Analysis on Students' Acceptance of Digital Reading in Ubiquitous Cooperative Inquiry-based Learning Environment

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Abstract: Due to the advanced ubiquitous technology, learning can happen almost anywhere and at any time. Most students can learn by using mobile devices they want. Digital reading is an important part of students' learning which can increase their learning interesting and support them learning. And ubiquitous cooperative inquiry-based learning demonstrates improvement of student engagements and expectations for personal success by learning and sharing experiences in small groups. More and more researchers become interested in examining the potential benefits of digital reading supported by ubiquitous technology. This paper tries to investigate students' use of digital reading in a classroom context while they engage in collaborative inquiry-based learning. Studies were conducted to examine whether individuals' reading motivation will affect they acceptance of digital reading and test scores of the subject. Results show that firstly, reading motivation correlates highly with students' acceptance of digital reading; secondly, if students have higher degree of acceptance of digital reading, their digital reading behaviors show more active. Teachers need to pay more attention to students' reading motivation to improve their digital reading performance and learning outcome.
Keywords: Digital reading, ubiquitous technology, user acceptance, reading motivation

1. Introduction

With the popularity of wireless communication and ubiquitous technologies, ubiquitous and mobile learning has become more and more important and helpful in education (Chu, Hwang, Tsai &Tseng, 2010). Ubiquitous learning is often regarded as "learning anywhere and at anytime "(Hwang& Tsai, 2011).Mobile devices (e.g. smart phones, laptops or iPad) are emerged to assist students to learn in a ubiquitous learning environment. Supported by these ubiquitous technologies, students can acquire and communicate knowledge in anywhere, and at anytime. Reading is a necessary part in every discipline. The paradigm of reading, in particular for young people, is increasingly using digital reading rather than paper (Mangen, Walgermo, & Brønnick, 2013). Digital reading provides students a lot of functions (e.g. highlight, hyperlinks, notes) to assist them to read. If students can use these digital reading tools effectively, it might improve their memory and learning outcome. Motivation can affect their performance in different learning areas, including reading (Wigfield & Guthrie, 1995). And the level of user acceptance of information technology will also affect their using behaviors (Davis, 1989). There exists a large body of researches on how to use these technologies to enhance teaching and learning in different disciplines, but few are focused on the impact factors of students' acceptance of digital reading in ubiquitous cooperative inquiry-based learning environment.

Two studies were conducted in this paper. First, a study was conducted to investigate students' usage of the network and social software usage (N=1327). Based on the first study, 102 students in Grade 7 were invited to participate in the second study, to further investigate their use of digital reading in a classroom context while they engage in collaborative inquiry-based learning. In this study, we designed a collaborative inquiry-based learning activity. PDF tool and MOODLE platform were used in this study to support students' reading and learning. Students were encouraged to use reading tools (e.g. highlight, notes) in learning activities, for better memorizing and understanding. Analyses were conducted to examine whether individuals' reading motivation will affect their acceptance of digital reading and test scores of the subject.

2. Literature review

2.1 Ubiquitous learning

Yahya et al. (2010) proposed that Ubiquitous learning(U-learning) is a learning paradigm which takes place in a ubiquitous computing environment that enables learning the right thing at the right place and time in the right way, to make it easier to understanding the concept of u-learning. Ubiquitous computing technology in u-learning constructs a ubiquitous learning environment to enable anyone to learn at anyplace at any time. In recent years, a variety of computing and communication technologies have been developed, such as wireless communication equipment, smart mobile phones, PDAs (Personal Digital Assistant), which are being used in our daily life (Sakamura et al., 2005; Friedewald et al., 2011; Yahya et al. 2010) .For example, smartphones have been proved possible to serve as u-learning devices by researchers (Shin et al., 2011; Chen et al., 2009). A student equipped with a mobile device can connect to any other devices, and access the network by using wireless communication technologies (Uemukai et al., 2004). So creating an effective ubiquitous learning environment can increase students' engagement in learning.

