Learning at Your Finger Tips: The Effectiveness of Mobile Learning among Distance Learners

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Purpose: The purpose of this study was to examine distance learners' performance and interest after using mobile learning. Another purpose of this study was to investigate distance learners' views after the intervention. This mobile learning with QR code allowed the distance learners to access mobile apps easily and communicate with peers and lecturers anytime and anywhere. **Research Methods** The mix-method explanatory design was used in this research. The quantitative study employed descriptive method and follow-up interviews served as the qualitative method. A set of performance tests was used as an instrument for the study. A total of 152 Malaysian distance learners who majored in economics were the sample. GLM Univariate mean were used for analysing the data. **Findings**: The findings showed significant results for distance learners' performance and interest. However, the students who had taken economics in secondary school had higher level interest and also performed better as compared to those who did not take economics in secondary school. The qualitative responses from six distance learners also showed positive results. **Implications for Research and Practice**: The effectiveness of implementing technology can produce new opportunities for self-directed learning in an effort to enhance student achievement and interest. Researchers have proven the potentials of mobile technologies. The findings of this research has implications for educators, in terms of teaching and learning method. QR code use is advantageous due to quick access, increasing the ubiquity of mobile learning amongst distance learners and keeps pace with current education trends. Future research into mobile learning can focus on developing the applications that will enhance distance learner critical thinking.

Key words: *Distance Learners, Performance, Mobile Learning, Interest Mixed method Research, QR code.*

Introduction

Distance education is growing in line with the slogan of lifelong learning as emphasised by the Ministry of Education Malaysia. Online learning has strongly influenced the distance education market and cut the expenses of resources (Koole, McQuilkin, & Mohamed Ally, 2010; Traxler, 2018) in term of lecturer recruitment. For those open and distance learning institutions with well-equipped infrastructure and large student populations, it is wise to adapt the online learning environment (Danaher & Umar, 2010; Arkorful & Abaidoo, 2014). In reality, the majority of distance learners are part-time students, most of them are working adults, so it is not easy for them to interact with their lecturers by using laptops. Therefore, mobile learning is the best choice for distance learners because this learning method allows learners to access learning anywhere and anytime. The creation of the mobile learning method has made learning closely related to the reality of each student's daily life as most of them own a smartphone.

Lee (2004) and Ganyaupfu (2013) postulate that the academic achievement of students depends greatly on the teaching methods of lecturers in universities. Lecturers who can deliver quality teaching determine the outcome of student results. Computer or web-based teaching can deliver the teaching content, involve students actively and provide feedback (Abdul Wahab Ismail, Kamaliah Siarap & Hasrina Mustafa, 2006; Mahdi, 2019). However, the effectiveness of using information technology depends on the ability of lecturers and students.

Based on the early investigation in this research, the majority of distance learners were not highly autonomous because they were unable to cope with their work and study due to time constraints. According to Loizzo, Ertmer, Watson, & Watson (2017), distance learner characteristics impact on performance. Distance learners will tend to select the flexible learning method as it can fit into their busy schedules which involve work, family and other responsibilities. However, some students may be reluctant to be self-directed learners because it takes more effort and time to take control of learning. Distance learners may have expectations that tutors will provide expertise and be the source of knowledge (Clouston, Westcott, Whitcombe, Riley & Matheson, 2010). As a result, distance learners may lose interestin study if they do not cope with their study or do not perform well in examinations. The main purpose of this study was to examine distance learner performance after using mobile learning. Another purpose of this study was to investigate distance learner views after the intervention.

Literature Review
Theoretical Perspectives of Mobile Learning

There are theoretical perspectives relevant to this study that underlie work in mobile learning. In recent years, there has been an increasing number of theories related to mobile learning, for

instance, Behaviorist Learning, Collaborative Learning, Context Awareness Learning, Connectivism Theory, Problem based Learning and Social Cultural Theory. However, this study only focuses on the Socio-Cultural Theory and Mobile Learning Theory.

