



Understanding intention to use mobile learning: a perspective of the extended unified theory of acceptance and use of technology

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ABSTRACT

The objective of this research paper is to gain a better understanding of the intention of students to take up mobile learning (m-learning) through an examination made on the underlying basis of the unified theory of acceptance and use of technology (UTAUT). There are a number of factors influencing the acceptance of m-learning, such as: technology factors (including effort expectancy and performance expectancy); implementation environment factors (facilitating conditions and social influence); and individual factors (self-regulation and self-efficacy). Ultimately, the findings of the research could enrich the student experience by giving schools a tool to better understand those factors impacting on the students' ability to effectively utilize m-learning; thereby allowing schools to adapt their programs to enhance learning by way of the usage of m-learning. From the review of the literature and subsequent to the factors identified as mentioned above, a research model has been proposed. The model has the ability to enhance the current level of understanding as to the motivating factors influencing students' motivation to utilize m-learning. This enhanced level of understanding can assist efforts to encourage and provide support for m-learning.

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1. Introduction

In this era of digital disruption, there is an opportunity to minimize the risks and maximize the opportunities following the fast paradigm shift from personal computers in the home to small hand-held mobile devices that are portable and provide a combination of telephone, data storage, internet, management features and applications (apps). One such opportunity is m-learning through data and communication transfers made possible by mobile technologies (Attalla et al., 2012). An obvious benefit is that m-learning users can learn anywhere on the planet at any time through the use of mobile devices and the wireless Internet. Such m-learning devices include mobile phones, smart phones, personal digital assistants (PDAs), as well as digital audio players (Wang et al., 2009). Accordingly, the users of m-learning are able to interrelate with educational resources whilst away from their usual place of learning such as the classroom or their desktop

computer. These mobile devices which have independence of place have a number of advantages for e-learning environments; for instance permitting students and teachers to use their spare time whilst traveling in buses or trains to finish any allocated homework or to prepare lessons (Virvou and Alepis, 2005). With e-learning it allows learning to be made away from the environment of the classroom, m-learning, as an extension, allows learning to be made away from a fixed locale. However, there is a contention that m-learning through these portable devices will never take the place of the classroom or other e-learning methods in accordance with Motiwalla (2007). Therefore, m-learning can be viewed as a complementary activity to both traditional learning and e-learning. Furthermore, m-learning can assist with collaborative learning by fostering a sense of responsibility, whereby teachers and students can work together in a group setting rather than working independently. Moreover, m-learning permits a more rapid way in which to keep students informed through the use of text messaging (SMS) and this method of adaptable delivery can be made across a physical space that is not confined to a computer in a designated place.

Whilst there has been rapid and widespread development of m-learning applications for K-12

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education, only a few studies have examined whether m-learning has the capacity to attract increased number of K-12 learners or not, as most of the studies have been on university students. Accordingly, it is of paramount importance that a more thorough investigation is made of the factors influencing the intention of learners to utilize m-learning in the interactive learning environment of mobile-based devices (Cheng, 2015).

Therefore, on the basis of the unified theory of acceptance and use of technology (UTAUT) as proposed by Venkatesh et al. (2003), this study's objective is to determine and examine the determinants, in addition to the gender and experience differences in relation to the acceptance of m-learning. In the next section of this paper, a review of the UTAUT is discussed along with the rationale for the adoption of UTAUT as this study's theoretical framework. This is followed by descriptions of the research model and the concluding argument.

2. Literature review and the conceptual foundation

2.1. Technology acceptance model (TAM)

Technology acceptance model (TAM) is one of the powerful models used in explaining the acceptance of information technology (Lee et al., 2003). Davis et al. (1989) developed TAM by proposing two factors, the perceived usefulness (PU) and perceived ease of use (PEU), are critical factors for explaining the adoption of new technology. External variables can be effect on PU and PEOU. TAM states that actual use of a system is determined by behavioral intention to use a system, where the intention to use the system is determined by the attitude of a person toward using the system. Person's attitude towards using the system is affected by perceived usefulness (PU) and perceived ease of use (PEU).