2.2 Reading motivation

It's well known that children's motivation can affect their performance in different learning areas like reading (Wigfield & Guthrie, 1995). Previous researches suggest that motivation is very important to reading engagements (Wigfield etc., 2004), which can indicate children's behaviors, including choice of which activities to do, hold on at these activities, and their level of effort expended (Wigfield, 1997; Guthrie & Wigfield, 1999). Reading motivation represents students' personal goals, values and beliefs with regard to the topic, processes, and outcomes of reading (Wigfield & Guthrie, 2000).It can influence children's reading skills (Morgan& Fuchs, 2007). So reading motivation gives students powers to read and learn. Other studies use strategies to stimulate students' motivation in order to improve their reading in different subjects, such as science (Guthrie& Wigfield, 1999). In a digital world, students' learning behavior might be totally different when they are in traditional learning. Vogel, Kennedy, and Kwok (2009) suggested that students' motivation plays a significant role in engaging and sustaining students to use mobile devices for learning purposes. So some features of digital reading devices might influence students' reading motivation, and then affect their attitudes and behaviors of reading. But few studies focus on the relationship between reading motivation and digital reading behaviors. Therefore, this study attempt to find whether reading motivation related to degree of digital reading acceptance and reading behaviors in a digital reading environment.

2.3 User acceptance of digital reading

With the development of information technology and network, a lot of digital services support people reading and learning. Although almost all the children today are regard as "digital natives" and familiar with information technology, their acceptance and usage pattern of technology are different (Kennedy, 2010).Therefore, user acceptance of information technology might affect students' learning in digital learning environment. Prior researches have done some study about user acceptance of information technology, mainly focusing on assessing the design and application of systems, such as on-line learning systems (Saadé& Bahli, 2005). According to literature review, many studies analyses user acceptance level and factors by using IS success, Task- technology fit and User Acceptance of Information Technology (TAM) model .TAM is the most widely used in the study about user acceptance by using different technologies, including perceived usefulness, perceived ease of use, attitude toward using, and actual usage behavior (Davis, 1993).Davis (1989) also suggested that both usefulness and ease of use had important correlation with usage behaviors, and usefulness had a significantly greater correlation with usage behavior than did ease of use. Bennett (2008) noted that some potential factors might affect user acceptance of information technology like Socio-economic status, sex and specialized disciplines etc. Jones and Healing (2010) claimed that students' Initiative decided the students' participation in technology. Davis (1992) once used motivation theory to understand user acceptance and usage of new technology. So this study put user acceptance into a

specific reading situation, and analyzes the correlation between reading motivation and user acceptance of digital reading.

2.4 Reading behavior

As to students' reading behavior, previous studies have investigated how students read in traditional learning. Morrow, Rand, & Smith (1995) suggested that read aloud behaviors in upper elementary grades can improve story reading. With the change in the traditional learning environment, the usage of ubiquitous technology support students' learning process, and change their learning behaviors. Past researches have focused on user behaviors in Web environments (Liu, 2005; Nicholas, et al., 2008).Liu (2005) claimed that digital readers are likely to develop the screen-based reading behavior which is characterized by more time spent on browsing and scanning, keyword spotting, one-time reading, non-linear reading, and reading more selectively. Until recently, little attention has been drawn to analyze reading behaviors when in a specific discipline situation. This study researches reading behaviors in the digital environment from a different perspective by observing students' reading behaviors (e.g. highlight, make notes and using navigation) in digital reading process and analyzing the relationship between students' acceptance of digital reading.

Recent researches have mentioned that motivation, user acceptance, behaviors and outcomes have some correlation, but not take it a specific learning situation into consideration. Therefore, this paper tries to examine whether individuals' reading motivation will affect their acceptance of digital reading and test scores of the subject in a ubiquitous collaborative inquiry-based learning environment.

3. Research question

In this study, two main research questions were addressed regarding students' use of digital reading in a classroom context while they engage in collaborative inquiry-based learning:

What are the relationships between students' reading motivation, digital reading acceptance and test scores?

