

Mobile Learning Services Acceptance Model among Higher Education Students

Dr. Naji Shukri Alzaza

Faculty of Information Technology

University of Palestine, Alzahra City, Gaza, Palestine

ABSTRACT

Mobile learning (m-learning) is considered the next form of e-learning using mobile technologies to facilitate education for teachers and learners anywhere and anytime. Engaging the m-learning services in the higher education could improve the availability of education. This study aims to develop a theoretical model for explaining and predicting student acceptance and use of m-learning services in the higher education environment. Students' perspective is very important to investigate the use behavior of m-learning in the higher education environment. Findings of the study suggest that the behavior intention to use the m-learning by students in the higher education environment have positive influence on the use behavior. Consequently, the availability of facilitating conditions is an important to influence students' use behavior. The study suggests several factors as important determinants of the behavior intention to use the m-learning in the higher education environment. Specifically, behavior intension to use appears to be adopted and facilitated by the usefulness of m-learning services, so more usefulness of m-learning leads to more acceptances among students in the higher education. Besides, the perceived service quality is important role in determining the level of behavior intention to use.

Keywords: *Mobile Learning Services, Mobile Learning Acceptance Model, Mobile Learning in Higher Education, e-learning*

I. 1.0 INTRODUCTION

Mobile services, and their internet based, have been widely emerged to daily life since 1999. Mobile services have been widely used in many areas such as education, health, entertainment, marketing, and banking. The occasional and sustained usage of such services in the higher education environment could encourage students to keep in touch with their education environment. Although the benefit of mobile technology is enormous and it enables learning services to be used anywhere and anytime, the application and adoption of the m-learning services is still need to tackle the obstacles that are preventing students' motivation to use such technology and the university to utilize such technology widely. Furthermore, insufficient research on m-learning adoption results in a lack of a complete view of m-learning adoption (Liu & Han, 2010).

Engaging the m-learning services in the higher education environment will improve the availability of education (Alzaza & Yaakub, 2011). This meets the priority of Malaysian higher education strategy to brand the education (Robertson, 2008). Moreover, Robertson (2008) highlighted that the number of international students in Malaysia had increased between 2006 and 2008 by 30 percent. Hence, these motivate researcher to study the students' acceptance of m-learning services in the higher education environment.

II. THEORETICAL FRAMEWORK AND HYPOTHESES

The theoretical constructs pertinent to this study are consumer (student) acceptance, adoption, and behavior prediction. Two of the well-established adoption and intention models, Technology Acceptance Model (TAM) and Innovation Diffusion Theory (IDT), can help develop a solid theoretical foundation for this study. Williams (2009) concluded that Unified Theory of Acceptance and Use of Technology (UTAUT) model did not provide as much insight into m-learning environment as it had when applied to other technology contexts.

A. Technology Acceptance Model (TAM)

Theory of Reasoned Action (TRA), proposed by Ajzen and Fishbein (1980), is well-established model that has been used broadly to predict and explain human behavior in various domains (Wu & Wang, 2005). Based on TRA, TAM was designed to explain the determinants of user acceptance of a wide range of end-user computing technologies (F D Davis, 1986).

The original TAM consisted of perceived ease of use (PEOU), perceived usefulness (PU), attitude toward using (ATU), behavioral intention to use (BI), and actual system use (AU). PU and PEOU are the two most important determinants for system use. The ATU directly predicts users' BI which determines AU. PEOU refers to the degree to which a user believes that using a particular service would be free of effort while PU is defined as the degree to which an individual perceives that using a particular system would enhance his or her job performance (Davis, 1989). However, PEOU and PU are the key beliefs leading to user acceptance of information technology (Liu & Han, 2010).

Venkatesh and Davis (2000) proposed an extension, TAM2, which included social influence processes (subjective norm, voluntarism, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and PEOU), but it omitted ATU due to weak predictors of either BI or AU.

B. Innovation Diffusion Theory (IDT)

IDT is another well-established theory for user adoption; it is proposed by Rogers (1962, 1983, 1995, 2003). Innovation diffusion is achieved through users' acceptance and use of new ideas or things (Zaltman & Stiff, 1973). The theory explains, among many things, the process of the innovation decision process, the determinants of rate of adoption, and various categories of adopters, and it helps predict the likelihood and the rate of an innovation being adopted. Rogers (1995) stated that an innovation's relative advantage, compatibility, complexity, triability and observability were found to explain 49 to 87 percent of the variance in the rate of its adoption.

- i. *Relative advantage* is the degree to which an innovation is perceived as being better than the idea it replace.
- ii. *Compatibility* is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters.
- iii. *Complexity* is the degree to which an innovation is perceived as relatively difficult to understand and use. In general, more complex, or less well understood innovations are more difficult to adopt.
- iv. *Triability* is the degree to which an innovation may be experimented with on a limited basis. Adoption becomes much easier if adopter can try an innovation on a small scale.
- v. *Observability* is the degree to which the results of an innovation are visible to others. The rate of adoption increases with visibility.

These characteristics are used to explain the user adoption and decision making process (Wu & Wang, 2005). They are also used to predict the implementation of new technological innovations and clarify how these variables interact with one another. The central concept of innovation diffusion is "the process in which an innovation is communicated through certain channels, over time, among the members of a social system" (Rogers, 1995, 2003). However, several researches (Agarwal & Prasa, 1998; Tornatzky & Klein, 1982) have suggested that only relative advantage, compatibility and complexity are consistently related to the rate of innovation adoption.

