

Using Mobile-Memo to Support Knowledge Acquisition and Posting-Question in an Mobile Learning Environment*

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This study developed a mobile-memo system that supports the knowledge acquisition and posting-question to assist learners' learning in a ML (mobile learning) environment. To understand the effectiveness of our proposed system, the data were collected from the system logs, such as the elements of multimedia used in posting-question and a questionnaire regarding the students' learning attitude as well as satisfaction towards the use of the mobile-memo system. The experimental result showed that the mobile-memo was effective for learners to gather information in construction and reflection during the learning activities. In other words, the mobile-memo system can effectively support learners to acquire knowledge and post question relating to the learning course contents during learning activities.

Keywords: ML (mobile learning), mobile-memo, knowledge acquisition, question-posting

Introduction

In the past decade, there has been increased research for the use of digital learning and mobile tools to support ML (mobile learning) environment. Because of small size, light weight, portability and wireless communication features, handheld devices are seen as a potential tool to achieve a great positive impact on learning (Pownell & Bailey, 2000; Roschelle, 2003). In fact, handheld devices are significantly changing human-computer interaction, communication and learning activities. Research has shown that handheld devices provide new opportunities for communication and innovative learner interaction both in and out of the learning setting (Tatar, Roschelle, Vahey, & Penuel, 2003; Clough, Jones, McAndrew, & Scanlon, 2007). Although several studies have demonstrated the benefits of ML (Chen, Chang, & Wang, 2008), the limitation of handheld technology for the delivery in learning objects was the small screen that could be available for effective display (Churchill & Hedberg, 2008). That is, a potential limitation of such screen size leads to the lack of effective presentation of information and knowledge acquisition. Besides, in such ML environments, learners can only retrieve learning materials given solely by the systems.

Prior research showed that gender issues in technology use have been noticed. For example, the males had more positive attitudes, more confidences and more competencies than the females in using the computers and further in participations of technology-related works (Fountain, 2000). Additionally, female students tend to express their ideas verbally and the least amount of visual representations (Ding, 2009).

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This paper presents an implementation of handheld devices in support of a ML on a real curriculum. From another learning perspective, it is taken into account that educational materials could be provided by the learners. By doing so, learners could actively discover their learning contents for themselves rather than via passive guidance to achieve the purpose of knowledge acquisition and sharing. Here, research questions are as follows:

- (1) What is the relationship between multimedia elements regarding posted content in the ML?
- (2) What is the preference for the use of multimedia elements by different genders?
- (3) By using the mobile-memo system, what are the effects on learner's learning activity and their satisfaction?

Literature Review

ML (Mobile Learning)

Learning via mobile devices is widely accepted by the learner community. Learners are interested in using all available learning resources through portable computers, palms, mobile phones and PDAs (Personal Digital Assistants) to access information anytime and anywhere (López, Royo, Laborda, & Calvo, 2009). The aim of ML is to provide an educational environment where learners can learn without any limitation of time, place, or device, thereby, realizing a more creative and learner-centered educational process (Joo & Kim, 2009).

ML potentially moves learning outside classrooms and into learners' environments, both real and virtual, thus, reconceptualize personal, situational, collaborative and lifelong learning. According to the findings of prior research, the use of mobile devices to support learning activities offers several benefits (Evangelos, Elissavet, & Anastasios, 2008; Y. M. Huang, Jeng, & T. C. Huang, 2009; Huseyin, Nadire, & Erinc, 2009; Chu, Hwang, & Tsai, 2010; Chen, 2010). These include the ability to: (1) improve communication and collaborative interaction; (2) provide more learning opportunities for geographically dispersed persons and groups; (3) encourage active learning; (4) enhance the learner's feedback process; (5) emphasize time on task; and (6) acquire content rapidly.

Additionally, D. Churchill and N. Churchill (2008) stated handheld technologies for education have five potential benefits: First, portability, as handhelds can be taken to different locations; second, social interactivity, as handhelds can be used to collaborate with others; third, context sensitivity, as handhelds can be used to find and gather real or simulated data; fourth, connectivity, as handhelds enable connection to data collection devices, and to a network; and fifth, individuality, as handhelds can provide scaffolding to the learners' approaches to investigation. Besides, mobile devices have the potential to change the ways learners behave and interact with one another and their attitudes towards learning (Homan & Wood, 2003). Nevertheless, Kukulka-Hulme (2002) suggested mobile devices are more suitable as an extension of current learning tools, rather than replacing them, but how to effectively combine mobile and Internet learning is yet to be empirically explored.