For students with high degree of acceptance of digital reading, do they also show more active digital reading behaviors?

4. Design and Method

4.1 Contexts

In these years, Shanghai has been focusing on the IT construction in basic education and supplying personalization and ubiquitous quality education to learners from the aspect of policy and practice. The experiment school we choose is one of the earliest experimental bases for Information technology education in Chang Ning district in Shanghai. Chinese, Mathematics, English, Geography and other disciplines are involved into ICT support teaching research projects.

The reason why this study chooses geography as the experimental subject is that, this subject has its own website and laboratory room to support students studying in a ubiquitous learning environment; furthermore, in geography class reading and remembering a lot of information in maps and pictures are required. It has a high demand for color and multiple media. Therefore, geography materials are more suitable for the student to carry on digital reading.

4.2 Participants

Two studies were conducted to investigate usage of network in middle school students and understand students' acceptance of digital reading while they engage in collaborative inquiry-based learning. The participants in two studies are all from one middle school in Chang Ning district in Shanghai.

In the first study, there were 1327 student participants. A survey is designed to analyze the usage of network and social software (eg. Wechat).The second study tries to understand how digital reading can be integrated into a collaborative inquiry-based learning. In the second study, 102 students

in grade 7 were involved. They were between 14 and 15 years old (49.1% female, 50.9% male).The experiment was conducted during their geography study.

4.3 Instruments

In the first study, a questionnaire is designed to investigate students' network usage. This questionnaire has 16 items which includes respondents' basic information, usage of network and social software.

In the second study, we use the reading motivation scale based on the Motivations for Reading Questionnaire (MRQ) which designed by Wigfield (1996) to measure students' reading motivation. The MRQ contains 54 items and assesses 11 possible dimensions of reading motivations, including reading efficacy, reading challenge etc. It can be used with children in late elementary school and middle school.

On measuring students' acceptance of digital reading, this study uses a model of technology acceptance to examine students' feeling about using mobile devices to read and learn in a cooperative geography learning course. This questionnaire is adapted from the technology acceptance model (TAM) which has been widely used to study user acceptance of new computer technologies.

By observing the students' digital reading behaviors in geography class, we designed a digital reading behaviors questionnaire (6 items) to analyze the correlation between degree of acceptance of digital reading and digital reading behaviors.

4.4 Design

This study integrated reading process into in a ubiquitous Jigsaw cooperative learning environment. During four weeks inquiry–based learning activities, whether there is a significant correlation between students' reading motivation and digital reading acceptance and test scores are investigated.

Our study choose'1.4 Hu-Ning-Hang district' of the seventh grade geography course as research content. The four-week inquiry theme was "the design and production of thematic maps in Hu-Ning-Hang district in Shanghai". The detail of learning activity design as shown in Table1.

Table 1: Learning activity design of Hu-Ning-Hang district

the stages of Inquiry Learning	Students' activities
Stage 1a: expert views on one aspect of background research	Students were separated into four expert groups which read different digital materials. During the reading phase, students should utilize the annotation services to make annotations (such as highlighting and underlining) on emphatic text and then answered the inquiry questions in MOODLE.
Stage 1b: Background research on all aspects of Hu-Ning-Hang district in shanghai	Reorganized new teams which each team was made up by four different experts and every team discuss the questions in MOODLE and made a presentation.
Stage 2: Design proposal preparations	Read digital materials the teacher offered, each team chose what kind of thematic map they wanted to make. And find relevant information online, copy useful information and upload the final version to the MOODLE.
Stage 3: Peer review of design proposals for the thematic map in Hu-Ning-Hang district in shanghai.	Draw the thematic map on computer or ipad according to the design proposal, and then upload the final thematic map to MOODLE.
Stage 4: Summary and reflection	Discussed and evaluated other teams' works in the

	MOODLE and class.

