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New Mobile Learning Process Model for Higher Education Students in Jordanian Universities

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Abstract: Mobile learning is still in its infancy, adoption and implementation of m-Learning are significant issues for universities. Although, the TAM is applicable to various technologies, constructs in the TAM must be extended by incorporating additional factors. These additional factors depend on the target technology, users and the context. In order on increase the number of students who will use m-Learning especially with higher education students. This study will adopt TAM model as a theoretical framework and extend this model with external variables to propose a new model. Therefore, this study extended TAM model with external variables (mobile readiness, perceived interaction). Moreover, this research examined the following seven factors: perceived usefulness, perceived ease of use, attitude to use, mobile readiness, perceived interaction and actual use mobile learning. The results indicate that perceived ease of use and mobile readiness had significant effect on perceived usefulness. Perceived usefulness and perceived ease of use and perceived interaction had significant effect on individual attitudes. The effect of perceived usefulness on attitude and actual to use m-Learning is reflective. M-readiness affects perceived interaction but perceived ease of use had no effect on perceived interaction and m-readiness was found to be significant to perceived ease of use. Finally, the results will provide valuable implications for ways to increase college students' acceptance of mobile learning.

Key words: TAM model, mobile readiness, perceived interaction, HES, a doption

INTRODUCTION

Mobile devices have many features and capabilities like desktop or laptop such as recording audio/video, taking pictures, downloading and uploading data, sending and receiving messages, Wi-Fi and accessing to the internet; all of these features lead researchers and universities to use these devices in learning process (MacCallum and Jeffrey, 2009). So, using mobile device in learning process will lead researchers to focus on a new channel of learning which is called Mobile learning (m-Learning).

e-Learning refers to using desktop or laptop applications in learning process. Also, m-Learning refers to using hand held devices like mobile device in learning process (Goh, 2006). M-Learning is not just e-Learning with mobile device usage; m-Learning will create a new learning channel which allows educators to access content of materials anywhere and anytime (Park *et al*., 2012).

Mobile devices can be used as a way of teaching and learning processes (Paige, 2013; Traxler, 2013) by allowing students to send and receive academic email (Zhang *et al*., 2011), access library staff, record videos (Sharples and Roschelle, 2010), download course documents (Hewagamage *et al*., 2012) and peer collaborate on projects (Cochrane and Bateman, 2010).

To compare e-Learning which uses laptop and desktop computers (Huang *et al*., 2008; Liu *et al*., 2010a, b; Lowenthal, 2010; Coursaris and Kim, 2011; Cheon *et al*., 2012) with m-Learning which uses hand-held devices that lead researchers to face fewlimitations (Huang *et al*., 2008; Liu *et al*., 2010; Lowenthal, 2010; Coursaris and Kim, 2011; Cheon *et al*., 2012) like screen size, performance and memory space among others (Iglesia, 2012), these challenges mean that adapting m-Learning in learning at the universities is not an easy work and that users may be inclined not to accept m-Learning (Wang *et al*., 2009).

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Problem statement: Mobile learning is still in an early stage especially at Jordanian universities as well as the lack of scientific researches in this field. According to literature review, this study finds gaps or reasons that prevent using the mobile device in learning process:

- Lack of full understanding of students' needs towards m-Learning
- Low features of mobile device especially the content of mobile device
- M-Learning systems have three components (student, educator and content). Low interactions among components themselves lead a decrease in the number of students who use mobile devices in a learning environment

According to the gap, this study will use TAM model as an essential model to find out students' needs and attitudes towards m-Learning. Finally, this study will focus on mobile readiness as an external factor in TAM model because the quality of the m-Learning is related to the limitations of mobile devices; also, interaction plays an important role in m-Learning that leads this study to use perceived interaction as internal factor in TAM model.

Literature review

Technology Acceptance Model (TAM): Technology Acceptance Model (TAM) was introduced by Davis (1993). This model has three main factors: Perceived Usefulness (PU), Perceived Ease of Use (PEOU) and Attitude toward Use (ATU) shown in Fig. 1.

Related studies (TAM model and m-Learning): Technology Acceptance Model (TAM model) has been employed in many information technology fields. All previous studies agreed that TAM model can be used as a tool to expect the adoption of information technology and systems by users' that illustrate in Table 1.

