Full Length Research Paper

Students’ acceptance of using smartphone in a mobile learning context

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Development of mobile phones provides the students a different learning choice compared to studying in a traditional classroom. This study investigated undergraduate students’ experiences with using their smartphones to receive learning contents for the improvement of their computer literacy. Through a survey and a pretest and posttest, the findings showed mobile learners expressed positive perceptions after their experience with the m-learning and the scores on the posttest were significantly higher than the scores on the pretest.

Key words: M-learning, SMS message, computer literacy, undergraduate students.

INTRODUCTION

Computing and Internet technology skills and knowledge are important or essential requirements for the workforce in the information age. Enterprises expect new employees to possess literacy skills in information and communication technology, which include using technology efficiently (Ali and Katz, 2010). Therefore, undergraduate students need a certification to prove their abilities for enhancement of their chances of finding jobs after graduation. In Taiwan, students in higher education were encouraged to gain various nationwide occupational certifications, skill tests, professional licenses, and worldwide professional certificates to make preparations for their future careers (Lee et al., 2010). An institute in a county of central Taiwan provided a face-to-face classroom training course to assist the students prepare for the certification exam. However, most students spent their time preparing for and reviewing their regular courses and had less time for the training course. The problems of a time limitation and a space restriction causing students’ insufficient learning toward the preparation for the certification exams needed to be solved. This study aimed to examine undergraduate students’ acceptance on using their smartphone to receive their learning materials in order to supplement the learning in the training course.

LITERATURE REVIEW

Use of technologies and devices on mobile learning

Many researchers have utilized diverse technologies and various mobile devices in education and reported the significant and positive results (Brett, 2011; Chang et al., 2011; Chen and Huang, 2010; Mathur, 2011). Investigating students’ perceptions of mobile applications...
for the college course management system, Blackboard Mobile Learn, Mathur (2011) found that the students intended to use the system via their iPhone or smartphone for several specific functions that included seeing the course announcements, finding information such as the syllabus, professor's emails, or office hours, and checking their grades. Further, Brett (2011) collected information to understand students' experiences and engagement with Short Message Services (SMS), a service using a text message to communicate via mobile phone, for learning in higher education and found positive responses on administrative communications and learning support. Evaluating the acceptance of a novel mobile knowledge management learning system through various mobile devices, Chen and Huang (2010) found that the learners who utilized the system achieved more than those who accepted classroom learning only.

Use of SMS on language learning

In the field of language learning, the literature presented positive evaluation on the use of SMS in m-learning (Kennedy and Levy, 2008; Zhang et al., 2011). By researching vocabulary learning via mobile phones, Kennedy and Levy found that students appreciated the useful message content pushed by the teachers and enjoyed the experience. Through an experiment to reexamine the effectiveness of vocabulary learning via mobile phones, Zhang et al. found that successful learning with mobile phones might involve multiple learning strategies, and the students tended to use mobile phones as a supplementary tool for vocabulary learning. However, due to the limitation of 160 characters per SMS text message (Brett, 2011; Carrier and Benitez, 2010; Chang, 2008; Kennedy and Levy, 2008; Zhang et al., 2011), the materials of vocabulary learning such as words themselves, translation, and definitions must be compressed to be as succinct as possible (Chang, 2008).

The Internet and Computing Core Certification (IC³)

Worldwide computer certificates such as Microsoft Office Specialist Official Certification and the IC³ Certification provide opportunities for students to prove their abilities of completing related tasks. Students who intend to confirm their computing knowledge and skill have to pass the exams and earn the certification. The test for the IC³ Certification comprises three exams including Computing Fundamentals, Key Applications, and Living Online (Certiport, 2012). The Computing Fundamentals exam assists users obtain the most value from computer technology by testing a foundational understanding of computer operating systems, software, hardware, peripherals, and troubleshooting. The Key Applications examination helps users to work smarter by testing skills in familiar word processing, spreadsheet, and presenta-
tion applications and the general features of all applications. The knowledge confirmed by the Living Online examination includes communication networks, electronic communication and collaboration, web browsers, and the Internet.

Aims of the study

This study was aimed to investigate undergraduate students' acceptance on using mobile devices for learning to enhance their computer literacy. It examined students' experiences of receiving learning materials and review questions via their own smartphones to supplement their inadequate learning in the classroom course. The study also evaluated the effectiveness of the instructional materials and review questions that are delivered via learners' mobile devices when compared to face-to-face learning.

METHODOLOGY

Research design

An experimental research method (Gay et al., 2009) was utilized to conduct this study. The instruction delivery format was the independent variable that was tested out with the experimental design. The variable had two levels: instruction delivered via learners' mobile devices and instruction delivered via face-to-face classes. The students in the experimental group will receive a treatment, which is to deliver instructional materials and review questions to the students via their smartphone. The dependent variable was the effectiveness of the different instructional delivery formats, as measured by the posttests results of the students in the control and experimental groups after the treatment was delivered to the experimental group.

