t is the Internet news communication; $e^{i\theta}$ is the random interference factors in the process of Ideological and moral cultivation in higher school transmitted in the downlink interval; i=1 2, ... is the representative of the types of communication.

When the network news communication mode changes, that is, when i is 1, 2, ..., to observe the numerical changes of Y_t, assuming that the model of network news dissemination and the university ideological and moral cultivation is as follows:

$$\log Y_t = (\sum_{i=1,2,3\cdots n}^{100} \alpha_{e^{i\theta}}\beta_{e^{i\theta}}) \log Q_t - (\sum_{i=1.2.3\cdots n}^{100} \chi_{e^{i\theta}}\delta_{e^{i\theta}}) \log E_t - \varepsilon_t \quad (2)$$

To make the model appear clearer and easier to understand, the formula 2 is decomposed and deformed, and the following relational models are obtained:

$$\begin{aligned}\log Y_t = {} & \alpha_{e^{i\theta}{}_t}\beta_{e^{i\theta}{}_t} \log Q_t + \alpha_{e^{i\theta}{}_{2t}}\beta_{e^{i\theta}{}_{2t}} \log Q_{2t} + \alpha_{e^{i\theta}{}_{3t}}\beta_{e^{i\theta}{}_{3t}} \log Q_{3t} + \alpha_{e^{i\theta}{}_{4t}}\beta_{e^{i\theta}{}_{4t}} \log Q_{4t} \\ & + \alpha_{e^{i\theta}{}_{5t}}\beta_{e^{i\theta}{}_{5t}} \log Q_{5t} + \alpha_{e^{i\theta}{}_{6t}}\beta_{e^{i\theta}{}_{6t}} \log Q_{6t} + \alpha_{e^{i\theta}{}_{7t}}\beta_{e^{i\theta}{}_{7t}} \log Q_{7t} + \alpha_{e^{i\theta}{}_{8t}}\beta_{e^{i\theta}{}_{8t}} \log Q_{8t} + \\ & \alpha_{e^{i\theta}{}_{9t}}\beta_{e^{i\theta}{}_{9t}} \log Q_{9t} + \alpha_{e^{i\theta}{}_{10t}}\beta_{e^{i\theta}{}_{10t}} \log Q_{10t} + \chi_{e^{i\theta}{}_t}\delta_{e^{i\theta}{}_t} \log E_t + \chi_{e^{i\theta}{}_{2t}}\delta_{e^{i\theta}{}_{2t}} \log E_t + \chi_{e^{i\theta}{}_{3t}}\delta_{e^{i\theta}{}_{3t}} \log E_{3t} \\ & + \chi_{e^{i\theta}{}_{4t}}\delta_{e^{i\theta}{}_{4t}} \log E_{4t} + \chi_{e^{i\theta}{}_{5t}}\delta_{e^{i\theta}{}_{5t}} \log E_{5t} + \chi_{e^{i\theta}{}_{6t}}\delta_{e^{i\theta}{}_{6t}} \log E_{6t} + \chi_{e^{i\theta}{}_{7t}}\delta_{e^{i\theta}{}_{7t}} \log E_{7t} + \\ & \chi_{e^{i\theta}{}_{8t}}\delta_{e^{i\theta}{}_{8t}} \log E_{8t} + \chi_{e^{i\theta}{}_{9t}}\delta_{e^{i\theta}{}_{9t}} \log E_{9t} + \chi_{e^{i\theta}{}_{10t}}\delta_{e^{i\theta}{}_{10t}} \log E_{10t} + \varepsilon_t\end{aligned} \quad (3)$$

In formula 3, the parameters $\alpha_{e^{i\theta}{}_t}$ and $\chi_{e^{i\theta}{}_t}$ are the growth factor and dissemination lag factor of network news dissemination at time t, when parameter $\chi_{e^{i\theta}{}_t}$ is larger, the greater the coefficient $\alpha_{e^{i\theta}{}_t}$ is, indicating that the network news media has a stimulating effect on the ideological and moral cultivation.

RESULTS

The Positive Influence of Network News Report on Ideological and Moral Education of University Students

It is helpful for university students to participate actively in society. Because of the characteristics of freedom and reciprocity, the network has attracted great attention to university students. University students can understand society, serve the society and gain social recognition through various news websites. Internet news is an important channel for university students to understand society and participate in society. Network news in the dissemination process, for various social news event selection and reasonable processing production, can attract students' attention in various forms of communication, so as to improve the students' attention to the society, stimulate students to participate in social consciousness.

It will help to improve the legal consciousness of university students. The network news media have certain selectivity, therefore, a lot of network news will choose social bad events as news content. In fact, the network media can expose the dark side of society, to help people play an important role in raising awareness. However, if the network media hold extreme positions or prejudice to report the news events, it will be a negative guiding role for university students. Happily, the mainstream news media will help students improve the legal consciousness and awareness as reported in various criminal events. This can help university students to improve the legal consciousness and awareness. Therefore, the network news spread alarm bells ringing effect on university students' play.

The Negative Influence of Network News Report on Ideological and Moral Education of University Students

To make wrong guidance to the value outlooks of university students. The network news media have certain selectivity and position, therefore, the network news media on the values of university students have a profound impact, and even make some students have doubt and negative psychological conflict on the current social mainstream value concept. Taking the network news media of "Peng Yu event" as an example, when most people haven't fully understood the facts, many people make a conclusion for the nature of the incident according to their first impressions, and the one-sided public opinion is formed. The kidnapping of public opinion on morality, will be very easy to interfere on university students' ideological and moral, so that part of the values of university students have deviation, and the concept of "It's better to save trouble, no good deed goes unpunished" is generated. The negative influence of the social public opinion and value kidnapping caused by selectivity and position of network news communication, on the ideological and moral quality of university students can be seen.

Let university students produce crisis of confidence. Because of the characteristics of selective and stand in network news, there will be many inaccurate news reports, which will mislead university students. University students' ideological and moral concept has not yet mature, which is very easy to get lost in the wrong direction under the guidance of network news, do not trust the psychology of society and the people around, it brings some obstacles for the students' social communication. From the "Peng Yu event", the network news media contributed to the case that the university students had panic relief to such events, when they met the old man fell to the ground, they will instinctively make it with "Peng Yu event" together, this crisis of confidence, are derived from the impact on the network the news brought. As the mainstream group of the future society, university students are inevitably affected by the negative effects of Internet news communication.

The irrational emotions and behaviors of university students are induced. Network news communication has a strong attraction to people because of its unique perspective and various forms of expression. University students are the most active groups in the network, they have a strong enthusiasm on the hot social events reported in the news network, but university students is not a mature group, their life experience and social experience is relatively shallow, therefore, in the process of news dissemination in network participation, they are not irrational in their performance. A lot of network news is out of the public eye to attract interests or economic purposes, did

not fully consider the factors of the ideological and moral aspects, resulting in a lot of moral events exaggerated. While the resolution of university students is not strong, it is vulnerable to these events or deliberately exaggerated speech infection, resulting in some irrational emotions and even hostile social psychology. All these are the consequences of improper dissemination of Internet news.

DISCUSSION

In view of the influence of network news communication on the ideological and moral education in higher school, effective measures should be taken:

To set up ideological and moral websites for university students. The moral educators in higher school can carry out ideological and moral education of university students through the network, in the way of education, it can be through distance education, by inviting celebrities from all walks of life to give university lectures, to improve the coverage of education. Compared with classroom education, network education has a greater advantage in the ideological and moral cultivation of university students. Ideological and moral workers in higher school can carry out ideological and moral education to university students through abundant teaching cases. It will make it easier for university students to combine multimedia with colorful teaching contents. At the same time, because of the interactive characteristics of the network, teachers and students can interact in real time, thus enhancing the teaching effect.

To strengthen the education of network news dissemination among university students. The network is a new type of media, the network news media will be influenced by Western decadent ideas, so as to reduce the university students' Ideological and moral standards, so, it is necessary to strengthen the network news media on university students' education, the university students can establish a correct concept of network ideological and moral. It is necessary to let students know whether in the real world or the network world, it also need ethics system to make certain constraints on people's behavior. We should guide university students to consciously resist the erosion of unhealthy network news, strictly abide by the laws of the state in the network, and develop good Internet habits.

To strengthen the network legal education of University students. At present, most of the universities have set up the legal aspects of the curriculum, but according to laws and regulations of the network, the current law teaching content is almost blank, such as some hacker behavior and human behavior, and it has no corresponding teaching, making that some students think these are the correct behavior. This shows that the laws and regulations in the network of education is still lacking, but also need to strengthen the relevant laws and regulations publicity and education. University students are the special group, for them, it needs to have specific laws and regulations of education, to help them establish the correct Three Outlooks, and improve the ability to resist bad information of university students, which is an important and arduous task.

To improve the filtering mechanism and standardize the censorship of network news. First of all, network media, as producers and disseminators of Internet news, should do a good job in censorship of network news. Secondly, the country should establish a perfect network news production professional norms and network news review mechanism, thereby ensuring the credibility of the network news from the source. We should make professional rules for Internet journalists, and use legal means to restrict Internet journalists. In order to standardize the network news communication and ensure the healthy development of the network media, many countries have already set up the corresponding professional norms according to their own national conditions. The norms of network news communication need to set up a set of criteria to meet the social conscience, and gradually promote in the network news media industry, so as to guide the network news dissemination.

CONCLUSION

In the use of the network, university students should correctly face the impact of network news communication. On the one hand, university students should make full use of the existing ideological and moral teaching resources and network teaching resources on the campus, and constantly improve their ideological and moral level. On the other hand, university students should actively seek ideological and moral teaching resources, and actively improve the level of self-discipline. Only university students' ideological and moral level has reached a certain height, can they correctly face the confusion caused by network news media, to make a correct judgment of network news, and take reasonable actions and consciously to resist the bad news network. It is of great value to improve the ideological and moral standards of university students.

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Research on Physical Education Problems and Management Reform of Chinese Colleges and Universities

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ABSTRACT
Research purpose: Chinese college students' physique condition not improved for many years, profoundly affected the national talent training quality and effect, the colleges and universities sports work caused many concerns and questions, by analyzing the problems existing in the college sports, puts forward some countermeasures for China's colleges and universities sports management reform. Research methods: the research methods of the paper are literature and questionnaire survey, which have surveyed 406 PE teachers from 10 universities in China. The research process: the paper analyses to retrieve relevant literature, this study was carried out on the questionnaire survey information statistics, combined with the Chinese government policy document interpretation of the college sports, analyzes the realistic problems in the college sports, finally puts forward some countermeasures for the reform of sports management in colleges and universities. Results: School leaders should pay more attention to school sports; Universities should implement relevant policies of the state; Develop student development as the goal of sports work; 4. Establish a management system of multi-subject co-participation.

Keywords: China's colleges and universities, university physical education, real problems, management reform

INTRODUCTION

Why do college students have years of physical health without reverse? Why does the country introduce regulations and regulations to strengthen college sports work, the effect is not satisfactory? Why is the "sports element" in the evaluation system of college talent? Why is there no obvious reform in college sports management system? According to the above problem, only seek answers from the national policy laws and regulations safeguard level, is clearly not enough, also should be the internal operation status of sports management system and mechanism in colleges and universities and the dilemma for answers. Constructing a set of practical and effective college sports management measures is the necessary condition for the development and management of college sports. The research methods of the paper are literature and questionnaire survey, which have surveyed 406 PE teachers from 10 universities in China. Research process: the author has been working in college sports for many years and has been thinking seriously about this issue. So the author in the thesis analyses to retrieve relevant literature, the questionnaire on the basis of the statistical information, combined with the Chinese government policy document reading of college sports, analysed the practical problems of college sports, finally puts forward some countermeasures for the reform of sports management in colleges and universities. The results of the paper are: School leaders should pay more attention to school sports; Universities should implement relevant policies of

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Contribution of this paper to the literature

- The author summarizes the practical problems of Chinese university sports through questionnaires.
- Reform of Sports Management Mode in Chinese Universities.
- The direction of the reform of sports management system in Chinese colleges and universities is the multi - subject participation.

the state; Develop student development as the goal of sports work; Establish a management system of multi-subject co-participation.

RESEARCH SIGNIFICANCE

The Quality Assurance Action of China's National Talent Strategy

Youth is the future of the country and the hope of the nation. Youth is a popular nation, while a young man is strong. It is the basic and strategic work of the country to promote the better growth and development of young people. On June 23, 2016, the state council issued the national fitness plan (2016-2020), the biggest bright spot of the file is "breakthrough" of the national fitness, the national fitness as the strong support of healthy Chinese construction well-off society of national business card and signature. The service target of college sports is basically adults who have reached the age of 18. College sports should also serve the national strategy of "healthy China".

The state of high school personnel training quality of high standards and high requirements, the specific expression is "moral, intellectual, physical and aesthetic development" of the socialist builders. The "body" should be interpreted as: physical and mental health, comprehensive sports quality is better, master more than two sports skills and participate in the general sports competitions comprehensive ability. April 13, 2017, the CPC Central Committee and State Council issued a "long-term youth development plan (2016-2025)" pointed out that to continue to enhance the nutritional level of young people and physical health, youth physical compliance rate of not less than 90%. Hard Restrictions on Strengthening Physical Health Index in School Education. Strengthen the school sports work; improve the national sports and health curriculum standards, play a school sports assessment and evaluation system to guide the role of physical training and extracurricular exercise time to be implemented. Organize young people to participate extensively in the national fitness campaign, cultivate sports hobbies, improve physical fitness, master sports skills, develop lifelong exercise habits.

In fact, college sports still have many difficulties and problems, especially the decline of college students' physical health level has not fundamentally reversed. There are problems of insufficient students' exercise, there are problems in the teaching of physical education, there are problems of lack of supervision means, and its foothold is the reform and perfection of the college sports management system. Effective institutional arrangements are the prerequisite and guarantee of scientific management. The stability of the system can clearly guide the development direction and ensure the sharing of results. Perfect system of the system is to achieve the development of the functions of the carrier; of course, strict implementation of the system is to achieve the realistic development of shared protection.

College Student's Physical Situation is Worrying; College Sports Caused Many Concerns and Doubts

August 15, 2015, "China Youth Sports Development Report (2015)" officially released, the report shows: Chinese student's physical health problems are still prominent, overweight and obesity is serious, the incidence of myopia continues to increase, speed, strength and quality growth tends to Stagnation, endurance quality trough hovering, flexibility and quality grades for the better, poor blood pressure regulation function is more common. As one of the major Aspect, a number of physical fitness tests show that college students physical quality as high school students.

Over the years the physical condition of college students worrying, has become a prominent problem in higher education and social concern hot issues. Chinese adolescents from primary school first grade physical education to complete the university study, at least 14 years of physical education, physical health test data in front of the physical education class seems "no credit, not to mention hard labour", criticized. Over the years, college sports experienced "competitive sports for the country glory" "quality education" happy sports "successful sports" "lifelong sports" and "health first" series of educational philosophy of change, now seems to be confused. The reason, there are many years of its "test-oriented education baton" historical issues, but also students "like sports but do not like physical education," the objective reality dilemma. However, from the system design, the college sports management system lagging behind, the reality is not perfect, to get academic proof. With the rapid development of China's modern university system and the construction of world-class universities and first-class subject goals, the innovation of university curriculum management system has become an important means to reform the current teaching management system in China; to improve the quality of university courses, but also for college sports Management system reform provides an opportunity.

The Reform of College Sports Management is Imperative at Present

On May 6, 2016, the General Office of the State Council promulgated the Opinions on Strengthening the School Physical Education to Promote the All-round Development of Students' Physical and Mental Health, aiming at "daily exercise, healthy growth and lifetime benefit" Reform and innovate the institutional mechanism, comprehensively improve the quality of physical education, improve the quality of students' personality, and earnestly play the role of sports in cultivating and practicing the socialist core values, promoting the comprehensive effect of quality education, cultivating moral and intellectual development, successor. The first one is affirmed the importance of school sports work, the second is that the school sports management system, the mechanism should be innovative reform.

Reforming the ills in the cultivation of talents in Chinese colleges and universities lies in the innovation of institutional mechanisms. Combing the school sports files, can be described as "policy stock" quite abundant, and some documents are instructive and strong binding, such as: the Third Plenary Session of the Eighteenth Central Committee of the Communist Party of China considered and adopted the "Central Committee on the comprehensive reform of a number of major issues "The basic criteria for the work of higher education in colleges and universities promulgated by the Ministry of Education on June 11, 2014 is to assess and examine the work of higher education in colleges and universities. Important basis, those who do not meet the "basic standards" requirements, the physical health of students for three consecutive years of decline in the school, "undergraduate teaching in the evaluation of colleges and universities" shall not be rated as qualified.

Graduates of college students, physical test scores of less than 50 points by finishing (that is, get the diploma and degree certificate). March 8, 2015, the Chinese State Council General Office "on the issuance of China's football reform and development of the overall program of the notice" requirements to the development of campus football as the starting point for the development of school sports. May 6, 2016, the State Council issued the "on the strengthening of school sports to promote the comprehensive development of physical and mental health of the views of students" to "every day exercise, healthy growth, life-long benefit" as the goal, reform and innovation system, comprehensively enhance the quality of physical education The To implement the solution to the problem of physical health of students as the starting point, to promote the university sports management system and the modernization of governance capacity, will become an important part of the reform of college sports.

"Sports" For the primary stage of socialism in China, its management system for many years to take the basic "top-down" model. One of the competitive sports, mass sports, sports culture, sports industry basically belong to the State Sports General Administration, school sports, including college sports belong to the Chinese Ministry of education. College sports is under the guidance of the Ministry of Education under the unified guidance of their own daily physical education teaching arrangements, the school sports culture and other issues and the physical condition of college students, college sports basic standards for supervision and inspection. Over the years, colleges and universities within the sports management mechanism and the system did not change significantly,

conservative and inertial dependence is to a large extent bound by the college sports management system reform and innovation. Whether it is the coordinated development of national education and the need for high-quality personnel training, or the development needs of colleges and universities, college sports should not be short-board, urgent need for management system reform.

RESEARCH METHODS

The main research methods adopted in this paper are literature and questionnaire.

Literature Method

The author uses two kinds of methods, such as paper books, newspapers and periodicals, periodicals and electronic data based on Internet data, to use the method of cross-examination and reverse investigation in the literature resources to "university (university) sports" College sports "management system" and other related terms for the keyword search and analysis of the literature.

Questionnaire Survey

In this study, a questionnaire survey was conducted on 500 college physical education teachers in 10 universities in mainland China by using the survey method of random selection of colleges and universities. The way of distribution and recycling is carried out by the team members in person. A total of 461 questionnaires were collected and 406 were valid questionnaires. The data were analyzed and analyzed by EXCEL software.

THE DEFINITION OF CORE CONCEPTS AND THE SUMMARY OF EXISTING RESEARCH RESULTS

The Definition of Core Concepts

University sports or university physical education

"University Sports or University Physical Education", narrowly refers to the students through the daily physical education classes, to enhance physical health, improve the level of sports technology, improve non-intellectual quality of emotional and social adaptation as the main objective of the public compulsory courses. Broadly refers to the physical practice of college students as the main means, through reasonable physical education, multiple campus sports activities and scientific physical exercise process, to enhance physical fitness, improve health, improve physical quality, school sports competition and active campus sports culture for the purpose of the sports as a factor of social activities in general.

China's Ministry of Education promulgated in 2002, "the National College Physical Education Curriculum Guide" stipulates: "Physical education curriculum is the physical practice of college students as the main means, through reasonable physical education and scientific physical exercise process, to enhance physical fitness, Health and improve the quality of sports as the main goal of the public compulsory courses; is an important part of the school curriculum system; is the central part of the work of higher education. It can be seen that the college physical education curriculum is an important way to promote the harmonious development of physical and mental health, ideological and moral education, cultural science education, life and sports skills education and physical activity, which is an important way to implement quality education and cultivate all-round development talents.

Management system

Management, refers to a certain system of people, money, things, things such as planning, organization, command, coordination, control, in order to achieve the objectives of the process. System, refers to the state organs, enterprises and institutions in the institutional settings, leadership affiliation and management authority division and other aspects of the system, system, methods, forms and so on. Such as political system, economic system.

Management system, mainly refers to the management system and management system. System specific performance in the institutional settings, the system, also known as regulations, regulations, regulations and so on.

The education system is the general term for the form, method and system of state organization and management education. Modern school management system is the modern school system of affiliation, institutional setting, management authority and responsibility and its organizational system and other mute-integrated structure system. Educational management institutions and a certain combination of norms is the education management system. School sports management system is a branch of the education system. College sports management system should also be a combination of college sports management institutions and school sports management norms.

Sports management system in colleges and universities

Sports management in Colleges and Universities, refers to the school education in accordance with the law and the laws of the law, in order to achieve the objectives of school sports management, give full play to limited human, financial, material, information and time and other factors The role of the best means and methods, the work of college sports and its internal and external factors and environmental conditions, the planning, organization, leadership, control and innovation and a series of comprehensive activities.

School sports management system, is the school sports management institutions, the division of authority, operation mode and other aspects of the system and the general term. School sports management system policy refers to the country in order to promote the smooth progress of the reform of China's school management system, the school management system reform in the management of the main body and the management of the establishment and management of norms and other aspects of the strategic and regulatory provisions Guidelines. School sports management system, the main solution is the school sports within a number of management issues or management norms, mainly related to how to regulate the school sports decision-making system, the school sports advisory system, the school sports implementation system and school sports Supervision of the relationship between the feedback system and so on.

Some of the Research Literature has been Outlined

Compared with foreign universities, China's college sports more "Chinese characteristics". As one of the educational policies and sports policy, the effective implementation of the school sports policy will be related to the full implementation of the educational policy and the expected realization of the new era of educational goals (Wang & Zhou, 2010).

Sports management system is an important part of the national political system, including sports management institutions, the division of authority, operating mechanism and other systems and systems. The problem of sports management system is the core problem of sports development. Sports management system has a variety of attributes: institutions, systems, methods, forms, architecture, guidelines and so on. Structured, logical science of sports management system, help to promote the progress of sports, on the contrary will restrict the development of sports (Wen & Xiong, 2013).

A country's economic system determines the sports management system, and sports management system determines the sports organization operating mechanism. Many colleges and universities sports management institutions generally by the physical education department of physical education or physical education department, the agency does not have the administrative functions, but assume the school sports administrative responsibilities and obligations, and did not establish a vice president of the leadership model (Zhang & Qin, 2009).

China's general college sports management system is under the leadership of the school sports committee sports department system management model. In this management model, the school sports committee is mainly responsible for the development of school sports objectives, the annual sports work plan arrangements, the implementation of sports supervision and so on. The Ministry of Sports is mainly responsible for the

implementation of school sports work, work is also very wide involved, the party secretary is responsible for party work, the director is responsible for administrative work, deputy director responsible for groups, training, competition, scientific research and student physical fitness test work, Under the Ministry of Sports has a variety of teaching and research section, responsible for the implementation of the work.

The author makes use of the theory of "institutional change" of the new institutional economics to elaborate the factors that affect the institutional changes of the college sports system, and think that organizational rigidity is an important factor influencing the changes of college sports system. The main reason is that the organization's important "members", teachers and students rarely have the opportunity to participate in the reform, the main decision-making are confined to the leaders of the office (Huang, 2017).

The problems of traditional Chinese sports are: education and teaching content of traditional methods and methods of neglect, methods of teaching, knowledge structure and ability is lagging behind. The concrete measures to implement the sports reform are: the scientific selection of teaching content, the combination of educational reform to create a good situation education, physical education teaching model of reasonable innovation, combined with the characteristics of students from the reality of education (Li, 2013).

At present, China's school sports reform outstanding problem is the lack of motivation at the grassroots reform, the lack of micro-reform forces to cultivate, reform "only in the implementation of national education policy" only. It is necessary to cultivate the micro reform force to ensure that the school sports reform is driven by the policy type to the innovation of autonomy. The inevitable choice from the stage promotion to the continuity exploration is the only way to bring together the wisdom of teaching practice and push forward the reform of school sports. (Pan et al., 2017).

At present, for the school sports reform, the biggest trouble is not the curriculum, teaching reform, but the national education laws and regulations, the implementation of policy encountered a reasonable crisis. Should be through the top design of the legislative regulation, strict policy accountability, to stimulate grass-roots micro-reform forces and other educational governance ideas, as soon as possible to crack the current reform of school sports in China cannot, policies and regulations cannot be implemented, preaching greater than the dilemma of law and contract, For the realization of China's school sports reform "decree" to lay a benign operating mechanism (Huang et al., 2016).

The first key word in the reform and development of higher education in China is "quality". Whether it is a world-class university and a first-class discipline construction, or a comprehensive reform of higher education, or modernization of university governance system and governance ability, its meaning has pointed to the improvement of the quality of higher education (Zhang, 2015). If you stand in the perspective of improving the quality of higher education, the responsibility and mission of college sports is to improve the quality of education services for the university, for the country to cultivate a strong body of outstanding talents. So, college sports should also conform to the reform of university management system, the implementation of the new era of college sports positioning, reform the existing management system of the drawbacks.

The call for the reform of the management system in colleges and universities has been coming from the 1990s, and the current management system is necessary in the specific historical period. However, in the 21st century, with the rapid expansion of the number and size of the school, higher education is no longer elite education, has become a mass education, the overall management system of colleges and universities lag, determines the need for reform of college sports management system.

Table 1. Teacher's Job Burnout Survey and Statistics (N = 406)

Region	Number of visitors	Percentage
Every day	9	2.22%
Most of the time	38	9.36%
Sometimes have	186	45.81%
The occasional	133	32.76%
never	40	9.85%

THE REALISTIC PROBLEMS OF PHYSICAL EDUCATION IN CHINESE UNIVERSITIES

Physical Education Teacher Supervision Measures are Missing, Strong Sense of Job Burnout

Teachers' professionalism is the guarantee of classroom teaching quality. The physical education teachers in Chinese colleges and universities generally have a sense of self-knowledge renewal is not strong, basically followed their own in the university stage of knowledge and skills to teach students. The times in progress, science and technology in development, knowledge is updated, and physical education teachers of theoretical knowledge and teaching methods are still in place. The reason for this phenomenon is the lack of evaluation system and supervisory mechanism for the teaching level and ability of serving teachers. The existing only the Office of Academic Affairs and school supervision (the vast majority of not part of the physical education teachers) regularly from time to time on the physical education classroom to check, the key check is: whether the teacher early or early leave, there is no lesson plans, students to class How to rate. As for the physical education teacher in the physical education taught what content, classroom teaching organization is standardized, teaching means is reasonable, the students have learned the knowledge and skills, students and teachers how to evaluate each other, and so on, the supervisors are generally not concerned about.

Survey shows that physical education teachers have a sense of job burnout, only "sometimes have a sense of burnout," the teacher accounted for 45.81% of the number of investigations. Choose "no burnout" teachers only 9.85% (As shown in **Table 1**).

