An Empirical Study on Context Awareness Integrated Mobile Assisted Instruction and the Factors

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ABSTRACT
Education is now an indicator of national modernization that countries in the world intend to promote the national quality and cultivate talents for national development through education. Especially, when human societies get into the 21st century, global societies, politics, economy, and culture are facing major changes. With the development of technology, the advance of the Internet, and the popularity of mobile devices, learning outside the classroom is no longer a problem and learning combined with authentic contexts becomes easier. When mobile devices are developed to connect to the network, it starts the mobile learning stage and ubiquitous learning becomes the easily accessible reality. Having Fujian Agriculture and Forestry University, Fujian Normal University, and Fujian Huaqiao University as the research objects, total 348 students of two classes each from the three universities are selected as the research objects in this study. The research results conclude 1.significantly positive correlations between context awareness and self-efficacy, 2.remarkably positive correlations between self-efficacy and learning motivation, and 3.notably positive correlations between context awareness and learning motivation. According to the research results, suggestions are proposed in this study, expecting to assist in the development of education.
Keywords: context awareness, mobile assisted instruction, self-efficacy, school-work learning motivation

INTRODUCTION

With the development of technology, the advance of the Internet, and the popularity of mobile devices, learning outside the classroom is not a problem anymore, and learning combined with authentic contexts becomes easier. The Internet has majorly changed working and learning time and location. It is considered that the world is been "smoothing", as the

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State of the literature

- There are answers on the Internet; connecting with the Internet all the time reveals that people do not need to store knowledge, but access the resources on the Internet whenever they need or want to learn, as the best learning effect.
- When learners can randomly extract knowledge related to the environment, the context-awareness learning could be proceeded to combine objectives and teaching materials with authentic living contexts.
- This study intends to integrate mobile devices with online cooperative learning platforms for assisting students in learning so that students could acquire learning knowledge and extract context data anytime to achieve the ubiquitous learning.

Contribution of this paper to the literature

- Stability of network environment: a portable wireless network card for each group is prepared for the stable network.
- Compatibility of mobile devices: The system compatibility problem is not directly related to teaching contents, but could largely influence the continuity of students' learning process. It therefore requires special attention, and the regulation flexibility should be remained.
- Simplified operation interface and audio/video contents: context awareness through texts or lectures can no longer meet learners' needs; and, audio/video learning contents are believed to better satisfy learners' demands.

application of technology has constantly changed the profit model of enterprises and the lifestyle of human beings. The Internet allows working anytime anywhere and learning being far-reaching; anyone connecting to the Internet could access global knowledge. The popularity of mobile phones further tightly combines the Internet with life. When mobile devices are developed to connect to the Internet, past d-learning and e-learning are progressed to mobile learning and ubiquitous learning becomes the easily accessible reality. There are answers on the Internet; connecting with the Internet all the time reveals that people do not need to store knowledge, but access the resources on the Internet whenever they need or want to learn, as the best learning effect. Comparing contemporary technologies of mobile phones and tablet computers with traditional mobile devices of word cards, pocket dictionary, hand-held electronic dictionary, and MP3 players, current mobile devices present portability and expandability as well as immediate updating capability to extract resources from the Internet anytime anywhere. When learners can randomly extract knowledge related to the environment, the context-awareness learning could be proceeded to combine objectives and teaching materials with authentic living contexts. It is regarded as an ideal instruction. To respond to the demand for combining classes with living contexts, this study intends to integrate mobile devices with online cooperative learning platforms for assisting students in learning so that students could acquire learning knowledge and extract context data anytime to achieve the ubiquitous learning.

LITERATURE REVIEW

Mobile technology and mobile learning

Mobile devices might be the most popular technology nowadays. According to the report of World Bank in 2012, there were total 6 billion mobile users in the world and three-quarters of people possessed mobile phones; the rapid growth of mobile device owners had mobile learning become the key in education and be concerned (Wichadee, 2013). Burston (2013) considered that there were more and more people carrying mobile phones or similar mobile devices which would potentially become a critical tool for lifelong learning. Rodríguez-González & Castañeda (2016) mentioned that the higher education version also pointed out tablet computers as a handy personal learning environment. Shih (2013) regarded mobile learning as e-learning through mobile devices of personal digital assistant (PDA) and mobile phones and stressed on the application of electronic information in the learning process. In comparison with computer-assisted language learning, Moradi & Karimpour (2012) argued that portable devices provided new learning styles and presented continued learning, independent access, and cross-context interaction capability. Learners' demands are closely related to the environment, and mobile devices could cross different contexts so that the relationship between mobile learning and context is gradually emphasized. Gainesville (2012) regarded mobile learning as multi-channel web-based learning, where learning activity was preceded through mobile phones, personal digital assistant, portable notebook computers, or tablet computers, and emphasized that mobile learning could be proceeded through various media. Han et al. (2011) supported the close relationship between mobile learning and the development of e-learning that mobile learning was the extension of e-learning, highly conformed to learners' demand for "just in time, just enough and just for me" in the 21st century, and stressed on the information offered by mobile devices completely conforming to learners' needs at the time. Liu & Lu (2012) agreed with the importance of ubiquitous learning and the portability of mobile devices. Nevertheless, current definition of mobile learning focuses more on the importance of contexts, i.e. the capability of mobile learning crossing in-classroom and outside-classroom as well as formal and informal learning activity.