According to prior studies, the researchers are agreed with user's attitude is an important factor which influences the use of new technology (Davis *et al*., 1989). Perceived ease of use and perceived usefulness are the important determinants for an individual's acceptance and usage on mobile learning system (Davis *et al*., 1989). Moreover, the proposed research model will adopt

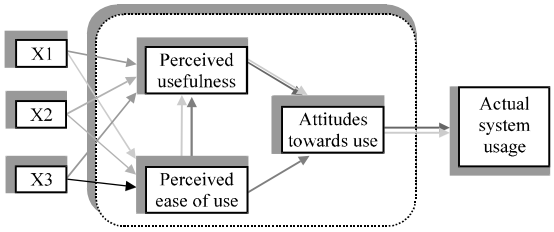

Fig. 1: The first and original TAM was proposed by Davis *et al*. (1989)

Table 1: Previous studies that adopted TAM model as essential framework in learning field

Country	Goal of study	External variables	Samples	Results
Malaysia (Ismail *et al*., 2010)	To find out the factors that influence the students' adoption to use m-Learning short message service learning via (SMS-learning) in the distance learning	Usability	Questionnaire was distributed for (105) students	Usability of the system contributed to be effectiveness in assisting the students with their study
Pakistan (Iqbal and Qureshi, 2012)	To find out students' perceptions about m-Learning adoption	Facilitating conditions perceived playfulness social influence	A survey was conducted among the students of 10 chartered universities operating in the twin	Perceived usefulness, ease of use and facilitating Conditions significantly affect the cities of Rawalpindi and Islamabad students' intention to adopt m-Learning, whereas perceived playfulness is found to have a less influence. Social influence is found to have a negative impact on adoption of m-Learning
Taiwan (Chang *et al*., 2012)	To find out students' attitude to use mobile in english learning	Perceived convenience	A survey was conducted among 158 college students from the middle part of Taiwan	Perceived convenience, perceived ease of use and perceived usefulness were antecedent factors that affected Acceptance of english mobile learning; perceived convenience, perceived ease of use and perceived Usefulness had a significantly positive effect on attitude toward using and perceived usefulness and attitude toward using had a significantly positive effect on continuance of intention to use

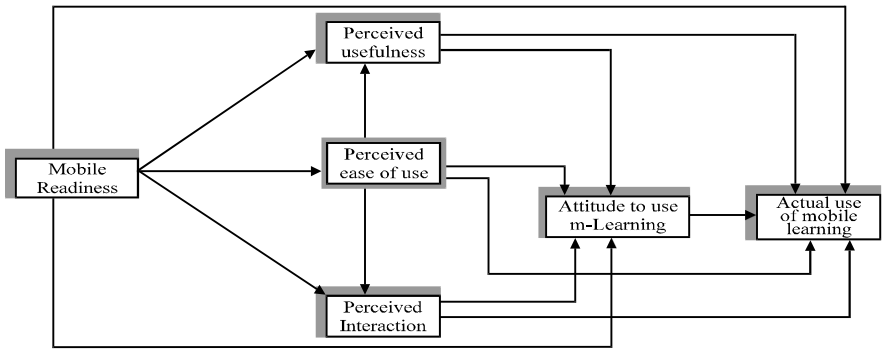

Fig. 2: Proposed research model based on TAM model for higher education students

technology acceptance model as a theoretical model as well as exploring mobile readiness as external variable and perceived interaction as internal variable with perceived ease of use and perceived usefulness to find the effect of these variables on students' attitude to use m-Learning for higher education students.

Theoretical framework: The proposed model in Fig. 2 explains the causal relationships between Mobile Readiness (MR), Perceived Usefulness (PU), Perceived Ease of Use (PEOU) and Attitude to Use (ATU), Perceived Interaction (PI) and Intention to Use M-Learning. Based on the above theoretical variables, this study presents research model and will discuss the relationships between all the factors that influence on M-Learning for higher education students. The proposed model is illustrated in Fig. 2.

Perceived Usefulness (PU): Perceived Usefulness was defined as the extent to which a person believes that using a system would enhance his or her job's performance and effectiveness (Davis *et al*., 1989).