C. Combination of Tam2 and IDT Models

Based on TAM and IDT models, the base model for studying student acceptance of m-learning services is displayed in Figure 1. Empirical studies have suggested that TAM be integrated with other acceptance and diffusion

theories to improve its predictive and explanatory power (e.g. (Hu, Chau, Sheng, & Tam, 1999; Wu & Wang, 2005)). By including the compatibility (C) construct of IDT, the model is able to address the social context in which m-learning takes place. Compatibility is evaluated by assessing the innovation's compatibility with existing values and beliefs, previously introduced ideas, and potential adopters' needs (Rogers, 2003). Like PEOU, C is suspected to have a significant impact on PU. The rationale behind this assumption is that if a student finds using an m-learning service compatible with his or her needs and lifestyle, the student will consider the m-learning services useful.

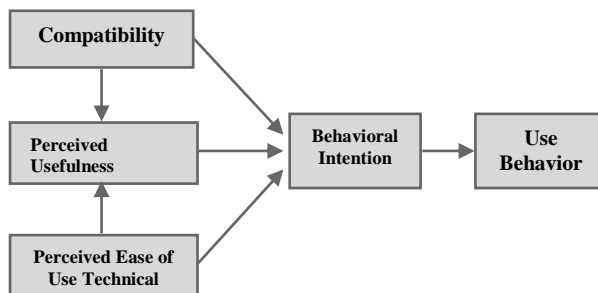


Figure 1: Based Model for Student Acceptance of m-learning

It also needs to be noted that although initial acceptance of an m-learning service is important, the student's continuance in using the m-learning service is equally, if not more, important. As an extension to the TAM research, the number of studies has addressed the important issue of Information System (IS) continuance in the recent few years. Parthasarathy (1998) and Bhattacharjee's (2001) works profiled potential discontinuity of a technology. They suggested that the potential factors of discontinuity could be identified based on the sources of the influence for users initial adoption (interpersonal), perceived usefulness, perceived compatibility, service utilization, and the usage of complementary product.

Adopting the Expectation-Confirmation theory, Bhattacharjee (2001) empirically proved that the decision of IS continuance was influenced by the user's satisfaction with the IS, which was a direct result of the confirmation or disconfirmation of the user's expectation. By the same token, students who will potentially discontinue using an m-learning service can be identified based on their confirmation / satisfaction and usage level of the m-learning service during the initial adoption.

The strong theoretical and empirical support for TAM and IDT ensures the validity of the base model in electronic commerce domain; however, the base model possesses a weakness inherited from TAM. While TAM has

been very successful in predicting the potential user acceptance, it provides little assistance in the design and development of systems with a high level of acceptance. One remedy for this weakness is to identify the determinants of PU, PEOU, and BI to supply system designers with meaningful solutions (Venkatesh & Davis, 1996). These determinants can also be used to help identify the student's confirmation and satisfaction level of an m-learning service, which has significant implications on predicting the student's continuance of usage. Hence, the next step in this study is to identify a list of students' acceptance factors that m-learning services need to focus on. The factors outlined in the next section will be incorporated in the final research model and will be tested for validity.

III. RESEARCH MODEL FACTORS

M-learning needs to tackle the obstacles that are preventing students' motivation to use such technology. This study takes the CSF approach to identify the key areas where things must go right for the m-learning to flourish. Identifying CSFs is a well-accepted practice that allows businesses to focus on a limited number of areas in which satisfactory results ensure successful competitive performance (Digman, 1990).

A. Perceived Service Quality

Perceived service quality is a recurring research issue for IS discipline. Service quality is crucial to its success. Perceived service quality is defined as the discrepancy between what customers (students) expect and what customers (students) get. It is also acknowledged as one of the measures of IS success (Pitt, Watson, & Kavan, 1995). Currently, m-learning courses and products are mostly sold as a kind of education products, such as in USA and China. M-learning users therefore gain a role as consumers as well. For customers perceived quality of products or services impacts customer's intentions to use them. Perceived quality is defined by Zeithaml (1988) as "the consumer's judgment about a product's overall excellence or superiority". Quality research tends to be most important stream of services research. Parasuraman, Zeithaml, and Berry (1988) identified five dimensions which consumers use to evaluate service quality. They are tangibles, reliability, responsiveness, assurance, and empathy.

Service quality has an affects users' acceptance intention. Furthermore, it has a positive causal relationship between the perceived overall service quality and a user's satisfaction towards a web portable (Liu & Han, 2010). Chiu, Hsu, Sun, Lin, and Sun (2005) and Liaw (2008) found that perceived quality is a significant predictor of perceived satisfaction with e-learning.

Gefen and Devine (2001) found that service quality effectively reduces the effects of perceived risk, cost to switch and relative price, thus creates more attention for m-learning usage. However, the quality of m-learning delivered would affect the perceived quality of services as a whole (Liu & Han, 2010). Therefore, the perceived service quality is an important determinant of students' attitude towards using m-learning.