Participants and context

Participants in this study were recruited from the student population of a university of technology in a county of central Taiwan. Undergraduate students from each academic year in the College of Management who were intent on pursuing an Internet and Computing Core Certification (IC³) exam attended a training course. The students of the course were randomly selected by counting off by twos after all of the participants were separated to males and females and lined up (Gay et al., 2009). One team was assigned as the experimental group and the other served as the control group. Before the course, all the students had no learning experiences via mobile device. Among the thirty-two students of the experimental group who participated in the blended training course, eighteen were male and fourteen were female: 37.5% of the students were freshmen or sophomores and 62.5% juniors or seniors. In the control group, thirty-two students, who attended the face-to-face training course only, included eighteen males and fourteen females; approximately 19% of the students were juniors, 44% seniors, 28% sophomores, and 9% freshmen. As the college is located in the suburbs, most of the students in the college have to travel a long distance between the school and their homes every morning and evening. Mobile phones are the common devices for the students to carry and communicate with each other. Mobile learning for the students is an option to utilize their time on the way to school or their homes.
Procedure

The implementation of the eight-week experiment contained three phases. In the first phase (the first week), all the participants who attended a traditional training course took a pretest at the beginning of the experiment and students in the experimental group learned about the treatment. Afterward SMS messages were sent to the students as checks to ensure that each of them were able to receive the SMS from the instructor via his or her own smartphone. In the second phase (from the second week to the seventh week), the participants in the experimental group received the treatment that included daily instructional materials from Monday through Thursday and weekly review questions on Friday. In the traditional classroom, instructor prepared the same instructional materials for both the experimental group and the control group. Further, the experimental group received the m-learning instruction in addition to the traditional training course, but the control group received only the face-to-face course. In the third phase (the eighth week), all the students attended a posttest after the experimental group received the treatment and only the participants in the experimental group filled in a questionnaire.

Both the pretest and posttest in the study as a measuring instrument were designed to estimate the average computer literacy of both the control group and the experimental group. The test questions for the pretest were generated randomly from the IC³ question bank as well as the posttest. The pretest was taken by the students of both groups at the beginning of the course. All the students took the posttest after the treatment at the end of the course.

The learning task, the treatment for the students in the experimental group, was to learn from instructional materials and review questions that were delivered via the learners' smartphones. Through short message services, the instructional materials regarding computing knowledge and skills could be delivered to learners' mobile devices. The limitation on the number of characters in a text message is 160 ASCII characters (Brett, 2011; Chang, 2008). Each English character uses 7 bits, so a message can carry 140 bytes. Because each Chinese word occupies two full bytes, a SMS message in Chinese can send out only 70 words. Therefore, the instructional materials and review questions that were delivered to the students for the treatment were modified into text messages in consideration of the limitation on the length.

Data collection and data analysis

A multi-method approach of quantitative and qualitative data collection and analysis (Gay et al., 2009) was utilized in the study to investigate undergraduate students’ acceptance of the learning experience for the improvement of their computer literacy via smartphones and to evaluate the effectiveness of the learning. Data for the study were collected through a survey, pretest, posttest, and interviews. The data gathered via the survey were analyzed to reflect the perceptions of the students in higher education after using mobile devices for the improvement of their computer skills and knowledge. A questionnaire which collected information including students’ satisfaction of m-learning and their feedback was designed by the investigator. The interviews which were conducted after completion of the questionnaire played a supporting role to gather information to complement the data that was collected from the survey. The data gathered via pretest and posttest were analyzed to assess the effectiveness of using mobile devices to deliver instructional materials and review questions. The exam questions for both the pretest and the posttest were generated randomly from the IC³ question bank. The range of the scores is from 0 to 100, and the data was tested by using SPSS statistical analysis software.

RESULTS

Findings from the survey and interviews

A survey was utilized to collect the undergraduate students' perceptions on using smartphones to receive learning contents and review questions for the improvement of their computer literacy. Data gathered from the questionnaire contained information regarding frequency, time, and location that students learned via their own mobile devices, quality of instructional materials and the review questions they received, influence of other students within the group, and effectiveness of using SMS for learning.

Experience of the use of mobile devices to receive learning materials and review questions

Through the survey, thirty-two students in the experimental group perceived their learning experience in a blended context that combines m-learning and classroom learning. Regarding the weekly frequency to read the instructional materials via their mobile device, some of the students (34.4%) in the experimental group read the materials approximately 13-18 times, some others students (31.3%) around 7-12 times, 15.6% more than 18 times, and 18.8% of the students 1-6 times. As the researcher sent four short-material messages to the students every week, each SMS was read two to four times on average.