The reason for this result is that: (1) the content of teaching and teaching methods of physical education for many years does not change; (2) the teaching of physical education teachers is a group of 18-20-year-old college students, inevitably single, monotonous; (3) physical education teachers how to teach in physical education, what to teach, the teacher a lot of freedom, there is no challenge; (4) the lack of awareness of the educational value of sports in the subconscious of physical education teachers; (5) the school did not give physical education "must be full" status, physical education teachers do not have the feeling of respect; (6) the school supervision and evaluation mechanism is missing, teachers are free.

These reasons, resulting in physical education teachers on their occupation is not too high, when there is a sense of job burnout.

Students Extracurricular Physical Exercise

Overdose, lack of exercise, mental stress, physical function degradation is the cause of sub-health of the four major killers, physical exercise is an effective way to improve the sub-health state. Extracurricular sports activities are a useful supplement to the physical education class. It is an extension of the PE teaching system in time and space. It is an organic part of the college physical education curriculum. It is also an important way to cultivate college students' physical exercise habit.

Through the investigation of the behaviour of students in their school physical education, the results showed that the choice of "very strong atmosphere" and "better atmosphere" teachers, accounting for 7.39% of the total survey and 6.65%. That is, more than half of the teachers that the school's physical exercise atmosphere is not very satisfactory (As shown in **Table 2**). Because college students do not love sports for many reasons, there is not

Table 2. Survey and analysis of extracurricular exercise atmosphere of college students (N = 406)

Region	Number of visitors	Percentage
The atmosphere is very good	30	7.39%
Good atmosphere	27	6.65%
A atmosphere	121	29.80%
Atmosphere in general	118	29.06%
The lack of atmosphere	110	27.09%

Table 3. High-level athletes in colleges and universities social competitiveness survey and analysis (N = 406)

Region	Number of visitors	Percentage
Strong competitiveness	34	8.37%
Better competitiveness	79	19.47%
Competitive	101	24.87%
Lower competitiveness	160	39.41%
No competitiveness	32	7.88%

strong sense of fitness, academic pressure, school sports resources and so on. For many reasons, the use of intelligent phones or online games on the phone to play the vast majority of leisure time. The use of intelligent phones for college students living and learning have had a tremendous impact. College students in the enjoyment of intelligent phones to bring convenient services and entertainment and leisure, but also inevitably passively accept it to bring a variety of negative effects. Many college students suffer from cell phone dependence, regardless of time without distinction of circumstances the use of intelligent phones, attention cannot be concentrated, regardless of classroom learning or participate in activities are absent-minded. As a result, college students spend far more time on intelligent phones than they spend on sports.

Sports Training and Sports Competition

Chinese colleges and universities to recruit high-level athletes have 30 years of history, this "combination of physical and educational" model is the new historical conditions to strengthen school sports, promote quality education, promote youth training for the country to cultivate and create high-quality workers And excellent sports reserve talents of a new important measure is to integrate sports, education and other resources and the implementation of the talent training strategy of the important measures, embodies the sports, education, the most fundamental training objectives, in line with the inherent requirements of personnel training.

From the perspective of personnel training, the social competitiveness of high - level athletes in colleges and universities is an unavoidable problem. In the survey of teachers' social competitiveness of high-level athletes in colleges and universities, it is considered that "highly competitive and competitive" accounts for 8.37% and 19.47% of the survey respectively. Choose the "competitive general" option of the teacher, accounting for 39.41%. It can be seen that the social competitiveness of high-level athletes in colleges and universities is low (As shown in **Table 3**).

The state's intention to set up the high - level athletes' enrollment system in colleges and universities is to carry out the pilot experiment of "combining sports and teaching", and try to reform and innovate the competitive talents of competitive sports in our country. But this type of college students is ultimately to the community, if there is no professional knowledge of the level of culture, its employment prospects are not optimistic, to a large extent affected the sustainable development of the model. Colleges and universities in the training of students in the professional choice should be encouraged to plural, should not all "public management professional", you can also choose science, engineering, liberal arts, law, economics, management and other professional. High level athletes should not be too much to reduce the curriculum assessment criteria, otherwise the knowledge and skills of ordinary college students with a large difference between the social competitiveness is bound to low.

Table 4. Investigation and analysis of the role of physical Fitness tests in promoting physical exercise (N = 406)

Region	Number of visitors	Percentage
Very useful	23	5.67%
More useful	74	18.23%
Useful	109	26.85%
Little useful	165	40.64%
No effect	35	8.62%

Test and Monitor of Physical Fitness of College Students

The evaluation of Physical Fitness of college students is an important part of school sports work, and it is also an important part of school education evaluation system. Through the test to promote students to actively participate in physical exercise, to develop the habit of regular exercise, improve self-care ability and Physical Fitness level, has important practical significance and long-term social significance. Colleges and universities through the quality of college students to test, to assess the physical health of students, but the reality of the situation did not receive the desired results. According to the survey of physical education teachers, it can be found that only 5.67% of teachers choose "very useful"; 18.23% of teachers think "more useful"; but 40.64% and 8.62% of respondents believe that through physical testing to promote the physical exercise The role is "little effect" and "no effect" (As shown in **Table 4**).

The state attaches great importance to the physical health of young people, the Physical Fitness level of students as a starting point, and then promote the school sports work in an orderly manner. The original intention is good, it is a measure, but the lack of supporting the monitoring mechanism, leading to the only data theory. Many schools are concerned only with the percentage of their school students as a whole, and the data are not analyzed and summarized. The survey shows that some students think that the body side does not make sense. The school should establish and improve the student's physical health test information feedback mechanism, cannot "a measured" students do not know their physical condition, teachers do not understand the student status of the "double-blind state." May use the information platform, give full play to the early warning function, urging students to know their own situation in the case of a regular scientific daily exercise.

THE MANAGEMENT MODE OF PHYSICAL EDUCATION IN CHINESE UNIVERSITIES

It is found that the management system of college sports has followed the "vertical" management mode of the eighties and nineties in the last century. The Ministry of Education of the State Council, as the competent department of sports administration of Chinese universities, is responsible for planning and guiding the work of physical education in colleges and universities. The Department of Education is the administrative department of sports at the provincial level, which is responsible for conveying higher-level policies and regulations and guiding the sports work in colleges and universities to a certain extent. The school physical education management system, is the school sports committee is responsible for the whole school physical education, group competition and other sports work; academic office with the physical education teaching department arranges college students physical education teaching; school Communist Youth League academic department with the physical education department do sports work; Physical education teaching department is responsible for physical education, student physical fitness test, sports competition and so on.

In the organizational system, the state despite the promulgation of a large number of documents and regulations, but the colleges and universities in the implementation of the policy, always greatly reduced, and some colleges and universities basically did not implement the corresponding requirements. In the internal organizational system of colleges and universities, there is no corresponding binding documents, various departments in the absence of supervision and supervision of the work, the effect can be imagined (as shown in **Figure 1**).

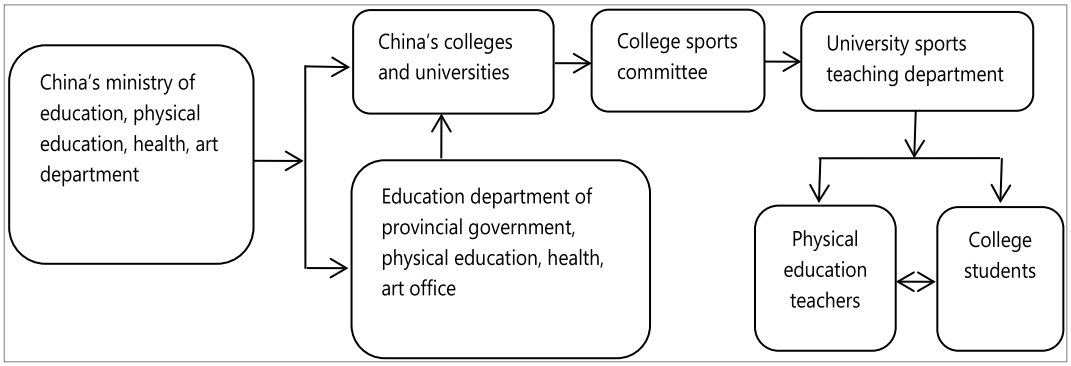

Figure 1. Structure of physical education management in Chinese universities

It is undeniable that this kind of "top-down" management system and management mode of university sports play an important role in the orderly development of college sports in certain historical periods. Over the years, colleges and universities within the sports management mechanism and the system did not change significantly, conservative thinking and management system of inertia dependence to a large extent bound by the college sports management system changes. With the gradual progress of the national governance system and the modernization of the governance capability, the gradual implementation of the reform of the management system and the higher expectation of the social work of the university have been deepened. The existing sports management system of colleges and universities has not adapted to the current development needs. Whether it is the national education undertakings and the development of high-quality personnel needs, or the development needs of colleges and universities, college sports should not be short-board, need to be based on multiple governance theory management system reform and innovation.

RESEARCH CONCLUSION

Institutional reform is a fundamental reform, unlike local reform. The reform of college physical education curriculum content, the reform of college physical education curriculum mode, the reform of college sports evaluation methods, etc., has been carried out over the years of reform and exploration, but also achieved certain results, but from the "people satisfied with the university physical education" or a large gap The reform of college physical education management system is a fundamental reform of colleges and universities, is a comprehensive, collaborative reform.

School Leaders Should Pay Attention to University Physical Education

As a university compulsory course, the Chinese Ministry of Education has attached great importance to school sports, and many regulations have been promulgated. The school level has also organized a variety of sports and cultural activities every year in accordance with the requirements of the Ministry of Education. The second year must be full of physical education points, individual schools also encourage junior, senior grade elective physical education; parents hope that children in the university to actively participate in physical exercise, lay the foundation for the development of the cause of the community that the symbol of college students is vibrant, Running, physical strength, high expectations for college sports. However, the physical health of college students for many years cannot be reversed, obesity rate, myopia, body function sub-health rate increased year by year, the state, society, schools, parents, students focus on the university physical education.

In view of the fact that the performance of the policy is weak, in the face of the fact that the college students' physical quality has been declining for a long time, neither the department nor the individual has any administrative and administrative responsibility. It seems that the relevant departments, when enjoying the public power transfer and giving, the school sports policy The diminishing administrative ethical responsibility has been "discarded" to the forgotten corner. Wang Dengfeng, director of the Department of Sports Health and Art Education of the Ministry of Education, said that it is necessary to put the students' sports work in a more

prominent position, to carry out the physical health test and the school sports assessment, and to implement the publicity and accountability system.

The School Should Truly Implement the National School Physical Education Policy

It is undeniable that the national government level, the school level, the functional department level as well as the first-line physical education teachers, have carried out the management of all aspects of college sports. Document measures, guidelines and regulations continue to introduce, can be described as "policy stock" rich, but the government level that the school in school sports work did not fulfill the obligations. May 6, 2016, the State Council issued the "on the strengthening of school sports to promote the comprehensive development of physical and mental health of the views of students", one is sure the importance of school sports work, the second is that the school sports management system, the mechanism should to carry out innovation and reform. At the school level, although the organizational structure, the authority of the division of responsibilities are carried out on the system, but the actual management of college physical education is still the Department of Physical Education, the role of other related stakeholders did not get play. Although the community to pay attention to college sports, but the performance of third-party assessment of college sports institutions, there is no more talk about social supervision.

The Student's Comprehensive Development as the Goal of Physical Education Work

June 23, 2016, the State Council issued the "National Fitness Program (2016-2020)", the biggest highlight of the document lies in the national fitness of the "breakthrough awareness", the national fitness as a healthy China building a strong support and signature built a well-off Social country card. College sports service object is basically over 18 years of age adults; college sports should also serve the "healthy China" national strategy.

June 14, 2017, the Ministry of Education issued a "general college health education guidelines", referred to part of the health awareness of college students indifferent, to maintain and promote their own lack of health, lack of exercise, lack of sleep, irregular diet, irregular diet Unhealthy lifestyles are becoming a risk factor for students' health. Colleges and universities should help students to establish a sense of health, to master the health of knowledge and skills, the formation of a civilized, healthy lifestyle, improve their health management capacity, enhance the health of the people to maintain a sense of social responsibility to promote students' physical and mental health and comprehensive development. Teaching students' movement and health, scientific exercise principles and methods, self - monitoring of sports load (Zhang, 2017).

The state of high school personnel training quality of high standards and high requirements, the specific expression is "moral, intellectual, sports, aesthetic education in all-round development" of the socialist builders. The "sports" should be interpreted as: physical and mental health, comprehensive sports quality is better, master more than two sports skills and participate in general sports competitions comprehensive ability. In fact, college sports still have many difficulties and problems, especially the decline of college students' physical health level has not fundamentally reversed. There are problems of insufficient students' exercise, there are problems in the teaching of physical education, there are problems of lack of supervision means, and its foothold is the reform and perfection of the college sports management system. Effective institutional arrangements are the prerequisite and guarantee of scientific management. The stability of the system can clearly guide the development direction and ensure the sharing of results. Perfect system of the system is to achieve the development of the functions of the carrier; of course, strict implementation of the system is to achieve the realistic development of shared protection.

The Establishment of Multi-agent to Participate in the Management System

Over the years, the university sports management model of inertia dependence, college sports have exposed the lack of system and the responsibility of the management problems caused by unclear. June 11, 2014 promulgated and implemented the "basic standards of sports work in colleges and universities", is the general requirements of full-time ordinary college sports work, but also assessment, check the important basis for higher education in colleges and universities. The state requires the university to set up sports work institutions, equipped

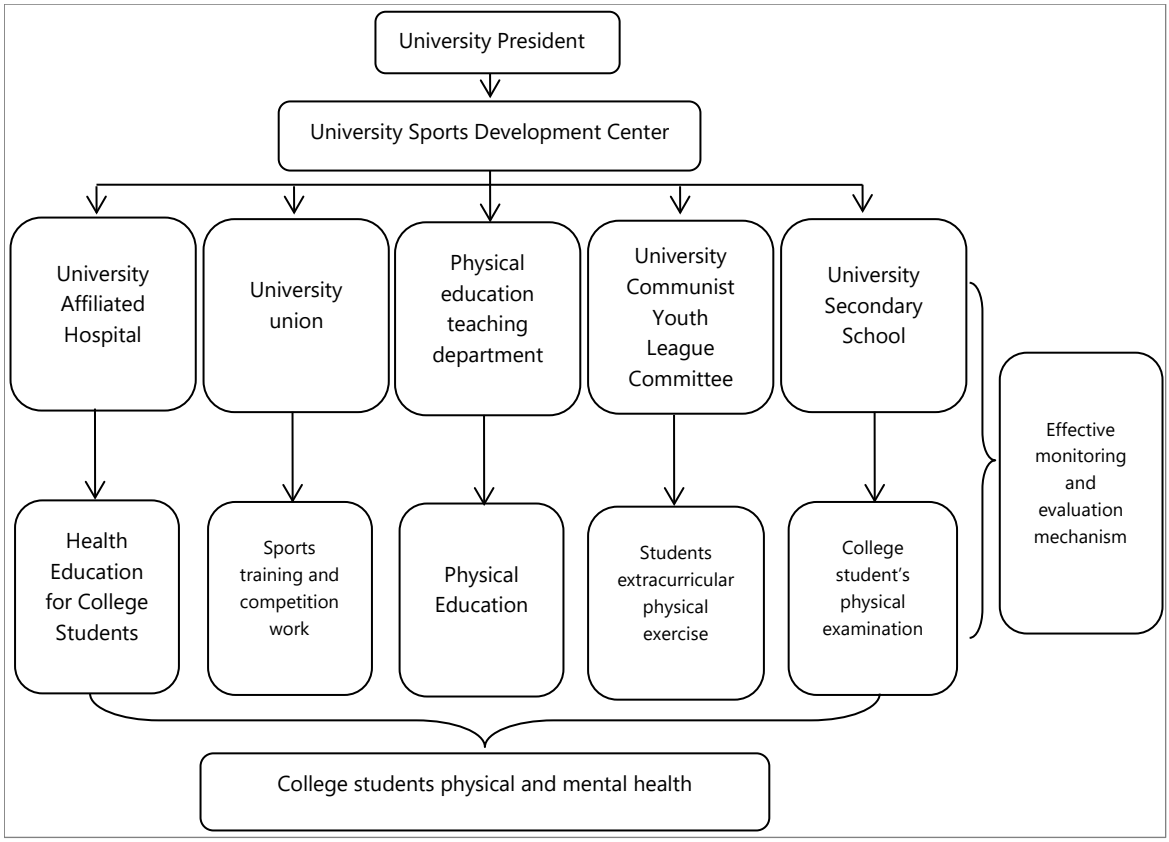

Figure 2. The Structure of Sports Management System in Colleges and Universities

with full-time cadres, teachers and staff, and give them to carry out the school sports work management functions. The relevant departments of the school actively cooperate with a reasonable division of labor, clear personnel, and the implementation of responsibility. The extracurricular sports activities into the school teaching plan improve the system (Zhang & Peng, 2017); improve the mechanism to strengthen the protection. For all students to set up a variety of alternative, effective, effective exercise program, organize students to participate in at least three times a week extracurricular physical exercise, and effectively ensure that students one hour a day sports time. The Structure of Sports Management System in Colleges and Universities (as shown in **Figure 2**).

Participation is the essence of university governance, and the direct and indirect main body of university sports elements participate in school affairs governance, which is a response to the reform of institutional management in colleges and universities in the new period (He & Ran, 2014). At present, the college sports stakeholders, usually considered to be physical education departments and students, on the grounds that: the physical education department is the responsibility of good physical education, is the necessary conditions for the existence of the department and physical education; students are educators (learn 2-3 sports skills, enhance the physical health level, through the training of social training and social quality of the will), is the necessary conditions for the existence of physical education. Those who hold this view represent the majority, which includes government education authorities and school-level policy document makers. In the deepening of the reform of the education system today, standing on the "university to cultivate what kind of person" "what is qualified talent" height, to improve the importance of college sports awareness, study the reform of sports management system of multi-party co-governance, to achieve national, School, society, individuals have the interests of the demands. Colleges and universities of the organizational units and behaviour subjects, consultation and governance, to achieve their legitimate interest's demands. The ultimate goal of the reform of college sports management system

is to realize the maximization of the demands of pluralistic main interests, straighten out the relationship between the government and the governance order and strengthen the scientific stability of the internal management system.

CONCLUDING

The majority of young people physical and mental health, strong physique, strong will, full of vitality, is a manifestation of a strong national vitality, is a sign of social civilization and progress, is an important aspect of national comprehensive strength. Physical exercise is an effective way to improve the health of college students, and has an irreplaceable effect on the formation of young moral character, intellectual development, aesthetic accomplishment and healthy lifestyle. It is of great strategic significance to strengthen the school sports in colleges and universities, to strengthen the constitution, improve the comprehensive quality of college students, realize the modernization of education, build a strong human resources and cultivate the socialist constructors and successors of moral, intellectual and aesthetic development.

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Idea of Resource Saving Higher Education Development on the Integration and Optimization of Educational Resources

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ABSTRACT

The basic thought foundation of the integration and optimization of higher education resources is embodied in the concept of resource conservation and development, with the integration of limited off-campus resources, presenting the resource characteristics. Based on the regional development of resources, make full use of school-based education resources, and highlight regional resource fusion. Through the characteristics of higher education resources, further model and analyze the feasibility of coordination between educational resources. We put forward the thought of integrating the industrialization development of universities. Integrate and optimize the educational resources by combining the development of regional cultural industries. With the assistance of regional economic and industrial development, the industrial economy education resources are actively utilized. Based on the overall form of regional social development, the concept of resource saving higher education development is constructed. With the aim of saving resources, we can effectively optimize the concept of industrialization and integration of higher education resources. Promote the integration and optimization of regional industrialization resources, thus forming a substantive impact on the diversity and multi-channel of the development of higher education resources. It is demonstrated that the key to optimizing and integrating the resources of higher education is to explore the concept of resource conservation, and fully study its internal meaning and intrinsic value to reflect its function, thus promoting the integration of educational resources with a strong purpose and direction. The exploration of the resource-saving development of higher education systematically screen the resources of regional humanistic spirit and humanistic quality, which is conducive to promoting the integration of resource elements to promote the overall development of higher education, and develop new ideas for the development of educational resources for the overall construction of humanistic education resources, so as to make the development of humanistic education play a positive role in promoting the overall education.

Keywords: resource conservation, higher education, resource integration, resource optimization

INTRODUCTION

Higher education resource construction should maintain a high degree of unity with social development direction. It should be based on resource conservation and development thought, effective integrate and optimize higher education resources, so as to enhance the practicability and practical value of education resources. According to the basic characteristics of off-campus resources, the targeted and effective integration is made, so that the development of higher education resources has certain characteristics. Relying on the advantages of regional development, the

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Contribution of this paper to the literature

- According to the resource conserving education idea, the feasibility analysis of the cooperation among educational resources was carried out, and the reliability of the study was studied by data validation;
- The study is closely around the integration and optimization of resources, with layers of clear, orderly and progressive analysis;
- The strategy of education resource conservation development was put forward, providing feasible suggestion for the actual education development.

regional economy, culture, humanity, environment and other factors are effectively analyzed, so that the direction of integration and optimization of higher education resources can be kept highly clear. In improving the level of educational hardware resources, the integration and development of software resources are strengthened, and the essence of resource-saving strategy development idear is sublimated (Bai, Jia, Zhai, et al. 2016).

The deepening reform of higher education and resources is the key to the adaptive development of higher education. The starting point of the resource-saving theory is not only the reduction of the input of educational resources, but also the further improvement of the efficiency of the use of educational resources. The effective resources can play the role of promoting, and making concrete development of educational resources (Eiben, and Smith, 2015). Combined with the lower educational resources, and the specific integration of them, the resource characteristics are effective reorganized, which provides a new role in promoting the overall development of higher education curriculum. In view of the innovative ideas of resource integration, the effective integration of the resources around the school can further promote the functionality and service of educational resources. The integration and development of higher education resources have some characteristics, so that the off campus resources and internal resources can effectively integrate, and form new resources of higher education (Ge, and Zhang, 2016; Li, 2015). This is the concrete way to fully improve the effectiveness of educational resource development in line with the idea of educational resource saving, which highlights the innovation of educational resources development thought in the construction of resource-saving society (Lee, Wei, Voss, et al. 2016).

REVIEW OF CURRENT RESEARCH

Domestic Related Research Status

The regional strategic deployment of higher education resources, as an important component of the strategic development target of higher resources, embodies the overall characteristics of the integration and development of integration and regionalization for higher education resources. The geographical resources cover a wide range, including three aspects: regional cultural resources, regional economic resources and regional environmental resources (Liu, Ge, Hu, et al. 2015). Domestic scholars have proposed that the regional environment and human characteristics can be effectively integrated with their environmental and cultural factors according to their characteristics, so that the existing higher education resources can be optimized. In fully developing the hardware resources like educational sites, humanities education software resources can be coordinately developed, and the strategic resources of higher education development can be effectively deepened, to economical development, paving a way to resource-saving development, and laying a solid ideological foundation for constantly rising the utilization efficiency of higher education resources.

Overseas Related Research Status

Regional development of higher education is the basic direction of strategic transformation. The development and optimization of educational resources need to be effectively developed according to the development of regional resources (Menzel, Ranjan, Wang, et al. 2015). Focusing on the local differences in the development of higher education, effectively enrich of educational resources, combined with the basic characteristics of different regional economy, culture, humanities, environment, and make it an important factor of education resource development. Characteristic factors are absorbed, and become the strategic resources of higher

education after adaptive reuse (Ma, 2016; Ma, 2015). Research of overseas university show that in line with the actual situation of the integration and optimization of higher education resources, we should comprehensively consolidate the characteristics of regional educational resources, and explore the necessary factors for the integration and optimization of educational resources. We should dig out the resource factors that match the regional education resources, and integrate them into the educational resource system effectively (Reiche, Verbesselt, Hoekman, et al. 2015). This is the overall path of higher education resources development, but also an effective interpretation of resource-saving development ideas, which fully reflects the application value of the integration and optimization of educational resources, and forms the characteristics of the development of internal factors in the educational resources system (Sommer, Valstar, Leusbrock, et al. 2015).

METHODOLOGY

There are some differences in the construction of higher education resource system, the reason of which is that the development of higher education has certain regional, cultural and essential differences, and the demand direction of educational resources is different. In view of the resource-saving development idea, the key to optimize and develop the higher education resource system is to systematically understand the general situation of its configuration, integrate resources within the system of the same characteristics of educational resources, and combine the same coefficient of higher resources to make the internal adjustment of resources more targeted. Meanwhile, the resources of different characteristics are effectively arranged, and the effects of their coordination are analyzed comprehensively, in order that internal combination function of the higher education resource system can be maximized, and the ratio between the application efficiency and the application effect will be the best (Shen, 2016; Singh, Review, 2015). In this way, the feasibility of mutual coordination and cooperation between higher education resources can be scientifically summarized, and the coordinated and leading role of educational resources can be embodied to the greatest extent, so as to give full play to the role of higher education resources in promoting the overall development of education, providing effective analysis and research data for the comprehensive implementation of the integration and optimization of resources, and broadening the development path of resource-saving higher education resources system. The overall characteristics of the allocation of resources in colleges and universities are integrated, the feasibility of coordination among resources is analyzed, and the integration and optimization of regional industrial resources are promoted.

RESULTS

In order to integrate the overall characteristics of the resource allocation in universities, the feasibility analysis of the coordination among resources is analyzed.

In the analysis of the feasibility of data variable sequences, assume that there are time series variables Y_t and X_t in the integration, optimization and coordination of educational resources, with certain feasibility. Then the correlation regression model is:

$$y_t = a + \alpha x_t + u_t \tag{1}$$

A set of feasible data is like an invisible gravitational regression line, with the values near the regression line constantly regressing to the regression line, and forming a fluctuating regression line around the mean (Yang, Dong, 2016; Zhang, Zhang, 2016). However infeasible sequences basically do not return to a fixed value. Therefore, it is assumed that the mean, variance, and covariance of the random variable V_t are constant in the optimization integration process of educational resources. For any samples t, m, n,

$$\begin{cases} E(V_t) = E(V_{t+m}) \\ Var(V_t) = Var(V_{t+m}) \\ Cov(V_t) = Cov(V_{t+m+n}) \end{cases} \tag{2}$$

Integrating and optimizing the educational resources is called a feasible process. For all values t, m, n, A sequence of education is V_t feasible, and then it can be denoted as $V_t : I(0)$. The cooperation among educational resources is feasible.

Table 1. Descriptive results

Dependent Variable: Y			
Method: Least Squares			
Included observations: 97			
R-squared	0.6010	Mean dependent var	15.4389
Adjusted R-squared	11.1014	S.D. dependent var	14.4784
S.E. of regression	13.5359	Akaike info criterion	3.5301
Sum squared resid	31.4610	Schwarz criterion	4.2564
F-statistic	1.5451	Durbin-Watson stat	0.5681
Prob(F-statistic)	0.0325		

According to the above formula (2), a descriptive analysis of the optimization results of educational resources integration is made, shown in **Table 1**.