B. Perceived Trust

A number of studies suggest that the reason why many people have not yet used online services is due to the lack of trust in online businesses (L. Chen, Gillenson, & Sherrell, 2004; Gefen, 2000; Hoffman, Novak, & Peralta, 1999). However, user trust can be defined as feeling secure and confidence about relying on service. In the mobile services environment trust get an important factor for user to accept it (Kaasinen & Finland, 2007). Moreover, it has a positive influence on the development of positive user intention to use (L. Chen et al., 2004). Gefen (2000) found that familiarity, which was defined as an understanding of what, why, where, and when other parties do what they do, also contributes to trust in e-commerce situations.

Moreover, Prior research suggested that trust can be built up through interactions. In the context of m-learning, the influencing factors for students' lack of trust in wireless technology are found to be personal information privacy and data security concerns. According to a survey conducted in 1999, privacy is the number-one consumer issue facing the Internet (Benassi, 1999).

Hoffman et al. (1999) suggested that personal information privacy concerns are represented in two dimensions: environment control and secondary use of information control. Environment control refers to consumers' ability to control the action of m-learning services, and secondary use of information control refers to consumers' ability to apply control over m-learning service's use of the information for other purposes. When these two controls are perceived to be low, consumers are leery about giving personal information over the Web. Students' lack of trust is also partly due to their data security concerns. Information sent over the Internet travels through many unsecured computer systems, and it is at risk of interception and misuse. Many consumers are still hesitant about transmitting private information, especially financial information, over this open electronic network. Nevertheless, generally, m-commerce customers require more assurance of privacy protection and more control over the personal information that can be released (Khalifa & Shen, 2006).

However, if m-learning is not able to effectively demonstrate its commitment to superior data security technologies, few students will feel comfortable entrusting the m-learning services with their sensitive information. Information exchange in a trustful environment is an essential part of electronic commerce (L. Chen et al., 2004). Student trust can only be inspired if the risks associated with wireless connection are reduced to a level that is tolerable to students.

The theory of perceived risk has been applied to explain consumer's behavior in decision making since the 1960s (Taylor, 1974). The definition of perceived risk has changed since online transactions became popular. In the past, perceived risks were primarily regarded as fraud and product quality. Today, perceived risk refers to certain types of financial, product performance, social, psychological, physical, or time risks when consumers make transactions online (Forsythe & Shi, 2003).

C. Facilitating Condition

Facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system. This definition captures concepts embodied by three different constructs: perceived behavioral control, facilitating conditions, and compatibility (Viswanath Venkatesh, Morris, Davis, & Davis, 2003). Each of these constructs is operationalized to include aspects of the technological and/or organizational environment that are designed to remove barriers to use. Taylor and Todd (1995) acknowledged the theoretical overlap by modeling facilitating conditions as a core component of perceived behavioral control in Theory of Planned Behavior (TPB)/DTPB. The compatibility construct from IDT incorporates items that tap the fit between the individual's work style and the use of the system in the organization.

The empirical results of Viswanath et al. (2003) study indicated that facilitating conditions do have a direct influence on usage beyond that explained by behavioral intentions alone. Moreover, their study found that there is no significant influence on behavioral intention to use. Consistent with TPB/DTPB, facilitating conditions are also modeled as a direct antecedent of usage.

D. Cost of Service

According to behavioral decision theory, the cost-benefit pattern is significant to both perceived usefulness and ease of use. Chen and Hitt (2002) pointed out that consumers must deal with non-negligible costs in

switching between different brands of products or relative services in various markets. Transitioning from wired Electronic Commerce (EC) to MC implies some additional expenses. Equipment costs, access cost, and transaction fees are three important components that make MC use more expensive than wired EC (Constantinides, 2002). Furthermore, frustrating experiences, such as slow connections, poor quality, out-of-date content, missing links, and errors have infuriated online users. Unfortunately, consumers must pay for all these frustrations.

Undoubtedly, the anticipation is that these early investments will lead to a long-term stream of profits from loyal customers, and that this will make up for the expense. Otherwise, MC will not thrive because users can obtain the same information or results through alternative solutions (Wu & Wang, 2005).

Khalifa and Shen (2006) investigated the influence of services' price on potential adopters of m-commerce, they noted that m-commerce providers need to pay particular attention to their pricing strategy. Furthermore, Chiu and Wang (2008) found that cost of service has a major influence on students' learning behaviors adoption. Indeed, "adopters of m-commerce are highly sensitive to the issues of cost and privacy" (Khalifa & Shen, 2006). However, Wu and Wang (2005) concluded that although cost is one of major concerns in the initial stage, it has the less influence on users' behavioral intent than perceived risk, compatibility, and perceived usefulness. Furthermore, they provided some explanations for this based on the interviewed users as follow: (1) when there is an emergency or sudden need; the MC utility benefits will definitely outweigh the factor of cost. (2) Although the expenses for using MC are higher than Internet EC, users are still able to afford it.

IV. RESEARCH HYPOTHESES

The five potential CSFs are incorporated with the base model to form the final research model for this study (See Figure 2). This study intends to develop a theoretical model for explaining and predicting student acceptance and use of m-learning services in the higher education environment. The model adopts TAM's and IDT's belief - intention - behavior relationship. It hypothesizes that the use behavior of an m-learning (USE) is immediately determined by a student's behavioral intention to use (BI) (Viswanath et al., 2003). Based on this, the following hypothesis is proposed:

H1: A student's behavioral intention to use an m-learning service has effect on use behavior of the m-learning services (BI → USE).

