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Correlation Research on the Application of E-Learning to Students' Self-Regulated Learning Ability, Motivational Beliefs, and Academic Performance

Hsu Kuan (Jonathan) Liu
I-Shou University, TAIWAN.ROC

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Delivering knowledge and economic information through the Internet has been so popular that a lot of countries make major information technology construction plans to enhance competitiveness. In this case, sharing educational resources and narrowing the rural-urban education divide with computer networks have become a common trend globally. Educational reform in past years does not simply focus on memorizing materials, but learning practical knowledge so that the importance of cognition in learning processes is highlighted. When engaging in a task, a person has to know the resources which he/she owns, the task requirements, the timing for using strategies, solving problems, regulating oneself, and monitoring personal working conditions in order to effectively complete the tasks.
This study focuses on universities students majoring in hospitality management in Taiwan. A total of 600 copies of the questionnaire were distributed to college students and 396 valid copies were collected, with the retrieval rate of 66% for this study. The research results reveal that: 1. Self-regulated learning shows significant positive effects on motivational beliefs; 2. Motivational beliefs present remarkably positive effects on academic performance; and 3. Self-regulated learning appears to have notably positive effects on academic performance. According to the research results, conclusions and suggestions are proposed at the end of this study, intending to enhance teachers' instruction and students' academic performance.

Keywords: E-Learning, Self-Regulated Learning Ability, Motivational Beliefs, Academic Performance

INTRODUCTION

The popularity of the Internet and world-wide-web in the 21st century, and the

Correspondence: Hsu Kuan (Jonathan) Liu,
I-Shou University, No.1, Sec. 1, Syuecheng Rd. Kaohsiung, 84001, TAIWAN .ROC
E-mail: jonathan@isu.edu.tw
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application of network technology have changed the communication among peopleby breaking through the restraints of time and space. It becomes commonplace for a teacher to integrate information technology into subjects in order to diversify materials, teaching approaches, and teaching media to assist students in learning. It will be the common responsibility of educators to utilize new technologies and network information in order to make instruction more efficient, allowing students to enjoy learning and cultivate new generations with creativity, rational communication, and critical thinking.

Modern educational psychology no longer considers learners as passive knowledge accepters, but active knowledge constructors. Moreover, educational reform in past years does not simply stress memorizing material, but learning practical knowledge**.** As a result, the importance of cognition in the learning process is highlighted (Ibrahim et al.,2015).

Cognition plays a critical role in learning in various fields. A person has to know the resources which he/she owns, the task requirements, the timing for using strategies, how to solve problems in difficulties, self-regulation, and monitoring personal working conditions, when engaging in a task so as to effectively complete that task. The basis of science education is to cultivate people able to think and solve problems. For this reason, it is a primary objective of science education to allow students to use self-regulation abilities to successfully select proper strategies for solving distinct problems.

State of the literature:

- Learning practical knowledge**,** as a result, the importance of cognition in the learning process is highlighted. Cognition plays a critical role in learning in various fields.
- A teacher could improve students' self-regulated learning by guiding self-beliefs, goal setting and expectations, enhancing introspection dialogues, offering feedback, connecting abstract concepts, and providing new experiences.

Contribution of this paper to the literature:

- Students' self-regulation ability aims to effectively apply strategies to solve problems. Cognitive psychologists indicate that students should cultivate effective problem-solving methods in the process
- A teacher should explain the importance and value of math and allow students to understand that learning is not for parents, teachers, or others, but for themselves. The preciousness of learning is to cultivate motivational beliefs in automatic learning.
- Anxiety can easily result in unfavorable task performance. For this reason, teaching students to relax themselves when under pressure, stabilize personal emotion, and present their strengths without aberration are all methods to help students.

In addition to prepared strategies and follow-up introspection and review, self-regulated learning ability also involves a learner being able to utilize various problem-solving strategies, such as drawing pictures, simplifying problems, guessing, and examining, in the process. A teacher could improve students' self-regulated learning by guiding self-beliefs, goal setting and expectations, enhancing introspection dialogues, offering feedback, connecting abstract concepts, and providing new experiences. Such approaches reveal that a teacher could change students' strategy application and learning monitoring and further affect the learning outcome through instruction.