It is clear in **Table 1** that the R^2 value of the model is 0.6010, indicating that the regression items accounted for as much as 70% of the explanation part for the studied variables, the choice of resources integration is appropriate, and the regression results have certain reference value. The test values of AIC and SC for the model are 3.5301 and 4.2564, respectively, indicating the model used in this study passed the validity test of the Akaike information criterion and the Schwarz information criterion. Therefore, the model used in this study is suitable for analyzing the sample data obtained by investigation. The P value of the dependent variable y is 0.0325, indicating the estimated value of the dependent variable is credible in the 5% level of significance. In other words, the estimated value of the studied variable obtained by the model used in this study is very close to the actual value, and the research results have high feasibility.

Integrate the idea of industrialization development in universities and comprehensively integrate and optimize the educational resources of colleges and universities:

Combine the development of regional cultural industries, and effectively integrate the cultural and educational resources. The effective deepening of regional cultural resources plays a more important role in the overall development of higher education resources, and provide strong support for the overall development of higher education and the soft environment construction. The basic starting point of the ideological education resource conservation development is to emphasize the comprehensive construction on cultural resources. Take the regional cultural resources as an important supplement, effectively implement the deep development space of the cultural environment in the higher education system, and promote the effective implementation of the developing plan of talent strategy.

With the assistance of regional economic and industrial development, the industrial economy and educational resources should be actively utilized. The direction of regional economic development, as an important approach to the integration and exploration of higher education resources, is an inevitable choice for the development of higher education resources. According to the main subject trends of regional industrial structure adjustment, actively guide social investment and development priorities, highlight the important role of higher education in the development of social enterprises, and provide favorable conditions for the introduction of the internal resources of higher education. This is the key to the efficient utilization of higher education resources, and also an important challenge to the systematic development of educational resources.

Based on the overall form of regional social development, construct the concept of resource saving higher education development. The important component of the integration and optimization of regional resources in higher education is to explore the social and cultural resources of the region in an all-round way, and absorb valuable experience to enrich the human resources of higher education in an all-round way, so that humanistic education becomes the key link in the development of higher education quality. The idea of resource-saving society development is not merely an effective integration of material resources, but also includes a comprehensive deepening of human resources. This is a new concept in the development of higher education, which enriches the

inner essence of the development and introduction of educational resources, and probes into the integration of subject education resource, optimization and development.

With the aim of saving resources, effectively optimize the concept of industrialization and integration of higher education resources. The purpose of saving resources embodies in the level of resource optimization, and the premise of resource optimization is the effective integration of educational resources, removing unnecessary consumption of educational resources, and purification the function of higher education resources. Combined with the applicability and effectiveness of higher education curriculum, the system of higher education resources is detailedly constructed, and the sources of resource formation factors are analyzed. Take industrial development as an opportunity, and absorb industrial resources effectively, with a long period of processing, in order to make them an important component of higher education resources, and realizing the social sharing of current educational resources. Reduce the cost of resource development and research, and form higher education resources and develop resource saving targets.

DISCUSSION

Effective implement the basic idea of resource conservation, combined with social and economic development trends and the situation, and effectively integrate social education resources, in order to ensure that the development of higher education resources can be supported by regional social and economic development, and that higher education resources can be obtained from various aspects of society. Create more valuable and meaningful new ways of educational resources, and provide sufficient impetus for the integration and optimization of higher education resources. New ideas for the full development of the comprehensive construction of humanistic education resources enhance the connotation of the higher education development, and meanwhile, also provides an ideological concept of effective guarantee strategy for the sharing of educational resources, further supplementing the promotion of the ideological essence of higher education development strategy of resources saving. Further sublimate the substantive significance of the development strategy of higher education resources optimization, and promote the construction of educational resources can follow the basic steps of social development, so that higher education resources and social development can interact and promote together, providing a positive and effective impetus to the development of resource-saving society.

CONCLUSION

The development strategy of resource conserving strategy is the necessary prerequisite for the sustainable development of society, and provides positive ideology guidance for the effective utilization of social environment and resources. The idea of higher education resource conservation development is based on the principle of sustainable development of higher education. Comprehensively deepening the use value of educational resources promotes the interaction between educational resources and social development, and improves the efficiency of sustainable recycling of educational resources. Through the effective integration and optimization of educational resources, the innovation and sustainability characteristics of higher education resources development are manifested, providing effective ideological support for promoting the sustainable development of higher education, which is of great significance to studying and analysing the elements of educational resources.

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Mathematical Statistics-based University Students' Physical Health Conditions and Teaching Strategies Study

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ABSTRACT
Objective: China's relevant departments carried out investigation on physique and health conditions of all students in 2010. Result indicated that physical health conditions of China's University students were so bad that should attract people's attention as the students had important social roles. Research methods: in this paper, Anhui Agricultural University students' physique test data in 2016 was used as research evidence; literature consultation, questionnaire survey, logistic analysis, mathematical statistics etc. were applied to analyze the University students' physical health conditions and problems in students of Anhui Agricultural University. Research results: Physical health conditions of Anhui Agricultural University students were generally qualified, however the levels were lower, excellent rates were not high, and the development was imbalanced. We should improve school's physical education courses, increase class hour and set up health care course and physical education theoretic course to improve students' sports and cultural accomplishments; we should make a scientific and reasonable assessment on physical education and focus on students' individual development; we should improve organization and management of school's physical exercises and cultivate student's interest in physical exercises; we should constantly perfect sports sit facility's construction, utilize current sports sites facilities in a scientific and reasonable way and strengthen multi-function development of stadiums' facilities.

Keywords: physical health, teaching strategies, teaching methods, teaching evaluation

INTRODUCTION

It is well-known that University students are the mainstay of motherland's prosperity and development in future. They shoulder heavy responsibilities as national construction and realization of China dream; they are impetus of national sustainable development and promoter to social progress. Their health is closely related to all aspects that promote social progress. It mainly lies in judgment on university students' psychological and physical health-an important reflection of the success or failure that Chinese higher education would be. It is related to sustainable development of China's public fitness and lifelong sports, and is also a manifest of university sports teaching level (Zhang & Peng, 2017). Physique is quality of body, it embodies body's contour structure, physiological function on the basis of hereditary and acquired character, and it is synthetic and rather stable in psychological quality. In 1948, there was a definition of health in the Charter of WHO, "health is a harmony in state, body, psychology and society, not just meaning no disease or not being feeble" Chuanzhi Shi defined health as a good state in physiology, psychology and social nature, not just meaning no disease or not being feeble. Physical education is a fundamental

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Contribution of this paper to the literature

- We explore University students' physical health influence factors from the level of physical education, put forward improvement strategies so as to provide some theoretical reference for working plan with an aim to enhance University students' physical health level and also offer theoretical evidence for Universities' physical education.
- Focusing on students' individual development is very important for making assessment on physical education in a scientific and reasonable manner.
- We should improve school's physical education courses, increase class hour and set up health care course and physical education theoretic course.

path to fulfill physical education objective and task (Li, 2017)). It is an activity that both sports teachers and students engage, in which proper essentials are adopted to guide students to master basic knowledge, technology and sports skills of sports and health, enhance students' physique and cultivate their lifelong sports ability and good moral character (Zhang, 2017). Students being physical and psychological health are not only the core of school physical education but also a reflection of university physical education level; we promote students' comprehensive ability of health level through attaching great importance to university physical education (Lin, 2012). Documentary has shown that in recent years, there was a continuously declining tendency in physical health level of China University students. It is really worrying (Zhou et al., 2012). University students' physical health conditions at school not only directly exerts an impact on their serve to the society in a healthy and happy state or not after graduation, but also can reflect level of school physical education and reform effect of sports management level. Actually, paying attention to University students' physical health is stressing on University physical education (Liu & Zhang, 2008). Thus, in this paper, Anhui Agricultural University was regarded as research object. Investigation was made on physical health status of students thereof, analysis and research were made on problems during investigation, relative solving ideas and improvement strategies were put forward correspondingly, for the purpose of providing theoretical references for improving physical health level of Anhui Agricultural University students and making some contributions to Anhui Agricultural University students' health and physical education.

Chinese University Students' Physical Health Status

By investigation, Yang Zhang, Ling He found that there was overall continuous increasing tendencies in youth body shape while also a continuous rising tendency in obesity rate; improvement should be made on lung capacity and most of the physical quality indicators; there was a growing impaired vision status that showed a younger-age trend constantly. There was a continuous declining in university students' endurance, speed, explosive power, strength and other quality (Peng, 2010). Some indicators of university students were even inferior to those of middle school students. University students' physical quality has therefore become an important influence factor that impedes national physical quality's improvement.

During national students' physique investigation and study for six times from 1985 to 2008, Xiaojian Yin, Jianqiang Du etc. found that there was an increase in university male and female students' height, and a decrease in their lung capacity, 50 meters running and endurance performance, and a declining tendency in physical quality of university students in all era.

Ming Ye etc. made researches and analyses, they pointed out that imbalance development in physical quality of university students mainly embodied weaker upper and lower limbs' strength, as well as endurance quality.

By researching, Guangjun Fan found that there have been a continuous declining trend in China's University students' physical health level in recent 20 years, and physical health issue of university students has therefore become a common problem of China's universities. "2010 National Student Fitness and health survey" that jointly organized by Ministry of education, General Administration of Sport of China, Ministry of health and other ministries showed that there was a decline in Chinese male students' standing long jump, sit and reach, 1000

meters running and other indicators. And performance of female students in standing long jump, sit-up, 800 meters running was also far behind that in 2005.

Xin Chen, Lequn Quan obtained university students' physical health status by researching on body shape and lung capacity. In the view of body shape, main issue was shown as seriously polarization-to be specific, too fat or too thin, and there is an increasing trend in obesity university students. It can be said that obesity has become a major health problem in China's University students.

Domestic University's Physical Education Status

Tao Zheng thought that China University's physical education reform has made some achievements in recent years. However, previous old teaching mode was still used in university's physical education, theory and practice weren't closely integrated. In some universities' physical education, their teaching means were single that couldn't arouse students' interests in sports class. Some students even hated or skipped sports class. These had serious impacts on sports course. In addition, he thought contents of university physical education were little that was only some daily sports events.

Xinliang Zhou thought that current status of China's university physical education was still not optimistic, there were many inevitable contradictions. For instance, deficiency in practical knowledge of university physical education, teaching contents unable to advance with times, lacking of scientificity and practicability; simple teaching methods and university sports course are unable to arouse students' interests, insufficient cultivation in students' sports consciousness, moral sentiments and values; unclear teaching objects affects formation and development of students' comprehensive quality.

Dawei Song's analysis of current status of university physical education reform showed that traditional sports teaching concept as "favor practice over theory" still took the lead, current teaching mode restricted in the cultivation of students' lifelong sports ability, the form of teaching organization and way of test and evaluation affected students' interests in sports.

Lu Huang, Shaohua Wei carried out investigation and thought that most of the university sports teachers were young teachers. It was difficult for them to form the backbone as they lacked of certain teaching experience. University sports teachers' scientific and research projects were less, while their engaged sports teaching project activities were even little, their emphasis on these aspects were also not so high, and university physical education's quality was therefore affected. University sports sites and facilities construction status were there were not enough playgrounds, sports indoor sites in some universities were reconstructed using unused classrooms, sports sits and facilities could not satisfy demands of modern universities physical education. There was corruption between physical education assessment and examination ways and teaching concepts, mainly reflecting as excessive single evaluation system.

Research Objectives and Significances

Contemporary university students shoulder great responsibilities as building a socialist modernized country and are backbone to realize Chinese dream. They are also in the key period of physical and psychological development, physical and psychological health state have gradually been mature, while sometimes tended to unstable and imbalance. As university students' physical power has been declined gradually in recent years, shock always occurred to students in middle-distance race in school sports meeting; therefore university students' physical health issue has gradually attacked people's attention. School physical education is an indispensible part in school education, and also an important factor to students' sound growth both in physically and psychologically. However, for a long time, guiding thoughts of Chinese universities is mainly technological teaching and skill teaching, focusing on unity and standardization in teaching form, structure, content, method, mean, examination and evaluation etc., ignoring teaching demands –student-centered, which exerts a certain impact on university students' physical health. How to look on the effects of university physical education on students' physical health correctly, enable school physical education, health education and lifelong education to really go deeper, implement

specific education so as to improve university students' physical health condition is a focus of university physical education circle. Therefore, in this paper, Anhui Agricultural University students' physique test data in 2016 was collected, these students' physical ability (body shape, function, sport quality) development trend and problems were studied. University students' physical health influence factors were explored from the level of physical education, improvement strategies were put forward, which provided some theoretical references for improving university students' physical health level and offering theoretical evidence for universities physical education.

RESEARCH OBJECTS AND METHODS

Research Objects

Take Anhui Agricultural University test data in 2016 according to "Physical test standard" as data, select test data of 1800 people in total at random from partial university students in 18 departments, from which there are 900 schoolboys, and 900 schoolgirls. They are research objects of physical health condition.

Research Methods

Literature consultation

Consult and collect relative document literature via school's library and CNKI, read it and then make analysis and sorting to provide firm theoretical foundation for the paper.

Questionnaire survey

Collect relevant contents through questionnaire survey of partial students at school. The survey randomly distributed 200 questionnaires, 197 were recovered, and 190 are effective questionnaires. The effective rate was 96.4%.

Mathematical statistics

Make statistics, sort out, and analyze collected data using Excel.

Logistic analysis

Carry out thorough analysis of statistical results using logic analysis.

RESULTS AND ANALYSES

Investigation on University Students' Physical Health Conditions

Survey of University students' physical health status

We aim to understand University students' physical conditions and change rule, improve University students' physique and health level, cultivate students' lifelong sports consciousness, and promote physical education level. With regard to this, we take Anhui Agricultural University students as an example; carry out random check on physical test data of 1800 students in total in 2016. The University students' physical health investigation is in accordance with randomized cluster sampling method. 50 schoolboys and 50 schoolgirls in every department were sampled from university's overall 18 departments and composed of investigation samples. According to statistics, the number of people in investigation is 1800, from which 900 are schoolboys and 900 are schoolgirls (can refer to **Table 1**). Investigation test items are nine physical quality indicators, including height, weight, lung capacity, 50 meters, 800/1000 meters, sit and reach, pull-up, standing long jump and sit-up.

Table 1. Male and female university students Standard test overall score

Gender	Number of people	Excellent (%)	Good (%)	Qualified (%)	Fail (%)
Male	900	20 (2.2%)	212 (23.6%)	652 (72.4%)	16 (1.8%)
Female	900	6 (0.6%)	360 (40%)	531 (59%)	3 (0.3%)
Total	1800	26 (1.4%)	572 (31.8%)	1183 (65.7%)	19 (1.1%)

Table 2. Statistics of University students' body mass index

Gender	Number of people	Slightly thin (%)	Normal (%)	Slightly fat (%)	Obesity (%)
Schoolboy	900	139 (15.5%)	639 (71%)	103 (11.4%)	19 (2.7%)
Schoolgirl	900	193 (21.4%)	646 (71.8%)	52 (5.8%)	9 (1%)
Total	1800	332 (18.4%)	1285 (71.4%)	155 (8.6%)	28 (1.6%)

Table 3. University students' lung capacity index statistics

Gender	Number of people	Excellent (%)	Good (%)	Qualified (%)	Fail (%)
Schoolgirls	900	66 (7.3%)	118 (13.1%)	543 (60.3%)	173 (19.2%)
Schoolboys	900	105 (11.7%)	88 (9.7%)	573 (63.7%)	134 (14.9%)
Total	1800	171 (9.5%)	206 (22.9%)	1116 (62%)	307 (17.1%)

Test score analysis

Table 1 shows the physical condition of University students is generally qualified, with a qualified rate of 98.9%. Among them, fail accounts for 1.1%, qualified accounts for 65.7%, good accounts for 31.8%, and excellent accounts for 1.4%. The test results conform to normal distribution. The test data show that schoolboys' fail rate is 6 times the schoolgirls, which may be related to their test options and evaluation standard, such as most schoolgirls get full score in sit-up while schoolboys feel it difficult to get such score in pull-up. Anhui Agricultural University students are overall qualified in physical test, however the ratio as 31.8% good, 1.4% excellent indicates that improvement should be made on the students' physical level, the excellence rate should be further promoted so that overall students' physical condition can be excellent.

Body shape analysis

As an important indicator to evaluate body shape growth level and body symmetry degree, body mass index ca indirectly reflect body composition, evaluate fat or thin conditions correctly and manifest body's width, thickness, dimension and density. **Table 2** shows that schoolboys and schoolgirls show no big differences in body shape, nearly 71% of their body mass index are in normal scope. However, the rest 30% students are in the abnormal scope, they are either too fat or too thin, the number of obesity in schoolboys is more than that of schoolgirls. This may be resulted from easy and comfortable university life and insufficient exercises. Less obesity amount in schoolgirls perhaps, due to their relative care for figure and stronger willpower to control personal weight.

Body function refers to body metabolic function and working efficiency of all organs and systems, which mainly reflects running state of human body's organs and systems' physiological functions. **Table 3** shows overall lung capacity index score is qualified, schoolboys account for 60.3% and schoolgirls account for 63.7%, schoolboys and schoolgirls are equal in breathing function and cardiovascular system function. On a whole, schoolgirls' body function is better than that of schoolboys.

Physical quality analysis

Physical quality is body's functional ability, such as speed, strength, endurance, sensitivity, flexibility, balance, coordination that represented in sports process. **Table 4** indicates situation of poor strength quality, in the regard of pull-up, a reflection of upper limber strength, fail rate of schoolboys reach as high as 45.6%, while fail rate of schoolgirls reach 20.8% whose waist and abdomen strength is poor. In the regard of standing long jump, a reflection of lower limbs' explosive power, schoolgirls are better than schoolboys, the former's pass rate is 91.7% while the latter is 86.6%. Both of them need to improve their strength quality.

Table 4. University students' physical quality index statistics

Gender	Item	Number of people	Excellent (%)	Good (%)	Qualified (%)	Fail (%)
Man	Pull-up	900	99 (11%)	75 (8.3%)	316 (35.1%)	410 (45.6%)
Man	Standing long jump	900	46 (5.1%)	136 (15.1%)	598 (66.4%)	120 (13.3%)
Woman	1min sit-up	900	7 (0.8%)	32 (3.6%)	674 (74.9%)	187 (20.8%)
Woman	Standing long jump	900	152 (16.9%)	140 (15.6%)	533 (59.2%)	75 (8.3%)

Table 5. Statistics of University students' other quality index statistics

Gender	Item	Number of people	Excellent (%)	Good (%)	Qualified (%)	Fail (%)
Man	50 meters	900	241 (26.8%)	124 (13.8%)	519 (57.7%)	16 (1.8%)
Man	Sit and reach	900	100 (11.1%)	129 (14.3%)	605 (67.2%)	66 (7.3%)
Man	1000 meters	900	72 (8%)	78 (8.7%)	584 (64.9%)	166 (18.4%)
Woman	50 meters	900	49 (5.4%)	133 (14.8%)	664 (73.8%)	54 (6%)
Woman	Sit and reach	900	155 (17.2%)	134 (14.9%)	565 (62.8%)	46 (5.1%)
Woman	800 meters	900	85 (9.4%)	160 (17.8%)	616 (68.4%)	39 (4.3%)

Table 5 indicates that schoolboys' speed quality is good, their pass rate is 98.2% and excellent rate reaches as high as 50.6%. However, their endurance and flexibility quality are weak; schoolgirls have shown better physical quality than schoolboys, their flexibility and endurance are superior to that of schoolboys. Schoolboys' endurance is rather poor with fail rate 18.4%. We should pay attention to promote level of schoolboys' endurance quality.

To sum up, there are imbalanced development in all physical quality items of schoolboys and schoolgirls. They have their own strength and weakness. Schoolboys' speed quality is relative good, while their upper limbs' strength quality and endurance quality are relative weak. The overall situation of schoolgirls is basically superior to schoolboys, especially in flexibility and endurance, while their waist and abdomen strength are rather poor. Body shape of Schoolboys and schoolgirls are basically in the normal scope, however approximately 30% of them are abnormal. Obesity is more shown in schoolboys. On a whole, university students' physical health is overall qualified but in lower level with low excellent rate. University students' physical health level is not optimistic, which may be related to students' week sports consciousness, little exercises at ordinary times, insufficient amount of exercises in sports class as well as other physical education factors. Therefore, relative departments of school should take positive and effective measures to promote students' health level.

University Students' Physical Health Influential Education Factors

The ultimate purpose of school physical education is to enhance students' physique through school physical education, and develop students' lifelong physical exercises habits so that facilitate their sound development physically and psychologically. In the paper, it makes analysis of students' physical health influence factors mainly through investigation on Anhui Agricultural University's physical education course and extracurricular sports activities. Analysis finds that students' physical health is related to school sports' sites and facilities, curriculum setting, students' sports consciousness, education evaluation, teaching contents and extracurricular activities.

Effects of sites and facilities on university students' physical health

Table 6 results suggest that 32.1% students think school's sites and facilities can basically satisfy their sports demands, while only 5.7% students think them could completely satisfy their sports demands. This shows school's sports sites and facilities is not perfect enough that cannot fully satisfy students' sports demands, which may affect their physical exercises to a certain degree. It should be noted that there are 32.6% students suppose that their sports demands on school sites and facilities could not be satisfied. In their opinions, problems in school's sites and facilities are mainly little events can organize, the equipment is not enough, the site is too small and too little. These may reduce their interests in participating in physical exercises. In the long run, it will affect the efficiency of their physical exercises and further affect their physical health conditions.

Table 6. University students' demands on school sports sites and facilities (N=190)

Degree of demands	Number of people/Percentage
Completely satisfy	11 (5.7%)
Relative well satisfy	56 (29.5%)
Basically satisfy	61 (32.1%)
Cannot satisfy	62 (32.6%)

Table 7. Influence factors of University students' engagement in physical exercises (N=62)

Reason	Number of people
The site is too small, too little	36
The site quality is so poor	21
The equipment is not enough	37
Equipment quality is too bad	19
Little events can organize	48
Too expensive	9

Table 8. University physical education curriculum setting

Course arrangement	Teaching arrangement
Elementary course	Two classes every week in the first term of freshman year
Elective course	Two classes every week in the second term of freshman year and the whole terms of sophomore year

Effects of curriculum setting on university students' physical health

Table 8 indicates that University has arranged sports course in freshman and sophomore year as two classes every week and roughly 36 class hours every term, the main items are elementary course and elective course. This shows irrationality in university sports course setting – only elementary and elective courses are set, sports theory course including health care course isn't set independently. Students' understanding on sports knowledge as well as basic knowledge of sports health care could only rely on teachers' explanation in the first lesson when school starts or at ordinary class hour. The theory learning time is so short that is not enough for students. Moreover, it is classroom teacher rather than professional sports health care teachers to instruct sports health care and other knowledge, which may lead to students unable to master all-around knowledge. As most of the universities, Anhui Agricultural University only set sports course in freshman year and sophomore year rather than junior year. There are 36 class hours every term, while most of students may be able to take the course for at least two due to causes, such as weather, illness or else. In such little time, students couldn't master one or several sports skills at all, let alone their physical exercises demands are well satisfied. This may not play the role in students' body-building, and be hard to bring students into sports habits.

Effects of students' sports consciousness on university students' physical health

Table 9 indicates that 41.5% of the students like sports course, 37.4% ones have no feeling in sports course, and 21% ones dislike sports course. This suggests that most of the students don't have strong sports consciousness, and even a part of students don't form correct sports consciousness; they don't realize the promotion of sports on physical health, let alone take initiative in exercises to improve physical health level. It also finds that causes affect students' attitude toward sports course are mainly students get bored in sports course, they don't have any desired sports events; sometimes they can't be satisfied by sites and facilities so that don't want to take sports class and even dislike it. Actually, all of these are caused by their low sports cultural accomplishments and shortage in correct sports consciousness. This is quite harmful for students' physical and psychological health and has a great impact on their physical health.

Table 9. Students' attitude toward sports course (N=190)

Attitude	Number of people / Percentage
Love	25 (13.1%)
Like	54 (28.4%)
Normal	71 (37.4%)
Not so much	23 (12.1%)
Dislike	17 (8.9%)

Table 10. Causes affect students' attending sports course (N=190)

Causes	Number of people / Percentage
Dissatisfied with sports teacher	19 (1%)
No sports event to their fondness	44 (23.1%)
Dissatisfied with sites and facilities	34 (17.9%)
No fun in sports course	80 (42.1%)
Too tired in sports course	13 (6.8%)

Table 11. Students' attitude toward teaching evaluation (N=190)

Attitude	Number of people / Percentage
Very satisfied	13 (6.8%)
Relative satisfied	90 (47.3%)
Normal	42 (22.1%)
Dissatisfied	45 (23.7%)

Table 12. Causes for students' dissatisfaction with teaching evaluation (N=190)

Cause	Number of people
Without consideration of students' individual differences	26
Focus on physical health test score	8
Focus on skill examination	22
Disconnection between examination contents and course objectives	15
Single evaluation method	33
Less rigorous examination	10

Effects of teaching evaluation on university students' physical health

Above **Table 11** and **12** shows half the students are relative satisfied with teachers' examination and evaluation method, but some students think teacher's evaluation is general, while others are dissatisfied with teacher's evaluation. This suggests that there are problems in Anhui Agricultural University teacher's evaluation. Students' dissatisfaction with teacher's evaluation mainly because teachers take no consideration of their individual differences when evaluating, the teacher's evaluation method is single, evaluation focus on skill examination and so on. Improper evaluation is bad for cultivation of university students' sports interests, ability, habit and lifelong sports values and it may exert negative effects on students.

Effects of teaching contents on university students' physical health

Table 13 and **14** has shown that students are mildly interested in the contents of sports course, and there are 17.9% students show no interest in them. Investigation finds that students prefer to new type of sports events set in sports course, such as sports games, balls, swimming and so on. By far, Anhui Agricultural University has set some events in sports course, such as basketball, football, volleyball, badminton, table tennis, cuqiu, sports dance, aerobics, cheerleading, line dance, martial arts, free combat, self-defense, yoga, dragon dance, from which are mostly excessive traditional, not novel enough and not easier to attract students' interests. Emerging sports events such as yoga, Pilates, tennis that are closely integrated with the times haven't yet widely spread. Students tend to prefer to access to emerging sports events and strong challenging ones, while sports teaching contents lack of a certain innovation, which seriously affect students' sports attitude and also have a certain impact on students' physical health.