As Parthasarathy (1998) and Bhattacharjee (2001) found in their researchs, online service utilization ensured continuance in service adoption. Therefore, both intention to use and actual usage were employed to measure student acceptance of m-learning in this study for these reasons.

The model expands the belief concept in TAM and IDT by including five more constructs: perceived service quality (SQ), perceived Trust (T), facilitating condition (FC), and cost of service (CS). The inclusion of perceived service quality represents the service-oriented aspect of m-learning, and the inclusion of perceived Trust addresses a common concern of students about mobile technology and the Internet in general.

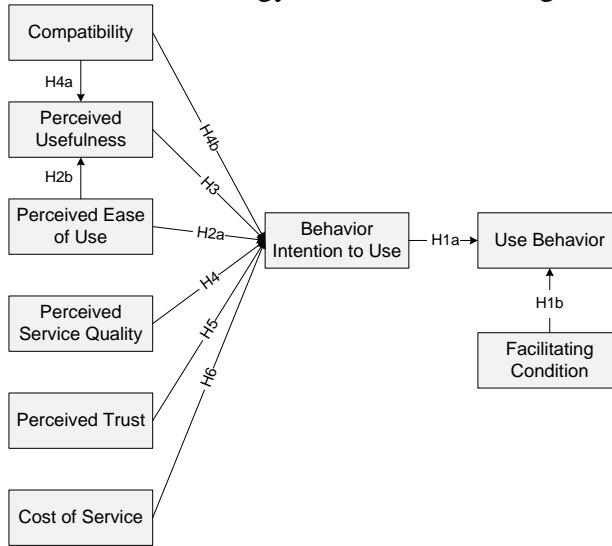


Figure 2: Proposed Research Model for Students' Acceptance of m-learning Services

The model proposes that PU, PEOU, C, SQ, T, FC, and CS form a student's attitude about an m-learning. Based on this, the following hypotheses are proposed:

H2a: A student's perceived ease of use of an m-learning service has a direct effect on behavioral intention to use the m-learning service (PEOU → BI).

H2b: A student's perceived ease of use of an m-learning service has a direct effect on perceived usefulness of the m-learning service (PEOU → PU).

H3: A student's perceived usefulness of an m-learning service has a direct effect on behavioral intention to use the m-learning service (PU → BI).

H4a: The compatibility has a direct effect on perceived usefulness of the m-learning service (C → PU).

H4b: The compatibility has a direct effect on behavioral intention to use the m-learning service ($C \rightarrow BI$).

H6: A student's perceived service quality of m-learning service has a direct effect on behavioral intention to use the m-learning service ($SQ \rightarrow BI$).

H7: A student's perceived Trust has a direct effect on behavioral intention to use the m-learning service ($T \rightarrow BI$).

H8: the facilitating condition of m-learning service has a direct effect on actual use of the m-learning services ($FC \rightarrow USE$).

H9: The cost of m-learning service has a direct effect on behavioral intention to use the m-learning service ($CS \rightarrow BI$).

V. METHODOLOGY

A. Study Population and Sample

A purposive (non-probability) sampling method was used in selecting the participants (subjects). In Malaysia, within the sphere of the ministry of higher education's control, there are 20 full-fledged public universities, 21 polytechnics and 37 community colleges in Malaysia today. The public universities can be further divided into four research universities, four comprehensive, and twelve focused universities (Ministry of Higher Education [MOHE], 2011). Subjects of the study were the students of the five public higher education of Malaysia: Universiti Utara Malaysia (UUM), Universiti Malaya (UM), Universiti Sains Malaysia (USM), International Islamic University of Malaysia (UIAM), and Universiti Putra Malaysia (UPM).

To determine the sample size, the study used the rule of thumb by Roscoe (1975) by multiplying the number of variables by 10. The model of the adoption and use of m-Learning services consisted of nine variables. Therefore, following the rule, the minimum sample size required is 90. However, to ensure this minimal response number, 623 questionnaires were distributed to both undergraduate and postgraduate levels, male and female from distinctive universities and various courses. Indeed, the questionnaire was pilot tested with 33 students.

B. Data Collection Procedure

Both primary and secondary data were collected for this research part. The primary data was collected by distributing questionnaires (survey) to the students of five public Malaysian universities that are UUM, UM, USM, UIAM, and UPM. Those students are different in terms of education: Science Business and, Art Studies; and education level: bachelor, Master,

PhD. The survey was conducted to answer the research question: “What are the factors that influence the acceptance and use of m-learning in the higher education environment?”

The instrument comprises four sections that are general information; using m-learning services; m-learning services acceptance factors; m-learning services. Some of the sections' items were generated from previous research and modified to fit the context of m-learning when necessary. New items were developed through a thorough literature review on the topics.

Section A (General Information) was not containing any personal identifiable questions. The general information functions as a mechanism to collect users' demographic data and users' experience and knowledge with the mobile technology media. The general information used in this section is gender, age, education, current study program, own mobile device, mobile device type, mobile applications experience, wireless connection used, mobile service provider. This section was adapted from Khalifa and Shen (2006); Karim, Darus, and Hussin (2006); and Walton, Childs, and Blenkinsopp (2005).