Social Constructivist Theory

Social constructivist theory is strongly related to learning strategy. Mobile technologies potentially promote, facilitate and enhance student collaboration and interaction processes, serving as a means of discovering, gathering, discussing and sharing an individual's thinking. These benefits are proved to be equally useful in improving the learning environment.

Constructivist learning environments demand a meaningful and authentic context for social and collaborative activities (M. Neo & T. K. Neo, 2009) and learners play a more active role as learners as they contribute to developing their own knowledge. The constructivist approach focuses on fostering learners' critical thinking in multiple ways to achieve higher-level learning (Gomez, Wu, & Passerini, 2010). The critical features of constructivist learning can be summarized as follows (Cole, 2009): (1) All knowledge is constructed through a process of reflective abstraction; (2) Cognitive structures within the learner facilitate the process of learning; (3) The cognitive structures in individuals are in a process of constant development; and (4) If the notion of constructivist learning is accepted, then the methods of learning and teaching must agree.

Therefore, the present study designed a mobile-memo system that allows students to gather information and post question to the website where they can view and share in the classroom or at home. Moreover, the teacher encourages the students to participate in the designed learning activity.

Gender Issues in Technology Use

The gender issues of computer education have captured the interest of both psychologists and computer educators for decades (Whitley, 1997). Several studies have examined the role of gender in computer-related attitudes and different aspects of computer use (Shashaani, 1997; Imhof, Vollmeyer, & Beierlein, 2007). Generally, gender-typed attitudes are found to significantly differ for males and females, especially as learners advance to higher school grades (Hativa & Shorer, 1989; Lage, 1991). In particular, gender needs to be taken seriously as a possible variable.

Based on the above, the present study thus utilized gender as the personal characteristic to understand its importance in influencing the opinion of mobile technology in a ML environment and the elements of multimedia used in posting-question.

Methodology

Before the experiment, a mobile communication experience survey was used to assess learners' ML experience. According to the results, about 85% of learners did not have relevant mobile device experience in using mobile communication. It implies that most learners had insufficient knowledge with regard to the ability and experience operating mobile devices. Thus, before the experiment, learners had to study how to use mobile device to correctly operate each tool in the system.

The Proposed System

Mobile-memo is a service that provides both handheld devices and website to support ML. The workflow and operation scenario of the system are shown in Figure 1. Apart from the mobile support, the system also provides a flexible Web environment for both discussion and communication. During the learning activities, the mobile-memo system can assist learners to post knowledge/questions by using handheld devices and these contents were subsequently stored in the database server for knowledge sharing and question discussion.

System Implementation

In this study, the mobile-memo system uses Microsoft Windows Server 2003 as operation system, Microsoft Visual studio 2008 as developing tool and Microsoft .NET Framework 4.0 as executive environment. Mobile device is HTC (high tech computer) with Window mobile 6.1. Moreover, to prove that the system can be executed on a real mobile device, several pictures were taken from the real mobile device instead of using screenshots of a mobile simulator. The functionalities and user interfaces of the system are illustrated in Figure 2.

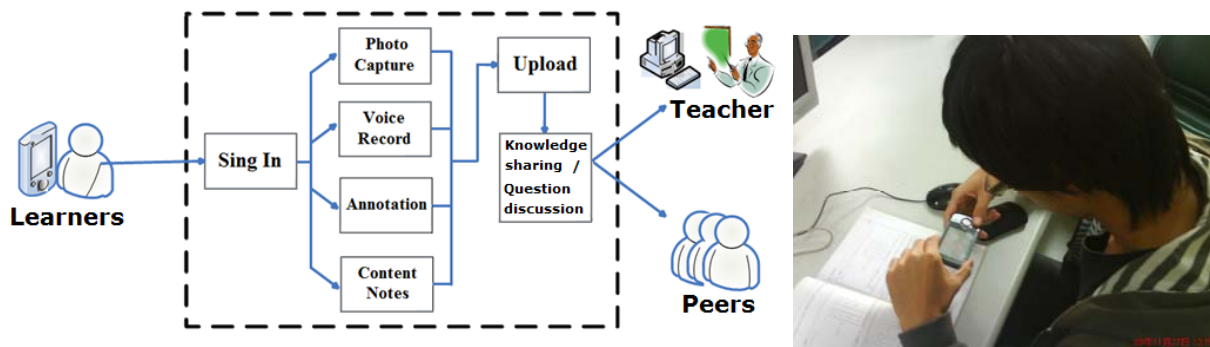


Figure 1. System operation flow.