Travers and Sheckley (2000) indicated that a teacher could improve students' self-regulated learning by the introduction of self-belief, objective setting and expectation, the promotion of self-reflective dialogue, the provision of feedback, the connection with abstract concepts, and the connection with new experiences. Such applications revealed that a teacher could change students' strategy application and learning monitoring through teaching to further influence learning success. Vocational education of hospitality in Taiwan has grown rapidly since the foundation of National Kaohsiung University of Hospitality and Tourism in 1995. The progress of the hospitality industry and the boom of hospitality education have made curricula more flexible without being restricted to time and space. Furthermore, domestic research rarely discusses how hospitality-related courses teach students to use, monitor, check, and assess strategies in self-regulated

learning. Nevertheless, there is not a domestic study discussing whether a teacher guides students on how to use strategy application, monitoring, examination, and evaluation in self-regulated learning in order to help students' self-learning, the effects of such formal and informal guidance on learning effect, the relationship with students' self-regulated learning ability, motivational beliefs, and academic performance. Accordingly, understanding self-regulated learning, from the students' perspective, in daily instruction and the relationship among self-regulated learning ability, motivational beliefs, and academic achievement is regarded as the motivation for this research.

LITERATURE AND HYPOTHESIS

E-learning

Chen et al. (2013) explained e-learning as applying networks to facilitate learning, including the production, delivery, and acquisition of learning contents, the management of learning experiences, and the exchange between learning communities. Different from traditional learning, e-learning integrates all activities related to learning, such as the production of teaching materials and their delivery, as well as the learners' learning processes of studying, discussion, searching of data in libraries, registration, and paying fees, through information technologies of the Internet, Web-Service, and databases (Hwang et al., 2011). According to the report of the US WR Hambrecht, Hwang et al. (2013) classified e-learning into computer-assisted learning, online learning, e-learning, and distance learning:

(1) Computer-assisted learning was a sub-set of online learning, which compacted communication contents in CDs or floppy disks.

(2) Online learning, as a sub-set of learning, compacted communication contents in the Internet and the internal network of a company.

(3) E-learning, as a sub-set of distance learning, generally referred to all learning methods transmitting contents through electronic media, including the Internet, internal network of a company, satellite, tapes, video tapes, and interactive TV and CDs.

(4) Distance learning was an educational context when teachers and students were separated because of time or space limitations. The education or training courses were delivered synchronously or asynchronously, including emails, text, figures, sound, video tapes, CDs, online learning, video conferencing, interactive TV, and facsimile, to a distant location (Hwang et al., 2013).

Self-regulated learning ability

Montola (2011) stated Bandura's self-regulation concept that an individual would regulate their behaviors because of self-observing or experiencing external results; such a regulation process resulted from the self-instruction ability of human beings, and such ability would control and guide personal thought, emotion, and action through behaviors. Chen et al. (2013) pointed out that self-regulated learning ability is the process which students can control their actions and guide their personal learning behaviors. Alvarez et al. (2011) defined self-regulated learning ability as students, with goal orientation, actively integrating several learning strategies to properly design and apply to their academic performance and to observe the relation between specific actions and successful learning.

Liu et al. (2011) regarded self-regulated learning ability as the learning approach or learning function for an individual effectively applying learning skills and regulating personal behaviors and environment factors to self-control learning processes, i.e. students' actions and processes to actively acquire learning

information and skills. Johnson et al. (2012) indicated that students' cognitive activities could help the development of self-regulated learning ability, especially self-monitoring which not only could help acquire knowledge, but could also enhance the generalization and transfer of knowledge and skills (Liu et al., 2010). Montola (2011) regarded self-regulated learning ability as students actively participating in cognition, motivation, and behaviors in the learning process.

