Assessing Students' Attitude and Intention to Use M-learning in Higher Education

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Abstract: Mobile learning (m-learning) is a key solution for education in order to improve the learning effectiveness of students. Increasing mobile penetration in the world, particularly among the young generation urges the investigation of the factors affecting m-learning use in higher education institutions. The primary aim of this paper is to utilize *general extended technology acceptance model for e-learning* (GETAMEL) developed by Abdullah and Ward (2016) to examine the factors driving the undergraduate students' attitude and intention to use m-learning in Azerbaijan with the moderating effect of Technology innovativeness (TI). The study used a survey conducted across the undergraduate students in the 7 universities located in the Baku city. The survey questionnaire was used to collect valid data from 698 samples. The Structural Equation Modelling (SEM) results revealed that Experience (XP), Subjective norms (SN), Enjoyment (ENJOY), Information and communication technologies anxiety (ICTA), and Self-efficacy (SE) significantly influence Perceived Usefulness (PU), while only XP and ICTA have an impact on Perceived ease of use (PEOU). It did not affect PU of m-learning. TI was found to have moderating effect on the relationship of PEOU and PU with Attitude (ATT), but not the relationship of ATT with Intention (INT). This study filled the gap in the m-learning literature in Azerbaijan, and provided significant implication for both academic and government institutions willing to increase the penetration of ICT technologies and m-learning in higher education.

Key words: M-learning, GETAMEL, higher education, Azerbaijan
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0 Introduction

By reviewing 107 e-learning adoption studies, Abdullah and Ward (2016) proposed GETAMEL, in which the authors combined the most prevalent external variables with PEOU and PU of Technology acceptance model (TAM), namely SE, SN, ENJOY, CA (replaced with ICTA), and XP. Abdullah and Ward (2016) considered SN and Social Influence (SI) as similar factors due to the fact that both of them highlight the influence of social factors on technology usage (Venkatesh et al., 2003). However, CA was replaced with ICTA due to the fact that CA covers the anxiety regarding the use of computers in a learning process. It is described as "the tendency of an individual to be uneasy, apprehensive, or fearful about the current or future use of computers in general" (Igbaria & Parasuraman, 1989, p. 375). Hence, it is considered as a crucial part of studies on e-learning adoption (Alenezi et al., 2010). ICTA and its impact on m-learning, compared to ICT use in general, was not extensively studied (Wang, 2007). In spite of a wide adoption of mobile devices and an increasing rate of Internet penetration across the country, there is no study exploring the attitude and adoption intention of m-learning among Azerbaijani undergraduate students. M-learning refers to a learning via the use of small computing devices, including smart phones and portable handheld devices (Mcconatha, Praul, & Lynch, 2008). Based on the GETAMEL, this study fills this gap in the literature by adding external variables validated in the study of Abdullah and Ward (2016) in order to examine undergraduate students' ATT and INT toward using mobile devices for educational purposes. Based on former studies in the context of consumer behavior, technology usage among the students, e-book acceptance of undergraduate students, and m-learning in higher education, we included TI as moderating variable in order to examine whether the TI level can alter the acceptance of undergraduate students toward m-learning (Nysveen, Pedersen, & Thorjornsen, 2005; Raman, 2011; Ngafeeson & Sun, 2015).

By considering that Azerbaijan is in the early stages of ICT and mobile technology penetration in the society and educational institutions, our approach will provide significant insight for decision makers of higher edu-

cational institutions as well as government organizations such as the Ministry of Education to take actions for m-learning adoption and create sustainable infrastructure for it, which can facilitate learning process and motivate the active inclusion of all students in the interactive learning process. Without investigating the factors creating positive attitude and undergraduate students' intention to adopt m-learning, it would be difficult to deploy the m-learning environment and infrastructure at the universities.