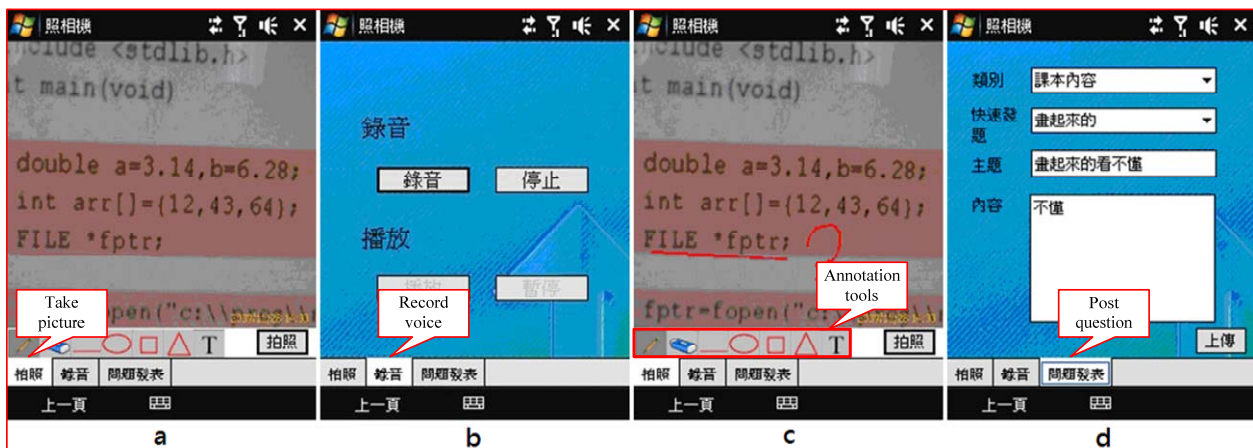


Figure 2. User interfaces: (a) take picture; (b) record voice; (c) annotate notes; and (d) input text.

Participants

The participants included 20 graduate students (10 males and 10 females) in Department of Information Management, Taiwan, and each learner has a handheld device with network communications.

Learning Activities

In this study, the learning activities were designed based on social constructivist theory and ML strategy. These learning activities stress a need to place learners in a ML environment in which they can engage in effortful interactions with real-life context, system and peers to improve their learning. With learning devices, wireless connections and the mobile-memo system, the learning activities were executable without constraints of time or location.

More specifically, the designed learning activities were to investigate the assistance of using handhelds to support learning in a computer programming course. The teacher gave lessons with a broadcast system in a PC (personal computer) classroom. During and after class, the students can use handheld devices with the mobile-memo service to support their learning. They can create new contents by using the handheld devices to take photos from their computer screen or textbook, record voices, annotate notes and input some texts. All the contents they captured were sent by network communications from the handheld devices to the platform.

Procedures

The designed learning activities were deployed for four months (18 weeks) in a semester including training phase, knowledge interflow and evaluation phase. The training phase took one week. In this phase, the teacher

assistance instructed the use of the mobile-memo system and introduced the learning activities and tasks. The knowledge interflow learning activities took place in the next 16 weeks, and the students' task was to investigate the process of analyzing and selecting sources/objects by using the handheld devices to collect relevant information. Students could present their knowledge or question in the classroom or share them with peers. In the final week, each student needed to accomplish a questionnaire, indicating their perception of use the system.

Results

Effects on Elements of Multimedia Used

The correlations between multimedia elements used were significant (see Table 1). For example, the result indicated a significantly negative correlation between photo and voice ($r = -0.831, p = 0.000 < 0.01$). Moreover, there were significant negative correlations between the multimedia elements used, such as voice and note ($r = -0.463, p = 0.000 < 0.01$).

Table 1

Correlations Between Multimedia Elements Used

	Photo	Voice	Note	Text
Photo	1.000			
Voice	-0.831**	1.000		
Note	0.634**	-0.463**	1.000	
Text	0.357*	-0.816**	0.119	1.000

Notes. * $p < 0.05$; ** $p < 0.01$.