Socio-Cultural Theory

Preliminary work on social interaction as a force in mental development was undertaken by Vygotsky (1997). Vygotsky (1986) believed that the development of higher order thinking skills is dependent on social interaction and cognitive development. This phenomenon is called the Zone of Proximal Development. The Zone of Proximal Development theory (ZPD) holds the viewpoint that knowledge is a social construct and that learning awakens a variety of development processes that are achieved when students are interacting with peers (Vygotsky, 1997). In this zone, cognitive development can be achieved through the help of different agents such as teachers, other team members and equipment such as a mobile phone or reading material.

The framework (scaffolds) consists of four types which include conceptual, metacognitive, procedures and strategies. Facilitators guide the involvement of individuals in a collaborative process to build interactions with students to develop their thinking skills and achieve an understanding of a concept. This process helps students learn something in order to achieve a certain level of cognitive development capability. This role involves new knowledge and social interaction of students (Taylor, King, Pinsent-Johnson, & Lothian, 2003). Thus, all cognitive processes are initially social, shared between lectures and students. Overall, Vygotsky (1997) indicates a less skilful student is able to develop a more complex level of understanding with the assistance of a capable peer.

Mobile Learning Theory

Sharples, Taylor and Vavoula (2006) found that the theory of mobile learning is based on the following assumptions:

i.   users are continuously on the move;
ii.   learning occurs outdoors-outside of classroom and lecture halls;
iii.   learning is based on current learning practices that facilitate successful learning; and
iv.   learning must consider personal and shared technology in terms of its ubiquitous use.

Previous research findings reported that mobile learning occurs outside the home and office (Sharples, et al., 2006).   Mobile learning occurs in the lecture room, outside the lecture room or other locations. However, Sharples et.al, (2006) noted that mobile learning has a few

important key elements; the interaction between students and learning is more important than the technology. The learning goal must be managed by the lecturers and understood by the students.

Distance Learner and Mobile Learning

According to Gregson & Jordaan (2009), mobile learning showed a significant result in the improved performance of distance learners. Another research finding from Muhammad Imran (2007) indicated that the implication of mobile learning could improve the entirety of distance education by promoting ways of communication among facilitators, distance learners and support staff. According to Muhammad Imran (2007), the implementation of mobile learning can provide assistance to distance learners in the following aspects:

- The outline of course content.
- The responses of the students.
- The technology support services to the distance learners.
- Links to the website and other electronic resources.
- Interaction among students, lectures and faculty.

Research has also proven that mobile devices allow learners to carry reference and communication tools with them into real-world environments easily. This flexibility permits learners to communicate with experts and peers, retrieve information just-in-time, update documentation of personal experiences, receive feedback immediately and assesses their learning progress easily. Further, lecturers can monitor their students by using mobile devices to interact with the learners and assess the learner progress on the spot. Similarly, findings from Issham, Thenmolli, Koh, & Rozhan (2010) showed a significant result between satisfaction and the implementation of the mobile learning method. The results also supported the claim that mobile learning helped students to clarify specific points. This learning method is also convenient to respondents since the text messages are powerful, brief and can be received on the spot.

Mobile Learning enhances Student Performance

In a study conducted by Hwang & Chang (2011), it was found that the mobile learning environment is helpful to improve students' learning achievements. Similarly, Ozan (2013) also viewed mobile learning as having positive effect on learners' performance by facilitating the management of the learning process. Previous studies further reported that mobile learners performed better in examinations (Thornton and Houser, 2005). From the findings, there is an unambiguous relationship between mobile learning and performance. Students who received learning materials from a mobile phone were 'prodded' into studying more often than those in

a conventional setting. In other words, 'delivering' learning materials with technology to students, produced positive results.

The emergence of evolving technologies has a significant impact on educational development. A number of researchers have reported the integration of technology in the process of teaching and learning as efforts to enhance students' performance, self-directed learning, teachers' productivity and teaching effectiveness (Malik & Shabbir, 2008; Jamil & Shah, 2011). The potentials of mobile technologies were studied for English language literature in secondary schools (Rahamat et al., 2011) and mathematics for primary schools (Mahamad et al., 2010). However, not many previous studies have investigated the effect of mobile learning for the economics subject.