Chen & Lee (2011) proposed the three dimensions of goal setting, planning and strategy selection, and performance execution and evaluation for self-regulated learning ability. In their research, the scores in the "self-regulated learning scale" represent self-regulated learning ability, where the higher score reflected the higher self-regulated learning ability of a student. The scale contains three items:

(1) Pre-learning plan: A student would evaluate the characteristics of assignment and select the execution method before learning or solving problems.

(2) Will control: It refers to resist the temptation of other goals in the process of executing plans and pursuing goals and to further protect the learning process from being interfered.

(3) Monitoring introspection: A student monitors the learning or problem-solving process and introspects and thinks of the results to discern the advantages and shortcomings for improvement of their next learning.

Motivational beliefs

Johnson et al. (2011) pointed out motivational beliefs as an individual being willing to pursue success for the tasks which he/she are interested or considered important. Antle et al. (2011) explained motivational beliefs as individual motivation to get involved in tasks for personal curiosity, interests, or challenge, without obvious external rewards, and to acquire the senses of competence and satisfaction in learning. Especially, an individual with high motivational beliefs would invest in more attention and effort in learning activities and would not give up when faced with learning difficulties (Enyedy et al., 2012).

Referring to Chen & Sun (2012), the following dimensions of self-efficacy, motivation, anxiety, and task value are utilized for this study:

(1) Self-efficacy refers to students acquiring a belief in their success in specific fields, in short, the estimation of their ability to perform certain tasks. It contains the confidence in learning and problem-solving ability, with which a higher score shows higher self-efficacy.

(2) Motivation refers to students' intention to engage in relevant activities, to acquire fun from math learning processes, and to actively explore learning problems, with which a higher score reflects a higher motivation, e.g. actively looking for related books usually.

(3) Anxiety refers to students' anxious reaction when confronted with learning activities. It is a kind of nervous, uneasy, and frightened perception from inside, with which a higher score shows higher anxiety, e.g. being uncomfortable with tests.

(4) Task value refers to student perception of the importance of a task, including its usefulness for daily life and future work, with which a higher score reveals a higher task value. For example, learning could help solve several difficulties, or it might be useless after learning.

Academic performance

Chang et al. (2013) agreed with the identical idea of academic performance, learning performance, academic achievement, and learning achievement, i.e. students' learning results of school subjects, or the persistent result through learning processes. Laine et al. (2010) regarded academic performance as students

learning knowledge and skills in schools through certain curricula and materials, which were normally presented by examination performance or academic tests. Gentes et al. (2010) pointed out academic performance as knowledge, comprehension, and skills acquired through special education experiences in formal curricula and teaching design, i.e. individuals acquiring certain information and familiarizing skills through special instruction. Accordingly, learning achievement could be specialized and generalized.

Magal-Royo& Lopez (2012) explained generalized academic performance as students' learning records in schools, such as assignments, quizzes, mid-term exams, and final exams. Chen & Wang (2011) described specialized academic performance as learning performance of subjects or comprehensive mean performance of subjects. According to the real meaning of education, academic performance indeed was student performance on the enhancement of life adaptation and physical and mental development through learning (Chen & Wang, 2011). The specialized academic performance is therefore applied to this study.

Relationship among self-regulated learning ability, motivational beliefs, and academic performance

OuYang et al. (2010) discovered that successful learning relied on students' self-regulated learning ability, which was particularly effective in non-structural contexts; besides, students' self-efficacy, self-monitoring, and motivational beliefs revealed notably positive correlations. Chen & Shih (2012) found out the effects of students' learning nature and processes on motivational beliefs and self-regulated learning ability, in which learning strategies and thinking strategies commonly affected students' involvement in learning and further influenced their academic performance (Tamim et al., 2011). Huang et al. (2010) indicated that those perceiving higher self-regulation ability tended to present higher motivational beliefs.

Consequently, the following hypotheses are proposed in this study:

H1: Self-regulated learning ability reveals significantly positive effects on motivational beliefs.