2.2. Unified theory of acceptance and use of technology (UTAUT)

The model of the unified theory of acceptance and use of technology (UTAUT) was proposed and developed by researchers through the combination of eight major theories in behavioral prediction. In relation to UTAUT it is comprised of four independent variables: social influences; effort expectancy; performance expectancy; and facilitating conditions. It is these variables which are the determinants of behavior; in other words a behavioral intention.

Effort expectancy relates to the level to which an individual perceives the system can be easy to adopt and use and this is similar to the ease of use construct as denoted in the TAM. Performance expectancy is the measurement of the degree to which an individual perceives that using the system could assist to increase the level of their

performance, and this concept is also similar to the construct in the TAM. Social influence is a measure of the degree to which an individual believes that others whom they care about are of the view that a particular system should be used. In measuring facilitating conditions, it is the degree to which an individual perceives that there is a presence of organizational assistance to facilitate the use of the system. The two variables of effort expectancy and performance expectancy in UTAUT are similar concepts to perceived ease of use and the perceived usefulness in TAM. Furthermore, social influences can be likened to the factor of a 'subjective norm' in TAM2, which is an extension of TAM. Also, facilitating conditions is having the same meaning of compatibility construct from diffusion of innovation theory (DOI) in accordance with Venkatesh et al. (2003). The UTAUT also takes into consideration the moderating variables. These variables are: age; gender; voluntariness of use; and experience.

In selecting UTAUT as the underlying theory, this was made on the basis of its comprehensiveness and its global approach. As previously mentioned, the UTAUT constructs have been construed from eight acceptance models of behavioral prediction (Venkatesh et al., 2003). The UTAUT covers off on the significant influencing factors of the acceptance of technology by users such as technology factor that describes the characteristics of a technology and implementation environment factor that includes organization characteristics (Marchewka and Kostiwa, 2014; Venkatesh et al., 2003). Furthermore, the UTAUT moderating variables of age, gender, voluntariness of use and experience can be defined as individual differences influencing an individual's attitudes concerning a given technology. Indeed UTAUT can effectively predict about 70 percent of the cases for an uptake of information technology, whereas other models to measure user adoption could only do so in approximately 40 percent of the cases (Davis et al., 1989; Venkatesh et al., 2003).

Significantly, as UTAUT is a new theoretical framework there ought to be consideration given to more investigation to corroborate its robustness as the underlying theoretical basis for research endeavors (Straub, 2009). In this regard, recent studies in wide-ranging research domains have adopted the UTAUT as the underlying theoretical basis. These studies have included an examination of organizational learning systems (Wong and Huang, 2011), mobile banking implementations (AbuShanab and Pearson, 2007; Zhou, 2012), 3G mobile communication (Mardikyan et al., 2012; Wu et al., 2012) and wireless communications (Anderson and Schwager, 2004). Furthermore, the UTAUT has been adopted as the theory to examine the acceptance by students of blackboard technology as indicated by Marchewka and Kostiwa (2014); Pynoo et al. (2011) applied UTAUT to measure the level of acceptance and utilization of a digital learning environment by secondary school teachers, and UTAUT has been adopted as the theoretical framework to examine

training in health care systems (Marshall et al., 2011).

The review of the literature indicates that there are three main factors influencing the acceptance of technology: (1) the technology factor; (2) the individual factor; and (3) the factor of the implementation environment (Chau and Hu, 2002; Hu et al., 1999; Nanayakkara, 2007; Sekaran and Bougie, 2010). In relation to the factor of the implementation environment, it involves the organizational characteristics (Dadayan and Ferro, 2005; Nanayakkara, 2007), whilst it is the technology characteristics that are associated with the factor of the technology. Measurement of these characteristics was made by examining the ease of use and the usefulness of the technology (Dadayan and Ferro, 2005; Nanayakkara, 2007; Venkatesh et al., 2003). For this study, the factor of the implementation environment was measured by way of two variables: social influence; and the facilitating conditions.