Section B contains questions to determine the m-learning services that often use in the higher education environment. The respondents were given a list of nine services that could be available at their universities. Participants were given a chance to add more mobile services that may use, other than the nine listed. A five point Likert scale type was used and students were required to state the extent to which services in their point of view were important or not important for them as students. The scale was started from 1= Lowly to 5= highly. Questions in this section were adapted from Karim et al. (2006).

Section C covers nine subsections that include the following: use behavior, behavior intention to use, perceived usefulness, perceived ease of use, compatibility, perceived service quality, perceived trust, cost of service, facilitating condition. All participants' answers for subsection should be based on the m-learning services that they have chosen in section B.

Subsection 1 contains questions that targeted at use behavior of m-learning services in the higher education environment. The respondents were given two questions. The first was whether the participant uses m-learning services frequently. A five point Likert scale type was used for the first question. Second question targeted at how often use m-learning services. Respondents were given four frequent periods that are daily, weekly, monthly, and a few times a semester, then they asked to report the approximate number of times they used the m-learning services. Although both questions can be used to as alternative measures for usage; Igbaria,

Zinatelli, Cragg, and Cavaye (1997) suggested that frequency provided a different perspective of usage from the actual number of times of use, hence they are both employed in this section to measure actual usage. Questions in this subsection were adapted from Chen et al. (2004), with minor modifications just make them suitable for m-learning services context.

Subsection 2 contains questions that targeted at behavioral intention to use m-learning services in the higher education environment. Four items were used to measure the behavioral intention of respondents towards using of m-learning services in their higher education environment. Questions in this subsection were adapted from Venkatesh et al. (2003) with modifications to make them suitable for m-learning services context.

Subsection 3 contains questions concerning the perceived usefulness to use m-learning services in the higher education environment. Six items were used to measure the respondents' perception towards usefulness to use m-learning services in their higher education environment. Questions in this subsection were adapted from Davis et al. (1989) with modifications to make them suitable for m-learning services context.

Subsection 4 contains questions targeted at the perceived ease of use m-learning services in the higher education environment. Six items were used to measure the respondents' perception that used m-learning services in their higher education environment and found them easy to use. Questions in this dimension were adapted from Davis et al. (1989) with modifications to make them suitable for m-learning services context.

Subsection 5 contains questions concerning the facilitating conditions of m-learning services in the higher education environment. Four items were used to measure the respondents' perception towards availability of the facilities needed for actual use of m-learning services in their higher education environment. Questions in this subsection were adapted from Venkatesh et al. (2003) with modifications to make them suitable for m-learning services context.

Subsection 6 contains questions targeted at the compatibility of m-learning services in the higher education environment. Three items were used to measure the degree to which using m-learning services is compatible with the most aspects of their education purposes and information seeking; their lifestyles, and their engaging in the higher education environment. Questions in this subsection were adapted from Chen et al. (2004) and Moore and Benbasat (1996) with modifications to make them suitable for m-learning services context.

Subsection 7 contains questions targeted at the perceived service quality of m-learning services in the higher education environment. Twelve items

were used to measure the performance based of using m-learning services in the higher education environment. This subsection reflects five dimensions with which respondents use to evaluate service quality: tangibles, reliability, responsiveness, assurance, and empathy. Questions in this subsection were adapted from Chen et al. (2004) and Cronin and Taylor (1992) with modifications to make them suitable for m-learning services context.

Subsection 8 contains questions targeted at the perceived trust of using m-learning services in the higher education environment. Eight items were used to measure the information privacy aspect of perceived trust of using m-learning services in the higher education environment. This subsection reflects four dimensions of students' information privacy concerns: collection, errors, unauthorized secondary use, and improper access. Questions regarding students' security concerns are included to reflect the data security aspect of trust. Questions in this subsection were adapted from Chen et al. (2004) and Smith, Milberg, and Burke (1996) with modifications to make them suitable for m-learning services context.

Subsection 9 contains questions concerning the cost of using m-learning services in the higher education environment. Three items cover the cost of mobile device, access cost, and transaction fees; were used to measure the respondents' perception towards use of m-learning services in their higher education environment. Questions in this subsection were adapted from Wu and Wang (2005) with modifications to make them suitable for m-learning services context.

Section D contains questions to determine the m-learning services that would like to use in the higher education environment. The respondents were given a list of nine services that may available at their universities. Participants were given a chance to add more mobile services that may use, other than the nine items listed in the questionnaire. A five point Likert scale type was used and students were required to state the extent to which services in their point of view were important or not important for them as students to use. The scale was started from 1= Lowly to 5= highly. Respondents were given a space to register their comments and opinions about m-learning services from their point of view. Questions in this section were adapted from Karim et al. (2006).

VI. FINDINGS

A. Data Overview

To increase the credibility of the response rate, the questionnaires were distributed to students during their stay in the classrooms. This way provided an opportunity to clarify the objective of the study, and

encouraged them to be accurate in the questionnaire filling (Alzaza & Yaakub, 2011). Each respondent took approximately 20 minutes to complete the entire questionnaire. As expected, after conducting pilot test, there were some confusion on the sentences in the questionnaire, thus some amendments were made to the final version.

For data collection purposes, 623 questionnaires were distributed to higher education students in five public Malaysian universities out of twenty universities. Out of this number, 28 questionnaires were excluded because they were incomplete. Thus, a total of 595 responses were usable and used for subsequent analysis, giving a response rate of 95.5 percent. The sample size appears to be adequate and response rate obtained from students as respondents in higher education environment (Walton et al., 2005).