The rest of the paper is organized as follows. Section 2 provides theoretical framework by initially reviewing technology acceptance model, its relationship with learning technologies and external variables that affect the attitude and intention to use m-learning, then proposing hypotheses between external variables and m-learning system use. Section 3 presents methodology with the inclusion of data collection and study measures. Section 4 demonstrates the testing of measurement and structural model and identifies significant relationship. Finally, discussion and conclusion are given in Sections 5 and 6 respectively

1 Theoretical framework

1.1 General extended technology acceptance model for e-learning

The TAM has been widely used to identify the factors affecting learners' decision to use a new learning system. The major purpose of TAM is to explain individual's behavior towards a technology adoption, and central variables are PEOU, PU that are affected by external variables. According to Alsabawy et al. (2016), PU is a vital factor in assessing the acceptance and success of an e-learning system due to the lack of evidence on the effect of IT infrastructure on usefulness of a system. ATT influences INT towards the technology, which in turn affects actual use. As an extension of TAM model, Abdullah and Ward (2016) developed the GETAMEL. With a meta-analysis based on 107 former researches on the use of extended TAM in different e-learning adoption settings, the authors proposed GETAMEL. Their study discovered that among 152 external variables, SE, SN, ENJOY, CA and XP were the most extensively used external variables of TAM. The GETAMEL is based on these five factors. The SE is a "belief in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997), while SN is referred to as "a person's perception that most people who are important to him think he should or should not perform the behavior in question" Fishbein and Ajzen (1975, p. 302). Park, Son, and Kim

(2012, p.379) defined ENJOY as "the extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use." Venkatesh et al. (2003, p. 432) characterized CA as "evoking anxious or emotional reactions when it comes to performing a behavior." XP refers the extent to which individuals with more experience in computer use, Internet and email, as well as saving and locating files are more likely to have favorable feelings towards the e-learning system's usefulness and ease of use (Lee et al., 2013; Purnomo & Lee, 2013). Finally, TI has been defined as the personal willingness for trying new information technologies (Agrawal & Prasad, 1998). This study intends to employ and empirically tests the GETAMEL in m-learning domain, by examining the influence of those five external variables on students' PEOU and PU of m-learning, and determines how students' attitudes may influence their adoption intention on m-learning use for educational purposes.

1.2 Hypothesis development

The GETAMEL framework has been employed to test the relationships between external variables of TAM with the inclusion of PEOU, PU, ATT and INT for adoption (Abdullah & Ward, 2016). Another study used the same external variables of TAM to investigate their influence on PEOU and PU of e-portfolios (Abdullah et al., 2016). The authors excluded the variable of "Attitude" from TAM due to the findings from previous studies that there is a weak association of PU with ATT, but a strong connection with INT (Davis et al., 1989, p. 997), and weak relationship of ATT with INT (Venkatesh et al., 2003, p. 461). However, in other studies PEOU and PU are found to be critical elements affecting the level of user attitude (Davis, 1985, 1989; Davis et al., 1989). Furthermore, Liu (2010, p. 54) stated that eliminating the variable of "Attitude" from TAM could produce better perception on the influence of PEOU and PU on "Behavioral intention" variable.

Nevertheless, in a country in which technological innovations, mobile technologies are newly introduced in different sectors such as government, education, social services, it is very important to perceive how students think about mobile technology usage for their educational mission. Without knowing their attitudes towards deployment of new technologies in education system, the study would create non-productive outcomes. Therefore, in this study, it is important to know students' attitudes firstly and then examine how

their ATT will affect INT. For this purpose, the recent study preserves the variable in model testing as it has originally been proposed by Abdullah and Ward (2016)

(shown in Fig. 1). The proposed relationships between study variables are presented further.