Table 13. Students' attitude towards sports course teaching contents (N=190)

Attitude	Number of people / Percentage
Have no interest	34 (17.9%)
Mildly interest	87 (45.8%)
Rather interest	40 (21.1%)
Specially interest	9 (4.7%)

Table 14. Students' favorite course projects in sports course's setting (N=190)

Project	Number of people
Balls (basketball, football, volleyball, badminton, table tennis, cuqiu)	89
Sports dance, aerobics, cheerleading, line dance	48
Martial arts, free combat, self-defense	55
Yoga	45
Dragon dance	23
Swimming	78
Sports games	88
Emerging sports events(orientation movement, rock climbing, outward bound sports)	98

Table 15. Status of students' weekly extracurricular sports activities (N=190)

Activity status	Number of people / Percentage
Hasn't participated in	75 (39.5%)
Once	46 (24.2%)
Twice	34 (17.9%)
Three times	23 (12.1%)
Over three times	12 (6.3%)

Table 16. Causes for students' engaging in extracurricular sports activities (N=190)

Cause	Number of people
No organizer and instructor	45
No sports specialty	41
Heavy academic burden	34
Tight sites and equipment	56
No interest and habit	87
No proper accompany	67
No requirement from school	156

Effects of extracurricular activities on university students' physical health

Table 15, **16** and **17** indicates that students rarely engage in extracurricular sports activities, from which the participants account for 39.5%, and the participants with three times and more experience only account for 18.4%. It can be seen that Anhui Agricultural University's extracurricular sports activities are in poor organization. The extracurricular sports activity is the extension and supplement of sports course and practical training of sports course, which has great impact on fostering students' sports interests and physical exercises habits. Poor organization of extracurricular sports activities couldn't promote students' physical health level. Research finds that causes for its poor organization are mainly because school hasn't organized enough extracurricular sports competition, the school has no strict requirement on extracurricular sports activity, students have no interest in participating in extracurricular sports activities, and they lack of accompany when are willing to take exercises and so on.

Table 17. Frequency of school organizing extracurricular sports competitions (N=190)

Frequency	Number of people / Percentage
Very frequently	5 (2. 6%)
Rather frequently	12 (6.3%)
General	84 (44.2%)
Basically don't organize	68 (35.8%)
Never organize	21 (11.1%)

Improvement Counter Measures for Physical Education

i) Sports sites and facilities are basic material conditions for implementing sports activities, school physical education relies on sports sites and facilities, school should strengthen management and utilization of sites and facilities, increase sites and facilities of diversified sports events, carry out scientific management on current sites and facilities, utilize them properly so that maximize utilization of limited resources.

ii) It is available for school to increase sports course class hour, set up sports theoretical course independently; as for junior, it is available to arrange one sports course every week or alternatively, increase exercises between course for them. Increase students' physical exercise duration, cycle and theoretical knowledge may offer students enough time to better master sports skills.

iii) School should strengthen transmission of sports and health knowledge, upgrade students' sports and cultural accomplishments through various ways. Teachers should define the concept as "Health comes first", "Lifelong physical education" in teaching.

iv) Adopt multiple evaluation method, students' sports performance evaluation should be done in accordance with students' sports classroom performance at ordinary time, attendance, engagement in extracurricular sports competitions, sports learning process and else. In class, we should arrange course contents and make teaching evaluation according to students' different personalities, physical conditions and others.

v) Teaching contents should be flexible, adapt to the demands of lifelong physical education. We should update teaching contents timely, advance with times. We could arrange innovative sports games, oriental sports, and various competitions as teaching contents.

vi) The school should include extracurricular sports activities into school physical education working planning; strengthen propaganda on sports health knowledge. School should be proactive in organizing diversity extracurricular sports training and sports competitions, positively mobilizing all school's strength, such as instructors that take charge of students work in all departments, teacher in charge, class leader. Let them to participate positively to strengthen and impel organizational management and guidance on school's extracurricular sports activities.

CONCLUSIONS AND SUGGESTIONS

Conclusions

i) Analysis report of physical test's overall performance of Anhui Agricultural Anhui Agricultural University students in 2016 suggests the physical health level of the students is not optimistic, most of them are just qualified; most of the schoolboys pass the test, in particular; while overall schoolgirls' physical conditions are better than that of schoolboys.

ii) In the view of body shape, as schoolgirls relatively care for their figure, most of them are thin. Whereas schoolboys have shown higher fraction defective in weight, most of them are obesity.

iii) One's entire physiological function condition can be referenced by lung capacity index. Research finds that Anhui Agricultural University students show general physiological function level, however, schoolgirls' function level is better than that of schoolboys.

iv) In the view of all indicators related to physical quality, on a whole, students' strength quality is poor; in terms of speed quality, schoolboys are better than schoolgirls in 50meters running, while schoolgirls in turn have an advantage in flexibility over schoolboys, schoolboys should work hard to improve their endurance quality.

v) Analysis from the perspective of physical education, university students' physical health conditions' influence factors are fewer sports events available in sites and facilities, less class hours in sports course, teaching contents lacking of innovation, unreasonable teaching evaluation, low sports and cultural accomplishments of students, less students engage in extracurricular sports activities and so on.

Suggestions

i) The school should pay close attention to the students' health, lay emphasis on school physical education, increase supports on sports teaching, and create a good environment for physical exercises.

ii) The school should improve its sports curriculum, increase class, set health care and sports theory courses, to improve students' sports cultural accomplishments, getting students overall exercises in both body and mind.

iii) The school should make a scientific and rational sport evaluation, pay attention to students' individual development, use diversified evaluation methods, and lay emphasis on process evaluation.

iv) The school should hold sport competitions actively, improve organization and management of school physical exercises, cultivate students' interests in physical exercises, stimulate students' enthusiasm and initiative in participating in physical exercise, and promote students to develop good habits of participating in physical exercises consciously.

v) The school should constantly improve the construction of sports sites and facilities, make rational use of current ones, strengthen multi-functional development of stadiums and facilities, and improve utilization rate thereof.

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Transformation Research on Teaching Practice Mode of Physical Education Major Based on Applied-oriented Talents Cultivation

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ABSTRACT
Objective: Social sports is an emerging major, its teaching works in various aspects just start and so need teacher and students to make further improvement and perfection in new problems of the major. Among them, cultivation of social adaptability in teaching process becomes more important. Research methods: Literature consultation and questionnaire survey are applied to investigation and analyze practice of students in our schools' physical education major in Grade 2011 and 2012. Result shows: With the presently rapid development of Chinese social sports industry and people's increasing demands on fitness, there emerged more sports job vacancy in society. However, social sports major are still in the preliminary stage, students of the major came across many problems in teaching practice process. We should carry out market-oriented talents' cultivation, adjust practical work duration, optimize curriculum setting, discriminate practice base, reinforce supervising link, promote comprehensive quality to provide effective evidence and guarantee for formulating reasonable practical work link in social sports major and strive to improve practical quality of students major in social sports.

Keywords: teaching practice, talents cultivation, teaching countermeasure, social sports

INTRODUCTION

Chinese social sports major have still been a professional discipline as the slowly rising sun. Though it is relatively new, it has a promising start. The popular mass sports have facilitated the emergence and prosperity of social sports. The success of Beijing Olympic Games in 2008 and spread of national fitness has further promoted to Chinese social sports major is development. It is believed that social sports major would have huge potential and wide prospects (Zhang & Wang, 2008). As social sports develop under the promotion of social progress, social sports major in our school have also entered into fast development stage. As the major is emerging, its teaching work in various aspects just starts, so that needs teacher and students' efforts to improve and perfect new problems thereof. Thus, we make feasible research on social sports practice in our school, evaluate and summarize status and future transformation road, which is of realistic and profound significances in the reform of our schools' social sports practice.

Research Background and Status

In investigation, the paper totally consulted that 1066 journal articles related to social sports major through searching key words "Social sports major" from Wanfang database, whereas only 63 ones related to social sports practice (Chen, 2007). Through repeatedly reading and thinking these journals, I recognized formers' focus, and would like to state my personal views and theories through finding new research views with the formers' help in

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Contribution of this paper to the literature

- Teaching practice is the first link in university students' contact with the society. Only do a good job in researching and penetrating through on the teaching practice, we then can provide reliable and effective methods and suggestions on social sports practice transformation to make contributions to our broad groups of students' practical work.
- On the basis of students' practice response, we brainstorm, stand on market demands, focus on students' practice situation and summarize experience and lesson by optimized adjustment on internship duration, reinforcing supervision link, promoting comprehensive quality, discriminating practice base and other effective means, timely solve various problems and explore a road of professional practice that adapts to social progress and talents-job requirements.

the way of learning their research views and methods. By researching results, it is clear that society and scholars have attached great attention to social sports major, which also suggested the important role of the major in society and academic research (Zhang, 2017). However, documents related to "Our school's social sport major "were only four, and even little in studies on our school's social sports practice. By searching documents, it is clear that society and relevant scholars have increased focus on social sports major, there showed an increase demand on it (Zhang & QIN, 2012); however, research targeted at our school's social sports practice were relatively insufficient, which also becomes an important evidence for the paper's selective research.

In 2007 "Chinese universities' social sports professionals' employment status investigation", Zhangyu Chen suggested that there were lower proportion of social sports graduate students engaging in social sports work (Chen & Zhang, 2016). By analyzing employment influential factors, there was disconnection between cultivation goals and social demands, non-standard job setting, non-conformance between graduate students' concept of employment and market demands (Zhang, 2008). Thus, he put forward we should combine employment market, school with development of students, and expand space of students' employment and development.

In 2007"Analysis of problems in Chinese social sports development status", Jinlong Li and Shuhong Wang made investigation on university cultivation mode, teaching conditions, students' resources quality, professional thinking and employment situation by questionnaire survey and literature consultation. As the investigation only targeted at leaders and teachers in universities and not go deeper into studying students' subjective factors, it had certain constraints (Zhang & Peng, 2017). In the paper, it put forward that "external challenges for social sports development were insufficient cultivation of employment market, extremely imbalance distribution in employment areas, especially for little proportion of the number of employees in graduate students from middle and western regions" (Yuan & Wei, 2011). It went deeper into observation on employment regional distribution of graduate students in social sports major.

In 2001"Universities' social sports establishment status and development countermeasure and suggestions", Jun Liu regarded "universities that set up social sports major in Jiangsu province" as investigation research objects, analysed problems of social sports from university cultivation, curriculum setting and faculty construction (Yang, 2012). In the paper, it pointed out the importance of teachers' internal and external resources' sharing and practical work.

In 2013 "Sichuan provincial Universities' physical education professional teaching and learning status and countermeasure study", Jing Shi carried out investigation and analysis of Sichuan provincial universities physical education major's preparation stage before teaching, practical work implementation stage and assessment and summarization stage after practical work, found out problems and causes in practical work of physical education major in Sichuan province (Fan & Wang, 2012). So that provided some new thoughts and theoretical supports for Sichuan provincial universities physical education major is teaching practice and undergraduate students' comprehensive abilities better adapting to social development.

Research Objectives and Significances

Chinese social sports major have still been a professional discipline as the slowly rising sun. Though it is relatively new, it has a promising start. Social sports are a part in Chinese sports industry, its construction and booming is and would be an important implementation direction for Chinese sports industry (Liu et al., 2011). Social sports major aims to cultivate special talents in social sports and its development is closely related to Chinese social sports (Yao, 2006). Under this circumstance, Chinese universities should take compelling obligation to vigorously establish and develop new sports major facing to society. Social sports practical work is an important link in social sports major as it exerts an important impact. Fail in solving problems in social sports practical work would restrict in the further progress of social sports.

Recently, China has shown an increase trend in the number of graduate students, from2.13 million people in 2003 to 7.49 million people in 2015, increasing 4.5 times in 12 years. However, employment rate of graduate students has always been not optimistic, remaining in around 75%. That is to say, a great part of universities faces with unemployment after graduation. As a new major, social sports bear huge pressure and confront great test under such circumstance. As it is a new major, it also has problems as not profound and perfect practice mode. How to cultivate students to get work smoothly would be common problems in all teachers and students of universities running social sports major (Li et al., 2017). So how to reduce or avoid unemployment in social sports major of our school and always contribute to university students' employment status? The most direct way was school offered students better practical platform and environment through practice mode transformation during the students' practical work, enabling them to get better opportunities, letting them to have a good performance in practical work that was also their first important contact with society, making them to fulfil practice smoothly and then complete employment choice. Teaching practice is the first link in university students' contact with the society (Li et al., 2016). Only do a good job in researching and penetrating through on the teaching practice, we then can provide reliable and effective methods and suggestions on social sports practice transformation to contribute to our broad groups of students' practical work (Fang & Xia, 2014).

This paper just went preliminary exploration on practice conditions of students in our school's social sports major to find out which aspects transformation should be made in social sports teaching practice mode so that can shape universality students in an all-around way. It summarized specific methods to provide concrete suggestions and reliable guidance for social sports teaching practice transformation, narrowing universities' difficulties during practice period, letting them to walk out campus leisured, fulfill practice and even smoothly find a job.

RESEARCH OBJECTS AND METHODS

Research Objects

Research objects are undergraduate students in our school's social sports major in Grade 2011 and 2012.

Research Methods

Literature consultation

Search and collect relevant documents by school's library and electronic journals network, analyze and sort out them to provide firm theoretical basis for the paper's research.

Questionnaire survey

To recognize status of teaching practice in students of our schools' physical education major, we adopted self-compiled "Questionnaire on transformation research on social sports major's teaching practice mode" to survey on our school's graduate students in physical education major in Grade 2011 and 2012. It totally released

Table 1. Investigation on students' expected teaching practice duration (N=115)

Expected teaching duration Grade of undergraduate students	Three months	Four months	Half a year	Over half a year	Total
Grade 2011	3	5	7	23	38
Grade 2012	4	17	20	36	77

120 questionnaires, recovered 118 ones, the recovery rate was 98.33%, from which there were 115 valid ones, and valid rate was 95.83%.

Mathematical statistics

Sort out recovered questionnaires and use EXCEL software to implement mathematical statistics with questionnaire data.

RESULTS AND ANALYSES

We defined the specific transformation aspects in social sports teaching practice mode to shape a more all-around university students, through investigation on status of teaching practice of students major in social sports major and make further analysis and research. Then we summarized concrete methods to provide concrete suggestions and reliable guidance for social sports teaching practice transformation, narrowing universities' difficulties during practice period, letting them to walk out campus leisured, fulfill practice and even smoothly find a job.

Investigation on Teaching Practice Duration

In Our school's physical education institute cultivation plan in 2011, there defined one term as teaching practice stage that was the seventh term, totally four months. However, with further implementation of teaching practice, exchange with practice units and feedback of students, there showed shorter teaching practice duration. As shown in **Table 1**, intern students in Grade 11 an 12 generally hoped that teaching practice could be longer so that easier to connect with students' teaching practice with work after graduation. When students entered into practice units, most of them took practice at fixed posts. When they just got into the role and worked on track through training and learning in earlier stage, they would face with the end of teaching practice. As far as students are concerned, in this way, they could not effectively arrange working tasks, which increased their difficulties during teaching practice and affected their quality and efficiency in teaching practice. Similarly, for practice units, they would face with repeated training tasks-just trained students should leave without really getting into work state whereas next a group of intern students would enter into school.

Investigation on Students' Satisfaction with Practice Units

From our school's cultivation goals on students, there are mainly two choices on practice units, first is working as fitness advisor in fitness club-implementing physical training on students; secondly is working as membership consultant in fitness club, selling and consulting.

By questionnaire survey, it shows that students' satisfaction with practice units' hardware distribution reached 68%, that with their software facilities reached 58%, and that with their treatment reached 60%. Basically, students showed approve with regard to satisfaction with practice units (can refer to **Table 2**), but some students also reflected their disapproval toward practice units' environment and post setting, mainly reflecting in inconsistency between work in practice units and major in school. This caused students' in adaptation and difficulties in accepting teaching practice occurred in work. Secondly, in the regard of practice unit treatment, individual units' lodging and salary could not satisfy students' expectation, causing them feeling down and reducing their working efficiency. Finally, in training of teaching practice of practice units, some units could not arrange pre-job training on students as required, even required students to directly start working, causing greater difficulties in their practical work and seriously affecting their quality in practical work.

Table 2. Investigation on students' satisfaction with practice units (N=115)

Practice units' various comprehensive indicators	Satisfied	Percentage	Dissatisfied	Percentage
Practice units' hardware distribution (region, site etc.)	79	68%	36	32%
Practice units' software facilities(management standard, training of teaching practice)	67	58%	48	42%
Practice units' treatment(lodging, salary)	69	60%	46	40%
Practice units' post(whether consist with major)	44	38%	71	62%
Achievement of teaching practice	47	40%	68	60%

Table 3. Investigation on teaching practice efficiency influence factors(N=115)

Influence factors	Frequency of selection	Percentage	Ranking
Disconnection between classroom teaching and practice	98	85%	1
Deficiency in personal professional skills	66	57%	6
Insufficient ability of contacting with customers	77	67%	5
Change concepts of teaching practice	88	76%	3
Lack of effective training in practice units	89	77%	2
Teaching treatment and welfare	78	68%	4
Others (city distribution, traffic etc.)	56	48%	7

Table 4. Investigation on Students' opinions on reinforcing teaching practice (N=115)

Students opinions on reinforcing teaching practice	Frequency of selection	Percentage	Ranking
Further discrimination and selection on practice base	79	69%	1
Increase institute's negotiation and exchange with practice units	76	66%	2
Organize courses adapt to teaching practice	65	56%	4
Further optimization on teaching practice duration	45	39%	6
Leading teacher's guidance at any time	68	58%	3
Others	58	50%	5

Analysis of Teaching Practice Link Influential Factors

As shown in **Table 3**, "Investigation on students' personal factors that affect teaching practice efficiency" indicated that disconnection between classroom teaching and practice reached 85%, change concept of teaching practice reached 76%. Main factors that affected teaching practice was difficulty in students' role transformation, regarding themselves as a social worker; in addition, their deficiency in personal professional skills caused them could not solve sports fitness room's fitness guidance and membership consultant problems; during teaching practice process, students may not well observe and think changes in work, especially many students had shortage in exchanging with customers and even lacking of service consciousness during the practice process in fitness club.

Investigation on Teaching Practice Management Link

Through questionnaire survey, it is clear that students' opinions on further discriminating practice bases reached as high as 69% and rate of their opinions that hoping institute to increase negotiation and exchange with practice units arrived at 66%. Teaching practice management link is indispensable in teaching practice; good management would contribute to promote quality of teaching practice. In the entire teaching practice management process in our school's social sports major, school has taken a series of measures, such as mobilization before practice, leading a team to enter into practice units, arrange intern students' post, introduction to practice units, paying a regular return visit and feedback, implementing teaching practice closure report and so on. Meanwhile, there are one to two teachers in every practice unit as person-in-charge for teaching practice; they would timely learn students' problems in practice at each stage, and meanwhile offer timely help and solution to the problems. However, questionnaire survey on intern students showed that students' low recognition on teachers' guidance shortly. This may be because some students' practice units were far that the teachers could not learn work situation and solve problems at any time, as shown in **Table 4**.

Table 5. Investigation on students' opinions on reinforcing professional course construction (N=115)

Course learning should be reinforced in students 'opinions	Frequency of selection	Percentage	Ranking
Speaking English communication	34	30%	4
Practical computer operation ability	24	21%	6
Etiquette education, interpersonal communication	89	77%	1
Property management knowledge	6	5%	9
Secretary relevant ability	18	16%	7
Learning and practice of various laws and regulations	25	21%	5
Learning of public security and fire-fighting knowledge	15	13%	8
Reinforcement and practice of professional skills	84	73%	2
Chinese social sports development trend	76	66%	3

Investigation on Curriculum Setting of Social Sports Major

As shown in **Table 5**, "Investigation on reinforcing construction of students' professional courses" indicated that students' selection ratio in etiquette education and interpersonal communication reached 77%, suggesting that students were keen for strengthening training on social communication and etiquette. Our school's physical education institute began to recruit undergraduate major in social sports since 2007; the major was new in our school. Thus, there haven't formed individual unique advantage in social sports curriculum system structure, setting, module selection and professional teaching practice link, especially not completely getting rid of physical education course constraints in teaching course setting. The major's characteristic may not reflect accordingly. By questionnaire survey on intern students, it showed that students thought that social sports major should reinforce some courses, such as etiquette education, interpersonal communication. This reflected that students realized that they should not only master enough professional knowledge and skill after entering into society, but also learn how to get on well with others and realized interpersonal communication was also an important wealth during teaching practice. In addition, at the same time, reinforcement should be made on professional skills and practice as well as China's social sports development trend. Feedback of students' teaching practice link would enable us to make proper professional course choices.

COUNTERMEASURE RESEARCH

Through investigation on practice conditions of students in Grade 2011 and 2012, we found that there are many problems in their teaching practice. If the problems could not be effectively solved, the goals in students' cultivation may not reach while also definite professional, application and peculiarity in social sports may not realize. Undefined social sports major's teaching practice cultivation mode made students not be able to combine theory with practice, causing difficulties in students' judgment and positioning on their employment and future development. We should think about problems in teaching practice, find out social sports characteristic teaching practice mode from problems, and enable the major to develop for a long time.

Change Students' Concept of Teaching Practice

Through studying on questionnaire, we found that students in social sports major would be dispirited in case that they were hard to get help from school and would further affect their teaching practice. With regard to this, school should attach great attention, hold mobilization meeting before students' starting teaching practice, firstly it should have students learnt that they were regular labors with knowledge and ability. Having recognized current serious employment environment, students would upright their attitude towards teaching practice, regard the practice as an opportunity to examine their ability in four years' university life from heart. By doing so, the teaching practice would build firm practical operation base for university students' future work, and students in turn should positively reflect their behaviors in practice process, find out shortcomings and correct so as to constantly perfect themselves.

Strengthening Management Link in Teaching Practice Stage

By far, our school's social sports major has took a long teaching practice duration with rather scattered practice sites, advisors may not stay with students for a long time to guide and manage students' practice, which in fact led to shortage of necessary supervision in the overall teaching practice, and even partial of practical work were left alone. Facing with this problem, school should arrange one to two teachers as person-in-charge to communicate with institute, in addition, they should also adopt irregular visiting, consulting with practice units by phone, strengthen exchange between school and practice base to learn students' overall performance during practice. At the same time, the school should regularly do spot checking on students by telephone to learn their recently actual situations, carry out timely coaching and help on students came across difficulties, making the whole teaching practice well supervised and information opened.

Further Discriminate Practice Bases, Realize the Survival of the Fittest

By investigation on students, we found that most of the students were unfair treated in practice sites during practice period, or they could get no benefits to their future development in practical work. Some practical units even treated intern students as normal employers, letting them to work in fixed and single post to implement repeated simple work. Teaching practice is also a comprehensive practical teaching. The aims of teaching practice could not surely reach if regarding teaching practice as a general labor relationship between school and practice units, let students to go in for simple and repeated work in the same post and even non-major work. Thus, in the selection of practice base, school should conduct meticulous investigation and go deeper into field visiting from multiple aspects and multi-perspective; besides, they should determined remove practice units that could not guarantee for requirements and impair students' interest. School should ensure quality of teaching practice, and meanwhile steadily exploit construction on social sports practice bases.

Be a Strong Support of Intern Students, Guarantee for Students' Basic Interests

In investigation on students' teaching practice situation, we also found that individual practice unit could not provide welfare treatment in time as stipulated in signed agreement, and even increased work load and extended working time randomly in work. All of these seriously impaired students' basic interests, caused certain economic loss for students and even led to students' resistance to practice units as the worst and leaving out of work without permission. Therefore, teachers in institute should frequently communicate with students. In case of contradiction occurred to practice units and students, the teachers should hurry to students' practice unit at the first time to learn the causes of such matter and students' willing, and then negotiate with the units as "official", argue strongly on just grounds, guarantee for students' basic interests and be a strong support of them.

Promote Students' Comprehensive Ability in an All-around Way, Strengthen Cultivation of Comprehensive Quality

With feedback of investigation on students' teaching practice conditions, most of the students during the teaching practice period generally reflected that they should strengthen personal comprehensive quality, reinforce learning on the application of occupational skills, and meanwhile need to acquire more certificates on various occupational skills, further combine with relevant knowledge contents and skills of professional certificate, and promote their comprehensive ability to solve practical problems. During teaching practice, university students would reassure practice unites and customers if they work with relevant certificate. Besides, they should learn some basic skills, such as basic standard of essay writing and social etiquettes.

Reinforce Team Construction of Faculty Advisors

At present, most of lecturers in our school's social sports courses are originated from school physical education major, they are hard to overcome existing knowledge system to pass on knowledge to students targeted at characteristics in social sports major. This would lead to some drawbacks in students' major in social sports in

the application of sports skills and theoretical knowledge. Therefore, we should further train in-service social sports teachers, and adopt the way as "going out and coming in" to conduct professional social practice training to help sports teachers to get rid of fixed thinking mode, find out scientific and reasonable teaching methods; we could train them by getting them into social practice, the teachers could go to fitness club, resident community and other sports activity places to carry out in-situ simulation teaching and systematic training in spare time, so that help students to master more fixed social practical skills with personal experience.

CONCLUSIONS

Every discipline would come across many problems in the beginning of establishment and development. Social sports are set to cultivate social sports professionals, its development level and conditions would seriously impact on Chinese sports undertakings. Therefore, Chinese universities must take compelling obligations to strive to establish and develop new social-oriented sports major. For our school's social sports existing teaching practice mode, we should base on students' practice feedback, brainstorm, stand on market demands, focus on students' practice situation and summarize experience and lesson by optimized adjustment on internship duration, reinforcing supervision link, promoting comprehensive quality, discriminating practice base and other effective means, timely solve various problems and explore a road of professional practice that adapts to social progress and talents-job requirements so as to cultivate new generation sports talents with high quality and comprehensiveness application for Chinese education.

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Effects on Female University Students' Physical Health

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ABSTRACT

Objective: With the development of economy, our living level is being improved, and we pay more and more attention to physical health, whereas a well-built and shapely body and good temperament is also an inevitable requirement of social development. With regard to this, implementing aerobics teaching in universities could adapt to the demands of social development. Research methods: In this paper, literature review, experimental comparison, mathematical statistics were applied to mainly explore the effects of aerobics on female university students' physical health. Research results show that aerobics teaching were mainly divided into physical training and dance training, which were characterized by elegant, artistic, comprehensive, targeted, rich movement contents and simple movement. Aerobics teaching could correct undesirable female university students' body shape, contribute to their well shape building, reduce excessive body fat and improve body functions effectively, enhance their heart and lung functions and cardiovascular system and then further promote their physical health level.