Mobile Learning Enhances Student Learning Interest

Mobile learning is a more attractive learning method when compared with the text book in that it can trigger the motivation and interest of learners (Hwang & Chang, 2011). Thornton and Houser (2005) have widely investigated the use of mobile learning in campus. The findings revealed that students are the frequent users of mobile phones, especially texting messages. Thus, the potential of using a smart phone for learning can promote their learning interests. Other studies (Fatma Tansu & Ersun, 2014) have considered the use of mobile learning environments and the continuation of the learning process for the learners. The students showed interest in mobile learning cooperative methods also (Uzunboylu & Ozdamlı, 2011). In the study on mobile learning, Liaw, Hatala, & Huang (2010) found that student interest increased when online learning and published learning sources were used together. Thus, with the increase of learning interest, student academic performance will also improve.

Several studies showed the increase of student interest in mobile learning (Attewell, 2005; Nian, Wu & Yin, 2019; Talke, Singh., Raj, Patil, Jawalgekar & Shitole, 2019). The usage of mobile phones in learning allowed students to organize ideas, record information, interact and collaborate with peers as well as lecturers. It was proven that it can enhance learning and interest (Wu and Lai, 2009). Recent findings (Anatalyevna, et al. 2018; Pence, 2019) indicate an increased interest from educators in mobile learning which is equivalent to the increase of the number of the students who own mobile devices and that there is a consequent increase of student interest in online learning.

Method

The mixed method explanatory design (quan + qual) was employed in this study. The descriptive method was employed in the quantitative research and follow-up interviews were used as the qualitative method. The mixed method design is defined by Creswell and Plano

(2017) as a procedure for collecting, analyzing and linking both quantitative and qualitative data in a single study. The combination of quantitative and qualitative data provides a triangulation for the research rather than the mere use of one type of data.

Participants
Quantitative Samples

Random sampling techniques were employed in this study. A total of 152 distance learners from one of the universities in Penang was selected as a sample. There were only 60.8% of 250 respondents who answered the online questionnaire. All the respondents were freshmen in the Faculty of Economics. However, 79 of them had studied economics as a subject during high school and 73 of them were totally new to the economics subject.

Qualitative subjects

A total of six subjects were selected as interview subjects. They were selected using purposive sampling technique. Even though gender was not a selection criterion for this study, it was noted that an equal portion of male and female subjects was selected. There were three female subjects and three male students. The purpose of the interviews was to provide students with the opportunity to share their experience after the intervention. The interviews also provided information about how the intervention could be carried out more beneficially and effectively. An interview protocol was developed to guide the follow-up interviews. The five-question protocol was constructed by the researcher and contained open-ended questions that prompted the students to express their thoughts and feelings.

Instrument

A set of 25 items comprise the performance test and a set of semi-structured interview questions were used as instruments for the study. The performance assessment was constructed by the researcher. The performance test contained multiple choice items.

Data Collection and Analysis

Before employing the actual research, the lecturers and students had to attend a briefing to learn the relevant skills in mobile learning environment. The mobile software's framework was created by Jaquery and Jaquery mobile. The database was built by mysq1 and the script was written in PhP. A briefing was given when the distance learners attended their intensive course. QR code (Figure 1 below) and guideline of using mobile learning were distributed during the training session. Students could get immediate access online by using the smart phone with the QR code.

The distance learners needed to download the QR reader and scan the QR code. Users also had to register/sign up before using the app. This app could be logged into easily with the QR code and was free of charge. However, this software could only be read on mobile phones and was not accessible through laptops. Specifically, this would encourage gadget-oriented students to read on mobile phones anywhere and anytime because students could save the notes uploaded for the selected chapters. At the end of each chapter, a quiz was prepared to test student understanding of the content knowledge delivered. At the same time, students could also post their questions and views to the lecturers and friends at any time if they faced any problems. With the QR code, students could also scan learning materials and share their lessons in 'WeChat' or online.