The underlying framework of the UTAUT was originally formulated to describe and better understand organizational adoption of information technologies. Of note is that the uptake of mobile technology is more personalized in relation to the individual (Carlsson et al., 2006). However, it has been claimed the UTAUT does not take into consideration the factor of an individual's characteristics as claimed by Dadayan and Ferro (2005) and Nanayakkara (2007). Accordingly, this paper has included the individual factor in order to ascertain an individual's characteristics such as their knowledge and level of skills and their perceptions such as their capacity to utilize m-learning in a meaningful way. In examining the literature concerning information technology and the models of user acceptance, a number of constructs have been utilized to measure the individual factor. For this paper, the individual factor was measured by way of two determinants: self-efficacy; and self-regulation (Chung et al., 2015; Liaw et al., 2014; Park et al., 2012). Fig. 1 below presents the m-learning factors as well as the important sub-factors. Indeed it is these factors which will be utilized for this study as the research model's underlying foundation.

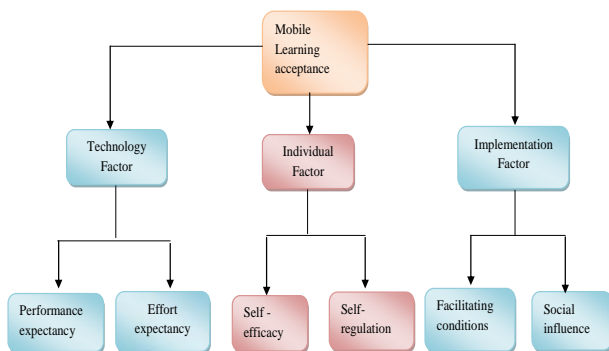


Fig. 1: Factors and sub-factors of m-learning acceptance

3. Research model and hypotheses

As mentioned above, the UTAUT has been adopted as the underlying theoretical basis for this study by applying some modifications to the traditional UTAUT model to take into consideration the individual factor. Indeed, the actual usage concept was removed from the revised model of the UTAUT, as the technology of m-learning is still in the stage of infancy in relation to development. In fact the purpose of this paper is to examine the future acceptance of the m-learning technology emergence, rather than the current usage of the technology as previous studies have indicated that the actual usage of m-learning is not a cogent method of measurement of the m-learning value (Lu et al., 2003; Yang, 2005). Accordingly, behavioral intention was identified as a dependent variable of the acceptance of m-learning and the actual use or the construct of use behavior was eliminated. Furthermore, this study has examined the acceptance by students of m-learning in the context of totally voluntary usage and by using a population of students of the same age and, therefore, voluntariness of usage and age have been eliminated as moderators. The proposed research model utilized in this research endeavor is shown in Fig. 2. Furthermore, the measurement items for the constructs have been identified from prior studies, as shown in Table 1. The constructs of the UTAUT are described in detail as well as its relevance to this research endeavor in the following sections.

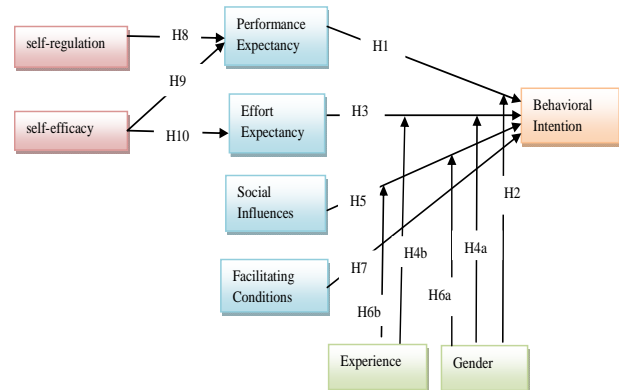


Fig. 2: Proposed research model

3.1. Performance expectancy (perceived usefulness)

In relation to the new technology, performance expectancy (PE) can be defined as the degree to which a person perceives that utilizing the novel technology will assist them to achieve a benefit in relation to performance of a task (Venkatesh et al., 2003). Studies have indicated that the determinants of gender and age act as moderators in the relationship between behavioral intention and performance expectancy in the use of information and communication technology in accordance Venkatesh et al. (Abu-Al-Aish and Love, 2013; Chang, 2013; Jambulingam, 2013; Nassuora, 2012). With respect to m-learning, many studies have suggested that performance expectancy (PE) influences an