B. Profile of the Respondents

While majority (67.9%) of the respondents are females, (32.1%) of the respondents are males. This consistent with the current distribution of students in the Malaysian higher institutions (MOHE, 2009). It is reported that the majority of students (60.1%) are females while (39.9%) are males. Most of the respondents are young, where 73.1% are aged between 20 and 25 years, 21% are aged less than 20 years. However, only 5.9% are above 30 years old. Despite science background and business background made up the largest groups of respondents 31.4% and 44.2%, respectively, art studies were only 14.1% followed by Engineering (5.5%) and Arts (4.7%), respectively.

It is not surprising that majority (90.4%) of participants were in Bachelor level. This is reflecting the current practice of learning facilities in the higher education. However, master degree was 9.2% and PhD was 0.3% only. This result reflects the nature of the higher education environment that the Bachelor students who are the most interaction with the university daily services. Moreover, this is consistent with the distribution of students in the Malaysian higher education where MOHE (2009) reported that the majority of students in the public higher institutions are bachelor (84.8%) followed by Master degree (11.3%). The PhD is only 3.8%.

99.5% of the participants declared that they own a mobile device. Among those who own mobile devices, 90.8% own mobile phone and 6.4% own smart phone, while only 2.7% own PDA. In terms of mobile application experience 43.9% have less than 5 years of using the mobile application experience; 48.5% 9 have experience between 5 and 9 years; while only 7.2% have more than or equal 10 years. This indicates that the respondent experience, in terms of mobile application, is respectable and meet with results of Alzaza and Yaakub (2011).

This study also examined the data on how participants connect through the wireless networks, 48.7% of participants are connecting through GPRS and 35.5% connecting through Wi-Fi, while 15.8% have no knowledge or experience before about the terms of wireless network connection. Regarding the mobile service provider, MAXIS (40.8%) was made up the highest rate followed by CELCOM (37.1%) and DIGI (22%). This consistent with the result of the preliminary study that found MAXIS (44.8%) users made up the highest rate followed by CELCOM (34.5%) and DIGI (20.7%)

To conclude, the above discussions indicate that the sample of this study does not deviate significantly from the general population of students in Malaysian higher education and the sample is therefore deemed representative of the population of interest.

C. Validity and Reliability Testing

Most of the items used to measure the variables have been adopted from the literature. Even though the adopted measurements have been confirmed of its discriminate and convergent validity, it is felt necessary to re-examine the validity of these measures. This is because this study is undertaken in the Malaysian context which may be different from other countries. The existing literatures on adoption and diffusion of technology have been done in other countries, particularly in the euro-countries where the environment and culture are entirely different from Malaysia.

In order to ascertain whether the measurements used in this study have construct validity, that is, measure what they are supposed to measure, exploratory factor analysis was conducted on all items measuring the constructs of Use Behavior, Behavior Intention to Use, Compatibility, Perceived Usefulness, Perceived Ease of Use, Perceived Service Quality, Perceived Trust, Cost of Service, and Facilitating Condition.

Table 1 below summarizes the reliability test of all measures after factor analysis has been done, all items of Compatibility factor were eliminated. The Cronpach Alphas of the measures were all comfortably above the lower limit of acceptability that is $\alpha \geq .7$. Hence, all the measures were highly reliable.

Table 1: Reliability Coefficients for all the variables

| Variable | # of items | Reliability |
|---------------------------|------------|-------------|
| Use Behavior | 2 | .777 |
| Behavior Intention to Use | 4 | .918 |
| Perceived Usefulness | 6 | .920 |
| Perceived Ease of Use | 6 | .900 |

| Variable | # of items | Reliability |
|---------------------------|------------|-------------|
| Perceived Service Quality | 12 | .908 |
| Perceived Trust | 8 | .890 |
| Cost of Service | 3 | .895 |
| Facilitating Condition | 4 | .748 |

D. Descriptive statistics

Descriptive statistics for the final list of variables of the study are shown in Table 2. With the exception of second item of *User Behavior*, the scale measurements used is a five-point Likert scale. The ranges of five point Likert-scales were categorized into equal sized categories of low, moderate, and high. Therefore, scores of less than 2.33 [$4/3 + \text{lowest value (1)}$] is considered as low; scores of 3.67 [$\text{highest value (5)} - 4/3$] is considered high; and those in between considered moderate.

The mean values for all variables (i.e. Behavior Intention to Use, Perceived Usefulness, Perceived Ease of Use, Facilitating Condition, Perceived Service Quality, Perceived Trust, and Cost of Service) fall in the range of 2.98 and 3.53. Indeed, respondents are generally moderate in all variables towards the m-learning services use. However, with standard deviation of all variables are fall in the range .60 and .88, it indicates that statistically, the variation of Behavior Intention to Use, Perceived Usefulness, Perceived Ease of Use, Facilitating Condition, Perceived Service Quality, Perceived Trust, and Cost of Service among respondents are high.

