USERS' BEHAVIOR TOWARDS UBIQUITOUS M-LEARNING

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ABSTRACT

Mobile technologies have enabled a new way of communicating, for whom mobile communications are part of normal daily interaction. This paper explores the proposed and verified Technology Acceptance Model (TAM) that can be employed to explain the acceptance of Mobile Learning (M-learning), an activity in which user's access learning material with their mobile device. 100 students from private and government higher learning institutions around Klang Valley area were selected as the sample for this study. There are five major variables in the study but only two of the variables were supported. Malaysian mobile phone users' intention to positively accept the use of M-learning is due to encouraging factors such as perceived mobility value and perceived usefulness of the Mobile Learning. This study is beneficial for leaning institutions which desire to use M-learning.

Keywords: Technology Acceptance Model, Users' Behavior, Ubiquitous, M-Learning, Malaysia

INTRODUCTION

The availability of mobile and wireless devices is enabling different ways of communicating. The advent of mobile technologies has created opportunities for delivery of learning via devices such as PDAs, mobile phones, laptops, and PC tablets (which are laptops designed for handwriting rather than a keyboard interface). A wide definition of m-learning is the ability to learn independently of place and time, facilitated by a range of mobile devices (Ufi/learndirect and Kineo, 2007).

Meanwhile Sharples, Taylor, and Vavoula (2007) define it as 'the processes of coming to know through conversations across multiple contexts amongst people and personal interactive technologies'.

According to Saedah and Mohd Paris (2005), the increasing number of tools in education in ICT era has change the way of conventional teaching process to the usage of information technology. According to Sharples (2006), there is need for a massive effort in understanding how we can usefully adapt and enhance technology for the benefit of society – and how we need to adapt society to maximize the benefits of new technologies. There is far too little attention being paid to social processes and emergent behaviour of learning communities who adapt to new technologies, such as mobile phone (McLean, 2003).

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M-Learning provides the opportunity to connect informal learning experiences that occur naturally throughout the day with formal learning experiences such as those encountered in the virtual classroom model, using games or in online learning implementations.

As an evolving research area, many issues in M-Learning have not yet been exhaustively covered. M-learning acquisition in the academia to support teaching and learning is still immature. This immaturity creates a new interesting research issue on the users' perception on m-learning.

This research examines the users' perception on m-learning. It concentrates on the effectiveness of incorporating m-learning into mobile technology as a new instructional model for academician. Smaller screen, interruptibility, high latency, limited storage and functions (Roschelle, 2003) are the deterrents of mobile technologies.

This research aims to increase the acquisition and comprehension of m-learning as a new learning pedagogy in academia for the development of knowledge creatively.

Hence, these all necessitates a need for the current study to explore the users' behavior towards ubiquitous M-learning from the perspectives of its potential to increase users' knowledge development in Malaysia by applying Technology Acceptance Model (TAM) in order to explain and predict the acceptance of mobile learning. TAM is a model for explaining the user acceptance of novel technology, and has been theoretically and empirically justified (Devaraj, Fan and Kohli, 2002).

LITERATURE REVIEW

Behavior prediction has been one of the major purposes of psychological theories. Some of the more useful theories include the Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975), the social cognitive theory (SCT) (Compeau and Higgins, 1995; Hill and Roldan, 2005) and Technology Acceptance Model (TAM) (Davis, 1989; 1993). TAM, originally presented by Davis (1989), is derived from TRA (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975). TAM is a behavioral model that describes the antecedents of the adoption of information technology (IT), and is considered a robust tool for measuring the adoption of new technology by users (Agarwal and Prasad, 1999; Davis, 1989; Doll, Hendrickson and Deng, 1998; Segars and Grover, 1993).

Over the years TAM has been validated by various applications and extensions, including web-based information (van der Heijden, 2003; Yi and Hwang, 2003), Internet banking (Wang, Wang, Lin and Tang, 2003) and electronic commerce (Henderson and Divett, 2003; van Dolen and de Ruyter, 2002). The M-learning technology is novel, and is therefore appropriate to be examined using the TAM model.

Figure: 1 illustrates TAM, which includes six constructs, namely external variables, perceived usefulness, perceived ease of use, attitude, behavioral intention and actual usage. It shows that user behavior is determined by perceptions of usefulness and the ease of use of the technology (Adams, Nelson and Todd, 1992; Davis, 1989; Mathieson, 1991).