Perceived Ease of Use (PEOU): Perceived Ease of Use was defined as the extent to which a person believes that using a system would be free of mental effort (Davis *et al*., 1989).

Attitude to Use (ATU): Attitude is defined as "individual's positive or negative feelings about performing the target behavior". Personal attitudes are a major factor in affecting individual usage of information technology (Davis *et al*., 1989).

Mobile Readiness (MR): Recently, researchers have found that using mobile phones in delivery of educational content was restricted to the features available on mobile phones. So, mobile readiness in learning process can be defined as propensity to embrace and use mobile device to accomplish goals in learning.

Perceived interaction: Perceived interaction is defined as following interaction between human and system and interpersonal interaction between students and instructors through exchanging information, knowledge, ideas regarding course content and received feedback from them.

Main research hypotheses: According to research objectives and previous study, this research tested the following hypotheses:

- H_1: University student's intention to use m-Learning is affected by their attitude (H_{11}), perceived usefulness (H_{12}), Perceived ease of use (H), perceived interaction (H_{14}), mobile readiness (H_{14})

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MATERIALS AND METHODS

The method employed in this study is an analytical study survey. Mixture is used to collect information from library and field research methods, library method is mainly used to study the literature and history of research and practical experience familiarity with TAM model and how it will be used in the field of this study.

Based on the literature's review, we constructed a questionnaire. We used feedback from experts and three workshops to test and improve the questionnaire. We chose to use multiple methods for data gathering in order to provide a rich description on the topic. We gathered quantitative data via questionnaire (380) respondents. This was complemented with in-depth qualitative data, gathered via interview with 33 students in higher education. The results were validated by interviews with

Table 2: Description identifying the main variables of study and number of paragraphs and sources used in preparing

Variables	Paragraph number	References
MR	2	Self supported
PEOU	2	(Davis *et al*., 1989; Davis, 1993; Venkatesh *et al*., 2003)
P U	3	(Davis *et al*., 1989; Davis, 1993; Venkatesh *et al*., 2003)
P I	2	(Liu *et al*., 2010)
ATU	3	(Davis *et al*., 1989; Davis, 1993; Venkatesh *et al*., 2003)
AU	3	(Davis *et al*., 1989; Davis, 1993; Venkatesh *et al*., 2003)

13 sector experts based on the literature of TAM Model and workshops with experts. We constructed a questionnaire containing 15 factors, covered the six variables of our framework. Each factor in the questionnaire had to be scored on aprocess can be defined as propensity to embrace and use mobile device to accomplish goals in learning.

Perceived interaction: Perceived interaction is defined as following interaction between human and system and interpersonal interaction between students and instructors through exchanging information, knowledge, ideas regarding course content and received feedback from them.

H_2: University student's attitude to use m-Learning is affected by perceived usefulness (H_{21}), perceived ease of use (H_{22}), perceived interaction (H_{23}), mobile readiness (H_{24}).

H_3: University student's perceived usefulness is affected by perceived ease of use (H_{31}), perceived interaction (H_{32}), mobile readiness (H_{33}).

H_4: University student's perceived interaction is affected by perceived ease of use (H_{41}), mobile readiness (H_{42}).

H_5: University student's perceived ease of use is affected by mobile readiness.

Likert-5 cale: The questionnaire was distributed to students either as hard copies or electronically (by creating an online version of the questionnaire). The questionnaires were distributed randomly to students from in private and public universities in Jordan.

Study sample and population: We applied the study parameters to eight private and public universities in Amman City in Jordan. The sample population included (>15000) students. We drew a random sample of (380) students from the community; this sample size is an appropriate minimum according to Sakeran.

Statistical procedures: Data collected by the questionnaire were coded by research assistants, the data were recorded first in an MS-Excel program and later transferred to SPSS 20. A random of 7% of the entered data was checked for coding accuracy. Descriptive statistical analysis such as mean, standard deviation percent and correlation were implemented using SPSS.

Structural Equation Model (SEM) was used to assess the factorial validity of the measuring instruments e-Readiness, perceived usefulness, perceived ease of use, perceived traction, attitude towards using and actual using of mobile learning. Amongst the fit indices produced by the Amos program is the Chi-square statistic (χ^2) which in the test of absolute fit of model. And additional best-fit indices were used and computed for each scale because of the sensitivity of (χ^2) to sample size such (RMSEA) (TLI) (GFI) (AGFI) (NFI) (CN) (Table 2).