Figure 1: Qr Code

The intervention took eight weeks. After the intervention, all the distance learners needed to sit for the Principles of Economics assessment in the mobile app. In addition, the distance learners needed to answer the questionnaire in the mobile app. All the data were analysed using SPSS. Follow-up interviews were conducted with three male and three female students. The main questions revolved about their experiences in using the smart phone learning and other questions probed their opinions about the advantages and disadvantages of mobile learning. The researcher tape-recorded all the distance learners' answers and recorded their answers on the interview protocol sheet. A semi-structured interview approach was employed. The researcher was instructed to prompt students to further explain or clarify responses to the interview questions until their responses were deemed completed.

Pilot test

Before conducting the actual research, a pilot test was carried out to examine the validity and reliability of the instruments. Prior to the pilot study, the same syllabus was taught to a group of 47 students in a public university who were not going to participate in the actual study. Content validity of the questionnaire was checked by a group of expert teachers and a performance assessment was established by a team of lecturers in education. Meanwhile the reliability of the questionnaire was estimated by calculating the Cronbach alpha coefficient value .951. This result is in line with the benchmark that an instrument with the coefficient of 0.70 or above has a high reliability standard (Sekeran and Bougie, 2010). Therefore, all the items were found reliable and usable.

Findings
Analysis of Students' Performance

During the intervention, the respondents were required to answer the 25-item quiz questions that were based on the notes. The findings revealed the performance of the participants as illustrated in Figure 2 below . Overall, there were 0.7% respondents (n=1) who scored full marks 100 and 3.9% (n=6) students who obtained 4 marks.

Figure 2. Students' Performance
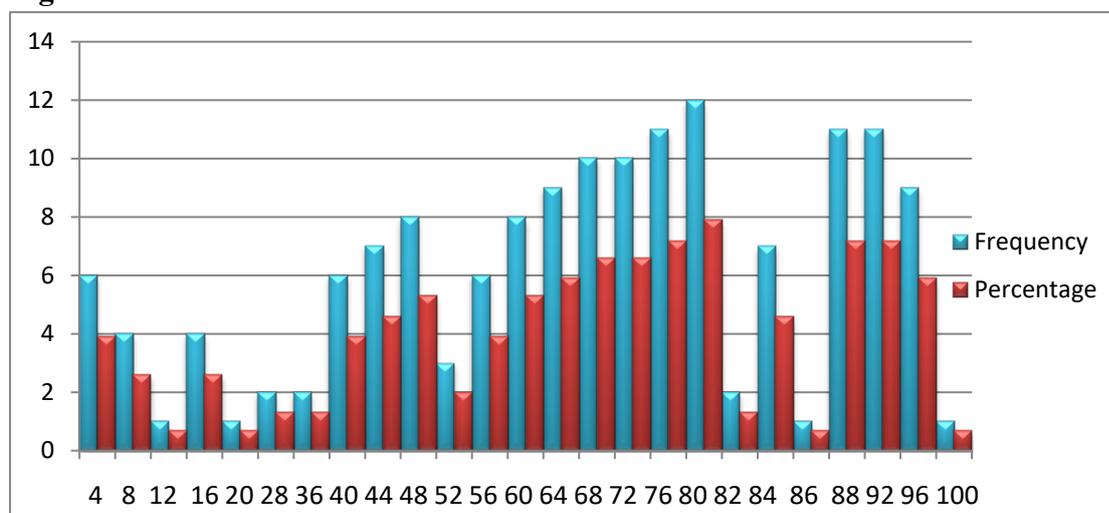
The majority of them obtained scores between the range of 80-68 marks. There were 7.9% (n=12) students who scored 80, 7.2% (n=11) students scored 76 marks, 6.6% (n=10) students scored 72 marks and also 6.6% (n=10) students scored 68 marks. Overall, 73% (n=111) of the distance learners passed the examination as 50 marks was the passing marks.

 Testing of Hypothesis Ho1
Before conducting the GLM Univariate, Levene's Test of Equality of Error Variance was tested. Levene's test is significant (p=.000, p<.05) and that means the variances are significantly different, thus the assumption is violated. In addition, the assumptions of independent observations and normal distribution of each group were checked.