The concept of actual usage was eliminated from the revised TAM model, because M-learning technology is still at an early stage of development.
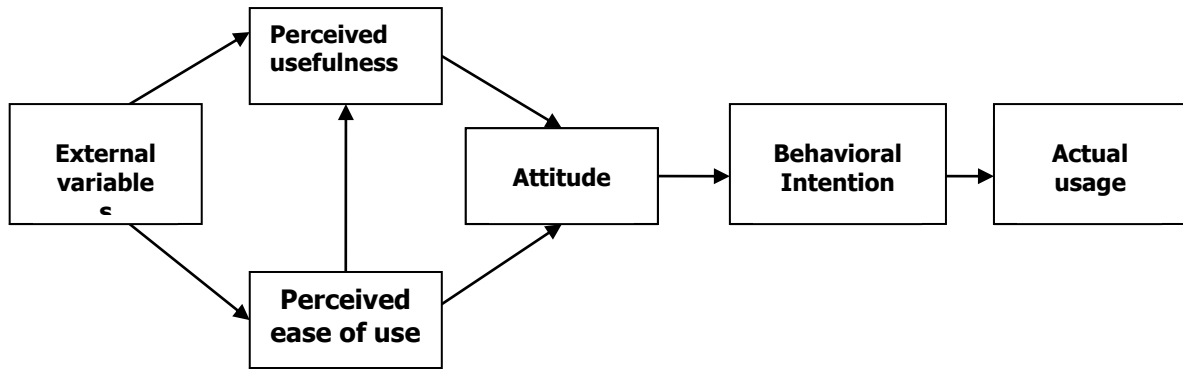
Figure: 1
Technology Acceptance Model (TAM)

This study investigates the future acceptance of the emerging M-learning technology, rather than its current usage. Actual usage is not a cogent measure of the value of M-learning, as indicated in previous studies (Lu, Yu, Liu and Yao, 2003). The following sections describe the constructs of TAM in detail, and its applicability to the present study.

Perceived Enjoyment (PE)

Individuals engage in activities because these activities lead to enjoyment and pleasure (Teo and Lim, 1997). According to Davis *et al.* (1992), perceived enjoyment is defined as "the extent to which the activity of using the technology is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated". In this study, perceived enjoyment denotes the extent to which an individual finds the interaction of M-learning intrinsically enjoyable or interesting. Perceived enjoyment is seen as an example of intrinsic motivation, and it has been found to influence user acceptance significantly. Furthermore, research on the role of enjoyment suggested the importance of enjoyment on users' attitudes and behaviors (Igbaria, Iivari and Maragahh, 1995; Teo and Lim, 1997; Wexler, 2001; Yi and Hwang, 2003). Hence, perceived enjoyment is addressed as a key factor for influencing user acceptance of M-learning. Prior studies on technology acceptance behavior examined the effects of perceived enjoyment on perceived ease of use (Igbaria, Parasuraman and Baroudi, 1996; Venkatesh, 2000; Venkatesh, Speier and Morris, 2002; Yi and Hwang, 2003). New technologies that are considered enjoyable are less likely to be difficult to use.

H1. Perceived enjoyment has an effect on behavioral intention.

Perceived Mobility Value

Perceived mobility value (PMV) denotes user awareness of the mobility value of M-learning. Mobility has three different elements including convenience, expediency and immediacy (Seppälä and Alamäki, 2003). Mobility permits users to gain access to service/information anywhere at anytime via mobile devices. In other words, mobility brings the ability to guide and support users in new learning situations when and where it is necessary. Previous studies found that mobile users valued efficiency and availability as the main advantages of M-learning, and these advantages are a result of the "mobility" of a mobile device (Chen *et al.*, 2003; Hill and Roldan, 2005; Ting, 2005). Therefore, M-learning is valuable because of its mobility. Consequently, the perceived mobility value is a critical factor of individual differences affecting users' behaviors. This study treats perceived mobility value as a new variable in the TAM.

PMV has not been tested previously, but it relates to users' personal awareness of mobility value. Mobility enables users to receive and transmit information anytime and anywhere (Hill and Roldan, 2005; Ting, 2005).

The mobility associated with time-related needs will encourage users to adopt mobile technology since enhanced accessibility is expected to affect dynamic interaction and high levels of engagement (Anckar and D'Incau, 2002, p. 48).

Hence, users who perceive the value of mobility also understand the uniqueness of M-learning and have a strong perception of its usefulness.