Keywords: aerobics teaching, female university students, physical health, educational function

INTRODUCTION

Aerobics teaching is a kind of comprehensive art that integrates fitness, bodybuilding exercises, music and dance. The event has become well received by people especially for women with its increasing popularity. It is able to exercise one's body and enhance one's physique. As social living standards improve, there come two kinds of unhomely body shapes-too fat or too thin. Aerobics is a kind of aerobic exercise that contributes to weight loss and physique enhancement and beautiful body shaping. Female University students are in the period of perfecting and improving of physical and psychological development in university, anyone of them is longing for a good figure and healthy body, and they greatly care for personal body shape and beautiful figure (Li et al., 2017). The aerobics is a kind of body exercise events based on aerobic energy supply and characterized by health, strength and beauty. For female university students, they are in the stage of unformed body; the implementation of aerobics teaching plays an important role in correcting their body shape and improving their body functions. Moreover, the beautiful body movement in aerobics could be used to facilitate female university students' physical and formal beauty (Chen & Zhang, 2016). On this basis, we gradually cultivate their pursuit of art to improve their comprehensive ability

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Contribution of this paper to the literature

- Aerobics teaching can correct the unhealthy body shape of female college students and shape the beautiful body of female students, so as to improve the health of female students.
- Aerobics teaching and training can reduce the body fat of female college students.
- After the training of aerobics, the girl can prevent the occurrence of obesity can also improve the body's immunity, promote the blood circulation, ensure the health.

and accomplishment. In this paper, we make analysis of the effects of aerobics on female university students' physical health.

CURRENT STATE OF UNIVERSITY AEROBICS TEACHING

Body Teaching

There are two kinds of body-static and dynamic, which mainly including arms, eyes, trunk, head and other parts' external expression in cardinal points during movement process. No matter folding or extending, grace or rough, there shows straight and elegant body during instantaneous static or flowing shift from beginning to end, giving people visual directness and emotional appeal (Zhang & Peng, 2017). Body training is mainly cultivating students' correct and elegant movement and postures through some basic exercises of ballet; it is able to train students' coordinate ability in all body parts, rhythm sensation of movement and flexibility of joints through typical dancing and combined exercises, to improve students' body controllability, artistic expressive force and aesthetic consciousness.

The body teaching mainly covers bar exercises as training lower limbs and trunk strength, flexibility, skillfulness and coordination, enhancing control on the center of body and promoting balance ability effectively, and meanwhile standardizing students' body and posture, especially shaping the posture in leg. Basic part exercises-oriental exercises of various physical parts, such as swinging and circling of arms, circling of trunk, flexion and wave exercises. Grouping exercises, which is to compile a section of small groups with exercises in several single parts (Zhou et al., 2016). Ground grouping exercises, which are also low posture exercises, such as sitting(rectangular sitting, split sitting, kneel sitting, cross-legged sitting), lying(rear lying, front lying, lateral lying), supporting(rear supporting, front supporting, lateral supporting, ground supporting).We can even show our healthy and beautiful body through certain physical training.

Dance Teaching and Training

Implementation of dance teaching and training mainly aims to improve students' coordination and flexibility in body as well as grasping the rhythm, enhance students' physical quality, reinforce plasticity in body, enable students to control their body and extend limbs more freely, which is beneficial to student's expression of physical movement. At the same time, we should follow the principle of progressive and from simple to difficult when training to guarantee for efficiency during aerobics teaching. Generally, aerobics teaching adopts modern dance, jazz, Latin dance and folk dance in sports dance etc. (Zhang & QIN, 2012). As an art, dance generally brings beauty enjoyment to people, students should pay attention to personal body shape when taking dance training, and they should be chest out and abdomen in, tending an overall upward body. Only straight beauty is realized in body, rhythmic beauty of dance movements can be presented during the dance process, and dancers' understanding on movement can be integrated in limbs' coordinated movement and audience emotions can be mobilized. The key points that we should pay attention to during teaching and training process are pushing the whole with the part of body, unremittingly exercising. By doing so, dance training could then be fulfilled.

Characteristics of Aerobics Body Teaching

Elegant and artistic

Aerobics is artistic and elegant. In the process of training, student usually fulfills training and exercises of aerobics through elegant and slow movement, followed by the rhythm and transferred emotions and context in music. The elegance and artistry are shown in the process. Body training covers cultivation of people's spirit, temperament and style. People would form into a kind of elegant temperament gradually by grasping statistic, energy and spirit as required in training. Beauty body, decent appearance and polished manners may exert a larger impact on people's inner world; contribute to exercisers' elegant temperament. The elegant temperament is a closely combination of external form and spiritual world. As Confucian thinks, people's inner spiritual state is shown through external body, whereas beauty of character and spirit should be more a unified beauty of inner spirits an external body than only beauty of moral sentiments. No doubt, body training is a magic key to correct unhealthy body and shape elegant shape and temperament.

Comprehensive and targeted

Aerobics is a kind of general and dynamic aerobic sports with a combination of walking, running and jumping movements, which may develop whole bodies' joints and muscles fully and balanced. Aerobics teaching may mobilize exerciser's entire muscle during training process, enable their muscles to be better relaxed and exercised, remove excessive fat and effectively extend muscle and ligament of body. This may better improve female university students' uncomely body and physiological defects. In particular, it is conductive to correct X-type legs.

Diversified teaching contents

There are various aerobics movements, including all kinds of basic movements in gymnastics and numerous movements from dances and martial arts. Among them, body exercise is conductive to correct body shape, chest out and waist erect, extend muscle and ligament, making human body slim and tall, letting appearance and body more beautiful and elegant. Meanwhile it exerts an impact on the changes of temperament in female university students. In aerobics teaching and training, ballet, dance and contents from gymnastics are generally adopted, which has rich movement contents, greatly arouse students' interests in learning aerobics, and enhance their positivity in learning aerobics. In addition, most of the aerobics movements are simpler, and it reduces difficulties and lower barrier of students' aerobics learning, enabling students to learn the event.

ROLES OF AEROBICS TEACHING

Roles of Aerobics' Body Teaching

In aerobics teaching, increase body exercises properly may improve students' positivity in learning such event. Teachers could timely correct some students uncoordinated movements in class promote their learning exercises and make classroom come alive through body teaching. There is uneven students' physical quality in university, so most of them do not know how to fully show their body beauty. When taking aerobics exercising, students could not comprehend deeply various techniques that an exerciser should pay attention to during exercises, and so their movement could not reach the standard, making them passive. Body exercises, however, are simple and graceful; students are easier to grasp sense and strength of movement when exercising. Therefore, they are easier to reach movement requirement. Furthermore, with the combination of students' favorite fashionable elements, doing exercises accompanied by music, which conforms to interest and habits of contemporary students, additional body exercises in aerobics class targeted at students' poor situation of uncoordinated and imitation ability, not only can make classroom come alive but also enhance students' passion for learning. On a whole, university students are weak, which mainly because they lack of corresponding physical exercises, and female university students, in particular. As elective course in university, aerobics provide a well platform for female

students exercising. As aerobics movement is elegant, easier to access as well as rich in contents, while also is conductive to remove excessive fat, prevent from obesity, shaping perfect figure through aerobics teaching, it greatly arouses students' interests in learning aerobics to a great level.

Roles of Aerobics Dance Teaching

Dance training is helpful for improving students' coordination, flexibility and sense of rhythm. During dance, there would be strict and meticulous demands on movement of legs, increase proper dance movement exercises in aerobics training could therefore enrich students' comprehending on rhythm and movement, contribute to their sensation of perfect integration of movement and music. This is helpful for students' better presenting rhythm beauty of performing aerobics. Dance training can relax students' limbs; contribute to improvement of student's expression in body movement, better present movement. Aerobics learning and exercising could enhance physique, promote aesthetic ability and motivate characters. The increasing body beauty would make them more confident so that enable them to correctly examine their pros and cons, show their strong points and hide their weakness. Dance training in aerobics could greatly promote students' creativity, imagination and expression, and make great contributions to promotion of students' comprehensive quality.

RESEARCH OBJECTS AND METHODS

Research Objects

Select 10 female students from students taking aerobics as elective course in graduate 2014 to 2016 of this institute randomly, from which no obvious differences exists in their age, height and weight. All of them are in good physical quality without experience of taking special aerobics class.

Research Method

Literature review

Sort out relevant materials and documentary by searching aerobics teaching, body shape function via relative books, literature, CNKI and Wanfang Data.

Experimental method

In this study, vertical comparison is made on 10 female university students' body shape function changes before and after specialized aerobics training. They did not receive aerobics education, and will not take sports dance training after aerobics training.

Body shape test

Test items: chest circumference, waist circumference, hip circumference, thigh circumference, biceps circumference, subcutaneous fat in abdominal muscle, lumbar muscle and scapulae muscle

chest circumference, waist circumference, hip circumference, thigh circumference, biceps circumference;

Test instrument: tape

Test flow: Take test of chest circumference as an example, firstly, subject takes off clothes, stand at ease, put feet together, face right ahead and slowly lift lower jaw. Circle the tape on the chest (prominent point) horizontally from loose to tight.

subcutaneous fat in abdominal muscle, lumbar muscle and scapulae muscle

Test instrument: skin thickness tester

Test flow: Measurer holds skin and subcutaneous fat in measured parts with thumb and index finger of left hand (alternatively, other four fingers) as wrinkle, makes skinfold parallel to long axis of body, while right hand takes skin thickness tester to measure thickness at the root of skinfold. Then, he relaxes skinfold that slightly holds and hold it again to measure. He would measure for three times successively and take the mean. Pressure in skin should be moderate when measuring, neither too big nor too small.

Body function conditions test

Test items: heart rate, breath, lung capacity, systolic pressure, diastolic pressure

Resting heart rate

Test instrument: stopwatch

Test flow: The subject sits in the testing positing silently, puts forearm of right arm on the table flatly, put the center of palm upward. Tester sit in the right of subject, press his pulse and measure. Record-use time/min as unit.

Lung capacity

Test instrument: vital lung capacity instrument, blowing nozzle and nasal splint

Test flow: When testing, subject sits next to instrument, understands and masters test flow, keeps blowing nozzle in mouth and tight it with nasal splint.

Systolic pressure and diastolic pressure

Test instrument: Pressure meter

Test flow: Subject sits down and rests for a while, gets arm through armlet and binds, and then measure the pressure with the arm exposed. The center of armlet is at the same height of heart, keeping a distance of 1 to 2 cm from the elbow joint. Press user's key and start measurement automatically. When measuring, subject should relax palm, put palm onward and be relaxed. The subject is not allowed to speak or move during measurement, read the data after measuring.

PROCESS AND DISCUSSION

The Effects of Aerobics Teaching on Female University Students' Body Shape

Aerobics teaching can correct uncomely body shape of female university students

Body shape is external expression of human structure; there are different measurement standards on body shape in various periods and social backgrounds. By far, some female university students dare not correctly confront with personal physical growth. They tend to bow upper part and lower head when walking. Uncomely body shape mainly represents as special figure(too fat or too thin) and abnormal physical posture(chest backward, humpbacked, shrug, "X"-type legs, "O"-type legs, toe-in and toe-out etc.). Facts prove that these uncomely physical postures can be refined and corrected to shift them toward beautiful by scientific and targeted body shape correction training. Aerobics teaching requires coordination and cooperation of hands, legs and foot as well as other parts. Exercisers may correct personal uncomely body shape through aerobics teaching. It achieves efficiency of tightening muscle, consuming excessive fat and finally realizes body correction and develops into correct body through movement training in head, neck, chest, shoulder and legs as well as coordinated cooperation training in whole body's movement. Good body posture is an important factor to form a people's temperament and form. Taking body exercise for a long time is helpful for even and harmonious development in muscle, bone and joint,

Table 1. 10 female university students body shape before and after training (N=10)

Female students	Chest circumference Front Rear	Waist circumference Front Rear	Hip circumference Front Rear	Thigh circumference Front Rear	Biceps circumference Front Rear	Abdominal muscle (subcutaneous fat) mm Front Rear	Lumbar muscle (subcutaneous fat) mm Front Rear	Scapulae muscle (subcutaneous fat) mm Front Rear
1	84.40	68.07	87.82	52.19	22.03	16.87	12.50	11.30
	84.42	66.05	86.91	51.90	22.01	16.84	9.53	9.63
2	81.71	68.33	86.18	50.58	21.90	17.38	14.72	11.28
	81.72	65.27	85.26	50.36	21.89	17.03	11.80	9.87
3	87.55	68.16	87.82	51.55	22.87	16.90	12.57	11.37
	87.56	64.88	86.87	51.29	22.85	16.87	9.51	9.98
4	88.70	68.47	90.00	52.83	23.67	17.88	15.87	11.54
	88.71	65.46	89.04	52.62	23.66	17.42	12.79	10.08
5	85.34	68.55	89.45	53.80	22.88	17.94	16.34	12.27
	85.35	65.22	88.54	52.94	22.87	17.56	13.25	10.61
6	84.08	68.57	90.04	53.19	22.34	18.02	16.90	12.30
	84.10	65.41	89.06	52.88	22.32	17.53	13.87	10.55
7	84.17	68.27	88.09	50.30	23.30	17.34	13.11	11.48
	84.18	65.02	87.16	50.24	23.28	17.28	10.20	9.74
8	88.85	68.61	91.02	54.15	23.34	18.30	17.05	12.32
	88.87	65.35	90.09	52.54	23.33	18.01	13.96	10.61
9	92.85	68.82	93.36	54.39	24.02	18.53	17.08	12.34
	92.87	65.54	92.39	53.87	24.01	18.02	13.98	10.06
10	87.08	68.37	88.36	51.87	23.47	17.84	15.23	12.18
Mean	87.09	65.16	87.45	51.54	23.45	17.49	12.30	10.44
	86.47	68.42	89.21	52.48	22.98	17.70	15.13	11.83
	87.48	65.33	88.27	52.01	22.96	17.40	12.11	10.15
Standard values	90.31	63.75	91.64	53.79	23.2	12-20	12-16	10.4-12.4

refining uncomely body vigorously, forming elegant physique and further showing a good temperament and accomplishment in daily life, impressing people as vigorous, healthy and progressive. There is no medicine to cure uncomely body such as humpback in clinical, which could only be corrected through exercise therapy. In the exercise therapy, it exerts curative effects on erecting spine mainly through exercising spine and strengthening muscular strength of weak parts. As shown in **Table 1**, 10 female university students' mean scapula muscle sebum changed from 11.83 before professional aerobics exercises to 10/15 after such exercise. All were in normal scope. Subcutaneous fat in scapula muscle, however, decreases after exercising, showing a negative growth trend. The fat decreased obviously. The reduction can refine figure, strengthen muscle strength, and exercise joints in all body parts of students as well as develop muscle in a balanced way. Through aerobics training, subcutaneous fat could be consumed in various parts so that muscular strength could be enhanced. By regular aerobics teaching, uncomely bone could be developed towards correct direction by the impacts of pressure and tension so that realize uncomely figure correction.

Contribute to beautiful female university students' body shaping

All parts' muscle of female university students in sports major could be developed coordinated through elegant body exercises and event strength training. Meanwhile, coordination and sensitivity in their overall trank could be strengthened that makes up for drawbacks in their body and optimizes their form. Body training is a kind of fitness event. In training process, various movements such as walking, running and jumping could make a more beautiful figure for exercisers. At the same time, everyone can express inner feeling through personal body language. Therefore, it possesses exercise value of aerobics but also graceful characteristic of dance, from which athletes fully feel beauty and perform themselves accomplished by elegant music, which is very helpful for cultivating athletes' expression in movement. Research shows that female university students' rear hip circumference was reduced after exercises, suggesting such a aerobic fitness event as aerobics has a good exercising efficiency in improving fat female university students' external form. There are rich and varied aerobics

Table 2. 10 female students' body shape changes before and after training (N=10)

Female students	Chest circumference	Waist circumference	Hip circumference	Thigh circumference	Biceps circumference	Abdominal muscle (subcutaneous fat)	Lumbar muscle (subcutaneous fat)	Scapulae muscle (subcutaneous fat)
1	+0.02	-1.57	-0.91	-0.29	-0.02	-0.03	-2.97	-1.67
2	+0.01	-3.06	-0.92	-0.22	-0.01	-0.35	-2.92	-1.41
3	+0.01	-3.28	-0.95	-0.26	-0.02	-0.03	-3.06	-1.39
4	+0.01	-3.03	-0.96	-0.21	-0.01	-0.46	-3.08	-1.46
5	+001	-3.33	-0.91	-0.86	-0.01	-0.38	-3.09	-1.66
6	+0.01	-3.16	-0.98	-0.31	-0.01	-0.49	-3.03	-1.75
7	+0.01	-3.25	-0.93	-0.06	-0.02	-0.06	-2.91	-1.74
8	+0.01	-3.26	-0.93	-1.61	-0.01	-0.29	-3.09	-1.71
9	+0.02	-3.28	-0.97	-0.52	-0.01	-0.51	-3.1	-2.28
10	+0.01	-3.21	-0.91	0.33	-0.01	-0.35	-2.93	-1.74

movements, which not only integrates diversified basic movements in gymnastics, but also combines with various movements in martial arts, and possesses diversity in shaping body.

Aerobics body training is conductive to female university students in sports major to chest out and waist erection, correct body form, extend muscle and ligament, making human body slim and tall and appearance and body more decorous. Research results show that there occurred changes in body shape of 10 female university students after targeted fitness exercising to a different level. For instance, as shown in **Table 1**, 10 female university students have significant differences in circumferences of front and rear waist, legs and hips before and after training. Compared to standard value, mean of waist, legs and hip after training gets closer to such value. **Table 2** suggests that waist circumference, thigh circumference and biceps circumference show a negative growth trend after training. In the view of individual variable, all previous obesity and slim female students, have relative significant changes compared to others. This suggests that muscle strength is obviously enhanced, muscular fiber becomes rough and physique tends to more robust after systematic training. Hip circumference becomes even complete and gluteal line has somewhat upgraded. Besides, various chest movement exercises at ordinary times enriches chest and makes it high resilience, and then contributes to beautiful body shaping for female university students. There are varieties of exercising ways in entire aerobics exercise and widely exercise parts, as head, neck, shoulder, hip, chest, abdomen, waist, hip, thigh and shank, all have their own exercising ways.

Among them, flexibility exercises and basic body posture training are helpful for female university students in sports major to correct body form-chest out and waist erect. Various wave twisting and other movement is helpful for developing waist and abdominal and lumbar muscle, facilitating vigorousness and flexibility of waist and abdomen, and so sets curve of beauty body off. The kicking movement and hip movement in all directions build hip muscle strong and somewhat lifting, making people feel the enhancement of center and beautiful legs. Chest is an important manifestation of beauty body, various chest expanding and body extension exercises could make chest muscled and increase the volume of thoracic cavity. Thus, female university students in sports major could show their busty and resilient beautiful body form.

Contribute to remove excessive fat from female university students

As material civilization improves, there emerge civilized diseases such as obesity and hypertension. As all known, aerobic exercises are the best methods for losing weight, from which most effective ones are beauty-building and body-building exercises that exerts effects by metabolism way in low impact and high energy. After aerobics training, female university students in sports major could get burn their excessive fat and nutrient. This may prevent them against putting on weight and also improve their immunity, facilitate blood circulation and guarantee for physical health.

Table 1 indicators suggest that aerobics exert different impacts on various body parts, though its exercise duration is longer and participated parts of people are quite a lot. There are usually three parts composed of aerobics, part one is activity in each joint, which is mainly movement as extending and pulling; part two is ground

exercises, which is mainly exercises in abdomen and waist; part three is jumping exercises, which is mainly lower limbs exercises. We receive response from subjects and learn that most of them feel the exercise amount in waist, abdomen and lower limbs are larger, while those in upper limbs activities are smaller by comparing with them. Therefore, changes in circumference are larger. Relative research shows that our body water and fat would be consumed after taking physical exercises and then tended to be stable. However, there would emerge weight gain in regular sports exerciser after exercising in cycle, suggesting growth of muscle is a feature in such group of people. So, keeping a scientific aerobics exercises for a long time has a certain impact on controlling the weight.

Relatively, having entered into university, female students basically halted training with a great reduction in amount of exercises, their weight were therefore rebound to a certain degree, representing an increase in subcutaneous fat in waist, abdomen and thigh. Taking aerobics exercising could just prevent this from happening. In accordance with fat metabolism's exercise physiology, fatty acid generated by fat metabolism could be greatly burnt in skeletal muscle that finally contributes to fat reduction.

In **Table 2**, having received one term's aerobics teaching, the ten female university students' subcutaneous fat in lumbar muscle, abdominal muscle and scapulae muscle tended to negative growth. From the perspective of circumference changes, index of chest circumference, waist circumference, thigh circumference and shank circumference after exercising were obviously lower than those before exercising. That is because body's fat utilization improves comparing to sugar utilization after taking regular aerobic exercises. Thus, we could fight against metabolic disorders of fat through reduction body fat. Moreover, after exercising, both oxidation of fatty acid in body lactic acid and glycogen reserve that consumed would consume energy.

In addition, endocrine changes and temperature rising caused by exercises would make body metabolism at rest after exercising be higher than that before exercise and continue to one to two hours and even longer. Therefore, keeping aerobics exercises for a long time could reduce excessive body fat, strengthen our muscle strength, which plays a positive role in female university students in sports major to build beauty and lose weight so that shape themselves and keep a beauty figure.

Effects of Aerobics Teaching on Body Function of Female University Students

Improve physiological function of female university students in sports major

Body function refers to life activity displayed by entire human body as well as its systems and organs. The obviously improvement in heart and lung function is manifested by a reduced resting heart rate, obviously growing lung capacity. This suggests that aerobics play an obvious promotion to respiratory system and aerobic endurance. **Table 3** shows that 10 subjects' resting heart rates are within normal scope before and after training. **Table 4** indicates that a negative growth tendency occurs to such rates as obvious slower cardiac activity. At this time, it extends relaxation period of heart, has myocardium quite rested with enough blood. Additionally, after training, myoglobin contents would increase, heart nutrient will be strong, stroke volume will increase, oxygen utilization rate would be promoted and body would be economized. Thus, basic pulse becomes slower, and heart rate will slow down. From the perspective of breathe, 10 subjects' respiratory rate greatly decreases comparing to that before training, showing a negative growth trend, but lung capacity on the contrary obviously promotes, showing a positive growth trend. This shows that certain fitness exercises change functions of respiratory organs. Reasons for that are the enlarged thorax results in an increase in contraction strength and amplitude in respiratory muscle, and so there is an increase in lung capacity so that full supply of oxygen is ensured when exercising. In the view of blood pressure changes, there is an obvious increase in systolic pressure, showing a positive increase trend, while on the contrary an decrease in diastolic pressure, showing a negative growth trend. Both the increase and decrease values are within normal scopes, suggesting the implementation of systematic training has adjustment of central nervous system on cardiovascular system improved. This fully shows students have really reinforced their cardiovascular system by doing so.

Table 3. 10 female university students' body function conditions before and after training (N=10)

Female students	Heart rate		Breath		Lung capacity		Systolic pressure		Diastolic pressure	
	Front	Rear	Front	Rear	Front	Rear	Front	Rear	Front	Rear
1	78.70	72.90	18.50	16.10	2680	2784	108.3	112.3	81.3	76.4
2	88.70	82.60	24.70	22.45	3487	3420	127.7	128.6	89.5	84.5
3	70.30	64.70	16.90	14.80	2433	2539	103.1	107.5	75.4	71.2
4	88.43	80.83	23.10	20.80	3315	3319	125.3	127.8	88.1	83.0
5	68.38	63.94	12.30	10.85	1876	1987	102.3	105.8	71.4	66.4
6	86.42	79.82	22.70	21.10	3016	3121	120.4	123.9	86.9	81.4
7	86.15	79.55	20.90	18.40	2934	3043	119.7	123.2	86.7	80.9
8	72.86	68.26	17.30	15.30	2586	2682	105.2	109.6	78.7	73.7
9	78.81	73.21	20.50	17.90	2721	2925	110.9	115.3	85.9	80.1
10	69.45	64.30	16.10	13.70	2410	2516	103	106.1	74.2	70.2
Mean	78.82	73.01	19.3	17.14	2745	2833	112.5	116.0	81.8	76.7
Standard value	70	90	16	20	2500	3500	90	130	60	90

Table 4. 10 female students' body function changing conditions before and after training (N=10)

Female students	Heart rate	Breath	Lung capacity	Systolic pressure	Diastolic pressure
1	-5.8	-2.4	+104	+4	-4.9
2	-6.12	-2.25	+136	+2.9	-5
3	-5.6	-2.1	+106	+4.4	-4.2
4	-7.6	-2.3	+104	+4.5	-5.1
5	-4.44	-1.8	+111	+3.5	-5
6	-6.6	-1.6	+105	+3.5	-5.5
7	-6.6	-2.5	+109	+3.5	-5.8
8	-4.6	-2	+96	+4.4	-5
9	-5.6	-2.6	+204	+4.4	-5.8
10	-5.15	-2.4	+106	+3.1	-4

Female university students in sports major that taking aerobics exercises have increased their lung capacity and decreased resting heart rate. This suggests that implementation of aerobics exercises plays a positive role in promotion to physiological function of the students.

Promote heart and lung function of female university students in sports major

Table 3 indicates that 10 female university students' lung capacity has obviously increased after training, showing an increasing tendency. The mean changes from 2745 before training to 2833 after training within the scope of standard value. Additionally, **Table 4** shows that lung capacity tends to increase positively before and after training, suggests that female university students have improved their heart and lung function after training for a term. In aerobics, public aerobics are aerobic exercises, respiratory muscle improves when exercising. When breathing in, Chest can be fully extended, more pulmonary alveoli expands and more oxygen can be taken in ; when breathing out, contraction of thorax should be maximized so that more carbon dioxide waste could be removed. Through long-term aerobics exercising, people would get deeper breath, and breath times would be shortened. This is a most beneficial way to gain maximum breath, having respiratory muscle fully rested. Good respiratory function suggests strong working capacity of lung. And meanwhile, by doing so, lung resilience and respiratory muscle could be exercised, thorax therefore could grow better, and heart and lung functions could be improved. Specifically, by aerobics exercising, resting heart rate slows down, and lung capacity obviously rises. After training, resting heart rate decreases comparing to that before exercising, suggesting heart and lung's stroke volume increases after regular exercises. When resting, a low heart rate could satisfy the demands on body metabolism. Blood pressure's reduction is a sign of good changes in heart and lung functions, which may be related to the increase in tensity of Nervi vagus after exercising.

Strengthen cardiovascular function of female university students

As other tissues, cardiac muscle may strengthen its contractility, improve circulation condition of coronary artery and increase blood capillary and get fully nutrient supply by long-term moderate exercising. **Table 3** and **4** indicates that after aerobics exercising, 10 female university students' diastolic pressure reduces, showing a negative growth trend comparing to that before training. This indicates their heart relaxation period gets prolonged that provides longer rest time for myocardium and offers it plenty of blood. In the aspect of respiratory frequency, it slows down, showing a negative growth tendency. However, lung capacity promotes, showing a growth trend. This fully suggests that aerobics teaching can promote cardiovascular system of female university students in sports major remarkably, so that offers them plenty of oxygen during exercise process.