Fig. 1 Conceptual Model Based on GETAMEL with 5 Most Commonly Used External Variables
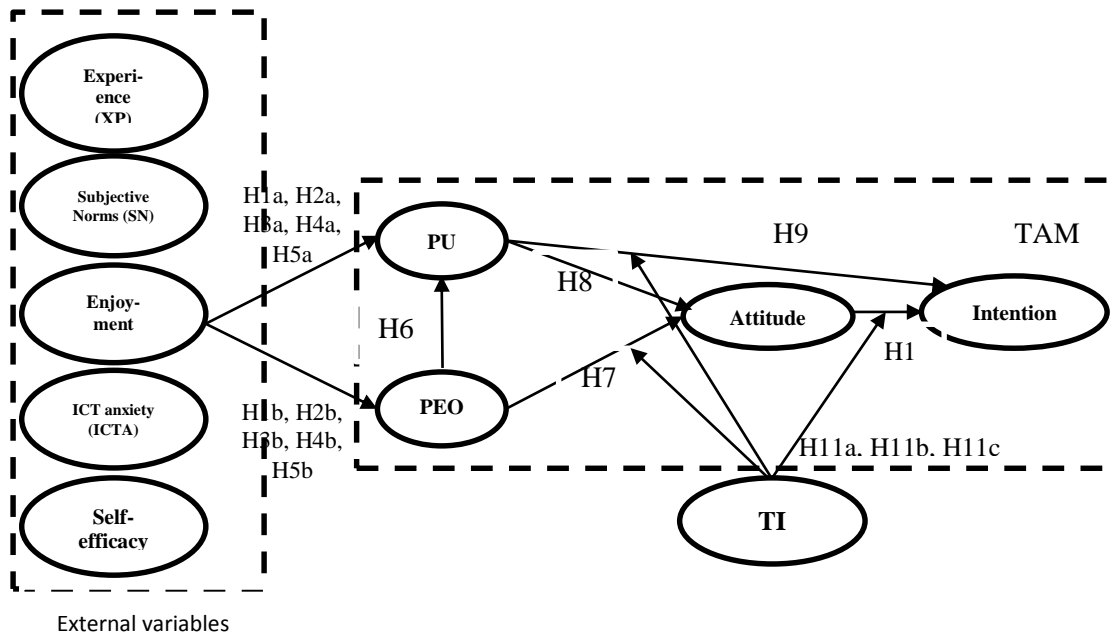
The literature related to e-learning acceptance confirmed that experience affects learners' PEOU (De Smet et al., 2012; Lee et al., 2011) and PU (Martin, 2012; Rezaei et al., 2008) on e-learning. XP also impacts the INT towards using different e-learning systems (Premchaiswadi et al., 2012; De Smet et al., 2012; Williams & Williams, 2009). The outcomes of several studies showed that SN is a significant determinant of e-learning systems' acceptance by students (AlGahtani, 2016; Park, 2009). The idea of enjoyment is in agreement with inner motivation (Ryan & Deci, 2000). ENJOY increases students' INT to use e-learning (e.g. Cheng, 2012; Yang & Lin, 2011). ICTA has been found to have a significant influence on ICT use (Parayitam et al., 2010; Beckers, Wicherts, & Schmidt, 2007; Imhof et al., 2007; Saadé & Kira, 2007; Smith & Caputi, 2007; Agarwal et al., 2000). A vast majority of researches indicated that computer anxiety would negatively affect adoption of ICT by educators in teaching process. SE is related not to the number of skills learner has, but to what learners' belief that they can do with what they have under a variety of circumstances or situation (Bandura, 1997; Rogers et al., 2008). The previous studies identified SE to be positively determined by motivation, effectiveness, and positive attitudes (Bandura, 1986).

In original TAM, there are casual relationships among user perceptual, attitudinal, and behavioral factors. (Davis, 1985, 1989; Davis et al., 1989). INT is predict-

ed by PU and ATT in the TAM. The attitudes on mobile chat service use are formed by beliefs on the outcomes of using the appropriate service, and evaluation of the favorability of the outcomes (Nysveen et al., 2005). TI has been identified as a trait (Midgley & Dowling, 1987). It is considered as a stable attribute of individuals, not related to situational considerations. In relationship with the existence of TI in technology use, Agarwal and Prasad (1998) implied that this happens through TI's association with beliefs. While concurring with Midgley and Dowling (1987) that the trait-behavior model inadequately represents the technology adoption behavior, they proposed TI as a moderator between antecedents and the consequence of perceptions in technology use. Based on the above discussion, we present the following hypotheses:

H1a, b. XP will have significant influence on PU and PEOU

H2a, b. SN will have significant influence on PU and PEOU

H3a, b. ENJOY will have significant influence on PU and PEOU

H4a, b. ICTA anxiety will have significant influence on PU and PEOU

H5a, b. SE will have significant influence on PU and PEOU

H6. PEOU will have significant influence on PU

H7. PEOU will have significant influence on ATT

H8. PU will have significant influence on ATT

H9. PU will have significant influence on INT

H10. Attitude will have significant influence on INT

H11a, b. TI will moderate the relationship of PU and PEOU with ATT

H11c. TI will moderate the relationship of ATT with INT

2 Methodology

2.1 Data collection

A questionnaire was designed to collect data and to test the proposed model. The data collection process took 44 days (from 4th of March to 16th of April, 2017) in eight leading universities, namely Baku State University, Qafqaz University, Azerbaijan Technical University, Azerbaijan State University of Economics, Azerbaijan University of Architecture and Construction, Azerbaijan Tourism Institute, Azerbaijan University, and Khazar University located in Baku city. A total of 698 valid responses were obtained from 725 participants with the rate of 96.3%. 27 answers were removed due to the fact that they were not properly completed. Demographic analysis of respondents shows that 401 (57.4%) of undergraduate students are males, while 297 (42.6%) of them are females (shown in Table 1).

2.2 Measures

The study variables were assessed with five-point Likert scale from strongly disagree (1) to strongly agree (5) due to the fact that Likert scales are broadly used in technology acceptance domain (Abdullah et al., 2016; Park et al., 2012). The variables, namely PU, PEOU, ATT and INT and their items were adapted from the extended TAM used by Huang et al. (2007) in the context of m-learning. The external variables and their items were adapted from Abdullah et al. (2016). Moderating variable – TI and its items were adapted from Ngafeeson and Sun (2015).

Table 1 Demographic Profile of Undergraduate Students

Demographic profile (N=698)	Frequency	Percentage (%)
Gender		
Male	401	57.4
Female	297	42.6
Age		
18-21 years old	486	69.6
22-25 years old	195	27.9
26+ years old	17	2.4
Year of study		
Year 1	382	54.7
Year 2	139	19.9
Year 3	106	15.2
Final year	71	10.2
Experience in using mobile devices		
Less than 1 year	19	2.7
1 to 3 years	179	25.6
3 to 6 years	336	48.1
More than 6 years	164	23.5

3 Analysis and results

This research used the quantitative method for the purpose of analysis due to the fact that it is efficient method to draw conclusion with the techniques emphasizing reliability and validity. Furthermore, descriptive statistics of this study was examined using SPSS 22. The data analysis also included the assessment of reliability and validity. For that purpose, Structural Equation Modelling (SEM) technique was used to test validity and proposed hypotheses of the conceptual model. SEM with AMOS statistical package was used because of its appropriateness for testing multiple dependent relationships, by considering that our conceptual model has multiple independent, dependent variables as well as moderator.

3.1 Reliability and validity

All the variables of this research were tested with reliability, convergent validity and discriminant validity analysis. According to Hair et al. (2010), reliability test must be applied prior testing its validity. It refers to the reliability of testing the consistency between variables' multiple measurements. Reliability was tested with the composite reliability scores. CFA was performed to test the relationship between items and their respective latent variables using AMOS. In other words, CFA is to test the convergent validity and discriminant validity. The Composite Reliability (CR), and Average Variance Extracted (AVE) of all the variables exceed the acceptance level of .7 and .5 respectively, representing good internal consistency (Hair et al., 2010). Furthermore, CR values range from .791

to .924, and AVE values range from .533 to .798, indicating good convergent validity. The square root of AVE for each variable must be greater than the correlation values of relationships between the variables of the measurement model. It was further discovered that square root of AVE for variable is greater than their correlation values with other variables (shown in Table 3), representing a good discriminant validity.