Table 2: Descriptive Statistics for All Variables

| variable | <i>M</i> | <i>SD</i> |
|---------------------------|----------|-----------|
| Behavior Intention to Use | 3.1791 | .86509 |
| Perceived Usefulness | 3.4316 | .76964 |
| Perceived Ease of Use | 3.3453 | .70922 |
| Facilitating Condition | 2.9868 | .69469 |
| Perceived Service Quality | 3.1754 | .60999 |
| Perceived Trust | 3.3511 | .73833 |
| Cost of Service | 3.5356 | .88982 |

E. Correlation Analysis

The values of the correlation coefficients (r) indicate the strength of the relationship between variables. The computation of the Pearson product-moment correlation coefficients was performed to obtain an understanding of the relationship between all the variables in the study. Preliminary

analyses were performed to ensure no violation of assumptions of normality, linearity, and homoscedasticity (Hair, Black, Babin, Anderson, & Tatham, 2009; Pallant, 2007).

Overall correlation values of the variables showed significant correlations coefficients. Furthermore, correlations amongst the measures of Use Behavior, Behavior Intention to Use, Perceived Usefulness, Perceived Ease of Use, Facilitating Condition, and Perceived Service Quality significantly correlated. However, the strong correlation were between *Behavior Intention to Use* and *Perceived Usefulness* ($r=.617$); *Perceived Ease of Use* and *Perceived Usefulness* ($r=.653$); *Behavior Intention to Use* and *Facilitating Condition* ($r=.609$); and *Perceived Service Quality* and *Facilitating Condition* ($r=.551$).

Despite Perceived Trust had significant correlation between all variables except Use Behavior, the strength was weak and fall in the range ($r=.13$) and ($r=.26$). However, the significant correlation between Perceived Trust and Cost of Service was medium ($r=.301$). With regards to Cost of Services and Behavior intention to Use; and Cost of Services and Use Behavior, the correlation is negative but also not significant.

F. Hypothesis Testing

In order to answer the research questions, that determine the factors those determine students' acceptance and use of m-learning in the higher education, regression analyses were conducted. However, before conducting the analysis, the data were first examined to detect whether there is any serious violations from the basic assumptions underlying the regression analysis, namely linearity, normality and homoscedasticity (Hair et al., 2009; Pallant, 2007).

The first assumption, linearity is assessed through an analysis of partial plots. The plots in Appendix G show the relationship between a single independent variable to the dependent variable. A visual examination of the plots indicated that there was no obvious U-shaped or other curvilinear relationship. Indeed, meeting the assumption of linearity for each independent variable.

The next assumption deals with homoscedasticity. As suggested by Hair et al. (2009) and Pallant , to show the existence of homoscedasticity, diagnosis is made by plotting the residuals (studentized) against the predicted dependent values and comparing them to the null plot. The scatter plots show no discernible patterns, thus, indicating homoscedasticity in the multivariate (the set of independent variables) case.

The final assumption that is normality is examined by normal Probability-plot (P-P) of the residuals. From the normal p-p plot, the values fall along the diagonal with no substantial or systematic departures, seating that the residuals are about normal distributed.

Overall, inspection on data revealed that there was no serious violation of the basic assumptions. Therefore, the use of regression for subsequent analysis is appropriate.

The interpretation of the regression analysis is based on the standardized coefficient beta (β) and R² which provides evidence whether to support the hypotheses stated earlier in the chapter or not.

Regression Analysis on the influence of Behavior Intention to Use on Use Behavior

In this analysis, *Behavior Intention to Use* and *Facilitating Condition* are treated as the independent variables, whereas *Use Behavior* as the dependent variable. Through regression analysis procedure, the model (*Behavior Intention to Use* and *Facilitating Condition*) explain 27.1 percent ($R^2 = .271$) of the variance in *Use Behavior*. Moreover, the model reaches statistical significance (Sig. = .000, this really means $p < .0005$). Table 3 shows that *Behavior Intention* positively influences *Use Behavior* ($\beta = .321$). Consequently, *Facilitating Condition* positively influences *Use Behavior* ($\beta = .290$). Therefore, Hypothesis H1a and H1b are supported.

Table 3: The influence of Behavior Intention to Use; and Facilitating Condition on Use Behavior

| | Unstandardized Coefficients | | Standardized Coefficients | |
|----|-----------------------------|------|---------------------------|------|
| | B | SE B | β | Sig. |
| BI | .193 | .024 | .321 | .000 |
| FC | .217 | .030 | .290 | .000 |

F= 75.6; Sig. F= .000; N= 585; Dependant Variable: USE

Regression Analysis on Factors influencing Behavior Intention to Use

Multiple regression analyses were conducted to test the hypotheses H2a, H2b, H3, H4, H5, and H6. In this analysis, the adoption factors: *Perceived Usefulness*, *Perceived Ease of Use*, *Perceived Service Quality*, *Perceived Trust*, and *Cost of Service* are treated as the independent variables, whereas *Behavior Intention to Use* as the dependent variable. Through regression analysis procedure, the model of adoption factors explain around 40 percent

($R^2 = .395$) of the variance in *Behavior Intention to Use*. Moreover, the model reaches statistical significance (Sig. = .000, this really means $p < .0005$). Table 4 shows that of all the variables included in the regression equation, only two variables emerged as significant predictors of *Behavior Intention to Use*. These are *Perceived Usefulness* ($\beta = .528$) and *Perceived Service Quality* ($\beta = .083$). As being hypothesized, *Perceived Usefulness* and *Perceived Service Quality* are found to have a positive influence on *Behavior Intention to Use*. Therefore, Hypothesis H3 and H4 are supported.