CONCLUSIONS AND SUGGESTIONS

Conclusions

i) Aerobics teaching and training is conductive to correct female students' uncomely body form, promote uncomely bone shapes developed toward correct direction under pressure and tension, and further correct uncomely body.

ii) Aerobics teaching and training is conductive to shaping of beautiful female students' body. It strengthens whole body's coordination and sensitivity, and optimizes our body.

iii) Aerobics teaching and training may reduce excessive fat of female university students. Through aerobics training, their excessive fat is burnt, which not only avoid obesity but also promotes physical immunity, facilitates blood circulation and ensures physical health.

iv) Aerobics teaching and training could improve physiological functions of female university students. Certain fitness exercises could increase contraction ability and amplitude of respiratory muscle, improving central nervous system's adjustment on cardiovascular system and so the female university students' physiological functions.

v) Aerobics teaching and training could promote respiratory function of female university students. Implementing aerobics exercises could have lung resilience and respiratory muscle exercised, and so contributes to better growth of thorax and better improve heart and lung capacity.

vi) Aerobics teaching and training could promote female university students' cardiovascular system. It is able to obviously promote their cardiovascular system so that offers sufficient oxygen during exercising process.

Suggestions

i) In aerobics teaching, female university students are not only required to correct uncomely postures with teachers' guidance in class, they should also practice after class. Exercising only in classroom is not enough; they should remain personal posture at daily life.

ii) Aerobics teaching does not accomplish in an action, similarly, beauty body shaping could be easily realized. When teaching aerobics, we should carry out systematically, and had better utilize some instrument to improve our body and promote our temperament.

iii) There are three kinds of aerobics teaching, such as aerobic, public and competitive ones. The female university students that just take specialized training should take more aerobics training when sharping body, which is of great help.

iv) It suggests that female university students should spend some time in physical exercising when concentrating on cultural course learning, and aerobics is an ideal sports event.

v) It is able to learn from advantages in female university students' participating in aerobics teaching, popularize general aerobics course in school, and select aerobics course conform to physiological and psychological characteristics of them. Besides, it should also active develop the second class to attract the students to take regular and lasting exercises as well as encourage male university students to join in aerobics exercises. This would build a foundation for lifelong sports.

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Research on Teaching Practice Growth Mode of Students Major in Physical Education

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ABSTRACT
Objective: Teaching practice is an important link in fostering physical education professionals. Teaching practice can effectively promote students' comprehensive quality and be conductive to better realize students' transformation to the role of teachers. Method: in this study, literature consultation, questionnaire survey and interviewing methods were applied to study on practice situations of students in Grade 2012 in our school's physical education major. Results: Practical ability cultivation was found to restrict in students' teaching level, especially for teaching practice link. Suggestions were put forward on the improvement of teaching practice by the study, in the hope of promoting students' teaching ability and facilitating their growth in comprehensive quality.

Keywords: teaching practice, teaching level, normal college's education, growth mode

INTRODUCTION

Teaching is one of the earliest works in the world. It has a profound history, while the emergence of normal college education just occurred in recent hundreds of years. France has pioneered teachers' training school until 1684.Normal school education generally can be regarded as professional education of training teachers. As a student in physical education major, one would become a sports teacher once starting to work. We not only should pass on theoretical knowledge to students, but also demonstrate professional skills to students and correctly demonstrate movement (Hu et al., 2017). Thus, students in normal colleges should perform " practical learning" in school with the guidance of school's leading teachers so as to acquire professional knowledge and promote teaching skills, and then further cultivate and promote practical education ability. The kind of teaching practice of fostering teachers becomes "teaching practice".

Normal college students perform teaching practice is a test and promotion to personal ability and also bring into fresh atmosphere to practice school (Imam et al., 2017). At the same time, teaching practice is conductive to normal college students' understanding on teaching post situation in advance, which is helpful for targeted adjustment in future work (Liu, 2000). Teaching practice situation also reflects normal colleges' cultivation on students, brings convenience for adjustment on school's running plan and more conforms to demands of talents cultivation.

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Contribution of this paper to the literature

- The research is of certain theoretical value in reforming school's course, enhancing graduates' comprehensive accomplishment and strengthening school's competitiveness.
- Partial students couldn't quickly transform roles and adapt to changes in environment, along with insufficient teaching experience, causing no significant enhancement in their mistake movement correction and teaching methods' application.
- Before teaching practice, the school should perform systematic and sufficient training on students, various courses and disciplines should fulfill personal cultivation tasks with higher quality to avoid excessive dependence on teaching practice.

Raise Problems

As first-tier working staff in education, teachers decide growth and progress of national next generation, which shows the importance of them. Thus, normal college education that is used as fostering teachers can be regarded as the foundation of the entire education.

However, as market economy gradually goes deeper, there occurred to a rapid expansion of the running scale in universities and a rapid increase in the number of students; no matter school's teaching quality or their employment situation, all face with huge challenges (Fang, 2012). Universities has expanded enrollment, but corresponding infrastructure thereof hasn't catch up with such expansion in time, making teaching resources especially tight, teaching quality frustrated and general disconnection between school and society. Most obviously, in school, most of the students cannot be trained sufficiently, leading to incompetent in working post (Luo, 2014).

In addition, having reformed education for several rounds in recent years, previous examination-oriented education has been substituted gradually by concept of quality-oriented education. In new curriculum standard, thinking of "Health comes first" has gone deeper into people's heart. Quality-oriented education is a kind of education that fosters students in multiple aspects and multi-level according to demands of social development (Zhang & Peng, 2017). As a university student that would participate in work, how to quickly adapt to new teaching environment and grasp core requirements of quality-oriented education and carry out teaching with definite objective (Xu, 2003). All of these are great challenges for students and teachers.

For universities, teaching practice can test school curricular setting and running orientation and thinking that bring convenience to school revision on teaching plan and promote faculty; as for students, it can test professional knowledge and comprehensive ability, is a required course to get into post as teachers and also essential preparation for engaging in education. Teaching practice is of special significance in school and students.

Development of teaching practice is a laborious process and suffers various factors' restriction. Present teaching practice mode has become rather mature after years' development. We should do a better job as required by social development, should constantly adjust our running mode with times advance, change and enrich our means of teaching practice.

It is an era with both opportunity and challenge now. Social competitiveness of normal college students is a sufficient reflection of running strength of normal colleges (Zhang & Zhou, 2014). The paper hoped to learn problems in our school students in teaching practice through investigation on students in Grade 2013 major in physical education. According to the problems, it put forward opinions and suggestions, improved talents cultivation link and facilitated talents' cultivation quality.

Research Purposes

By investigating on teaching practice situation of students in Grade 13 major in physical education, we learnt constituents that affected practice performance of students major in physical education. With references of domestic and foreign normal college students' teaching practice organization conditions and integration with our

school's physical education major students' specific conditions, we put forward opinions and suggestions so that would be convenient for improving students' personal ability in learning and working.

Research Significances

Theoretical value

The research is of certain theoretical value in school's curriculum reform, upgrading graduates' comprehensive accomplishment and reinforcing school's competitiveness.

Realistic significances

The research is of certain realistic significances in strengthening post recognition of students major in physical education, enhancing personal teaching ability level and fostering high quality sports teachers for society.

RELATIVE CONCEPTS AND CURRENT STATUS

Concept of Teaching Practice

Teaching practice is an indispensable practical experience for students major in physical education. Intern students are not only required to have certain professional knowledge and skills, but also should have the skill of effectively passing on personal professional knowledge to students that could be obtained and accumulated in practice. The concept of teaching practice has no definite and unified stipulation; however, many experts and scholars have summarized and analyzed it according to its characteristics. In teaching practice, students tend to experience processes such as probation and substitution, and some students would get involved in some administrative contents. Social development requires that school education should adjust working center accordingly, adapt to social development demands, but on a whole, there is no great changes in teachers' working tasks (Zou & Chen, 2014). Teaching practice should conform to cognitive law of teachers' work. Only by doing so, intern students could clearly recognize themselves in teaching practice work, and find out problems in teaching practice and easily solve problems so that be convenient to strengthen students' personal cognition and ability promotion. Cultivation of teaching ability forms in teaching practice. Teaching practice is an activity that applies theoretical knowledge and sports skills into practice, learning in school is just a process of simple learning, whereas teaching practice gets involved in learning contents and more importantly teaching. Let students to master knowledge and skills through teaching processes. Their grasping conditions tend to be affected by teachers' teaching ability and methods. In the teaching process, intern students on one hand, should pass on knowledge and skills; on the other hand, should make up deficiencies in the process of teaching, realize personal shortcomings, and strive to promote personal teaching level. On a whole, only by teaching practice, students could further perfect personal knowledge system, carry forward education policy in an all-around and correct manner, and better understand and fulfill teaching objectives.

In teaching practice, intern students should learn to fulfill teaching works and tasks independently, ensure teaching quality, and really realize take responsibilities of students and themselves. In the process, we surely would come across various difficulties; how to solve current difficulties is a reflection of students' ability in solving problems. In practice life, intern students exchange with advisers in work, make inquiry to leading teachers and discuss with other intern students, which can fast promote their ability of solving problems. Having experiences labor pains during teaching practice period, many intern students would feel promotion of personal teaching ability, and tend to have sense of mission and honor in education with promotion, and hope that they can contribute in education post.

Domestic and Foreign Study Status

Domestic physical education practice study status

Chinese physical education major is teaching practice develops followed by physical education major, but has not formed professional theoretical guidance. In 1950s and 1960s, China initially established relative perfect teaching practice system and various methods through employing experts from the Soviet Union to instruct their education experiences and theories. More and more universities has set up physical education major, cultivated a group of excellent students major in physical education, and more sports teachers perform teaching to contribute to Chinese modernization construction.

Normal schools arrange teaching practice could promote students' working ability and examine school's teaching achievement. Teaching practice is conductive to consolidate students' knowledge that learn in school and meanwhile absorb social experiences that teachers may be difficult to instruct in class teaching, which is a better supplement of promotion to students' social adaptability. Theory comes from practice; theoretical achievement regarding teaching practice emerged by generations of teaching practitioners' detours (Zhang, 2017). By numerous experts and scholars' yearly academic study on teaching practice, the implementation of teaching practice carried out more and more scientific and students' practice achievement would become more considerable.

Since 1996, China has successively carried out education reform for many times. Quality-oriented education has been widely spread in China, and quality of teaching has obviously promoted. In new teaching system, there is innovation in teaching objective, curriculum setting, and performance assessment to strive to promote students' comprehensive quality in all directions. New teaching system puts forward new requirements for education intern students and brings challenge for normal college teachers' teaching work arrangement. However, the real fact is usually institute's insufficient recognition on development orientation of future education work, causing students' mastered knowledge and skill when graduating not conductive to their adaptation to working post perfectly in the very beginning. Undeniable, partial students' individual ability also affected their teaching work, but at large, they were affected by school's professional arrangement.

Up to now, physical education teaching practice has formed system and attracted attentions of many universities. Many schools would attach more attention to changes in primary and secondary schools' campus demands in curriculum setting, and increased assessment on students' teaching practice, and strengthened supervision and guidance on students' practice. In students' selection on practice units, school took more comprehensive and multiple considerations, which fully promoted students' teaching level and school's running quality. But there are still some problems in physical education practice now. Though fixed systems have formed, they haven't been standardized; cognition on teaching practice was not comprehensive, which objectively only focuses on classroom teaching, ignoring teaching practice in other links. This could be reflected from evaluation on practice performance. Most schools' evaluation on students' practice performance referenced students' performance in practical classroom teaching, while little attention paid to students' performance in other aspects. Practice that organized to cultivate intern students' thought of becoming sports teachers was little that was bad for completely promoting intern students' comprehensive quality. While partial intern students were indifferent to engage in teaching practice.

Thus, to adapt to demands on social development, school should strengthen intern students' cognition on teaching practice and positively enrich practice contents, comprehensively promote practice quality, and make a strict standard in assessing practice performance to make teaching practice more standard, diversified and scientific.

Foreign physical education practice conditions

Foreign students ought to fulfill corresponding physical education practice to get qualification of sports teacher. America stipulated students as total practice duration should not less than 15 weeks, required them to discipline themselves as a formal teacher during practice period, and take initiative teacher's working task. The

form of teaching practice is divided into two parts, firstly it required students to fulfill combination between education theory and practice in universities, and initially get the knowledge of education post. Secondly, students could get into formal practice post after fulfilled school's practice working tasks. At the same time, after completing weekly practical work, students should return to university to quickly summarize personal performance in practical schools and records on task completion conditions, and fulfill summarization on weekly practice work. Nowadays, America has another new practice system, which specially targeted at normal college students, requires normal college students appear in cooperative normal colleges in the form of professional teaching personnel, they should take teaching tasks in whole term with certain guidance, finally endow students certain reward as a form of encouragement so as to improve normal college students' positivity in practical work.

Since 1975, Britain stipulated that teaching practice was required to cover 12 to 15 weeks of the total term weeks in regard of time, and meanwhile implemented teaching practice work plan by several time frames. During teaching practice, students usually should pay a visit to primary and secondary schools for several times, and investigate on conditions of the schools' curricular setting and students' psychological conditions so that build foundation for personal teaching practice.

Russia has always a country of laying extremely emphasis on teaching practice. They regarded teaching reform as a kind of most effective path to get effective data and provide plans. There were there forms in teaching practice, firstly was intern students should fulfill advisors' assigned practical work in summer vacation after the ending of sophomore course independently; secondly was a kind of teaching practice that learns specific conditions in school in the form of probation during the process of practice; thirdly was a teaching practical work that primary and secondary school carries out after mastering basic information of students in practice schools.

Many nations in the world extremely focuses on teaching practice, people in any nation should not ignore the role of teaching practice in promoting native education development. Teaching practice gets involved in students' academic fulfillment, and also reflect school's running level, which relates to school's development prospect. Most importantly, performance of students' teaching practice reflects native education level, and seriously affects development of native comprehensive strength. To better impel development of teaching practice, we need to formulate strict practice evaluation standard and perfect practice organization management system and also make proper practice plan.

RESEARCH OBJECTS AND METHODS

Research Objects

The research took Grade 2013 students major in physical education of our school as research objects, from which there are 73 schoolboys and 55 schoolgirls; it totally released 128 pieces of questionnaires, got 110 pieces valid ones, and valid rate was 93.75%.

Research Method

Literature review

Through consulting information in large-scale websites with strong reliability such as CNKI, Wanfang database and so on, we learnt specific condition and development trend of domestic and foreign normal colleges' students' implementation of teaching practice.

Questionnaire survey

The questionnaire report was formatted through consulting with advisors that were familiar with investigation in the direction and reading lots of questionnaire reports in the same type as well as combining with specific implementation plan in the investigation.

Table 1. Analysis of gender difference and teaching ability

	M (N=73)		W (N=55) SD (Parameter)			
	M	**SD**	**W**	**SD**	**T value**	**P value**
Teaching design ability	3.66	0.46	3.55	0.48	6.02	p≤0.01
Teaching implementation ability	3, 44	0.54	3.53	0.65	5.06	p<0.05
Teaching ability	3.71	0.47	3.54	0.47	8.01	

Table 2. Different professional achievement ranking's sports normal college students' teaching ability single factor variance analysis

Variable	**Top33%**		**Middle 34%**		**Rear33%**	
	M W	**SD**	**M W**	**SD**	**M W**	**SD**
Teaching ability	3.91	0.34	3.62	0.40	3.38	0.50
Various dimensions' teaching ability	3.70	0.38	3.42	0.63	3.21	0.53

Interview methods

We interviewed with partial students that returned to school after teaching practice, went deeper into investigation on how their teaching ability rapid improves during teaching practice and recorded in written form to sort out and file them.

CORRELATION ANALYSIS OF BASIC INFORMATION BEFORE TEACHING PRACTICE

Comparison of Teaching Ability in Different Genders before Teaching Practice

There is no special significant difference in different genders' teaching ability and various dimensions teaching ability of students major in physical education. Teaching practice mainly examines teaching theoretical knowledge and curriculum knowledge as well as special disciplines knowledge that mastered by students major in physical education. Of course, it would also examine their physical education means and methods' application. All of these examination items are not heavy physical labor, together with university students are young and strong in age, gender difference has therefore no correlations with development of teaching ability as shown in **Table 1**.

Comparison of Teaching Ability in Students with Different Professional Achievements before Teaching Practice

Various reflections of professional achievements ranking have very significant differences in teaching ability and various dimension' teaching ability. Students major in physical education with professional achievement ranking top 33%, middle 34% and rear 33% have shown a decreasing trend in teaching ability and various dimensions' teaching ability, with a reflection of students have good professional achievement would show higher teaching ability and various dimensions' teaching ability; while the students' professional achievement rank backward would show lower performance. This reflected different achievement rankings have stronger correlation with teaching ability as shown in **Table 2.**

ANALYSIS OF STUDENTS' TEACHING ABILITY DEVELOPMENT IN TEACHING PRACTICE

Significant Analysis of Teaching Ability Development

Students major in physical education have shown significant improvement in teaching ability after teaching practice. This was proved in interviewing with students returned to school; they basically expressed "have greatly improved" to the question "How much change in teaching ability". For instance, Intern student A said, "Having fulfilled teaching practice, I have greatly improved in teaching ability, especially I have made obvious progress in teaching contents' selection, teaching skills and teaching design ability and so on. I have gone deeper

Table 3. Ability of each item in physical education major

Variable	Almost no	A little	Good	Excellent
Teaching practice	8%	14%	46%	32%

Table 4. Analysis of students' performance in all dimensions after teaching practice

Dimension	Significant changes	Non-significant changes
Teaching design ability	83%	17%
Implementation of teaching skills	42%	58%

into understanding basic professional knowledge of teaching and also become more confident about working as a teacher".

As shown in above **Table 3**, students major in physical education has improved their teaching ability, which has closely connection with grasping of professional knowledge and skills in school and teaching practice links(preparation of teaching contents, teaching knowledge, probation of teaching). Undeniable, students' teaching practice is an important cause for their teaching ability improvement.

Specific Analysis of Development of Teaching Ability in Various Dimensions

Various dimensions' balance analysis

Intern students have shown improvement in teaching ability, and meanwhile they have occurred different changes in various dimensions of teaching ability. This mainly reflects in significant changes in teaching design ability and teaching skills as shown in **Table 4.**

Teaching design ability reflects teachers' reflect teachers' level of teaching theory and method application, while teaching ability reflects in revealing intern students' basic ability of fulfilling teaching plan and task through prearrangement on teaching objective and teaching methods. Promotion of teaching design ability is directly related to "Unified teaching practice in fixed base" teaching practice mode that our school' physical education institute carries forward, which mainly reflects in two aspects as follows. Firstly, in school trial lecturing link before teaching practice, it regards simulated class teaching and teaching plan design as important contents of examination, school arranged advisors usually would carry out targeted assessment and guidance on intern students' teaching plan design, and meanwhile would also require intern students to strengthen common exchange and discussion and put forward improvement suggestions on shortcomings of classmates in school's trial lecturing link. Secondly, in previous learnt "Sports teaching theory" course, lecturing teachers would take six to ten class hours to specially design teaching plan and carry out special topic lecturing, and further deepen students' cognition and understanding on teaching design.

Implementation of teaching skills bases on teaching design. Teachers ought to master ability to reach teaching goal. Skill of lecturing is a reflection of intern students' exchange ability. Their correct demonstration on movement, application of proper teaching method and performance of ability to correct personal and teaching objects' mistakes are essential. Development of implementation ability on teaching skills may be related to two aspects as follows. Firstly, intern students' opportunities in practical ability are rather deficient in physical education major that their implementation on teaching was rather weak. Having engaged in teaching practice for a while, students showed smooth performance and confidence in sports organization, management, technical movement description and demonstration. Secondly, some students in physical education major had worked as coachers in spare time in the past, even some worked as sports teachers in advance as they owed prominent professional skills. Through exercising in this way, they build foundation for physical education practice period. Moreover, school would organize many activities every year, such as competition of normal college students' teaching skills, which was conductive to promote participated students' professional teaching ability, master teaching flow to build firm foundation for future teaching practice, and meanwhile the propaganda and

Table 5. Analysis of students' teaching design ability after teaching practice

Variable	Significant improve	Improve	No improvement
Selecting teaching contents	80%	15%	5%
Making teaching plan	85%	10%	5%
Analyzing teaching objects	90%	7%	3%
Arranging teaching sites	50%	30%	20%
Implementing teaching objectives	38%	40%	22%

Table 6. Analysis of students' teaching skills application performance after teaching practice

Variable	Significant improve	Improve	No improvement
Application of teaching methods	20%	46%	34%
Lecturing skills	72%	20%	8%
Demonstrate movement	84%	9%	7%
Correct movement	3%	12%	85%

presentation of normal college students' teaching skill competition in turn could effectively promote students to positively participate in teaching.

Analysis of teaching design ability

Intern students have shown significant improvement in selecting teaching contents, making teaching plan and analyzing teaching objects that realized the expectation of teaching practice. But further analysis should be made on their ability of arranging teaching sites and implementing teaching objectives.

Ability of arranging teaching sits is a unique teaching content in physical education; its purposes are mainly to arouse students' learning interests and positivity to make preparation for implementing physical education smoothly. As a qualified sports teacher, one should have a clear teaching thought in mind, understand every teaching link, arrange teaching sites and facilities in advance and promote teaching quality. As shown in **Table 5**, intern students major in physical education haven't shown great improvement in arranging teaching sites.

Implementing physical education should firstly define teaching objectives, from which the defined long-term, short-term and classroom teaching objectives could be conductive to our better fulfill teaching. As a sports teacher, one should make reasonable teaching objectives, ensure students' learning quality, and comprehend requirement of textbook arrangement and school's specific conditions. At the same time, they should comprehend students' specific conditions. As shown in Table 5, intern students could not better define teaching objectives for teaching objects.

Analysis of teaching skills' utilization

Students major in physical education has obvious improvement in applying external assistant teaching ability and lecturing and demonstrating movement skills, and also certain promotion in applying teaching methods, while not obviously improvement in correcting ability as shown in **Table 6**.

By interviewing with students major in physical education, we found that most of students still should promote lecturing ability, correcting mistake movement and teaching method application. For instance, teaching intern student B said, "I am poor in verbal expression in school, dare not answer teachers' problems in class or express personal thought. However during practice process, I found that I could not correctly express when facing to students' questions and only told teaching objects that they did mistake movements, could not lecture and correct them."

Teaching intern student C said, "In broadcast exercises teaching, I found ideal teaching effects could not reach at all through front demonstration, but couldn't do mirror demonstration and occurred some problems. I don't know which teaching methods can be selected in teaching process, causing inharmonious in teaching atmosphere."

Teaching is a very complicated process, whether teaching objective could be fulfilled smoothly is also up to complicated teaching environment. Intern students in physical education major learnt required professional knowledge and skills in teaching as students during university, while they should transform into teacher in teaching practice process, in which time they passed on professional sports knowledge and skills to teaching objects and improve their sports ability. As they could not fast transform roles and adapt to changes in environment and due to shortage in teaching experience, causing no significant promotion in correcting mistake movement and application of teaching methods.

CONCLUSIONS AND SUGGESTIONS

Conclusions

i) Before practice, there is no significant discrepancy in students' practice base in different gender; but significant discrepancy in students with different learning performances.

ii) Students that go through complete practice have improvement in various abilities; research also shows that all elements that compose of students' teaching ability would be more even after teaching practice.

iii) In the process of teaching practice, though students have varied improvement in teaching ability, they could not completely and independently solve problems.

Suggestions

i) Before teaching practice, the school should perform systematic and sufficient training on students, various courses and disciplines should fulfill personal cultivation tasks with higher quality to avoid excessive dependence on teaching practice.

ii) School should prepare more rich contents in earlier practice and arrange more rich contents during practice process, letting intern students to be fully prepared in ideology and morality, professional theory and role transformation.

iii) In talents cultivation process, we should learn and carry forward advanced teaching concept, change traditional teaching thought, mode and method and promote teaching ability in an all-round way.

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Practical Teaching Reform on Computational Thinking Training for Undergraduates of Computer Major

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ABSTRACT

To improve undergraduates' practical ability, strengthen their computational thinking training, and meet the social requirements for computer talents, Agricultural University of Hebei (AUH) in China has reformed practical teaching for computer major since 2013. Practical ability training program is made to guide the practical teaching reform. The reform includes four aspects, i.e. project-driven teaching methods, teaching staff construction, teaching support platform, and creative ability training methods. After implementing the reform for several years, AUH have achieved satisfying results. In this paper, the concrete contents and measures of the reform is introduced to provide reference to other colleges and universities.

Keywords: practical teaching reform, computational thinking, computer major, colleges and universities

INTRODUCTION

With the development of computer technology, many colleges and universities in the world have set up computer major. There are more than 800 colleges and universities that have computer major in China. In recent years, computer education in Chinese colleges and universities has some serious problems. On the one hand, computer major graduates cannot find suitable jobs; on the other hand, employers cannot find high-end computer professionals (Liu, 2015). Some reasons lead to the problems. Firstly, colleges and universities do not train enough practical ability for computer major undergraduates. Colleges and universities pays attention to classroom teaching, but the practice teaching is not standard. Secondly, practice teaching method is unitary. Theory cannot be linked with practice. Thirdly, colleges and universities just instill computer knowledge, but they do not pay attention to developing undergraduates' thinking modes of solving problems with computers. Computer technology develops rapidly. Because computer major graduates lack computational thinking habits, it is difficult for computer major graduates to meet the requirement of the times.

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Contribution of this paper to the literature

- The contents and measures of practical teaching reform in AUH are proposed to train computational thinking ability for computer major undergraduates.
- A practical ability training program is made to guide the practical teaching reform.
- Four aspects of the practical teaching reform including project-driven teaching methods, teaching staff construction, teaching support platform, and creative ability training methods are introduced.

The practical teaching plays an important role in the whole teaching process in colleges and universities. Practical teaching can help undergraduates improve comprehensive quality, enhance practical ability and cultivate creative spirit. Graduates with strong practical ability are welcomed by employment institutions. So, practical ability training attracts colleges and universities' attention (Bhurtun, 1999; Du, 2011; Ran, 2010).

Computational thinking is first proposed by Jeannette Wing (Wing, 2006). It is a set of thinking skills, habits and approaches for problem-solving using computers (Lee, 2011). Computational thinking is a fundamental skill for everyone (Guzdial, 2008). Researchers has explored methods that infuse computational thinking into K-12 teaching (Allan, 2010; Barr, 2011; Settle, 2012). Hambrusch (Hambrusch, 2009) opened "Computational Thinking" courses for science major undergraduates. It is necessary to train students to obtain the ability of computational thinking in the daily teaching process. For computer major undergraduates, computational thinking ability is an elementary quality. However, colleges and universities pay attention to impart knowledge; the training of computational thinking is often neglected.