Context awareness integrated mobile assisted instruction

Luo (2014) defined context as being able to describe any information in a physical situation, where the physicality could be a person, a place, or an interactive object. A context-awareness system could offer users with relevant information or service according to context conditions and users' current tasks. Apparently, the combination of portable mobile devices with context-awareness technology allowed learners acquiring learning materials conforming to the context and assisted learners in interacting with the environment in authentic contexts. Nie (2012) stated that the portability of mobile devices and the capability to extract multimedia data anytime allowed them being the context-based learning tool; a lot of research on learning combined mobile devices with authentic living contexts to assist in

learning. The mobility of mobile devices allowed learners carrying teaching materials into the living context or sharing the living context with other learners. Furthermore, mobile devices matched with various context-awareness technologies could have learners acquire context-related learning materials at the time. Common context-awareness devices being able to detect/reflect learners' current locations contain Wireless Local Area Network (WLAN), Global Positioning System (GPS), Radio Frequency Identification (RFID), and Quick Response Code (QR Code).

Referring to Chen (2014), context is divided into computing context, user context, time context, and physical context in this study.

Self-efficacy

execute tasks. Self-efficacy was individual belief of a male or a female in completing a task (Rogerson-Revell, 2011). Agusalim et al. (2014) also pointed out self-efficacy as the trust in executing specific tasks. Yang (2013) defined self-efficacy that an individual confirmed the high efficacy to deal with a specific work or affair after several times of success and failure. Luo (2014) regarded self-efficacy as personal confidence in executing an action plan and successfully completing specific tasks. Tsai (2015) expressed the viewpoint of self-efficacy that Generalize Self-Efficacy (GSE) was the ability of a person dealing with new tasks and coping with broad stress and challenge in adversity.

Referring to Chuah (2014), the evaluation of self-efficacy contains magnitude, strength, and generality.

Efficacy magnitude: Individual belief in the ability to conduct behaviors with different difficulties. Tasks in the same area would appear different difficulties to affect personal judgment of self-efficacy.

Efficacy strength: Individual confidence in completing specific tasks. The weaker efficacy strength expected could have people more easily loose the confidence when encountering obstacles or difficulties. On the other hand, the stronger efficacy strength expected would have people present higher persistence and higher chance of success when encountering obstacles or difficulties.

Efficacy generality: Personal efficacy suitable for different areas. The evaluation of personal self-efficacy is not restricted to specific areas, but could be expanded to larger and broader activity.

Learning motivation

Miangah & Nezarat (2012) indicated that students with general motivation to learning connected the motivation, interests, habits, attitudes, and even will and value to the acquisition of knowledge into a consistent system to form the unique personality. Moreover, students with "specific motivation to learning" simply appeared learning motivation to some

subjects (Noletto, 2014). Ali & Segaran (2013) mentioned that students would expect to be praised the behaviors; therefore, the learning was purposive, but could be transformed from extrinsic to intrinsic motivation. Those with intrinsic learning motivation would independently determine things they would like to do, without incentives, to acquire fun and sense of accomplishment. Ones with extrinsic motivation, on the other hand, were induced the learning motivation by others' reward and punishment and the identity to certain value of action. Although intrinsic motivation was comparatively spontaneous, persistent, and high valued, environmental factors could also affect motivation that incentives and extrinsic support were necessary (Viberg & Grönlund, 2012). Saito (2013) argued that learning motivation, as the intrinsic belief, could guide individual learning goals, induce the learning behavior and continuous effort, reinforce the cognition process, and enhance and improve the learning outcome. Church & Oliveira (2013) pointed out learning motivation as the intrinsic psychological process to induce students' learning activity, maintain the learning activity, and have the learning activity approach the objectives set by teachers in order to achieve the instructional objectives and allow teachers preceding effective instruction. Fielding & Head (2012) regarded learning motivation as student intention or desire to participate in and make effort to learning, which was performed on students' selection of specific learning activity and strength to continue the activity. Accordingly, learning motivation is defined in this study as the motive intention which could guide students proceeding continued learning and making effort to learning goals set by teachers in the learning process. Referring to "expectancy value model" proposed by Lin & Yang (2011), motivation covers value of work, expectancy of success, and belief in capability in this study.