The frequency with which the students used the review questions provided via their smartphones was around two to five times for 50% of the students, one time for 25% of the students, and more than five times for 21.9% of the students. During the interview, the students with the higher scores expressed that more than one time per week to deliver the review questions would be welcome.

Regarding the location in which students read the instructional materials, the most popular places were on the way to another classroom (37.7%) and during the time that they waited for friends or meals (29.0%), and some of the students used the time that they waited for a bus or public transportation (23.2%) and during free time, such as TV commercial breaks (8.7%). In the question regarding the time that the students usually read the instructional materials, 46.9% of the students read the SMS soon after it arrived; 28.1% of them read the message every day when time was available; 6.3% of the students read messages approximately twice per week; 12.5% read them after receiving the review questions; and the rest of the students (6.3%) read the SMS on weekends.

Most of the students (40.6%) used the review questions they received via their mobile devices soon after the SMS arrived, 31.3% used them any day when time was available, 6.3% after reviewing all the instructional materials...
received during the week, 18.8% every weekend, and 3.1% before the posttest. The information presented that over half of the experimental students learned the instructional materials and the review questions soon after the SMS arrived or when their time was available. No matter where the learners located, most of them utilized their time to study between classes, in a restaurant, or at a bus stop.

**Quality of the instructional materials and the review questions learners received**

Students' experiences on the quality of receiving the learning contents and the review questions such as size of font and speed were analyzed. Through services the students purchased from different telecommunication service or mobile phone service providers, most of students (59.4%) were highly satisfied with the speed of the SMS messages they received, 34.4% satisfied, and only 3.1% dissatisfied. As the students possess their own smartphones with various brands and models, a majority of the students (90.6%) expressed that the font of the SMS messages had proper size or that it did not matter; only 9.4% thought it needed to be enlarged or reduced. Though mobile learners were expected to study in any location, smartphones may not receive a Wi-Fi signal in some areas such as wireless dead zones. Concerning the response to question regarding difficulties to receive the learning materials, 59.4% of the students never experienced any, 31.3% encountered difficulties one to three times, and only 9.3% over three times. In addition, an interviewee mentioned that students often received many advertising SMS messages that occupied the memory space of their mobile devices. Based on individual requirements, students expressed their satisfaction of quality of the materials they received. However, the size of the font is controlled by the phone manufacturer. The students can get new phones if they do not like the one in hand.

**Interaction with other students within the group**

The collected qualitative data reflected the positive experiences to the communication between the students. Regarding the influence of other students' interaction within the group, results showed that 40.6% of the students often read the instructional materials and used the review questions on their own, but 12.5% of the students needed reminders, and 9.4% reminded other students to read the messages. The results also revealed that the other 37.5% of the students did all three actions. Over half of the students strongly agreed (65.6%) or agreed (12.5%) that using the M-Learning SMS improved their ability to communicate with the other students in the class due to the various topics the daily messages created. Only a few of the students disagreed (9.4%) that this learning style could help them to interact with others. The interviewees expressed that m-learning created many topics of discussion among students. The topics of discussion included whether they had read today's message, they understood the materials, or they could answer the review questions. Compared with a face-to-face training course, m-learning in the blended training course increased opportunities for the students to communicate with classmates in the class.

**Effectiveness of using SMS on learning**

In the questionnaire, the feedback to the use of smartphone to learn was positive. The information collected regarding the effectiveness of using SMS on learning contained ease, convenience, speed to accomplish learning, improvement of performance, and helpfulness of the review questions provided via mobile devices. Students strongly agreed (75%) or agreed (12.5%) that using the M-Learning SMS to learn was easy for them. When compared to other methods, a majority of the students (87.5%) strongly agreed and 6.3% agreed that the M-Learning SMS was more convenient for learning. Regarding the question whether the SMS enabled the students to accomplish learning more quickly, 87.5% of the students strongly agreed and 3.1% agreed. Most of the students strongly agreed (87.5%) or agreed (9.4%) that learning through the mobile device improved their performance in the training course. Regarding whether the review questions via mobile devices were useful to review the learned materials, 84.4% of students strongly agreed and 12.5% agreed.

Students' experience with using mobile devices was that twelve students had one to three years of experience using mobile devices, fifteen students had four to six years or more, and only five students had less than one year of experience. Prior to the experiment, none of the students have learning experiences via mobile device. The gathered data revealed many students strongly agreed that using the SMS message to learn was easy and convenient and could accomplish learning more quickly and improve their performance.