Computer major of Agricultural University of Hebei (AUH) in China was established in 1994. AUH is one of the earliest authorized institutions of computer major in agricultural colleges and universities in China. In order to adapt to the AUH's orientation of "joining mainstreams and having characteristics", train high-quality talents which are applied, complex and personalized, strengthen undergraduates' thinking ability, practical ability and creative ability, practical teaching of the computer major in AUH has been reforming since 2013.

THE PRACTICAL TEACHING REFORM

The reform aims at improving students' practical ability and strengthening students' computational thinking ability. It is guided by practical ability training program. Project-driven teaching methods and teaching staff construction mechanisms were implemented. Teaching support platform was built. Undergraduates were encouraged to attend scientific research and competition to improve their creative ability. The ideas of practical teaching reform are shown in **Figure 1**.

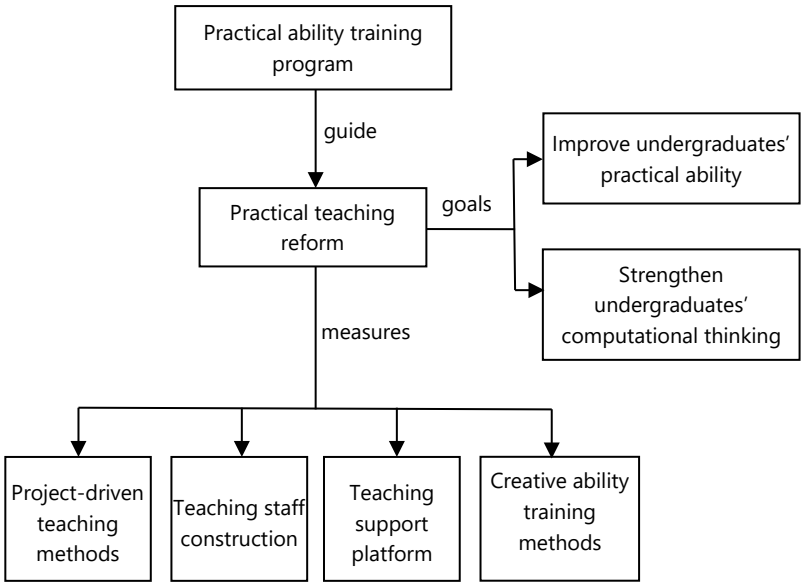

Figure 1. The ideas of practical teaching reform

Practical Ability Training program

The objective of practical ability training program is to cultivate practical talents with solid practice ability, computational thinking ability and creative ability. The training program follows four principles.

(1) Meet the employment and social needs. The arrangement of computer professional curriculum and teaching contents is to enable undergraduates to have the ability to meet the future employment and social needs.

(2) Strengthen practical teaching contents. To improve undergraduates' practical ability, extensive practical teaching contents such as experimental courses, curriculum designs, integrated practical training courses, graduation practice, graduation project and university-enterprise training are arranged.

(3) Strengthen the university-enterprise cooperation. The idea of university-enterprise cooperation is to set up practice bases in enterprises. Undergraduates go to the enterprise to practice. University-enterprise cooperation realizes the seamless connection between undergraduates and employment institutions, so as to improve their employment opportunities.

(4) Reforming the teaching system of computer courses. Based on the ideas of computational thinking, the target of the reform of teaching system is to cultivate undergraduates' sustainable development ability of computer application technology, promote their professional innovation ability.

Practical ability training program divides the training ability into three parts, i.e. basic ability, major core ability and expanding ability. The three abilities are subdivided into other abilities. The detail of ability partition in practical ability training program is shown in **Figure 2**.

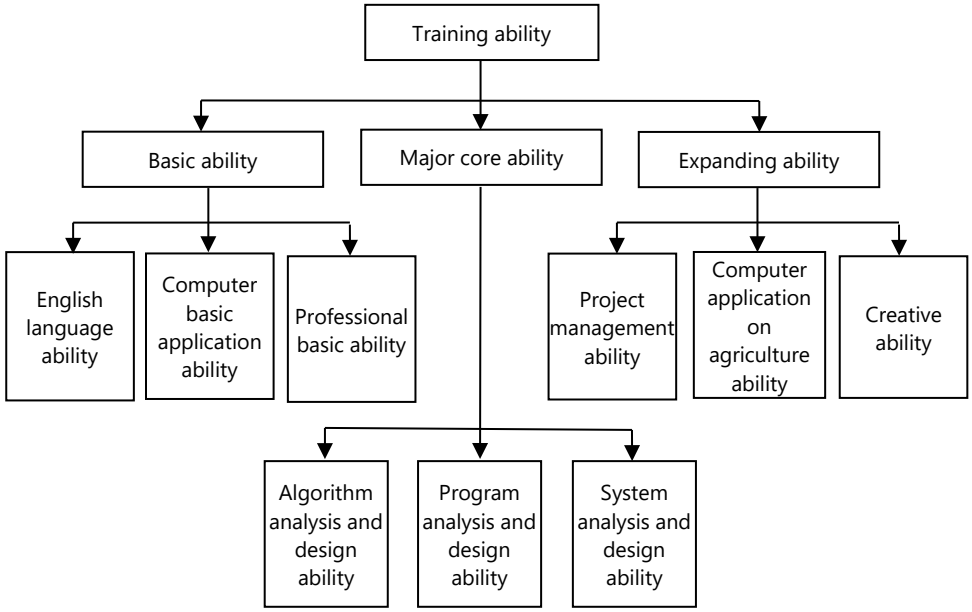

Figure 2. The ability partition in practical ability training program

The idea of computational thinking is to cultivate the habit of learning and thinking, and to improve undergraduates' innovative ability. The practical ability training program follows "skill-knowledge-thinking" three layers educational ideas. The computational thinking training runs through the whole process of the practical ability training program. In the stage of basic ability training, undergraduates establish formal, model description and abstract thinking. In the stage of major core ability training, undergraduates further consolidate and improve the computational thinking ability. In the stage of expanding ability training, undergraduates solve complex engineering problems using computational thinking ability. The corresponding curriculum arrangement is carried out step by step from three aspects, namely, undergraduates' quality training, thinking training and creative ability training, so as to achieve the reform goal of improving students' thinking ability and creative ability.

The teaching arrangement adopts "3+1" talents training mode, which divides four years in university into two stages. The first stage is the first three years. The undergraduates need to complete all the courses that the syllabus requires and they should have certain theoretical and technical knowledge. Then the last one year is the second stage. In the second stage, undergraduates practice in the enterprises and finish curriculum training, comprehensive training, graduation practice, and graduation project. The purpose of the teaching arrangement is to strengthen undergraduates' practical ability, seamlessly connect the undergraduates with employment institutions.

Project-driven Teaching Methods

Computational thinking emphasizes problem-solving methods and thinking. In order to strengthen computational thinking training, the traditional teaching methods including book centered, classroom centered and teacher centered need to be changed. Undergraduate centered, autonomous, cooperative project-driven teaching methods should be explored.

Project-driven teaching focuses on developing undergraduates' thinking methods and processes of problem-solving using basic concepts of computer science. The purpose of project-driven teaching is to enable undergraduates to gradually improve their computational thinking ability in the process of project realization.

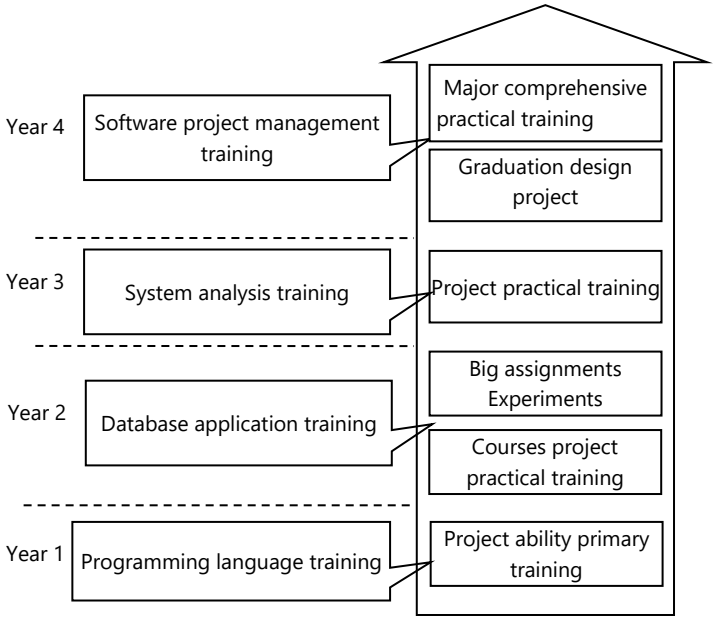

Figure 3. The project-driven implementation plans

Problem-solving using computational thinking follows progressive thinking processes, i.e. "Observation→ Association →Transformation". Take project of "license plate recognition" as an example, teachers guide undergraduates according to the project development process in their teaching. Firstly, let undergraduates "see" the case, i.e. requirement analysis, figure out the tasks that the project need to solve, for example, the above project should determine the position of the car's license plate, recognize characters, letters and digits. Secondly, undergraduates abstract the project based on "Association" thinking, which means that undergraduates abstract the processes that computer can solve, for example, the project can be abstracted as "Image acquisition→ License plate area location→ Character segmentation→ Character recognition→ Results output". Finally, undergraduates realize the project using Charge-coupled Device (CCD) to collect images, image segmentation and image recognition algorithm to realize the function modules after "Transformation" thinking. By problem-solving processes in the project, undergraduates can understand how the computer collect, store, represent and process the information, so as to train the undergraduates' computational thinking ability.

Up to now, the project case library including more than 30 project cases of computer related has been established in AUH. Project-driven runs through the whole four years undergraduates teaching. The project-driven implementation plans are shown in **Figure 3**.

Teaching Staff Construction

Teaching staff is the key factor to train undergraduates' computational thinking. In AUH, through overseas training, in-service studies, academic exchanges, professional training and other ways to strengthen teachers' understanding of the concept of computational thinking, and enhance the professional level of teaching staff.

More than 30% of teachers in AUH that are engaged in computer teaching have experience of studying in overseas. Through overseas studying, they broaden their outlook, improve their professional knowledge and strengthen their bilingual teaching ability.

Computer science and technology develop rapidly. In order to learn frontier knowledge and advanced technology, many teachers are organized to visit some famous software companies such as Microsoft, IBM, Oracle, HUAWEI etc, some famous experts at home and abroad are invited to give lectures to teachers.

Project-driven teaching brings forward higher requirements to the teachers. Two schemes i.e. "going out" and "bringing in" are adopted to strengthen their professional ability. "Going out" refers to send teachers to study or train in other famous universities or enterprises regularly. "Bringing in" refers to employ technicians from software companies to develop concentrated training for teachers.

Teaching Support Platform

To guarantee the implementation of practical ability training program, AUH strengthen teaching support platform construction including hardware and software construction in laboratory and university-enterprise training base construction.

Laboratory construction

Excellent laboratory condition is an important factor to train undergraduates' practical ability and computational thinking ability. In recent years, AUH increased funding for laboratory construction of computer major. Now, there are seven advanced laboratories, i.e. embedded application development laboratory, Java/Android application development laboratory, IOS application development laboratory, distributed laboratory, software engineering laboratory, computer network laboratory and computer component principle laboratory.

Laboratory construction not only concerns hardware equipment, but also pays attention to software configure. Seven experimental teaching platforms and one professional training project management platform were constructed.

Teaching of experimental courses and other practical activities including curriculum designs, graduation designs, and extracurricular innovation competition are arranged in the laboratories.

University-enterprise training base construction

In order to improve undergraduates' practical ability and vocational adaptability, university-enterprise cooperation has become an effective way to train high-quality and highly skilled talents in colleges and universities. University-enterprise cooperation talents training mode take the enterprise demand and undergraduates qualified for the enterprise's work as the main goal, make teaching plans on the basis of the enterprises' actual production and business activities, and carry out teaching activities in various forms by universities and enterprises. AUH has explored flexible and diverse forms of university-enterprise cooperation.

(1) IT educational enterprise courses training

AUH and the outside well-known IT education enterprises make training plan together, launch software and hardware technology, project management and software skills training courses. We have ever cooperated with Microsoft IT Academy and Intel Software College.

Microsoft IT Academy launched a new globally oriented IT education system, utilized strong technical advantage of Microsoft Corporation, provided high-end IT technology for global teachers and undergraduates in colleges and universities. Microsoft IT Academy train 2 to 3 main courses to computer major undergraduates in AUH annually. The Intel software college provides software and hardware technology courses, project management and software skills training courses based on Intel platform. AUH actively seek cooperation with domestic software corporations. We cooperated with Suodi education institution to provide professional skills training, cooperated with Uplooking Technology Company Limited to provide Android mobile phone

Figure 4. The figure of IT education enterprises training

development and Embedded development, cooperated with Zhuoweida company to provide training of PHP project development.

Through cooperation with well-known software companies, it is helpful for students to access to new IT technology, improve practical ability and increase job opportunities. **Figure 4** shows that IT education enterprises are training in AUH.

(2) Send teachers to train in the enterprise

Teachers are sent to train in the enterprises in a planned way. They participate in the project development in enterprises. This measure accelerates the renewal of teachers' knowledge and improves the professional level of teachers. 3 to 5 teachers of computer major are sent to enterprises to train annually in AUH. Through the professional training of teachers, we strive to achieve what businesses need, teachers are proficient in what, and undergraduates know what.

(3) Construct external practice and training bases

AUH actively construct stable practice and training bases of computer major. Undergraduates are really sent to IT enterprises according to the enterprises' software development process and management mode. They can see how the actual operation of the software company. Undergraduates' interest and employment competitiveness are improved.

The practical ability training program arranges 4 weeks of comprehensive training in the seventh semester. Undergraduates increase their practical ability and improve their combat experience through practical training from external training bases. Undergraduates, enterprises and universities achieve mutual benefit from university-enterprise cooperation. At present, AUH has 8 fixed external training bases and is still trying to contact software companies to build more external practice and training bases. **Figure 5** shows that undergraduates are training in external training bases.

Figure 5. The figure of undergraduates' external training

(4) Construct internal practice bases

Another form of university-enterprise cooperation is to invite enterprises into the university. University and enterprise construct internal practice bases in universities together. External practice and training in enterprises is undoubtedly a better form of university-enterprise training. But, enterprises are not laboratories of the university. It is impossible and unable to accept all the undergraduates. For most undergraduates, constructing internal practice bases in universities, taking the enterprises' project to finish in internal practice bases, creating simulated enterprises environment through the cooperation projects, also can achieve the effect of external practice and training.

Creative Ability Training Methods

The purpose of innovative education is to arouse the undergraduates to think on their own initiative, train undergraduates' ability to discover problems and solve problems. The objectives of practical ability training program are to train undergraduates' computational thinking, eventually increase their creative ability.

In the daily process of teaching, the idea is to guide undergraduates to solve the problem and conduct system design using the basic concepts, to enable undergraduates to understand the basic ideas of solving natural and social problems, and to develop undergraduates' creative thinking. In addition, utilizing modern teaching methods such as project-driven teaching methods, teaching support platform, combining stimulated approach such as scientific research and competition, the computational thinking ability and creative ability of computer major undergraduates has been significantly improved.

Encourage undergraduates to attend teachers' research projects

In AUH, a mechanism that undergraduates are integrated into teachers' projects has been formed and inherited. The scientific research projects have stimulated undergraduates' learning interest, improved undergraduates' professional core competence and innovative ability, and enriched the project case library.

Guide undergraduates to attend computer competition

The competition is to organize undergraduates to attend science and technology activities using learned professional knowledge to examine their basic theoretical knowledge and their ability to solve practical problems. Competition activities can stimulate undergraduates' strong interest in science, and also enhance their practical ability, cooperation spirit and creative ability.

Figure 6. The figure of undergraduates attending the first youth APP competition in China

In recent years, undergraduates have participated in various forms of Computer Applications Competition, Computer Design Competition, Innovation and Entrepreneurship Competition etc and won many awards. **Figure 6** shows that undergraduates attend the first youth APP competition in China.

THE EFFECT OF PRACTICAL TEACHING REFORM

After years of practical teaching reform, the quality of talents training is promoted. The practical ability, computational thinking ability and creative ability of undergraduates of computer major are improved. The talents with more practical ability and creative ability are highly favored by employment institutions. The employment rate and quality of employment increase obviously. In recent years, the employment rate of undergraduates of computer major exceeds 95%. Many graduates have been recruited by companies such as Baidu, Microsoft, Sina, Lenovo, 360, and Jingdong.

CONCLUSION

Computer related work requires high practical skills. To improve the employment rate of undergraduates of computer major, AUH in China has reformed the practical teaching for computer major. The goal of the reform is to improve undergraduates' practical ability and strengthen their computational thinking training. The guideline document for reform, i.e. practical ability training program is made. The reform starts from four sides, which are project-driven teaching methods, teaching staff construction, teaching support platform, and creative ability training methods. Concrete reform contents and measures are introduced. Many years of teaching reform practice has achieved satisfactory results, which proves that the direction of our practical teaching reform for computer major is right.

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Status and Countermeasure Study on Physical Education Teaching Practice

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ABSTRACT
Objective: Teaching practice is an organic part in the process of physical education, is the only way to foster a qualified sports teacher, and a main way to evaluate quality of talents cultivated by universities in an all-round manner. Method: In the paper, literature consultation, questionnaire survey and other methods were applied to investigate on physical education teaching practice status, and countermeasure study was made on problems in practice process and suggestions were put forward accordingly. Process: We conducted exploration from physical education teaching practice's trial teaching, practice preparation, practice school's basic information, practice schedule, practice location and advisors status, intern students' status as well as feedback by the end of practice in accordance with time sequence that intern students participated in teaching practice. Results: We found that there are some problems, such as low satisfaction with trial teaching, single way of intern students' practice units' selection, excessive concentrated practice bases, insufficient intern class hour for intern students, incomplete implementation of probation stage in teaching practice, irresponsible advisors and so on. By doing so, we would provide specific practice experience and theoretical evidence for standardizing and effectively promoting physical education teaching practice, and offer reference data for the progress of Chinese physical education.

Keywords: university students, physical education, teaching practice

INTRODUCTION

As an important part in university physical education's professional teaching plan, physical education teaching practice is not only a basic reflection in helping students to fulfill teaching principle of combining theory with practice, but also an important mean to contribute to realize school current cultivation goals and satisfy social demands (Li, 2005). Through teaching practice, students could realize transformation from professional knowledge to teaching skills and even fulfill teacher transition. At the same time, physical education teaching practice has important tasks as examining quality of universities' talents cultivation and reflecting shortcomings in universities physical education talents cultivation.

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Contribution of this paper to the literature

- In physical education teaching practice, there are some problems, such as low satisfaction with trial teaching, single way of intern students' practice units' selection, excessive concentrated practice bases, insufficient intern class hour for intern students, incomplete implementation of probation stage in teaching practice, irresponsible advisors and so on.
- From analysis of data in **Table 25** regarding investigation on physical education teaching practice influence factors, we found common guidance management of advisors and practice schools, and emphasis of school leaders respectively ranked in the first and second, with a proportion of over 50%. Construction situation of practice base and arrangement of teaching practice time and cycle ranked the third, and the fourth, respectively.

Physical education teaching practice is of important significances in physical education. It provides examination platform of knowledge and skills for students majoring in physical education of universities, and is able to provide theoretical evidence and suggestions for the development and reform of physical education major (Zhang & Peng, 2017). By consulting information and investigation, we found that there were little studies on physical education teaching practice. Thus, the writer supposes that the paper' investigation on physical education teaching practice is of great realistic significances.

Research Background and Status

Concept of teaching practice is complicated, and that by far has no unified demarcation in academic cycle. There is a rather complete annotation of teaching practice in works, such as Xiangru Li etc. "Chinese universities physical education teaching practice reform study" (Li & Qu, 2005). Wei Zhang and Zhaoqing Meng "Physical education teaching practice", "Word-ocean", Mingyuan Gu "The comprehensive dictionary of education", Nianhong Zhang chief complied "Encyclopedia of Chinese education", Huangting Zhang chief complied "Education dictionary" (Hu et al., 2017). Gaohou Xu "Teaching Practice". By analyzing opinions in above works, we could conclude that teaching practice is an activity that university intern students go to intern location to engage in education and teaching practice with the common guidance of the intern location and school (Imam et al., 2017).

The conception of physical education teaching practice has also been described by some scholars in their works, such as Chunlu Yu "Guidance and Practice in physical education internship", university textbook "Physical education teaching practice guidance" (Li et al., 2001). Qiming Wang "Physical education teaching practice". By analyzing their description, we could conclude that physical education teaching practice referred to an important part in university physical education professional teaching plan, and a link to promote students' comprehensive ability in the way that transforming students' personal theoretical knowledge to practical ability and shift their psychological state towards teachers by teaching practice.

At present, some domestic experts and scholars have also made rather comprehensive study on physical education teaching practice through extensive research methods and from various perspectives. In the study, they made investigation, made analysis, made summary and put forward new opinions and thinking as well as new challenges in teaching practice process targeted at current undergraduate practice status. There were rather mature description in some people's works, for instance, Chunlu Yu "Guidance and Practice in physical education internship", university textbook "Physical education teaching practice guidance", Qiming Wang "Physical education teaching practice" (Shi et al., 2004).

From physical education teaching practice's characteristics, it has own particularities-wider coverage, which not only remains in class but moreover is practice on entire school's sports work, including intern head teacher, sports teaching activity, sports training and other works (Xu, 2003). Siyong Xia thought that there were four characteristics in teaching practice, such as i) practicalness; ii) comprehensiveness; iii) normalization; iv) guidance. As Chinese university class teaching has improved systematically, it has some new exploration in theory and practice of teaching practice. However, on a whole, physical education has still defects and shortcomings, such

as short and concentrated practice duration, single form, ineffective practice guidance, which is bad for development of intern students' personality.

Society has attached high attentions by far to problems in teaching practice, and many Chinese experts and scholars have carried out rather mature study on physical education teaching practice mode, such as Xiaoju Shi "Research and practice in university physical education teaching practice mode". Cangfan Cheng "Discussing on reform in physical education teaching practice mode". Chunlu Yu "Research on physical education teaching practice mode". Cuixiang Dong and Yuejin Li "Initial exploration on Normal colleges' physical education teaching practice mode and management countermeasure". All have analyzed and explored current Chinese physical education teaching practice mode, and put forward teaching practice mode in multi-form, multi-channel and multi-plan. Jie Zheng "Advanced normal colleges' teaching practice mode comparative study and suggestions", Xiangchao Ling, Shumao Lan"Discussing on university physical education "Rolling" teaching practice", Ruxi Li put forward "Three in one" teaching practice mode. These researches have provided specific practical experience and theoretical evidence for universities' physical education teaching practice and constructive opinions and suggestions for development of Chinese physical education from physical education mode. Yao Luo "Contrastive research on Chinese and American normal college teaching practice", Chaoying Wang "Advanced university physical education internship's theory and practice", Fenghua Miao and Qiaomei Zhou "Teaching practice mode reform and advanced normal colleges' connotative development". These researches thought that by far main Chinese teaching practice ways were monocyclic teaching practice mode, dicycle teaching practice, "Three in one" teaching practice mode and open practice way;Replacement teaching, "national training plan" supporting teaching practice, concentrated teaching practice and scattered teaching practice and so on. Qiang Feng"Initial discussion on teaching practice evaluation on students major in physical education of advanced normal colleges" thought that advisors were difficult to make comprehensive, fair and correct evaluation due to lack of quantitative evaluation criterion, causing their evaluation on students' teaching practice being excessive subjective and arbitrary that affected students' positivity in teaching practice. Qiang Feng "Initial discussion on teaching practice evaluation on students major in physical education of advanced normal colleges", Bingkang Dang " Study on physical education teaching practice performance evaluation system", Jianqiu Jin etc. "Research on reform of teaching practice in physical education major". Shiyan Li, Zhanqi He and Yanhong Su "Construction and study on physical education teaching practice performance evaluation indicator system". Zhi Gao, Jian Liu and Wang Yao "Construction and empirical study on physical education teaching practice performance indicator system". Yu Wang "Research on Hebei Normal University's physical education students' replacement teaching performance evaluation indicator system". Yu Hao "Shanghai Normal University physical education teaching practice status investigation and mode reform study". All have presented their unique cognition and thoughts on Chinese physical education teaching practice evaluation, and also put forward opinions and suggestions on teaching practice evaluation. Anegleyce Teodoro Rodrigues has also explored plans for new teaching practice in "A questão da formação de professores de Educação Física e a concepção de professor enquanto intelectual- reflexivo–transformador".

To sum up, various contents of physical education teaching practice has been constantly perfected with formers' increasingly efforts, concept of teaching practice has been gradually clear, teaching mode has been increasingly optimized, arrangement of practice duration has been increasingly reasonable and teaching practice evaluation has been constantly normalized though. Most of the researches by far are unilateral researches from teaching practice mode, teaching practice status and teaching practice evaluation, lacking of specific and perfect case study. The study thus based on four-month teaching practice, combined with characteristics of physical education major, studied on Grade 2013 physical education teaching practice, which provided practice reference and certain theoretical evidence for physical education major and teaching practice of other departments, and was of theoretical and realistic significances.

Research Purposes and Significances

Physical education teaching practice is an important part in teaching work of physical education institute. It is an important mean to comprehensive investigate and examine students' physical knowledge, skill, technology and scientific training methods; it is an important path to further carry out professional ideological education and

training on students as well as improve their teaching ability; it is also an important link to cultivate a qualified sports teacher. It is an important evidence to fully examine students' learning conditions during university, and also a necessary link in comprehensive examination and promotion of students' teaching ability, and moreover the only way for students' shifting towards teachers. Thus, physical education teaching practice is very important for education major, especially for students majoring in physical education. Teaching practice results directly affected students' ability in future teaching.

Physical education teaching practice is of important significances in physical education major, it also provides examination platform of knowledge and skills for students majoring in physical education of universities. At the same time, it could also provide theoretical evidence and suggestions for development and reform of physical education major. By far, with the progress of Chinese society, they have increased requirements in physical education. So that it admits of no delay in strengthening teaching skills of students majoring in physical education of universities thoroughly. Universities ought to make proper perfection in knowledge and skill reserve of students majoring in physical education and strengthen their teaching practical ability in accordance with social demands. This puts forward new requirements for teaching practice of students majoring in physical education of universities. By investigation on physical education teaching practice status, the paper found problems and further put forward constructive suggestions that provided specific practical experiences and theoretical evidence for promoting physical education teaching practice in a standard and effective manner.

RESEARCH OBJECTS AND METHODS

Research Objects

Grade 2011 to 2013 undergraduate students majoring in physical education are research objects.

Research Methods

Literature consultation

This paper carried out extensive consultation on relevant documents as paper from school library and CNKI, consulted and analyzed them to provide firm theoretical base.