Table 1 below shows a significant interaction between the effects of economics uptake during secondary school and students' interest on economics performance, F (1,60)= 2.486, P<.05 The interaction showed significant effect on students' interest and economics uptake with F= (1,32)=1.963, p <.05 mean square =336.001, respectively. This finding indicated that students' who had taken economics in secondary school have higher level of interest and also performed better as compared to those who did not take economics in secondary school.

The findings rejected the hypothesis (Ho1) showing that there was significance between the students' performance.

Table 1: Two-Way Analysis of Variance for performance on a function of students' interest and economics in secondary

Variable	df	MS	f	p
Performance	1	928.394	5.424	.000
Interest	60	291.796	1.705	.022
Economics uptaken	1	35643.748	207.091	.000
Interest * economics in secondary	32	336.001	1.963	.013
Error	58			

Table 2 below shows the mean, standard deviation of performance, interest and students' up take of economics subject during secondary school for each cell. Games-Howell post hoc tests revealed that even students' interest was associated with economics uptake during secondary school. The students who had taken economics in secondary school (M=79.3, SD=8.879) outperformed the students who did not take economics in secondary school (M=43.09, SD=10.54).

Table 2: Means, standard deviation and total for performance on a function of economics uptake and students' interest

Dependent variables	Economics in secondary		Without Economics in secondary		Total	
	Min	SD	Min	SD	Min	SD
Students' interest	79.3	8.879	43.09	10.54	60.33	14.24

Distance Learners' Interviews after Intervention

All the distance learners agreed that mobile phone could assist them in learning. They explained that mobile learning was flexible as compared to laptops, they could learn anywhere and anytime. In addition, they could communicate with lecturers and share ideas with peers.

Paragraph 1

B1: "Learning with mobile phone is very flexible compared with learning with PC or
  in the portal; I can learn anywhere because it is easy to carry. I   even can lie
  on the bed and learn. We can bring the mobile with us even during working, during
  breaks can browse through the notes. What we need sometimes is just a paper."

B2: " It is useful because it is with the goal and more flexible, I have searched some web which is very useful."

B3: " It is easy to do revision wherever I am. It really helps and I   can fully use my free time especially adult learners like us."

G3 " I can learn everywhere. I can lie down and read and while taking   the afternoon tea also can read. I can online and communicate with   my lecturers and friends even late at night."

One of the distance learners, B3 also felt that mobile learning was suitable for adult learners because they could fully occupy their free time. It was useful and user-friendly.

The distance learners' responses indicated that all of them liked to log in with the QR code. Even though some of the distance learners were only experiencing using this application for the first time. All of them said that log in with QR code was convenient, faster and easier than the normal log in. B2 also stressed that with QR code, they were even able to access to 'Wechat' after reading the mobile online notes for discussion. Their responses are as follows:

Paragraph 2

B1:" It is an easy way to log in."
B2: "It is very useful because I can scan the QR code with Wechat and can transfer the material in Wechat. We can share or discuss our views with friends after reading. I know there are column for giving comments but sometimes we need some privacy so we can use it in Wechat."
B3: " QR code is easier for us to use but we need to download QR reader. It can save our time to log in."
G2: "This is my first time to use QR code but feel good."

The distance learners were then asked whether they encountered any problems when using mobile learning. The majority of them did not face any problem except with the speed of Internet and one of the distance learners found that the font was small because he was short sighted.

Paragraph 3

B2: "*The font is quite small because I am short-sighted.*"
B3: "*Not at all.*"

G3: "*The only problem is the line problem, if the line is fast then can get the respond very fast but if the line is slow is a problem.*"

Discussion, Implications and Conclusion

Mobile learning has become increasingly important in the era of Education 4.0 due to the high demand of users, especially distance learners. When distance learners are unable to cope or lose interest in their studies, mobile learning can tackle the problem. It allows distance learners to access anytime and anywhere with the assistance of the lecturers and peers. The distance learners will then not feel lonely on their learning journey.