individual's behavioral intention to utilize m-learning in a positive way (Abu-Al-Aish and Love, 2013; Chang, 2013; Jambulingam, 2013; Nassuora, 2012). In adapting this concept of PE to explore the acceptance of m-learning by students indicates that students will embrace m-learning in the event they perceive the technology has the capacity to improve their performance. In relation to the moderating variables of gender and age, this paper presents an argument that the gender of the students will indeed be a moderating variable in the relationship between the students' intention to utilize m-learning and performance expectancy. With the stated intention

to use a sample of a group of students of the same age, in other words to eliminate the moderating variable of age, this study will examine the behavioral intention of m-learning from the same age group of students. From the discussion above, the following hypotheses are formulated:

H1: Performance expectancy has a positive effect on the intention by students to utilize m-learning.

H2: Gender is a moderating variable impacting on the performance expectancy of the students' intention to use m-learning.

Table 1: Constructs and measurement items

Construct	Survey questions	Source
Performance Expectancy	Using m-learning would enable me to accomplish learning activities more quickly. Using m-learning would increase my learning productivity. If I use m-learning, I would increase my chances of getting a better grade in class. I would find m-learning useful in my learning.	Lowenthal (2010); (Venkatesh et al., 2003)
Effort Expectancy	Learning to operate m-learning is easy for me. It would be easy for me to become skillful at using m-learning. I would find m-learning easy to use.	Lowenthal (2010); (Venkatesh et al., 2003)
Social Influence	People who influence my behavior will think that I should use m-learning. People who are important for me will think that I should use m-learning. In general, the organization supported the use of m-learning.	Venkatesh et al. (2003); (Wang et al., 2009)
Facilitating Conditions	I have the knowledge necessary to use the m-learning. I have the resources to use the m-learning. Someone is available for assistance if I have difficulty with the m-learning.	Chang (2013); (Venkatesh et al., 2003)
Self-efficacy	I could complete learning through mobile phones if there is no one around to tell me what to do. I could complete learning through mobile phones if someone had helped me get started. I could overcome the difficulties encountered when I used mobile phones to learn. I could complete learning through mobile phones whatever mobile phone how difficult is.	Chung et al. (2015); (Venkatesh et al., 2003)
Self-regulation	I have the flexibility of learning with regard to time and place. I have the flexibility in choice of learning strategies and pace of learning. I have the opportunities for self-paced exercises and the application of one's knowledge. I have the opportunities for controlling one's learning outcomes (e.g. by self-tests). I have support for maintaining learning motivation.	Paechter, Maier, and Macher (2010)
Behavioral intention	I intend to use m-learning in the future. I predict I would use m-learning in the future. I plan to use m-learning in the future.	Venkatesh et al. (2003); (Wang et al., 2009)

3.2. Effort expectancy (Perceived ease of use)

The perceived ease of use or effort expectancy, in relation to m-technology, can be defined as the degree to which a person perceives this new technology will be easy to use (Venkatesh et al., 2003). User experience, age and gender have been identified as moderating variables in the relationship between behavioral intention and effort expectancy as indicated by Venkatesh et al. (2003). A number of

studies have claimed that there is a significant impact of the concept of effort expectancy on the intention of users to utilize m-learning technology (Abu-Al-Aish and Love, 2013; Al-Hujran et al., 2014; Chung et al., 2015; Jairak et al., 2009; Nassuora, 2012; Wang et al., 2009). In adapting the concept of effort expectancy an examination of the students' acceptance of m-learning indicates that students will accept m-learning in the event they perceive that this new technology will be easy to use. It is also of

interest to ascertain whether the relationship between the students' intention to utilize m-learning and the effort expectancy is moderated by the students' level of experience and by their gender. As mentioned previously, the behavioral intention of m-learning for students from the same age group will be investigated by way of omission of the moderating variable of age. Accordingly, the following hypotheses and sub-hypotheses have been formulated:

H3: There is as positive effect of effort expectancy on the intention by students to utilize m-learning.