(1) Value of work: Referring to students' evaluation of learning.

(2) Belief in capability: Referring to student perception of personal ability in the learning.

(3) Expectancy of success: Referring student expectation of future performance during learning.

Relationship between context awareness and self-efficacy

Han et al. (2011) proposed that context awareness was a different teaching style for learners, who mostly agreed with four dimensions for context awareness in self-efficacy, including selection of work difficulty (selection of learning difficulty), continuity in difficult work (continuity in learning), frustration tolerance, and capability of delay gratification. In other words, learners considered that context awareness was helpful to the enhancement of self-efficacy. Yang (2013) observed the learning process that learners still appeared interests in learned contents and re-learned them through context awareness, and learners generally presented good reaction to the learning style of context awareness. With technology, Chuah (2014) compared students accepting context-awareness teaching module and the others receiving traditional teaching and found out the significant outperformance of the former.

H1: Context awareness shows significantly positive correlations with self-efficacy.

Relationship between self-efficacy and learning motivation

Ali & Segaran (2013) indicated that the so-called "self-efficacy" was first proposed by A. Bandura, who regarded self-efficacy as individual judgment of personal ability when completing specific work; in the process, the judgment of personal ability was more important than the actual ability (Viberg & Grönlund, 2012). D. H. Schunk also mentioned that self-efficacy would affect students' selection for activity; regarding the effort, persistence, and academic achievement on school work, students with high self-efficacy presented higher persistence in difficulties and would make more effort than those doubting personal learning ability (Rogerson-Revell, 2011). Head (2012) particularly stressed on the effects of the role and attribution of perceived self-efficacy on perceived self-efficacy. Empirical research discovered that the use of learning strategies could indirectly affect learners' attribution and enhance the self-efficacy and academic achievement (Noletto, 2014). Lin & Yang (2011) found out the relationship between self-efficacy and the cognitive behavior and academic performance in the learning process; learners with high self-efficacy would have higher meta-cognition and could persist in facing more difficult or dull learning lessons to present the self-regulation.

H2: Self-efficacy present remarkably positive correlations with learning motivation.

Relationship between context awareness and learning motivation

Chen (2014) indicated that ubiquitous context-awareness computing technology could be applied to instruction through positioning technology or sensing technology, allowing learning systems recognizing learners' context information, such as location, time, learning state, and learning behavior, and then, with the assistance of mobile devices, allowing learners experiencing the learning fun under authentic contexts and enhancing the learning motivation (Luo, 2014). Nie (2012) preceded monument exploration context-awareness learning with PDAs in authentic contexts and revealed the positive assistance of context awareness in the promotion of learning motivation and effectiveness. Context-awareness learning, centered on learners, explores teachers' role of guidance; the effective application of the characteristics of mobile technology could assist teachers in offering more individualized and adaptive guidance for students.

H3: Context awareness reveals notably positive correlations with learning motivation.

SAMPLE AND MEASURING INDEX

Research sample and object

Fujian Agriculture and Forestry University, Fujian Normal University, Fujian Huaqiao University are selected as the research objects in this study. With experimental research, total 348 students of two classes each from the three universities are the research objects for the

16-week experimental instruction (three hours per week for total 48 hours) in this study. The retrieved questionnaire is analyzed the data with Liseral to test the hypotheses.

Reliability and validity test

Validity refers to a measurement tool being able to really measure the questions which the researcher would like to measure. In general, validity is divided into content validity, criterion-related validity, and construct validity. The questions in this study are referred to the research questions made by domestic and international researchers, and the formal questionnaire is distributed after discussing with the tutor and preceding the pretest that it presents certain content validity. The dimensions of context awareness, self-efficacy, and learning motivation are tested the cause-effect relation of the overall structure with Linear Structural Relation Model. The data entry is based on the correlation coefficient matrix of observed variables. The Linear Structural Relation Model analysis result appears the overall model fit reaching the rational range that it presents good convergent validity and predictive validity. According to Kerlinger (1986), item-to-total correlation coefficients could be used for testing the construct validity of questionnaire contents, i.e. judging questionnaire contents with item-to-total correlation coefficient obtained with reliability analysis. The item-to-total correlation coefficients of the dimensions are higher than 0.6, revealing certain degree of construct validity of the dimensions in this questionnaire.

Reliability and validity analyses are further proceeded to further understand the reliability and validity of the questionnaire. According to Cuieford (1965), the higher Cronbach's α shows the better reliability. The formal questionnaire in this study is developed based on such a standard that the Cronbach's α appears in 0.75~0.90, conforming to the reliability range.