The variables *Perceived Ease of Use*, *Perceived Trust*, and *Cost of service* are found have no significant effect with *Behavior Intention to Use*. Therefore, Hypothesis H12a, H12b, H5, and H6 were rejected.

Table 4: The Influence of Adoption Factors on Behavior Intention to Use

| | Unstandardized Coefficients | | Standardized Coefficients | |
|------|-----------------------------|------|---------------------------|---------|
| | B | SE B | β | Sig. |
| PU | .396 | .033 | .528 | .000*** |
| PEOU | .058 | .039 | .071 | .135 |
| SQ | .039 | .020 | .083 | .048*** |
| T | .008 | .021 | .013 | .705 |
| CS | -.075 | .044 | -.058 | .091 |

F= 108.2; Sig. F= .000; N= 585; Dependant Variable: BI

To investigate which factors that have the most influence on *Behavior Intention to Use*, we used the beta values. Of the two significant variables, based on the size of their beta, the predictor variables exercising the most influence on *Behavior Intention to Use* was *perceived Usefulness* ($\beta = .528$).

In order to test hypothesis H2b, multiple regression analyses were conducted. The *Perceived Ease of Use* is treated as the independent variable, whereas *Perceived Usefulness* as the dependent variable. Through regression analysis procedure, the model of adoption factors explain 43 percent ($R^2 = .426$) of the variance in *Perceived Usefulness*. Moreover, the model reaches statistical significance (Sig. = .000, this really means $p < .0005$). *Perceived Ease of Use* ($\beta = .65$) is found has a significant effect with *Perceived Usefulness*. As being hypothesized, *Perceived Ease of Use* is found to have a positive influence on *Perceived Usefulness*. Therefore, Hypothesis H2b is supported.

The regression analysis revealed that out of the nine hypotheses tested; only five hypotheses were supported. These include Perceived Usefulness, Perceived Ease of Use, Facilitating Condition, Perceived Service Quality, Perceived Trust, and Cost of Service (see Figure 3). Despite *Perceived Trust* had significant correlation between all variables, except Use Behavior, the strength was weak. The significant correlation between *Perceived Trust* and *Cost of Service* was medium. With regards to *Cost of Services* and *Behavior intention to Use*; and *Cost of Services* and *Use Behavior*, the correlation is negative but not significant.

T-test was conducted to explore the impact of Age, Education Background, mobile Experience, and Gender groups on levels of all measurements. Results indicate that respondents with different gender and education Background are found to perform similar level of all adoption variables.

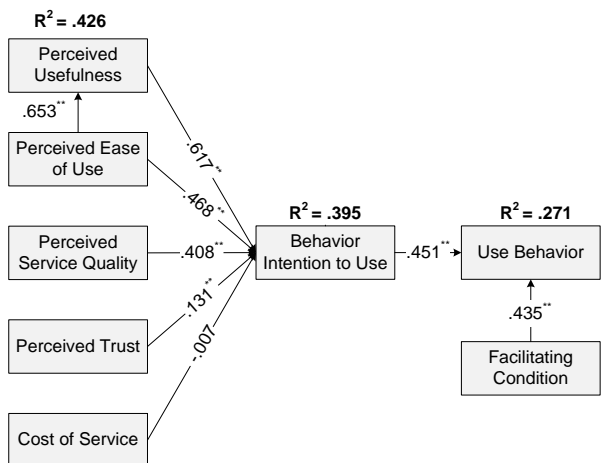


Figure 3: Research Model with Correlation Coefficients and Squared Multiple Regressions

Table 4 is presented below the summary of the findings from hypotheses testing:

Table 4: Summary of the Hypotheses Testing

| Hypothesis | Accept / Reject |
|-------------------|-----------------|
| H1a: (BI → USE). | Accept |
| H1b: (FC → USE). | Accept |
| H2a: (PEOU → BI). | Reject |
| H2b: (PEOU → PU). | Accept |
| H3: (PU → BI). | Accept |

| | |
|----------------------------|--------|
| H4: (SQ \rightarrow BI). | Accept |
| H5: (T \rightarrow BI). | Reject |
| H6: (CS \rightarrow BI). | Reject |

VII. CONCLUSION

Nowadays, m-learning services are interesting and very recent addition as a new vital platform for the higher education environment. Nevertheless, Student's perspective is very important to investigate the use behavior of m-learning in the higher education environment. Combination of education channels and alternatives helps students to be in touch with their educational environment anywhere and anytime.

Despite the low R^2 obtained, findings of the study suggest that the behavior intention to use the m-learning by students in the higher education environment have positive influence on the use behavior. Consequently, the availability of facilitating conditions is an important to influence students' use behavior. This suggesting that the higher education institutions should pay more attention to develop and support the infrastructure to facilitate their m-learning services more easily.

With regards to the factors that influencing the behavior intension to use, several inferences can be concluded from these findings. The present study suggests several factors as important determinants of the behavior intention to use m-learning in the higher education environment. Specifically, behavior intension to use appears to be adopted and facilitated by the usefulness of m-learning services, so more usefulness of m-learning lead to more adopt among students in the higher education. Consequently, the perceived service quality is important role in determining the level of behavior intention to use.

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