RESULTS AND DISCUSSION

Analysis of measurement model: Convergent Validity (AVE) test results are shown in Table 3, All AVE values were >0.5 which confirms the credibility of the main themes of the study. Shown in Table 3 reliability (internal consistency test) measured by cronbach's-alpha is >0.7 for all variables indicating the test is reliable. In the measurement model, convergent validity which implies the extent to which the indicators of a factor that are theoretically valuated should correlate highly (Park *et al*., 2012). We checked all factor loadings exceeded 0.70. Considering the size of the sample in this study, these scores are significant at ≤0.05 level. Table 3 shows the result of confirmatory and reliability test with some descriptive statics' mean, standard deviation. The measurement model also contains check of discriminate validity which shows the correlations among the variables. Table 4 shows that (constructs), all the correlations in were below 0.85 which doesn't indicate a poor discriminate validity in Structural Equation Model (SEM) (Davis *et al*., 1989). The structural model of the study was testing rendering the following fit results: χ^2 of

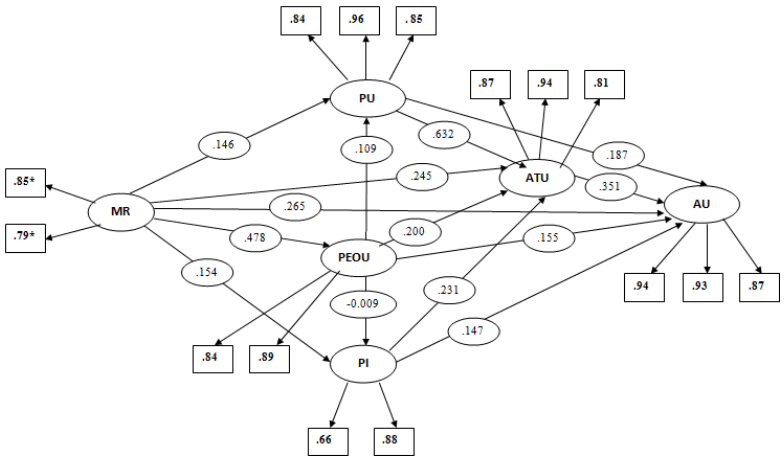

Fig. 3: Shows the standardized path coefficients estimated AMOS

Table 3: Measurement properties for multi-item constructs

Construct	Standard loading	Mean	SD	Cronbach's alpha
Mobile Readiness (MR)				
I have a propensity to embrace mobile device for accomplishing goals in learning	0.85*	3.540	1.14	0.8524
I have a propensity to use….	0.79*	3.280	1.04	
Perceived Use fullness (PU)				
Mobile learning would improve my learning performance	0.84*	3.480	1.07	0.7853
Mobile learning would increase Academic productivity	0.96*	3.560	1.12	
Mobile learning could make it easier to study course content	0.85*	3.570	1.05	
Perceived Ease of Use (PEOU)				
I find mobile easy to use	0.84*	4.060	0.99	0.8034
Learning how to use an E-mobile is easy for me	0.89*	4.290	0.95	
Perceived Interaction (PI)				
Mobile learning could make it easier to discuss relevance	0.66*	3.600	1.13	0.8321
Mobile learning would help me to engage in simultaneous learning interaction with other	0.88*	3.540	1.11	
Attitude To Use (ATU)				
Studying through mobile learning is a good idea	0.87*	3.850	1.06	0.8155
Studying through mobile learning is a wise idea	0.94*	4.000	1.01	
I am positive toward mobile learning	0.81*	3.680	1.03	
Actual Use (AU)				
I spend a lot of time on using mobile learning for academic use	0.94*	3.370	1.48	0.7962
I use the mobile learning quite often for academic use	0.93*	3.010	1.43	
I have been using the mobile learning for academic use for a very long time now	0.87*	3.070	1.46	

*The value significant at 0.05

Table 4: Correlation between study variables

Construct	MR	PEOU	PU	PI	ATU	AU
MR	-					
PEOU	0.48					
PU	0.49	0.75				
PI	0.35	0.55	0.48			
ATU	0.34	0.50	0.51	0.39		
AU	0.32	0.49	0.52	0.32	0.34	

382,041 (df = 340) (p = 0,00) RMR of 0.038 RMSEA of 0.040. GFI of 0.924, AGFI of 0.910, NFI of 0.911, IFI of 0.914, RFI of 0.914 , TLI of 0.980. The fit statistics on the all fit indices were acceptable. Figure 3 Shows the standardized path coefficients estimated AMOS.