H4a: Gender is a moderating variable influencing the effect of effort expectancy on student intention.

H4b: Experience is a moderating variable influencing the effect of effort expectancy on the intention by students.

3.3. Social influence

In relation to new technology and social influence, this type of influence can be defined as the degree to which a person perceives that the use of a new technology is based on others' belief of importance (Venkatesh et al., 2003). Studies have indicated that gender, age and experience have a moderating effect on the social influence on a user's behavioral intention to utilize m-learning (Venkatesh et al., 2003). Many studies in the related literature claim that social influence significantly impacts on a user's behavioral intention to utilize m-learning (Abu-Al-Aish and Love, 2013; Al-Hujran et al., 2014; Jairak et al., 2009; Wang et al., 2009).

In relation to young students, it is their parents and teachers who influence their intention to utilize m-learning; particularly in relation to the significance of the use of mobile technology in education (Liu, 2011). In fact the concept of social influence was adapted for this research endeavor to indicate that m-learning acceptance and the use of technology is dependent upon the opinions of parents and teachers. This study anticipates that the relationship between the intention of students to utilize m-learning and the social influence will be moderated by experience and by gender. Therefore, the following hypotheses and sub-hypothesis have been formulated:

H5: Social influence positively impacts on a student's intention to utilize m-learning.

H6a: Gender is a moderating variable in the relationship between a student's intention and social influence to utilize m-learning.

H6b: Experience is a moderating variable in the relationship between a student's intention and social influence to utilize m-learning.

3.4. Facilitating conditions

A facilitating condition can be defined as the degree to which a person perceives that the technical and organizational infrastructure is able to support the utilization of new technology in accordance with

(Venkatesh et al., 2003). In the relevant literature examining mobile technology, many studies have claimed that a facilitating condition can have a positive effect on an individual's behavior intention (Attalla et al., 2012; Iqbal and Qureshi, 2012; Jairak et al., 2009).

A crucial requirement for young students who wish to apply m-learning is that the students have ownership of a mobile device to encourage the process of m-learning (Liu, 2011). Accordingly, the support of parents is paramount for the successful implementation in K-12 schools of m-learning. Furthermore, with the agreement of parents, students can interact with mobile devices in the home (Liu, 2011). This concept can be adapted to m-learning, and this indicates that students have the perception that through the availability of mobile devices, by way of parental support allows access to suitable infrastructure and learning materials that will easily enable them to use m-learning, and will also facilitate interaction with teachers and with other students. Accordingly, the following hypothesis is formulated:

H7: There is a positive effect by the facilitating conditions on the intention by students to utilize m-learning.

3.5. Self-regulation

In assessing the significance of learning to learners, researchers highlight that learners ought to apply considerably more control by taking a more active role (Bidin and Ziden, 2013). In taking a more active role, there is an increased likelihood that students will take part in learning experiences if there is encouragement for them to do so (Selfe, 1999; Watts, 1997). Indeed m-learning opens up an opportunity for students to be central to the process of learning by taking an active role from the start and by ensuring they adhere to their goal right through to the stage of evaluation. A mobile device, unlike digital media, can be carried around at all times if required and allows its users to exercise a great level of control over when and how to access their devices.

The construct of self-regulation refers to an individual being able to self-manage cognition, motivation as well as behavior (Zimmerman, 1995). A number of research studies have indicated that self-regulation for students of distance learning may indeed be a more crucial factor than for those students learning by way of the traditional face-to-face method due to the changing role of students from being passive learners to becoming active learners (Johnson et al., 2008; King et al., 2000).