In other words, perceived mobility value has a positive effect on the perceived usefulness of M-learning. Therefore, this work treats perceived mobility value as a direct antecedence of perceived usefulness (PU).

H2. Perceived mobility value has an effect on behavioral intention.

Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Attitude (ATT), and Behavioral Intention (BI)

TAM posits that two particular behavioral beliefs, perceived usefulness (PU) and perceived ease of use (PEOU), are two fundamental factors for predicting user acceptance, and that the effect of external variables on intention are mediated by these two key beliefs (Adams *et al.*, 1992; Davis, 1989; Davis, 1989; Mathieson, 1991).

PU is defined as an individual's perception that using a new technology will enhance or improve her/his performance (Davis, 1989; 1993).

Applying this definition to this research context, PU means the users' perception that using M-learning enhances their learning performance. A strengthening of this belief creates a positive attitude toward M-learning, thereby increasing the user's intention to use M-learning.

PEOU is defined as an individual's perception that using a new technology will be free from effort (Davis, 1989; 1993). Applying this definition in this research context, PEOU represents the perception that M-learning is easy to use.

PEOU is hypothesized to be a predictor of PU. Moreover, both PU and PEOU are affected by external variables (Hu and Bentler, 1999; Venkatesh & Davis, 2000; Wang, Wang, Lin and Tang, 2003).

Furthermore, PU and PEOU have a positive effect on attitude. Unlike in TRA, the subjective norm is not a determinant of behavioral intention in TAM; instead, BI in TAM is affected only by PU and attitude (Davis, 1989).

TAM delineates the causal relationships between perceived usefulness (PU), perceived ease of use (PEOU), attitude and behavioral intention (BI) to explain users' acceptance of technologies. PEOU is hypothesized to be a predictor of PU. Additionally, attitude is determined by two salient beliefs, namely PU and PEOU (Davis, 1989). Finally, BI is determined by PU and attitude.

Thus, behavioral intention is pos itively influenced by PU and PEOU is proposed herein.
H3. Perceived usefulness has an effect on behavioral intention.
H4. Perceived ease of use has an effect on behavioral intention.

In TAM, BI is influenced by both PU and Attitude. This relationship has been examined and supported by many prior studies (Adams *et al.*, 1992; Davis, *et al.*, 1989; Hu *et al.*, 1999; Venkatesh and Davis, 1996; 2000). Therefore, this study presents the following hypotheses.

H5. Attitude has an effect on behavioral intention.

METHODOLOGY

100 respondents cooperatively provided complete response to the questionnaire, which consists of students of private and government higher learning institutions in Klang Valley area with 100% response rate. The questionnaire comprises of two sections:

Section A of the questionnaire presented all questions related to the respondent's demographic data such as gender, age, marital status, race and the respondent's occupation.

Section B presented separately the factors of PE (Perceived Enjoyment), PMV (Perceived Mobility Value), PU (Perceived Usefulness), PEOU (Perceived Ease of Use), ATT (Attitude), and BI (Behavioral Intention) (refer Appendix 1).

The structure of question provided in the questionnaire was based on likert scale and dichotomous question. Later, data collected are analyzed using multiple regression analysis, via Statistical Package for Social Sciences (SPSS) computer program version 14, as it is a powerful and flexible procedure for analyzing associative relationship between a metric dependent variable and one or more independent variables.

It is concerned with the nature and degree of association between variables and does not imply or assume any causality.

DATA ANALYSIS AND FINDINGS

Demographic Profile of the Respondents
The descriptive of the demographic profile of the respondents is presented in Table 1. Majority of the questionnaire were answered by female respondents (55%) compared to the male respondents (45%).

The highest number of respondents' is aged between 21-25 years old (39 respondents) followed by 26 – 30 years old (34 respondents), below 20 years old (22 respondents) and above 31 years old (4 respondents). 87% of the respondents are single and the other 13% married.

The largest number for the racial category is Malay (50%) while the smallest number of racial category is other races (8%). Majority of the respondents are degree/bachelor (55%) students while the minority of the respondents is PhD (1%) student.

Most of the respondents are studying in private higher learning institutions (62 respondents) while the rest is studying in government higher learning institutions (38 respondents).