The Preference in the Use of Multimedia Elements Between Different Genders

Figure 3 shows the results of using multimedia elements between genders. The results illustrated that most of the females' preference were to take photo (64%). Most of the males were to use voice recording (76%). This result revealed that the males and the females seemed to have different multimedia preference in the mobile-memo system.

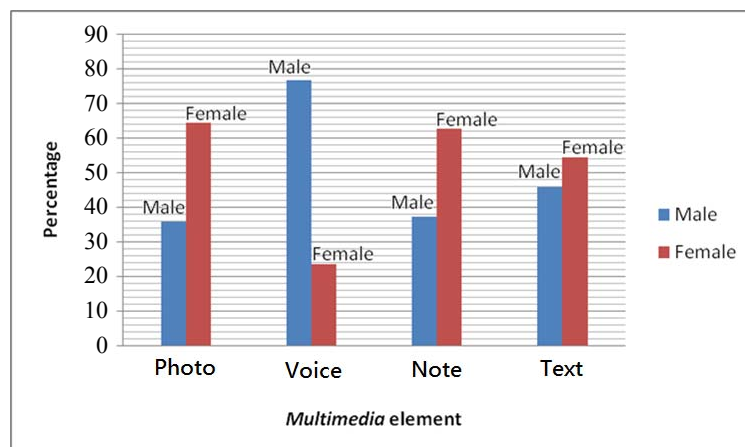


Figure 3. Gender differences in the use of multimedia element.

Evaluation of Students' Learning Attitude and Satisfaction Toward the Use of the Mobile-Memo System

The effectiveness of the mobile-memo system on students' learning attitude was conducted by a questionnaire. The responses of each question in the questionnaire were designed by using a seven-point

Likert-scale in which seven stands for “Strongly agree” and one stands for “Strongly disagree”. The study also examined the students’ attitude from an open-ended question which could present more realistic response. The statistical results were presented in Table 2. The present study adopted the questionnaire by Arbaugh’s (2000) study. The questionnaire item includes:

- (1) I am satisfied with my decision to take this course via the mobile-memo;
- (2) If I had an opportunity to take another course via the mobile-memo, I would gladly do so;
- (3) My choice to take this course via the mobile-memo was a wise one;
- (4) Conducting the course via the mobile-memo made it more difficult than other;
- (5) I was very satisfied with the course;
- (6) I feel that this course served my needs well;
- (7) I will take as many courses via the mobile-memo as I can;
- (8) Please comment the learning experience as a mobile-memo (open-ended question).

Table 2

Questionnaire Results

Item	Mean	St. deviation	Variance	Score ≥ 6
1	6.350	0.769	0.592	75%
2	6.425	0.675	0.455	90%
3	6.375	0.740	0.548	80%
4	2.570	0.670	0.450	0%
5	6.350	0.699	0.489	85%
6	6.275	0.784	0.614	80%
7	6.350	0.735	0.541	80%

According to the responses of item 8 (see Table 3), the mobile-memo system was regarded as a helpful and convenient tool in a ML activity and can stimulate students to look for more information on the system.

Table 3

Open-Ended Question Summary

Item	Summary
8	(a) ... I want to share more helpful online resources with my classmates ... (b) ... Mobile-memo system is convenient for me to post article and upload photo any time and any where ... (c) ... when I see an event which is related to the learning concept, I can take a photo by the handheld device and upload it using mobile-memo system immediately ...

Discussion and Conclusions

The present study developed a novel application for supporting knowledge acquisition and posing-question in a programming course. Since handheld devices are widely used in everyday life, several studies have suggested that guiding the students to learn in the mobile-learning environment has become an important and challenging issue. In this study, the questionnaire results reflected that the mobile-memo system could be used for ML, such as knowledge acquisition and posting-question. Additionally, educational practice could perform conveniently and easily at any time and any place. Interestingly, taking photo was a popular activity for females. However, the study observed more males created their own audio descriptions. It was not represented that students were focused on their devices, but rather that the technology mediates and extends a experience of e-learning environment.

In sum, using handheld devices as a learning tool can not only assist to amplify the feature of the pedagogic theory, but also stimulate students' learning satisfaction and improve students' learning enthusiastically.

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