The variable of self-regulation has been tested to better understand the attitudes of uses in relation to the m-learning environment in accordance with Liaw et al. (2014). The study indicated that the perception of self-regulation is an important predictor on the construct of perceived usefulness and this in turn has an influence on the learner's intention to utilize m-learning system. As the construct of perceived

usefulness is similar to that of performance expectancy (Venkatesh et al., 2003), this construct has been adopted in this study. Accordingly, the following hypothesis is formulated:

H8: Performance expectancy is positively affected by the construct of self-regulation.

3.6. Self-efficacy

The concept of self-efficacy can be defined as a person's perception of their ability to perform particular behaviors such as the capacity to undertake successfully certain tasks (Abbad et al., 2009). Indeed prior research in relation to computer self-efficacy has indicated computer self-efficacy plays a crucial role in understanding an individual's information and communication technology acceptance (e.g. Agarwal et al., 2000). The study also found that individuals were more likely to succeed at designated task if they possessed high efficacy expectations (Chung et al., 2015).

Prior studies have also utilized the construct of computer self-efficacy for the prediction of computer usage behavior. These studies indicated that the construct of computer self-efficacy is a robust predictor of intention by users to utilize information and communication technology (Grandon et al., 2005; Hussein et al., 2007; Miller et al., 2003). The construct of computer self-efficacy can have an indirect effect on the uptake by users of many software packages through usefulness and ease of use as indicated by Agarwal et al. (2000).

In the context of m-learning, the construct of mobile self-efficacy relates to the capacity of students to use their mobile device for studying, to manage information and for interaction with their teachers and other students. It was found that the construct of perceived self-efficacy indirectly impacts on the intention of users to utilize m-learning by way of the perceived ease of use (Liaw et al., 2014). A study was conducted by Chung et al. (2015) to investigate the behavioral intention of Taiwanese EFL college students to utilize learning resources for mobile English vocabulary. The study's findings indicated that the behavioral intentions of the students highly correlated in a positive way with the self-efficacy of the mobile devices by way of perceived usefulness and perceived ease of use. As previously mentioned, many scholars are in agreement that perceived effort expectancy and perceived performance expectancy are similar constructs to perceived ease of use and perceived usefulness (Venkatesh et al., 2003) and, therefore, this construct was adopted in this study. Accordingly, the following hypotheses are formulated:

H9: Performance expectancy is positively affected by the construct of self-efficacy.

H10: Effort expectancy is positively affected by the construct of self-efficacy.

3.7. Behavioral intention

The independent variable of behavioral intention has long been utilized in the relevant literature to investigate information and communication technology acceptance (Davis et al., 1989; Venkatesh et al., 2003). Indeed, studies examining m-learning have confirmed the existence of a positive relationship between the actual use and the intention to use (Bere, 2014; Mohammadi, 2015). Therefore, in these circumstances behavioral intention can be viewed as the likelihood that a student will utilize m-learning in the future. Thus this construct was adopted for this research endeavor indicating that students intend to utilize m-learning.

4. Conclusion

The objective of this study was to propose a novel model for m-learning in the K-12 school environment by identifying and investigating the factors affecting a student's intention to utilize m-learning. In order to identify these factors, this research endeavor has adopted the Unified Theory of Acceptance and Use of Technology (UTAUT) model as the theoretical framework and this model was then extended by adding two external variables to propose a new model. Through this new model, the influence of the adoption of m-learning by students was examined. Two moderating variables and six independent variables were identified to allow further research to be conducted on the impact of the intention of students to utilize m-learning. From the review of the literature, all six independent variables (social influences, effort expectancy, performance expectancy, facilitating conditions, self-regulation and self-efficacy) contribute in a positive way to the intention of end-users to utilize m-learning. Indeed, future research can test the proposed model by utilizing an application for m-learning by examining the intention by students from a number of schools to learn by way of mobile technology.

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