Tamim et al. (2011) pointed out the correlation between motivation and academic achievement. Liu et al. (2011) found out the remarkable predictive function of learning motivational beliefs and learning strategies on academic achievement performance. Schrader &Bastiaens (2012) argued that the difference in math academic performance among three groups of pupils with different learning motivational beliefs was that students with high learning motivational beliefs outperformed those with low learning motivation on math performance, and that learning motivational beliefs were the important predictive factor in math academic performance. Merabet1 et al. (2012) discussed the relationship between math learning motivational beliefs and math academic performance and discovered a significantly positive correlation.

As a result, the following hypothesis is proposed in this study:

H2: Motivational beliefs present remarkably positive effects on academic performance.

Shih & Chen (2012) considered the close relationship between motivational beliefs and self-regulated learning ability that the motivational beliefs in self-efficacy, motivation, anxiety, and task value were covered in the self-regulation learning process and were the mediator in the learning process. It was also discovered that task value and self-efficacy in learning motivation showed positive effects on academic achievement in both elementary and high schools (Chen et al., 2012). Motivational beliefs presented the effect of personal perception of events,

rather than external rewards or physiological conditions, on individual behaviors (Liu et al., 2011). Such a function analyzing motivational beliefs with cognition processes resulted in the close relationship between motivational beliefs and self-regulated learning ability.

The following hypothesis is therefore proposed in this study:

H3: Self-regulated learning ability shows notably positive effects on academic performance.

SAMPLE AND MEASURING INDICATOR

Research sample and subject

Aiming at the universities in Taiwan, the quasi-experimental research with experimental design is used in this study. A total of 600 copies of the questionnaire were distributed to college students after e-learning, and 396 copies were collected, with a retrieval rate 66%.

Reliability and validity test

The questions in the questionnaire are revised from domestic and international researchers' studies. The formal questionnaire was distributed before pretest so that it presents certain content validity. The dimensions of self-regulated learning ability, motivational beliefs, and academic performance are verified by the overall structure causal relationship. The analysis with Linear Structural Relation Model reveals the overall model fit reaching the reasonable range, showing favorable convergent validity and predictive validity. Item-to-total correlation coefficient is used for testing the construct validity of the questionnaire content, i.e. using item-to-total correlation coefficient through Reliability Analysis for judging the questionnaire content. The item-to-total correlation coefficient of the dimensions in this study appears higher than 0.7 so that the questionnaire shows certain construct validity.

Reliability Analysis is used to further understand the reliability of the questionnaire. According to the standard to develop the formal questionnaire, the Cronbach's α reliability coefficient appears in 0.81~0.92, obviously matching the reliability range.

ANALYSIS OF EXPERIMENTAL RESULT

Evaluation indicators in LISREL model

LISREL (linear structural relation) model, combining Factor Analysis and Path Analysis in statistics and including simultaneous equations in econometrics, could calculate multiple factors and multiple causal paths at the same time. Bagozzi et al. (1998) proposed preliminary fit criteria, overall model fit, and fit of internal structure of model to evaluate the model fit.

According to the data in this study, preliminary fit criteria, fit of internal structure, and overall model fit are described as below.

Table 1 shows that the dimensions (pre-learning plan, will control, monitoring introspection) of self-regulated learning ability present significant explanation of self-regulated learning ability ($t>1.96$, $p<0.05$) and the dimensions (self-efficacy, motivation, anxiety, task value) of motivational beliefs reveal remarkable explanation of motivational beliefs ($t>1.96$, $p<0.05$) on preliminary fit criteria. The

academic performance in this study is the math performance. Apparently, the overall model appears favorable preliminary fit criteria.

Table 1. Analysis of overall LISREL model

Item	Parameter/evaluation standard		Result	t
Preliminary fit criteria	Self-regulated learning ability	Pre-learning plan α1	0.815	10.83**
		Will control α2	0.836	12.75**
		Monitoring introspection α3	0.822	11.42**
	Motivational beliefs	Self-efficacy β1	0.803	9.38**
		Motivation β2	0.762	7.69**
		Anxiety β3	-0.733	6.63**
		Task value β4	0.786	8.51**

*Note: * stands for p<0.05, ** for p<0.01, *** for p<0.001.*

From Table 2, self-regulated learning ability presents notably positive correlations with motivational beliefs (0.806, p <0.01), motivational beliefs show significantly positive correlations with academic performance (0.873, p <0.01), and self-regulated learning ability reveals remarkably positive correlations with academic performance (0.857, p <0.01), in terms of fit of internal structure so that H1, H2, and H3 are supported.