**Recommendations of using the SMS to learn**

When the students were asked if other courses offered the M-Learning SMS, 81.3% of them strongly agreed and 15.6% agreed to attend. Students during the interviews recommended using the SMS messages to learn language, because they can memorize the new words at anytime in any location. Most of the students strongly agreed (87.5%) or agreed (9.4%) that they will recommend that other students attend a course that provides m-learning.
Findings from the pretest and protest

Data collected through the pretest and posttest were utilized to examine the effectiveness of delivering the instructional materials and review questions via learners’ mobile devices. Pretest scores of the sixty-four participants in the control group and experimental group were gathered in the first week of the experiment before the treatment, and posttest scores of all the students were collected in the eighth week of the experiment after the treatment. The results that compared posttest scores with pretest scores were presented by the mean scores were analyzed and discussed.

Pre-test

Data collected from pretest were tested to determine whether the mean was the same for the experimental and control groups. An independent samples t-test was utilized to compare the means of a distributed interval dependent variable for two independent groups (the experimental group and control group). In the results displayed in Table 1, the mean and the standard deviations of the pretest for the experimental group were 69.06 and 5.502. The mean and the standard deviations of the pretest for the control group were 69.01 and 5.268. After we used the “equal variances assumed” test, the independent samples t-test analysis indicated that the effectiveness of the pretest was $p = .969$. The observed probability value of the Levene’s test ($p = .969$) is greater than 0.05. The finding showed no statistically significant difference between the mean pretest scores for the experimental and control groups. In other words, the control group does not have a statistically significantly different mean pretest score (69.01) than the experimental group (69.06) before the treatment.

Post-test

After the experimental group received the complete treatment, the posttest scores were collected and analyzed to determine whether a difference occurred between the experimental and the control groups. Table 2 showed that the mean of the posttest for the experimental group was 86.41 and that for the control group was 70.73. The Independent Samples Test analysis indicated that the $p$ value is 0.000. Because the $p$ value (0.000) is smaller than 0.05, the result showed that there was a statistically significantly higher mean score of posttest of experimental group than the average score of posttest of control group.

The scores on the posttest after the treatment were significantly higher than the scores on the pretest prior to the treatment. The improvement of the students in the experimental group demonstrated the effectiveness of the instructional materials and review questions that were delivered via learners’ smartphones.

DISCUSSION

More learning opportunities via smartphones

The result of the study revealed students’ positive reflection on using SMS in their learning. Most of the students agreed that learning via their own mobile device was easy and convenient, and over 80% of them expressed that the delivered SMS messages improved their performance and enabled them to accomplish learning more quickly. The ubiquity of smartphones provided students more options to learn though learners stated several situations that prevented them from learning via their mobile devices included insufficient memory space, no charged battery, and overdue bill. Most of the students preferred to read the instructional materials between classes and a majority of them used the time spent waiting for friends, meals, and bus or public transportation. Compared with the face-to-face training course, the blended context that combined to deliver the SMS messages and classroom learning provided the students more learning opportunities.

Improvement of interaction with classmates

Approximately 60% of students in the experimental group expressed that they had communication with their classmates including reminding other learners and being reminded by others when they answered to the question of whether students learned via mobile device on their own or not. The m-learning provided more topics and contents of talking and improved the interaction between the students.
Experiment for various training courses

The current study is an experiment on pushing SMS messages to the receivers, but the researcher of the study received many responses to the review questions from the students. Therefore, the recommendation to researchers for future research includes using a different type of method to communicate with the students. In addition, the result of the study revealed that the difficulty of using the SMS message for the training course was finding how to use limited words to accomplish the detailed description of a manipulation. A multimedia messaging service, which is a service that sends messages comprising texts, photos, audios, and videos to MMS-capable handsets, may be an opportunity to address this issue for future research. Various training courses have various requirements, so development of future research will have to aim at the needs of learners.

Conclusion

This study investigated undergraduate students' experiences of using smartphones to improve their computer literacy and examined the effectiveness of the delivery of learning contents and review questions in a blended learning environment that combines m-learning and classroom learning. As the literature presented positive evaluation on the use of SMS in the field of language learning via mobile phones, the experiment in the study utilized smartphones to deliver the SMS messages to the students in the training course.

The study used survey and the pretest and post-test to evaluate the experiment. The result of survey revealed a positive reflection on the students in higher education using their own smartphones to learn computing and Internet technology skills and knowledge. The study also found that the scores on the post-test after the treatment presented significantly higher than the scores on the pretest prior to the treatment. Compared to learning on campus, the ubiquity of mobile devices provides the students a different learning option.

For future researches, more experiments will be conducted as the technology of the devices is upgraded and novel mobile devices can be utilized to examine the effectiveness of m-learning. In addition, different types of methods such as pulling system can be used on various training courses.

Conflict of Interests

The author has not declared any conflict of interest.