Table: 1
Demographic Profile of the Respondents

	Frequency	Percentage (%)
Gender		
Male	45	45
Female	55	55
Age (years old)	22	22
Below 20	39	39
21-25	34	34
26-30	4	4
Above 31		
Marital Status	87	87
Single	13	13
Married		
	50	50
Race	14	14
Malay	28	28
Chinese	8	8
Indian	22	22
Others	13	13
Education Level		
Foundation	55	55
Diploma	9	9
Degree/Bachelor	1	1
Master		
PhD		
	38	38
Institution	62	62
Government Institution		
Private Institution		

Reliability Analysis

The coefficient of cronbach α varies from 0 to 1 and the value of 0.60 or less indicates unsatisfactory internal consistency reliability. Table: 2 illustrates that the cronbach α value of all variables exceed the recommended value.

Thus, suit for further analysis.

Table: 2
Reliability Analysis

Variables	No. of Items	Cronbach α
Perceived Enjoyment (PE)	3	0.781
Perceived Mobility Value (PMV)	4	0.725
Perceived Usefulness (PU)	3	0.862
Perceived Ease Of Use (PEOU)	3	0.704
Attitude (ATT)	3	0.813
Behavioral Intention (BI)	3	0.950

Correlation Analysis among Variables

Table: 3 describe correlation analysis among variables. There are six pairs of variables were correlated at 99% significant level. They are:

Perceived Usefulness (PU) and Perceived Mobility Value (PMV), Perceived Ease Of Use (PEOU) and Perceived Mobility Value (PMV), Perceived Ease Of Use (PEOU) and Perceive Usefulness (PU), Behavioral Intention (BI) and Perceived Mobility Value (PMV), Behavioral Intention (BI) and Perceive Usefulness (PU); and Behavioral Intention (BI) and Perceived Ease Of Use (PEOU). This provides evidence for both discriminant and convergence validity.

Table: 3
Correlation Analysis among Variables

	PE	PMV	PU	PEOU	ATT	BI
PE	1					
PMV	-.056	1				
PU	-.179	-.335(**)	1			
PEOU	-.190	-.360(**)	.638(**)	1		
ATT	-.046	.259(**)	-.099	-.183	1	
BI	-.035	-.366(**)	.401(**)	.354(**)	-.075	1

** Correlation is significant at the 0.01 level (2-tailed).

Hypothesis Testing

The dependent variable for this study is BI (Behavioral Intention) while the independent variables are ATT (Attitude), PE (Perceived Enjoyment), PU (Perceived Usefulness), PMV (Perceived Mobility Value) and PEOU (Perceived Ease of Use). The R value for the predictors' variable is 0.479 while the R Square value is 0.230. After the R Square has been adjusted, the new value is 0.189. This suggest that the additional of another independent variables (PE, PU, PMV, PEOU) factors related to mobile learning, makes contribution in explaining the variances in BI (Behavioral Intention) towards mobile learning.

Table: 4 presented the output of the multiple regression analysis on the proposed hypotheses. The standardized beta (β) coefficient gives a measure of the contribution of each variable to the model. A large value indicates that a unit change in this predictor variable has a large effect on the criterion variables.

Table: 4
Regression Analysis of Factors Related to M-Learning

	Standardized Coefficients Beta (β)	t	Sig.	Result
Perceived Enjoyment	0.020	0.211	0.833	Not Supported
Perceived Mobility Value	-0.249	-2.457	.016	Supported
Perceived Usefulness	0.252	2.106	.038	Supported
Perceived Ease Of Use	0.115	0.940	.350	Not Supported
Attitude	0.037	0.391	.697	Not Supported

Note: R = .479; R^2 = .230

Hypothesis 1 proposed that perceived enjoyment has an effect on mobile phone users' behavior intention in Mobile Learning.

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From Table: 4, the significant value for perceived enjoyment is 0.833 which is far greater that 0.05 at 95% significant level. Thus, the Hypothesis 1 is not supported with β value 0.020. It was found that over 96% of the mobile phone users' agree that M-learning would make them feel good, interesting and would be fun to use it but only small number disagree with the statements.

Hypothesis 2 proposed that perceived mobility value has an effect on mobile phone users' behavior intention in Mobile Learning. Table 4 exemplifies that the significant value for perceived mobility value is 0.016 which is smaller that 0.05 at 95% significant level. Thus, the Hypothesis 2 is supported (β value -0.249, $p<0.05$). Only a small number of the mobile phone users' do not know that mobile device is a medium for M-learning. 61% of them disagree that M-learning is easy to access at any place at any time.

Furthermore, majority of the mobile phone users' agree that mobility makes it possible to get real time data and it is an outstanding advantage of M-learning.