The following questions were posted by the researcher in four stages to support the online discourse in a ubiquitous environment:

Stage 1a: Expert views on one aspect of background research

Question: Imagine you are a geologist, how would you introduce related information to someone who wants to know the advantages and disadvantages about geographical location, natural conditions, economic production, tourism and cultural aspects in Hu-Ning-Hang district in shanghai? Give your opinion.

Stage 1b: Background research on all aspects of Hu-Ning-Hang district in shanghai

Imagine you are one member of the Group of Experts on of China Geography, and you have been asked by the superior to design a thematic map in Hu-Ning-Hang district in shanghai:

Question 1: After reading some case studies about thematic map, what processes or stages do you think would be involved in developing a thematic map? Make a decision about what kind of thematic map your group would design.

Question 2: What information do you need? How do you decide which information is needed? Why is the information important?

Stage 2: Design proposal preparations

The superior has listened to the presentations of the expert groups and he would like all design groups to answer a few further questions during the preparations of the design proposal.

Question 1: What kind of materials are you intending to put into your thematic map?

Question 2: How to use your thematic map and what are the advantages of it compared with general map?

Stage 3: Peer review: review the designed proposals for the thematic map in Hu-Ning-Hang district in shanghai.

Question: after reviewing other groups' proposal, can you tell why do they design their thematic map like this? Based on the aspects of knowledge acquired in stage 1 and 2, would you elaborate factors that influence their design proposal?

Stage 4: Summary and reflection

Question: Now you have completed design of a thematic map in Hu-Ning-Hang district in shanghai. Based on your insights and knowledge gained over the four stages, can you discuss for some thematic map design theories specific to Shanghai for next year's students?

4.5 Data resources and method

In the first study, 1327 questionnaires were collected from all the students in this experiment school. In the second study, the reading motivation scale was distributed before the experiment, degree of acceptance of digital reading questionnaire and digital reading behaviors questionnaire were distributed after the four- week courses. 102 questionnaires were collected, of which 91 are valid. A correlation analysis was used to investigate the correlation with students' reading motivation, degree of acceptance of digital reading and digital reading behaviors. All analyses were conducted by using SPSS version 19.0.

5. Analysis and Results

5.1 Usage of network and ubiquitous technology

In order to know the students' network and ubiquitous usage, a survey were conducted in this experiment school. The following section describes some important results.

In terms of the network usage, over half students (53.05%) prefer using smartphone to search information online. And only 95 out of 1327 students do not use internet. In the question of "Do you really like the Internet", almost 72% students very like internet, and most of them (65.56%) have ability

of self-control, knowing when and how to use internet. In addition, when students meet difficulties in study, they (55.09%) first choose to search solutions online. Thus the data can imply that internet has become a large part of the students' life and they were familiar to use these internet devices with their own preferences.

As to students' attitudes about smartphones, 75.51% participants have a smartphone and the trend is still increasing. 91.18% participants think smartphone can be used as a learning tool. Smartphone can be regarded as a kind of ubiquitous technology tools which supports students to learning at anytime, anywhere. From the results, the participants' attitudes about smartphone is positive and they (43.48%) think smartphone don't affect their learning in a bad way.

In terms of the social software usage results, although over half of the participants (60.74%) still use phone or message to contact with family and friends, 39% prefers to use some social software such as QQ, Email, Wechat etc. And 945 participants (71.21%) have kept online in Wechat all day.

5.2 The relationship between reading motivation, learning outcome and students' acceptance of digital reading

Seen from table 2, participants' reading motivation and the reading scores of geography lesson were positively correlated, and reached statistical significance (r=．269，P＜0．01)in a digital reading environment. These results supported the comment that reading motivation affects directly the reading scores (Wigfield &Guthrie, 1995).Therefore, when students study in a digital learning environment, the one who has stronger reading motivation will has a better reading score.