This study has employed mixed method methodology which presented the statistical and interview data. From the study, it is determined that mobile learning had significant results on students' performance and Ho1 has been rejected. After the intervention of the mobile learning, distance learners showed good performance in their quiz. The findings revealed a significant of t-value (t=31.282, p =.000) and indicated the distance learners' performance after implementing the mobile learning. The interview with the lecturers also indicated that the distance learners' performance improved after implementing the mobile learning.

L1:"*... Overall, their performance is better in their final exam.*"

The results of the study found that distance learners who engaged in mobile learning can gain knowledge anytime and anywhere. The positive effects of mobile learning in improving learners' achievement have been supported by Thornton and Houser (2005), (Hwang & Chang, 2011), Ozan (2013)), Elaish, Shuib , Abdul Ghani, Yadegaridehkordi and Alaa (2017) and Ahmad (2018). The use of mobile phone is becoming more and more common and has become a necessity (Khairudin, Triatmaja, Istanto & Azman, 2019), therefore the design of mobile learning has created a social constructivist learning environment to suit the needs of distance learners. Significant changes in pedagogical approach and student participation was found to have affected academic performance positively.

The findings of this study are in line with the Sociocultural Learning Theory (Vygotsky, 1997) that states that learning occurs through interaction with social environment and not interpersonal. The findings are similar with the research conducted by Issham, Thenmolli, Koh, & Rozhan (2010) which indicate that this learning method helps students to revise on particular subjects and to clear any doubts. This learning method was also found to be convenient to the respondents since they could get feedback from lecturers and peers immediately.

The findings of this research have implications for educators. In terms of teaching and learning method, QR code quick access has the advantage of increasing the ubiquity of mobile learning amongst distance learners in line with current education trends. Since the findings showed that most students embrace mobile learning, educators should implement this teaching and learning method during their lesson preparation and delivery. This mobile learning creates the online learning experience (Tho & Yeung, 2017). However, there are limitations in this research because the researcher could only contact the interviewees during their intensive course. All of the interviewees are off campus, working adults.

The effectiveness of implementing technology to produce new opportunities for self-directed learning as an effort to enhance students' achievement has been widely discussed (Wang, 2017).). Time management and planning are the essential element for self-directed learning in an online learning environment (Mohd Muslim, Hasniza & Rosna Awang, 2019). Self-directed learners must be cognizant of their academic strengths and weaknesses in order to tackle the challenges in learning (Mazita & Mahani, 2010). Researchers have proven the potentials of mobile technologies (Mahamad et al., 2010; Rahamat et al., 2011; Deniz, Muge & Meltem, 2018) and there is a shared view Mahmut, Hakan and Tevfik (2018) that online learning brings satisfaction and motivation to learners.

Alternately, learner readiness to use the mobile applicaiton is essential to support the learning. Even when the mobile learning is widely implemented and readily accepted when the application is introduced there is always a challenge (Geng, Law & Nin, 2019). Without student readiness, no matter how effective the learning design, the outcome will not be achieved. Most of the distance learners were working adults and mature students and their readiness to accept new learning technology was not as fast as for young adults (Smith, 2014). Older adults face difficulties in adopting new technologies such as physical challenges like eye sight problems or difficulties in utilizing mobile phone functionality.

Based on the above findings, the following suggestions are posed in order to guide educators during course design based on mobile learning.

- Mobile learning is suitable for distance leaners but instructors need more time to prepare, therefore collaboration between instructors is suggested
- Prior training before the implementation of the application is important
- The application must be user friendly
- The applications must not require too many reading materials on one page
- The font in applications for reading materials must big enough for older adult learners
- The applications must have an allocated column for feedback
- The assessment after every topic must be provided

In conclusion, the implementation of mobile learning for distance learners was successful and improved student performance as compared to the conventional intensive course. The limitation of this study is the small sample size of the students involved and while 152 is considered an acceptable sample size for this research, future mobile learning research could focus on developing the application to enhance the critical thinking of distance learners with a larger student sample.

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