Table 2 Measurement Model and Convergent Validity

Variables	Items	Mean	STD	Factor loading	Cronbach's α	CR	AVE
XP	XP1	3.323	0.948	0.898	0.881	0.879	0.727
	XP2	3.059	0.948	0.923			
	XP3	2.978	0.929	0.893			
	XP4	3.146	0.92	0.352			
SN	SN1	2.975	0.93	0.86	0.864	0.784	0.798
	SN2	2.856	0.922	0.897			
ENJOY	ENJOY1	2.674	1.04	0.898	0.887	0.917	0.634
	ENJOY2	3.113	1.098	0.817			
	ENJOY3	3.005	0.917	0.903			
ICTA	ICTA1	1.848	0.968	0.944	0.91	0.924	0.672
	ICTA2	1.336	1.103	0.926			
	ICTA3	1.959	1.122	0.929			
	ICTA4	1.236	1.08	0.933			
SE	SE1	3.442	1.023	0.933	0.893	0.791	0.711
	SE2	3.157	1.213	0.889			
	SE3	2.954	1.386	0.876			
PU	PU1	2.784	1.362	0.914	0.905	0.846	0.683
	PU2	2.667	1.334	0.907			
	PU3	3.053	1.229	0.933			
PEOU	PEOU1	3.04	1.306	0.903	0.876	0.92	0.713
	PEOU2	2.855	0.876	0.882			
	PEOU3	2.394	1.051	0.89			
ATT	ATT1	2.906	1.062	0.898	0.854	0.901	0.733
	ATT2	2.731	0.974	0.913			
	ATT3	2.999	1.057	0.888			
INT	INT1	3.051	0.995	0.883	0.768	0.893	0.531
	INT2	2.592	0.88	0.461			
	INT3	2.841	0.886	0.885			
TI	TI1	2.941	0.977	0.918	0.853	0.904	0.678
	TI2	2.905	0.979	0.897			
	TI3	3.016	0.864	0.882			

Table 3 Correlation Matrix and Discriminant Validity

Variables	XP	SN	ENJOY	ICTA	SE	PU	PEOU	ATT	INT	TI
XP	**0.853**									
SN	0.409	**0.893**								
ENJOY	0.193	0.433	**0.796**							
ICTA	-0.049	0.232	0.302	**0.82**						
SE	0.335	0.377	0.351	0.487	**0.843**					
PU	0.323	0.387	0.327	0.067	0.681	**0.826**				
PEOU	0.372	0.352	0.287	0.034	0.54	0.671	**0.844**			
ATT	0.301	0.387	0.375	0.125	0.461	0.668	0.803	**0.856**		
INT	0.376	0.401	0.367	0.094	0.382	0.421	0.114	0.417	**0.729**	
TI	0.295	-0.071	0.119	0.051	0.291	0.045	0.091	0.273	0.339	**0.823**

NOTE: Diagonal values show the square root of AVE

3.2 Structural model

The structural model of this study was examined using AMOS. Table 4 demonstrates the outcomes of the structural equation model. The hypotheses (H1 ~ H11) in the conceptual model were tested for the sample. The first-fit index for the structural model indicated an acceptable fit (x^2 = 726.134; df = 538; p value = .000, NFI = 0.871; RMSEA = 0.046; CFI = .937; GFI = 0.868; TLI = 0.911). Among the 11 (a, b) hypotheses, 4 of them were not supported (SN to PEOU; ENJOY to PEOU; SE to PEOU; PEOU to PU. Figure 2 describes the results of the structural model test.
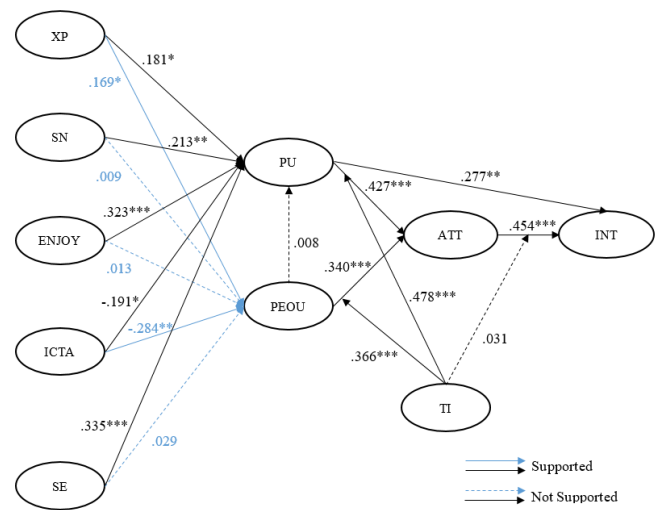

Table 4 Goodness-of-fit Statistics

Goodness of fit index	Good fit	Acceptable fit	Structural model
X² (chi-square)			726.134
df (degree of freedom)			538
X²/df	<2	2.0 - 5.0	1.3497
Probability	0	0.05	0
NFI	>.90	.85 - .90	0.871
CFI	>.90	.85 - .90	0.937
GFI	>.90	.85 - .90	0.868
TLI	>.90	.85 - .90	0.911
RMSEA	<.06	.06 - .08	0.046