To test the significance of the parameters at 0.05 level we used to value in addition to Gamma and beta shipmates: (Gamma: from exogenous construct to endogenous) (beta: from endogenous construct to endogenous construct). Gamma and beta estimates which where statistically significant were donated by asterisks and t-values between two-three were donated by one asterisks while t-values which are larger than three were donated by two asterisks. Table 5 shows the direct and indirect relationships among the constructs of the proposed model.

The SEM results revealed that the proposed external variable (m-Readiness) has significant effect on mobile learning use. Out of the proposed hypotheses, one was not supported which is related to the effect of perceived ease of use on perceive interaction. Table 5 shows that all the relationships between (the external and internal constructs) and (UML) were significant.

Table 5: The direct and indirect relationships among the constructs of the proposed model

Hypothesis sized path	DE	t-values	In-E	Total effect	Results of hypotheses
ATU→AU	0.351	(8.246)*	-	0.3510	Supported
PI→AU	0.147	(2.75)**	0.222	0.3690	Supported
PEOU→AU	0.155	(3.90)**	0.071	0.2260	Supported
PU→AU	0.187	(3.45)**	0.081	0.2680	Supported
MR→AU	0.265	(6.49)**	0.194	0.4590	Supported
PU→ATU	0.632	(7.09)**	-	0.6320	Supported
PEOU→ATU	0.200	(6.21)**	0.687	0.8860	Supported
PI→ATU	0.231	(3.721)**	-	0.2310	Supported
MR→ATU	0.245	(6.512)**	0.177	0.4220	Supported
PEOU→PU	0.109	(2.65)**	-	0.1040	Supported
MR→PU	0.146	(2.73)**	-	0.1460	Supported
PEOU→PI	-0.009	(-0.12)	-	0.0090	Not supported
MR→PI	0.154	(3.74)	-0.001	0.1497	Not supported
MR→PEOU	0.478	(10.236)**	-	0.4780	Supported

T-values between two-three were donated by *while t-values which are larger than three were donated by two**

The strongest value was found in a relationship between user Attitude to Use (ATU) and mobile learning use (351) followed by mobile readiness (265). On the other hand all of perceived usefulness and perceived ease of use and perceived interaction were found significant in affecting user attitude tones. Perceived usefulness of use had the effect on user attitude with magnitude (632) followed by perceived interaction (231) and perceived ease of use (200). According to Table 5, the direct effect estimates show that both of mobile readiness and perceived ease of use were affect perceived usefulness. Mobile readiness was identified as the largest determinant to perceived usefulness (146). Also, the direct effect estimates show that mobile readiness affects perceived interaction (154) but perceived ease of use had no effect on perceived interaction (-009). Finally, mobile readiness was found to be significant to perceived ease of use (478).

CONCLUSION

This study aimed at proposing a new model for m-Learning at a university environment; to identify and investigate the factors that affect on students 'attitude to use m-Learning within the context of higher education to find the actual use of m-Learning. Also, investigated how these factors can shape students' attitude to use mobile learning. In order to find the factors that influence on m-Learning adoption, this study adopted TAM model as a theoretical framework and extended this model with external variables to propose new model. A questionnaire survey was adopted being based to collecting required data. The findings in this study are similar to other studies. According to TAM model, this study confirmed that perceived ease of use and mobile readiness had significant effect on perceived usefulness (Davis *et al*., 1989); also perceived usefulness and perceived ease of use and perceived interaction had significant effect on individual attitudes. The effect of perceived usefulness on attitude and actual to use m-Learning is reflective (Davis *et al*., 1989). Finally, mobile readiness affected perceived interaction but perceived ease of use had no effect on perceived interaction and mobile readiness was found to be significant to perceived ease of use.

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