ANALYSIS OF EMPIRICAL RESULT

LISREL model evaluation indicator

LISREL model (linear structural relation), a research tool which could simultaneously calculate multi-factor and multi-causal path, combines Factor Analysis and Path Analysis in statistics and adds simultaneous equations in econometrics. Bagozzi (1998) proposed to evaluate model fit from preliminary fit criteria, overall model fit, and fit of internal structural of model.

The data result of this study is organized in **Table 1**. The preliminary fit criteria, fit of internal structural of model, and overall model fit of the model are further explained as below.

From **Table 1**, the dimensions for context awareness (computing context, user context, time context, and physical context) could significantly explain context awareness (t>1.96, p<0.05), the dimensions for self-efficacy (efficacy magnitude, efficacy strength, and efficacy generality) could remarkably explain self-efficacy (t>1.96, p<0.05), and the dimensions for

Table 1. Analysis result of LISREL model

Evaluation item	Parameter/evaluation standard		Result	t
Preliminary fit criteria	Context awareness	Computing context	0.783	12.85**
		User context	0.772	12.16**
		Time context	0.755	9.31**
		Physical context	0.761	11.22**
	Self-efficacy	Efficacy magnitude	0.810	16.72**
		Efficacy strength	0.804	15.63**
		Efficacy generality	0.796	13.58**
	Learning motivation	Value of work	0.758	9.42**
		Belief in capability	0.749	10.63**
		Expectancy of success	0.756	9.24**
Fit of internal structural of model	Context awareness→self-efficacy		0.859	24.58**
	Self-efficacy→learning motivation		0.844	21.47**
	Context awareness→learning motivation		0.872	29.46**
Overall model fit	X2/Df		1.583	
	GFI		0.953	
	AGFI		0.915	
	RMR		0.002	

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

Table 2. Test of hypotheses

Research hypothesis	Correlation	Empirical result	P	Result
H1	+	0.859	P<0.01	Supported
H2	+	0.844	P<0.01	Supported
H3	+	0.872	P<0.01	Supported

learning motivation (value of work, belief in capability, and expectancy of success) could notably explain learning motivation (t>1.96, p<0.05), in terms of preliminary fit criteria. Apparently, the overall model in this study appears favorable preliminary fit criteria.

Regarding fit of internal structural of model, context awareness presents positive and significant correlations with self-efficacy (0.859, p <0.01), self-efficacy reveals positive and remarkable correlations with learning motivation (0.844, p <0.01), and context awareness appears positive and notable correlations with learning motivation (0.872, p <0.01) that H1, H2, and H3 are supported.

In regard to overall model fit, the overall model fit standard χ2/Df appears 1.583, smaller than the standard value 3, RMR is 0.002, showing that χ2/DF and RMR are proper. Moreover, chi-square value is sensitive to sample size that it is not suitable for directly judging the fit. Nevertheless, the overall model fit standards GFI=0.953 and AGF=0.915 are

larger than the standard 0.9 (the closer GFI and AGFI to 1, the better model fit) that this model presents good fit indicators.

CONCLUSION

The research results reveal positive and significant effect of context awareness on self-efficacy and learning motivation. Mobile technology shows positive effects on assisting context-awareness learning that it could assist learners in proceeding interactive learning in authentic contexts and the learning content is more nature than learning in a situated classroom. For instructors, mobile technology assisted context awareness could shorten lecturing time for observing learners' learning attitudes and styles. For learners, mobile technology assisted context-awareness instruction provides a different learning style, in which learners could select the learning content, for encouraging them using more learning strategies. The features of portability, instantaneity, and autonomy have mobile devices assist in learning with cross-context that it is suitable for helping learners in authentic context. However, current research on mobile-assisted learning rarely focuses on context awareness. This study intends to fill up the gap to discuss the effect of context awareness integrated mobile assisted instruction on self-efficacy and learning motivation to school-work.

SUGGESTION

From the research results and findings, practical suggestions are further proposed in this study.

1. Stability of network environment: Learners are easily tired of frequent system log-in and long download and upload time. When using public network or campus network, wireless network signal sources can be easily changed because of movement to make learners automatically log out systems. Such systems would not offer sufficient and stable bandwidth that the time for learners downloading or uploading teaching materials would be delayed. In this case, a portable wireless network card for each group is prepared for the stable network.
2. Compatibility of mobile devices: Failure of learners' operating systems would result in frustration and delays the time for completing activity. It is a common problem for application developers that there are so many mobile devices which cannot be confirmed the compatibility with the systems. The system compatibility problem is not directly related to teaching contents, but could largely influence the continuity of students' learning process. It therefore requires special attention, and the regulation flexibility should be remained.

Simplified operation interface and audio/video contents: When using mobile devices for mobile guide, the simple operation is the key. Learners can more easily accept audio/video learning contents that such contents should better presented with audio/video.

After all, context awareness through texts or lectures can no longer meet learners' needs; and, audio/video learning contents are believed to better satisfy learners' demands.

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