Fig. 2 Structural Model

Table 6 Results of Moderation Analysis

Step	Path	Predictor	Moderator	Outcome	β values
Step 1	a	PEOU	-	ATT	.340 ***
Step 2	b	PU	-	ATT	.427 ***
Step 3	c	TI	-	ATT	.254 **
Step 4	d	PEOU * TI	Yes	ATT	.366 ***
Step 5	e	PU * TI	Yes	ATT	.478 ***
Step 6	f	ATT	-	INT	.454 ***
Step 7	g	TI	-	INT	.231 **
Step 8	h	ATT * TI	No	INT	0.031

***p < 0.001 **p < 0.01 *p < 0.05

4 Discussion

This study validated GETAMEL in terms of m-learning use of undergraduate students in the leading Azerbaijan universities for their educational purposes. It was revealed that the external variables proposed by Abdullah and Ward[1] with the review of 107 papers related to e-learning adoption predicts TAM factors of PEOU and PU differently. Hence, all of the external variables (XP, SN, ENJOY, ICTA, and SE) have significant relationship with PU, while only XP and ICTA significantly predict the students' perception on PEOU. Thus, H1a, b, H2b, H3b, H4a, b, and H5b are supported, while H2a, H3a, and H5a were rejected. It was also discovered that there is no significant influence of PU on PEOU (H6), which is against the finding of Abdullah et al. (2016) and Khanh and Gim (2014). The results show that students' perception on usefulness is more vital than their perception on ease of use in affecting their attitude to use m-learning (Huang et al., 2007). The relationship between ENJOY and PU shows that if students enjoy using m-learning system, they would find it to be useful, which is not in agreement with the finding of Huang et al. (2007). This research suggests that PU is important to determine the attitude toward use of m-learning for educational purpose (H9). This finding is similar to that of Davis, who assumed that PU is one of the central factors predicting user's attitude (Davis, 1989; Davis et al., 1989), as well as the findings of Zhu et al. (2012) in terms of m-learning in higher education in universities in China. The authors had also indicated that PU exerts more impact on user's attitude than PEOU does. Compared to Khanh and Gim (2014), this study found positive and significant relationship between PEOU and ATT (H7). This study had proposed TI to be moderator in the relationships of PEOU and PU with ATT (H11a, b). It was found that TI of the students increases the influence of PEOU and PU on ATT towards m-learning, which is not in agreement with the findings of Ngafeeson and Sun (2015). It implies that innovativeness level of the students will lead to higher perceptions of the usefulness and ease of use of the new technology. Therefore, educational institutions as well as government organizations will need to put more efforts on introducing new technologies and motivate the the young generation to get familiar with these technologies before the deployment of m-learning in the education system. Among all the latent variables, the mean value of technology innovativeness is considered to be satisfying (TI = 2.941) following SE, XP, INT, PEOU, and SN.

5 Conclusion

This study verified that GETAMEL can be utilized to explain and predict the attitude of the undergraduate students to use m-learning as an educational tool to facilitate their learning process and increase the efficiency. Furthermore, positive attitudes towards m-learning also increases the possibility of the adoption intention of this learning type in the universities. As we had discussed above regarding the academic and practical implications of this research, it was revealed that external variables identified by Abdullah and Ward[1], and employed by Abdullah et al. (2016) in e-learning, also applies in m-learning context. Hence, XP, SN, ENJOY, ICTA and SE are more significant determinants of PU compared to the PEOU. Thus, educational institutions must concentrate on promoting the usefulness of m-learning. In addition, PU affects ATT more than PEOU, showing that usefulness of m-learning is central for the students. Higher ICTA leads to negative ATT toward the usefulness and ease of use of the m-learning. Therefore, educational institutions and government bodies must try to reduce the anxiety of using new technologies among the young generation. Furthermore, innovativeness must be increased in order to create more positive ATT towards using m-learning. Increasing Internet penetration rate and mobile device usage among the young generation clearly shows that students are familiar with new technologies and willing to use them in their educational pursuits. Our findings can be a guide in planning the m-learning strategy across the leading universities in Azerbaijan.

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