Table 2. Analysis of overall LISREL model

Item	Parameter/evaluation standard	Result	t
Fit of internal structure	Self-regulated learning ability→motivational beliefs	0.806	18.92**
	Motivational beliefs→academic performance	0.873	26.42**
	Self-regulated learning ability→academic performance	0.857	23.16**

*Note: * stands for p<0.05, ** for p<0.01, *** for p<0.001.*

From Table 3, the standard overall model fit $\chi 2/Df$ appears 1.946, lower than the standard value 3, and RMR is 0.005, revealing the appropriateness of $\chi 2/DF$ and RMR. Furthermore, chi square is sensitive to sample size that it is not suitable for directly judging the fit. Nonetheless, the overall model fit standards, GFI=0.975 and AGFI=0.941, are higher than 0.9 (the closer GFI and AGFI to 1, the better model fit) that this model presents favorable fit indicators.

Table 3. Analysis of overall LISREL model

Overall model fit	X2/Df	1.946
	GFI	0.975
	AGFI	0.941
	RMR	0.005

*Note: * stands for p<0.05, ** for p<0.01, *** for p<0.001.*

CONCLUSION

The research results show the most predictive power of motivational beliefs on math academic performance, followed by self-regulated learning ability. From the aspect of students' "perception," this study proves the critical effect of teachers on students. Apparently, teachers exert great influence on students. Some research literature also points out the obvious effect of short-term self-regulation learning on academic achievement; especially, some students with low achievement could improve their performance by self-regulation learning to assist in the pre-learning plan, will control, and monitoring introspection. Each teacher therefore should

present the ability to teach students' self-regulation ability and be glad to teach students self-regulation learning so as to achieve the objectives.

Self-regulated learning could help students' learning. Previous domestic and international research also provides some empirical data to explain the close relationship between self-regulated learning ability and academic performance. In this case, it becomes essential to have students familiarize self-regulated learning. Moreover, it is also discovered that a "pre-learning plan" could predict academic performance. As a consequence, teaching students to make "pre-learning plans" is primary in self-regulation instruction.

SUGGESTION

According to the results and findings, the following practical suggestions are proposed in this study:

1. Reinforcing students' learning for self-regulation ability: Students' self-regulation ability aims to effectively apply strategies to solve problems. Cognitive psychologists indicate that students should cultivate effective problem-solving methods in the process. In this case, planning before actions is the difference between novices and experts and allows students to evolve from problem-solving novices to experts. In addition to experience accumulation, a teacher needs to further teach students how to plan and think, connect relevant clues, and form deeper principles when encountering problems. The systematic guidance of such pre-learning plans could largely assist students in solving math problems and math academic performance.
2. Reinforcing students' self-efficacy: Self-efficacy contains personal past performance and experiences, peer comparison, and others' expectations. Students in a class are inevitably divided into high performers and low performers. For those with low performance, it is more important to have such students experience success. This study therefore suggests that a teacher should give more encouragement. With encouragement and sense of achievement, a student would likely be more self-motivating. Failure, but without success, could easily result in "learned helplessness" to give up on oneself.
3. Reinforcing the promotion of the math task's value: A teacher should explain the importance and value of math and allow students to understand that learning is not for parents, teachers, or others, but for themselves. The preciousness of learning is to cultivate motivational beliefs in automatic learning.
4. Teaching students to learn to release anxiety: Anxiety can easily result in unfavorable task performance. For this reason, teaching students to relax themselves when under pressure, stabilize personal emotion, and present their strengths without aberration are all methods to help students. A teacher should teach students physical and mental relaxation, and students should learn to adjust their mood to face pressure naturally so as to achieve better math performance.

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