Questionnaire survey

The research created questionnaire in electronic edition, released it through WeChat, QQ and other network platforms, collected and analyzed data by questionnaire network platform and finally sorted out data using WPS software. It totally released 152 pieces of questionnaire, effectively recovered 152 ones, from which 68 ones answered by pupils and 84 ones answered by schoolgirls. Through analytic investigation on questionnaire data from students in Grade 2011 to 2013, it provided data supports for the paper's research results.

RESULTS AND ANALYSIS

Investigation on Preparation Status of Probation and Teaching Practice in Physical Education

Investigation on status of trial teaching in physical education major (can refer to Table 1, Table 2)

Trial teaching is a kind of teaching practice transition way that has intern students engaged in simulated class teaching through grouping and trial teaching with the guidance of advisors before teaching practice. In this way, the intern students could contact the physical education, practical teaching, know the rules of teaching so that build a good foundation for they completing teaching practice successfully.

Table 1. Investigation on satisfaction with trial teaching

Content	Yes		No	
	Number of people	Percentage	Number of people	Percentage
Whether attended trial teaching	145	95.39%	7	4.61%
Whether performed satisfactory trial teaching	104	68.42%	48	31.58%
Whether satisfied with trial teaching	101	66.45%	51	33.55%

Table 2. Investigation on trial teaching schedule and satisfaction

Option	Sub-total	Proportion
A. Satisfied	53	34.87%
B. Relatively satisfied	62	40.79%
C. General	30	19.74%
D. Not so satisfied	6	3.95%
E. Dissatisfied	1	0.66%

Table 3. Selection of practice school

Option	Sub-total	Proportion
School allocation	133	87.5%
Independent practice	17	11.18%
Others	2	1.32%

Duration for trial teaching in physical education major is one week that distributed in the sixth term; students would feedback the implementation of trial teaching.

From investigation on intern students' trial teaching participation and satisfaction, we found that though students' participation degree arrived at over 95% as school focused on the link, data analysis found that students' satisfaction with the link was less than 70%, suggesting that there were more room to promote time and work arrangement in trial teaching. In this link, over 30% students in total showed their dissatisfaction, suggesting that students' lower satisfaction in the link and they could get limited promotion, which may also reflect in formality trend in the link. We could make promotion from all of the directions.

Investigation on status of practice preparation

Selective mode of practice school (can refer to **Table 3**)

Most of intern students majoring in physical education carry out teaching practice by school's unified arrangement; however, by consulting information, affected by employment environment factors nowadays, there common occurs intern students' practice unit arrangement under recommendation of relatives and friends. Whereas there are more intern students taking the initiative to contact with practice unites with the hope of training personal ability through independent practice. Thus, with the progress of society, teaching practice opportunity moves forward multiple has become an inevitable trend. There are more room to strengthen selection of teaching practice ways in the stage of teaching practice.

Practice school basic information

Practice school is a place that intern students locate in teaching practice stage, rational selection on nature, location and learning stages of the practice school directly related to intern students' adaptation to practice location that would further affect intern students' personal teaching ability promotion (can refer to **Table 4**, **Table 5** and **Table 6**). The practice school's nature, location and other aspects' factors would exert various impacts on different intern students. Thus, for intern students that engaged in physical education teaching practice, investigation on nature and location of practice school and learning stages of intern students allocated school are of important significances in studying and promoting teaching practice level and quality of intern students majoring in physical education.

Table 4. Nature of practice school

Option	Sub-total	Proportion
Public school	87	57.24%
Private school	59	38.82%
Others	6	3.95%

Table 5. Practice school's location

Option	Sub-total	Proportion
A. Downtown	43	28.29%
B. Outskirts	61	40.13%
C. Villages and towns under the governance of city	30	19.74%
Other provinces and cities	18	11.84%

Table 6. Learning stages in practice school

Option	Sub-total	Proportion
Primary school	34	22.37%
Junior high school	55	36.18%
Senior high school	52	34.21%
D.Others	11	7.24%

From comprehensive analysis of **Table 4**, **Table 5** and **Table 6**, we found that physical education teaching practice school mainly located in public middle school, selection of practice schools is rather single. In addition, **Table 5** suggested that practice base mainly located in regions of this city, less in other provinces and cities. Intern students perform teaching practice in nearby regions would cause restricts in students' promotion and be bad for expanding views of them and harmful for their promotion in comprehensive quality.

Teaching Practice Stage

Investigation on opinions and satisfaction with schedule from intern students engage in postgraduate examination and those not engage

Through comparing investigation on practice time duration from intern students engage in postgraduate examination and those not engage (can refer to **Table 7** and **Table 8**), we found that the number of intern students though practice long and relative long covered 53.29% of the total, which goes beyond half the total. However, comparing intern students that engage in postgraduate examination and those not engage, among the formers, there were 17 people thought practice long, and 35 ones thought it longer, all above half in this item, whereas 43.43 % intern students thought teaching practice time moderate. from which the number of students don't engage in postgraduate examination accounted for 92.4%, therefore most intern students that engaged in postgraduate examination thought time arrange not reasonable, from which only 5 thought practice time shorter that accounted for 3.29% of the total. With regard to this, from data in comprehensive analytic **Table 8**, there shows serious polarization in attitude towards practice duration from intern students engage in postgraduate examination, which was mainly shown in the item of long, longer and shorter. By comparing, students that don't engage in postgraduate examination has higher satisfaction with time arrangement, those thought time arrangement reasonable covered high ratio.

Table 7. Investigation on time duration opinions from intern students engage and don't engage in postgraduate examination

Option	Sub-total	Proportion	Engage in postgraduate examination (two months)		Non-engagement in postgraduate examination (four months)	
			Number of people	Percentage	Number of people	Percentage
A. Long	29	19.08%	17	27.4%	12	13.3%
B. Relatively long	52	34.21%	35	56.5%	17	18.9%
C. Appropriate	66	43.42%	5	8.1%	61	67.8%
D. Relatively short	5	3.29%	5	8.1%	0	0
E. Short	0	0%	0	0	0	0

Table 8. Investigation on satisfaction with practice time arrangement

Option	Sub-total	Proportion	Engage in postgraduate examination		Non-engagement in postgraduate examination	
			Number of people	Percentage	Number of people	Percentage
A. Reasonable	72	47.37%	20	28.6%	50	69.4%
B. General	70	46.05%	47	67.1%	23	32.9%
C. Not reasonable	10	6.58%	10	100%	0	0

Table 9. Investigation on leading teachers and advisors' conditions

Content	Yes		No	
	Number of people	Percentage	Number of people	Percentage
Whether has leading teachers in this specialty	34	22.37%	118	77.63%
Whether has guidance with competent advisors	105	69.08%	48	30.92%

From data in **Table 8**, practice time satisfaction investigation reflected that 72 people thought it reasonable, accounting for 47.37%. Among them, there were 20 intern students engage in postgraduate examination, accounting for 28.6%; while 50 don't engage in postgraduate examinations, accounting for 69.4%, whereas 70 intern students thought it normal, accounting for 46.05% of the total, from which 47 were students engage in postgraduate examination, accounting for 67.1%, and 23 were students don't engage in postgraduate examination, accounting for 32.9%. And there were 10 thought it not reasonable, who engages in postgraduate examination. To synthesize data in **Table 8**, we can conclude that on a whole, there showed low satisfaction with physical education teaching practice time arrangement, which were mainly from intern students that engage in postgraduate examination.

Combine analysis in **Table 7** and **Table 8**, we can conclude that intern students have shown low satisfaction with time arrangement of teaching practice, from which are mainly intern students engage in postgraduate examination. So we should further arrange these students' teaching practice time more reasonable.

Investigation on leading teachers and advisors' conditions

Analyze table's data (can refer to **Table 9**), there were only 34 intern students had leading teachers in this specialty, only accounting for 22.37% of the total. This also reflected shortage of teachers in physical education teaching practice. In addition, over 30% intern students thought advisors incompetent. This was also a reflection of implementing practice base not thoroughly.

Investigation on intern students' probation stage

Probation stage is an indispensible part in the process of teaching practice. In this stage, intern students went into practice base to observe and emulate teacher's class to learn their teaching skills, technology and organization way, and then carry out practice and feedback to improve personal ability. On the other hand, probation stage could be a warm-up period for intern students and teaching objects, enabling intern students to initially know basic learning conditions of teaching objects, which is conductive to fast integrate intern students into teaching objects and promote practice efficiency.

Table 10. Whether goes through probation stage

Option	Sub-total	Proportion
A. Yes	102	67.11%
B. No	50	32.89%

Table 11. Intern students' weekly class hours investigation

Option	Sub-total	Proportion
A. 1-5 lessons	46	30.26%
B. 6-10 lessons	56	36.84%
C. 10-15 lessons	41	26.97%
D. 16-20 lessons	8	5.26%
Over 20 lessons	1	0.66%

Table 12. Whether submits teaching plan

	Sub-total	Proportion
A. Yes	111	73.03%
B. No	41	26.97%

Practice school is intern's internship phase of colleges and universities, the nature of the practice school, location selection, and reasonable period directly influences the intern can adapt to the status quo of ShiXiDian, thus affecting the trainee can improve their teaching ability. The nature, location and other factors of the practice school have different effects on different interns. Professional sports education practice, therefore, to investigate the interns, the investigation of the nature of the practice school, location, and interns in school period, to study to improve sports education professional level and quality of interns internship has important significance.

Table 10 reflected that probation problem in physical education teaching practice mainly lied in not thoroughly implementation. There are 50 intern students haven't experiences probation stage, accounting for 32.89% of the total. As an indispensable link in teaching practice, probation stage is of very important significance, not thoroughly, implementation would directly affect practice efficiency. Therefore, efforts should be made to reinforce implementation of probation in teaching practice. Practice school is a place that intern students locate in teaching practice stage, rational selection on nature, location and learning stages of the practice school directly related to intern students' adaptation to practice location that would further affect intern students' personal teaching ability promotion. The practice school's nature, location and other aspects' factors would exert various impacts on different intern students. Thus, for intern students majoring physical education under investigation, making investigation on nature and location of practice school and learning stages of intern students allocated school are of important significances in studying and promoting teaching practice level and quality of intern students majoring in physical education.

Investigation on intern students' weekly class hour arrangement status

Amount of intern students' class hours could reach proper requirement is a criterion to check whether the students could effectively train their teaching ability. **Table 11** suggested that physical education intern students with one to ten weekly class hours reached 102, accounting for 67.1%. Actually, intern students daily class hour is two lessons or below, and their weekly class hours are little.

Investigation on implementation of teaching plan

In teaching practice, teaching plan is a reflection of intern students' pre-class preparation and design of class, excellent teaching plans would be conductive to intern students' better fulfillment in teaching tasks. **Table 12** data suggested that over a quarter intern students haven't submitted teaching plans, which exerts great impacts on classroom teaching in teaching practice, and was bad for intern students' better designing and fulfilling classroom teaching in practical teaching.

Table 13. Investigation on intern students' practice tasks

Option	Sub-total	Proportion
A. Indoor physical education course teaching	74	48.68%
B. Outdoor physical education course teaching	148	97.4%
C. Head teacher work	50	32.9%
D. Second class	59	38.82%
E. Exercising in training team	53	34.87%
F. Sports competition organization, arrangement and referee	35	23.03%
G. Sports scientific research work	14	9.21%

Investigation on intern students' practice tasks

Physical education teaching practice is of important significances in physical education major, it also provides examination platform of knowledge and skills for students majoring in physical education of universities. At the same time, it could also provide theoretical evidence and suggestions for development and reform of physical education major. By far, with the progress of Chinese society, they have increased requirements in physical education. So that it admits of no delay in strengthening teaching skills of students majoring in physical education of universities thoroughly. Universities ought to make proper perfection in knowledge and skill reserve of students majoring in physical education and strengthen their teaching practical ability in accordance with social demands. This puts forward new requirements for teaching practice of students majoring in physical education of universities. By investigation on physical education teaching practice status, the paper found problems and further put forward constructive suggestions that provided specific practical experiences and theoretical evidence for promoting physical education teaching practice in a standard and effective manner.

Intern students' task in practice location is the main part of the students' teaching practice, reasonable practice tasks would be conductive to better improve intern students' various ability. In physical education teaching practice, intern students' task mainly reflects in outdoor physical education course that reached 97.4%, which is far higher than other projects. Indoor sports courses teaching is much less by comparison, only 48.68% less than half of the total. The number of people in other projects and their proportion of the totality were under 40%, reflecting the task in the education practice link is relatively single, and cannot satisfy the comprehensive development of the intern students. As shown in **Table 13**.

Exchange between intern students, advisors, and feedback

Investigation on exchange between intern students and advisors (can refer to **Table 14**, **Table 15** and **Table 16**)

Intern student is the main part of teaching practice, the reasonable practice tasks would help them to better improve their various ability. Effective communication between intern students and advisors would be conductive to better fulfill practice task and improve level of teaching practice.

Table 14. Whether carry out after-class summary and exchange with advisors

Option	Sub-total	Proportion
A. Yes	110	72.37%
B. No	42	27.63%

Table 15. Guiding frequency of advisors

Option	Sub-total	Proportion
Guiding once per class	30	19.74%
Guiding once per day	55	36.18%
Guiding once per week	49	32.24%
Guiding once per month	12	7.89%
Never guide	5	3.29%
Others	1	0.66%

Table 16. Investigation on advisors' guiding attitude

Option	Sub-total	Proportion
Serious	43	28.29%
Relatively serious	68	44.74%
General	28	18.42%
Not so serious	11	7.24%
Halfhearted	2	1.32%

Table 14 data suggested there are certain problems between intern students and advisors. From investigation on after-class summary and exchange between intern students and advisors, we found over a quarter intern students haven't engaged in the link. This reflected there were shortcomings in exchange between intern students and advisors in practice stage.

Effective communication between intern students and advisors would be conductive to better fulfill practice task and also improve level of teaching practice.

Investigation data of advisors guiding frequency on students shown that although most of the advisor had a reasonable guiding frequency, there still occurred little non-guiding or less guiding times.

In investigation on advisors' guiding attitude towards intern students, there are only 43 advisors with serious attitude, accounting for 28.29% of the total, whereas 68 ones with relatively serious attitude, accounting for 44.74% of the total. The proportion of advisors with serious and relative serious attitude reaches 73.01% in all. On a whole, intern students have higher satisfaction with advisor's guiding attitude, while the advisor could make further improvement. Total number of people that show general, not so serious and not serious is 41, accounting for 27% of the total. Guiding attitude of advisors is crucial for intern students' teaching practice. In case those advisors are halfhearted, teaching practice quality would be affected directly, so would intern students' positivity in teaching practice.

The investigation on communication way between intern students and advisors as well as leading teachers (can refer to **Table 17**) used Table data to reflect problems among their communication. From investigation on after-class brief summary and exchange between intern students and advisors, we found over a quarter of intern students didn't engage in the stage, suggesting shortcomings between intern students and advisors' communication in teaching practice. Effective exchange between intern students and advisors would be conductive to better fulfilling of practice tasks and promote level of practice.

Table 17. Investigation on communication ways among intern students, advisors and leading teachers

Option	Advisors		Leading teachers	
	Number of people	Percentage	Number of people	Percentage
A. Face to face communication	53	34.87%	58	38.16%
B. Telephone communication	59	38.82%	42	27.63%
C. Network communication	25	16.45%	39	25.66%
D. Get involved in all above ways.	15	9.87%	13	8.55%

Table 18. Investigation on implementation of open class

Option	Sub-total	Proporition
A. Yes	103	67.76%
B. No	49	32.24%

Table 19. Composition of teaching practice evaluation

Option	Sub-total	Proportion
Directly evaluated by school leading teachers	27	17.76%
Common evaluated by advisors and school leading teachers	66	43.42%
Common evaluated by advisors, school leading teachers and intern student members	53	34.87%
D. No evaluation	6	3.95%

From data in Table, communication among intern students, advisors and leading teachers in physical education teaching practice were mainly private communication, lacking of official teacher-student communication platform. In teaching practice, the effective teacher-student communication is precondition and base for success completing practice, and a reasonable and effective teacher-student communication platform is conductive to implement teaching practice. Efforts should be made in the regard.

Intern students' open class teaching task is an important mean to examine their efficacy in practice stage, and also an important component in teaching practice evaluation on intern students. It is intuitive reflection of the intern students' practice efficiency. From feedback of intern students in **Table 18**, the ones that haven't gone through open class teaching have arrived at 32.24%. This reflects there is a huge loophole in teaching practice examination; efforts should be made to implement teaching practice.

Teaching practice evaluation

Teaching practice evaluation is an important task in the ending stage of teaching practice. On one hand, it is objective evaluation on intern students' performance and progress in practice stage; on the other hand, it is recognition and encouragement on intern students' practical work, and is of great help in promoting intern students' work positivity. In the process of the evaluation, it bases on practice advisor and leading teachers' evaluation and in a single way. Selection of excellent intern students is an important result in teaching practice evaluation. The school should encourage and affirm excellent intern students that had good performance during practice. Evaluation on excellent intern students were fulfilled using data in **Table 19** and **Table 20**. In teaching practice, effective exchange between teacher and students is precondition and foundation for the success completion of teaching practice, and a reasonable effective teacher-students exchange platform is conductive to facilitate implementation of practical work that should be strengthened.

From analysis of data, evaluation on excellent intern students mainly based on scores of leading teachers and supplemented with other items. In actual operation process, only school leading teacher decided the evaluation results, which was bad for objective evaluation on intern students.

Table 20. Investigation on excellent intern students' evaluation

Option	Sub-total	Proportion
Advisors' practice scoring	60	39.47%
School leading teachers practice scoring	104	68.42%
C Practice open class scoring	64	42.11%
Trial teaching teachers' scoring	46	30.26%
E. Others	5	3.29%

Table 21. whether has gains through teaching practice

Option	Sub-total	Proportion
A. Yes	115	75.66%
B. No	37	24.34%

Table 22. Investigation on intern students' teaching skills promotion during teaching practice process

Option	Sub-total	Proportion
A. Teaching design ability	69	45.39%
B. Ability of observing and evaluation lesson	93	61.18%
C. Teaching plan written ability	78	51.32%
D. Specialized sports skills	60	39.47%

Teaching Practice Summary

Feedback investigation on teaching practice gains

Through **Table 21** data, intern students have shown promotion through practice, over 75% of them thought they had gains in the stage.

By **Table 22**, we found that intern students' class observation, evaluation ability, and teaching plan writing ability and teaching design ability respective ranked the first, second and third. That's because intern students should experience most on these three items during teaching practice. However, from feedback analysis of intern students, there showed little proportion of intern students' specialized sports skills' promotion in teaching practice. That's because intern students were newly required to be all-round practice teachers in social development, they should not only adept in their professional skills but also master other events. This was new requirement as "specialized and versatile" for intern students. But in teaching practice, we found there were differences between major and practice location's teaching or teaching contents in practice locations were neglected in university courses and even no corresponding course. Thus, most of the intern students have shown no significant promotion in specialized sports skills after teaching practice.

By investigation, we found that "enhance physical education ability" ranked the top in the gains of intern students' teaching practice; and "improve coaching ability in extracurricular physical exercises" ranked the second, while "Increase self-confidence and promote social communication ability" ranked the third; "Promote ability of leading extracurricular sports training" ranked the fourth. and "Foster sports competition organization, arrangement and referee ability" ranked the fifth, and the other three came last with similar proportion that generally lower than 20%, as shown in **Table 23**.

Table 23. Investigation on gains through teaching practice

Option	Sub-total	Proportion
Increase self-confidence and promote social communication ability	59	38.82%
Enhance physical education teaching ability	88	57.89%
Improve coaching ability in extracurricular physical exercises	74	48.68%
Promote ability of leading extracurricular sports training	58	38.16%
Foster sports competition organization, arrangement and referee ability	56	36.84%
Help themselves to transform into would-be teachers	27	17.76%
Cultivate ability in teaching and scientific researching	23	15.13%
Could correctly understand themselves, objectively evaluate their works and promote physical health test ability	23	15.13%

Table 24. Investigation on teaching practice problem feedback

Option	Sub-total	Proportion
Insufficient docking between university learning content and practical teaching in primary and secondary school	71	46.71%
Shortage of personal practical teaching ability and experience	82	53.95%
Practice school's students low recognition, disobey classroom discipline	78	51.32%
Not enough sites and equipment in practice school	55	36.18%
Be weak in arousing students' interests in physical education course	47	30.92%
Practice school's indifference to physical education and not support physical education teaching practice	23	15.13%

Table 25. Investigation on physical education teaching practice influence factors

Option	Sub-total	Proportion
A. Arrangement of teaching practice time and cycle	53	34.87%
B. Emphasis of school leaders	76	50%
C. Construction situation of practice base	74	48.68%
D. Common guidance management of advisors and practice schools	81	53.29%
E. Evaluation on teaching practice performance	44	28.95%
F. Teaching practice expenditure	28	18.42%
G. Intern students' emphasis on teaching practice	10	6.58%

Teaching practice problem feedback

In intern students' problem feedback, insufficient practical teaching ability and short of examination ranked the top that reached 53.95%, and selective rate of low recognition of practice school's students and disobey classroom discipline ranked the second. While the selective rate of practice school ignorance in physical education and sports work was the lowest that were only 15.13%, as shown in **Table 24**.

Investigation on teaching practice influence factors

From analysis of data in **Table 25** regarding investigation on physical education teaching practice influence factors, we found common guidance management of advisors and practice schools, and emphasis of school leaders respectively ranked in the first and second, with a proportion of over 50%. Construction situation of practice base and arrangement of teaching practice time and cycle ranked the third, and the fourth, respectively. Relatively, other items' selective rates are lower with little effects.

PROBLEMS AND COUNTERMEASURES

Problems in Physical Education Teaching Practice

i) Most of intern students majoring in physical education carry out teaching practice by school's unified arrangement; however, by consulting information, because of comprehensive effects of social various

factors on employment, there common occurs intern students' practice unit arrangement under recommendation of relatives and friends; whereas there are more intern students taking the initiative to contact with practice unites with the hope of training personal ability through independent practice. Thus, with the progress of society, there are more teaching practice opportunities. In addition, these opportunities move forward multiple is irresistible. However, the school data suggested that there is no significant reflection of diversity in the school teaching practice process.

ii) In the terms of practice base construction, it is mainly concentrated on cities, while less in other provinces, making students to simple take short-term teaching practice within province. This has constraints in promote their ability.

iii) Physical education intern students has fewer class hours every week, the ones with one to five weekly classes accounted for 30.26%, those with six to ten weekly classes accounted for 36.84%, and the proportion of over ten classes was only 32.89%. The general fewer teaching hours may not reach certain density as required.

iv) For trial teaching, though students' participation degree arrived at over 95% as school focused on the link, data analysis found that students' satisfaction with the link was less than 70%, suggesting that there were more room to promote time and work arrangement in trial teaching. In this link, over 30% students in total showed their dissatisfaction, suggesting that students' lower satisfaction in the link and they could get limited promotion, which may also reflect in formality trend in the link. All can be promoted.

v) Over 30% intern students haven't gone through probation, 26.97% ones haven't submitted teaching plan as no such requirement and over 30% ones haven't fulfilled open class lecturing. All of these show inappropriate implementation of teaching practice flow in the practice process, which exerts a great impact on intern students' practice fulfillment efficiency, fulfillment and implementation of teaching practice.

vi) Over 30% intern students haven't guided by advisors, suggesting that basic management construction in practice locations should be strengthened as well as guiding in teaching practice process. By analyzing data, we found that most of the intern students have communicated with school's leading teachers and advisors in the various ways, from which main ways are face-to-face communication, telephone communication and network communication. Guiding frequency of advisors on students is divided into three types, such as once a class, once a day and once a week. But there still occurred no guidance by analyzing. At the same time, in the investigation on satisfaction with advisors' guiding attitude, 25% has shown in general and not so earnest. The advisors could not timely guide intern students, some even hands-off after sending students to practical school, lacking of taking due responsibilities. Though practical school's advisors basically reach the requirement in education background, some of them hasn't undertake due obligations and some only handle with personal affairs instead of class matters.

vii) Intern students' insufficient teaching practice ability, lacking of experience, lower recognition in practice location have reflected that they should improve their comprehensive ability from the side.

viii) Evaluation on practice performance of intern students majoring in physical education are mainly combination with multiple ways, from which bases on advisors' evaluation and school leading teachers' evaluation. In practice evaluation, it fulfilled mainly by leading teachers' evaluation, practice advisors' evaluation, students' self-evaluation and open course scores, from which trial teaching accounts for the minimum in scores. This leads to problems in the implementation of trial teaching.

ix) From analysis of data in **Table 25** regarding investigation on physical education teaching practice influence factors, we found common guidance management of advisors and practice schools, and emphasis of school leaders respectively ranked in the first and second, with a proportion of over 50%. Construction situation of practice base and arrangement of teaching practice time and cycle ranked the third, and the fourth, respectively. Relatively, other items' selective rates are lower with little effects.

Suggestions to Problems

Enhance students' comprehensive ability and optimize probation stage

Targeted at sports class characteristics, school should consciously train students' conscious of teacher in four years' university education; require intern students to carry out orientation training with purpose by referencing sports teacher's ability. It should also strengthen students' ability of combining theory with practice, perform theory education on students and meanwhile integrate teaching practice into education to enable students to have certain ability to dock with actual teaching. The school could also arrange students to emulate and learn through getting into nearby practice base in every academic year and carry out teaching practice with conditions.

Strengthen quality of skill courses and dock with actual teaching conditions in primary and secondary school

The school should train high professional quality students as specialized and versatile, and meanwhile should foster students with personality and super hard professional skills under the circumstance that they satisfy students' employment demands and open courses in accordance with actual demands and social employment situation. They could strengthen professional course education by perfecting institute curriculum setting, and meanwhile focus on other courses, really implement "specialized and versatile".

Reinforce construction of practice base and encourage students to conduct independent teaching practice

Teaching practice base actual implementation, base quality, teacher quality and level directly affect practice efficiency and promotion on intern students. Universities should establish long-term cooperative relations with practice base schools, strengthen contact with the school, and reinforce students' positivity and emphasis on teaching practice. At the same time, school should properly expand zones of practice base in accordance with actual situation, establish more non-native practice base to offer intern students more choices. They should encourage students to carry out practice independently and create more practice opportunities.

Establish and perfect network resources platform systematically for ease of exchanging between teachers and students

Through exchange ways between intern students and advisors, in convenient information transmission era, establishment of a perfect and effective teacher-student exchange platform is an effective channel to make teaching practice perfect.

Lay emphasis on intern students' information feedback, make adjustment positively and advance with times

When teaching practice ended, school should reinforce emphasis on intern students' information feedback, adopt collective and reasonable methods to summarize and reflect on previous teaching practice process from the perspective of knowledge, ability and quality. Affirm students' advantages, carry forward them while also correct drawbacks, and correct face with defects to make later teaching practice process more targeted.

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An Empirical Study on Chinese Wushu's Promoting Physical Fitness and Social Adaptation of Adolescents.

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