Next, Hypothesis 3 proposed that perceived usefulness has an effect on mobile phone users' behavior intention in Mobile Learning. As presented in Table 4 and as similar to Hypothesis 2, significant result was found where the significant value for perceived usefulness is 0.038. The value is smaller than 0.05 at 95% significant level. It was confirmed that majority of the mobile phone users' agree while none of the them strongly disagree that using M-learning would save a lot of time, M-learning enhance effectiveness in learning and M-learning would be useful. With regard to mobile phone users' behavior intention in Mobile Learning, results show that majority of the respondents probably will use M-learning when it become available, intend to say something favorable about M-learning and intend to use M-learning routinely.

Hypothesis 4 proposed that perceived ease of use has an effect on mobile phone users' behavior intention in Mobile Learning. The significant value for PEOU is 0.350 which is far greater that 0.05 at 95% significant level. Thus, the Hypothesis 4 is not supported with β value 0.115. More than half of the mobile phone users' (63%) agree that their interaction with M-learning would be clear and understandable and M-learning is easy to use and would not require a lot of mental effort.

Hypothesis 5 proposed that mobile phone users' attitude has an effect on their behavior intention in Mobile Learning. In Table 4, the significant value for mobile phone users' attitude is 0.697 which is far greater that 0.05 at 95% significant level. Thus, the Hypothesis 5 is not supported. Positive mobile phone users' attitude leads to the positive respond towards M-learning. Mobile phone users' agree that M-learning would be very desirable to use. They also show interest in using M-learning and hold a positive evaluation on M-learning. Above all, previous study found that the entire hypotheses (Hypothesis 1, Hypothesis 2, Hypothesis 3, Hypothesis 4 and Hypothesis 5) were supported with each β value. Contrariwise to this study, only Hypothesis 2 and Hypothesis 3 are supported while the others are not supported with each β value.

CONCLUSIONS

All in all, it is proven that Technology Acceptance Model (TAM) can be employed to explain the acceptance of mobile learning by mobile phone users'. It was bring into being that Malaysian mobile phone users' intention to positively accept the use of Mobile Learning is due to encouraging factors such as perceived mobility value and perceived usefulness of the Mobile Learning.

Educators need to adapt from a role as transmitters of knowledge to guiders of learning resources. In addition, technology developers need to respond to concerns of security and privacy while designing devices and services that learners both want and will pay for. As for recommendations, room to further analyze the data using multivariate data analysis, such as Structural Equation Modeling, is open to future researchers by covering larger size of sample with additional variables on the acceptance towards M-learning and importance of M-learning. It would be beneficial in future research undertakings.

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RESEARCH VARIABLES

Variables	Items	Source	Questions
Perceived Enjoyment (PE)	3	Moon and Kim (2001); Yi and Hwang (2003); Yu *et al.* (2005)	(PE1) M-learning would make me feel good. (PE2) M-learning would be interesting? (PE3) I would have fun using M-learning?
Perceived Mobile Value (PMV)	4	Newly created	(PMV1) I know that mobile devices are the mediums for M-learning. (PMV2) It is easy to access M-learning anywhere at anytime. (PMV3) Mobility makes it possible to get the real time data. (PMV4) Mobility is an outstanding advantage of M-learning.
Perceived Usefulness (PU)	3	Davis (1989, 1993); Venkatesh and Davis (1996); Yang (2005)	(PU1) Using M-learning would save me much time. (PU2) M-learning would enhance my effectiveness in learning. (PU3) Overall, M-learning would be useful.
Perceived Ease Of Use (PEOU)	3	Davis (1989, 1993); Venkatesh and Davis (1996); Yang (2005)	(PEOU1) Using M-learning would not require a lot of my mental effort. (PEOU2) My interaction with M-learning would be clear and understandable. (PEOU3) M-learning would be easy to use.
Attitude (ATT)	3	Bagozzi *et al.* (1992); Hu *et al.* (1999)	(ATT1) In my opinion, it would be very desirable to use M-learning. (ATT2) I would like to use M-learning. (ATT3) I hold a positive evaluation on M-learning.
Behavioral Intention (BI)	3	Bagozzi *et al.* (1992); Hu *et al.* (1999)	(BI1) I intend to use M-learning when it becomes available. (BI2) If I were asked to express my opinion of M-learning, I intend to say something favorable. (BI3) In the future, I intend to use M-learning routinely.