Table 2: The relationship between reading motivation, learning outcome and students' acceptance of digital reading (N=91)

		reading motivation	Geography scores	Acceptance of digital reading
reading motivation	Pearson Correlation	1	.269**	.285**
Geography scores		.269**	1	
Acceptance of digital reading		.285**		1

**. Correlation is significant at the 0.01 level (2-tailed).

The result also indicated positive correlations between participants' reading motivation and degree of acceptance of digital reading reached statistical significance(r=．285，P＜0．01). So when students' demands for reading are higher, they show more positive attitudes for digital reading and more willingness to accept this new reading method. Among the sub-items of reading motivation (not shown), reading curiosity and reading efficiency are correlated with degree of acceptance of digital reading, but not very strong. Thus, if students have more desire and curiosity to read, they would prefer to try fresh reading methods. Therefore, it means that teachers should take students' reading motivation into consideration while using ubiquitous technology, in order to increase students' acceptance of digital environment. In these results, one thing should be considered is that although the co-relations are statistically significant, its effect sizes (r square) are not that high, which led to this result may be due to test questions in geography might not very relevant with digital reading contents. It will be improved in the further research.

5.3 The correlation between degree of acceptance of digital reading and digital reading behaviors

Students' acceptance of digital reading show high correlation with participants' reading behaviors which reached statistical significance(r=．706，P＜0．01) as shown in table 3. In a cooperative

inquiry-based learning environment, if a student has a high degree of acceptance when he read digital materials, it means his digital reading behaviors will be more active. Results from table 4 indicated that all the sub-items of digital reading behaviors correlated highly with students' degree of acceptance of digital reading. This study focuses on students' digital reading behaviors including using navigation, highlight, clicking hyperlinks, taking notes, searching tools, and reread the notes or highlights they have made, which can support students reading and understanding. Thus, the higher degree of acceptance of digital reading students have, the better they can adapt to digital reading. They will use digital reading tools more actively.

Table 3: The correlation between degree of acceptance of digital reading and digital reading behavior (N=91)

		Acceptance of digital reading	Digital reading behavior
Acceptance of digital reading	Pearson Correlation	1	.706**
Digital reading behavior		.706**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4: The correlation between degree of acceptance of digital reading and subitems of digital reading behavior (N=91)

		Using navigation	highlighting	Clicking hyperlinks	Take notes	Search tool	Reread the highlights/tags
Acceptance of digital reading	Pearson Correlation	.564**	.557**	.588**	.577**	.604**	.506**

**. Correlation is significant at the 0.01 level (2-tailed).

6. Conclusion

This paper mainly presents two studies. From the first study, the results indicate that almost all middle school students have passion on network learning and have ability to acquire knowledge by using ubiquitous technology (e.g., iPad, iPhone); furthermore, "digital natives" would like connect other people by using social software (e.g. QQ, Wechat), they have a high level of using mobile devices; thirdly, as to ubiquitous learning, 72% participants think mobile phone can be a learning tool, their attitudes are positive. Overall, if a good guide can be provided to students about how to use ubiquitous technologies to support learning, it might help them using network better.

In the second study, participants completed digital reading and cooperative inquiry-based learning activities in a geography course. This study focuses on investigating students' reading motivation, acceptance of digital reading and reading behaviors in digital learning environment. Results show that there's a high correlation among reading motivation, students' acceptance of digital reading and learning outcome. And if students have higher degree of acceptance of digital reading, their digital reading behaviors show more active. So when teaching in a digital learning environment, teachers can use some strategies to increase students reading motivation and students' acceptance of digital reading, which might affect their learning behaviors and improve their digital reading performance and learning outcome.

Certainly, this paper still has some limitations that need to be considered. In the second study, limitations stem from its scope, particularly the size and composition of the sample population. And in the data analyses process, a few of incomplete data were deleted, it might effect on the results of correlation analysis. But we try to remain the maximum data authenticity. This study has found that the relationship between reading motivation, students' acceptance of digital reading and digital reading

behaviors, there is a need for future research about how mobile technologies can be used to enhance learners' motivation and learning outcome.

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