Determinant of Mobile Devices Acceptance for Learning among Students in Developing Country

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ABSTRACT

This study was conducted to understand the determinant of mobile devices for learning among students in developing world. A sample of 247 undergraduate students from Malaysia and Nigeria were involved in the study. An adapted but modified survey instrument was used to gather the data of the study. The variable of the study are perceived usefulness, perceived ease of use, perceived enjoyment, facilitating condition, behavioral intention and student attitude are the independent variable of the study. T-test and Multiple regression analysis was conducted. The findings of the study shows that there is no significant difference in acceptance to use mobile device for learning among science and non-science students but there is significant difference in acceptance to use mobile device for learning among male and female students. Perceived usefulness, perceived enjoyment, facilitating condition, and behavioral intention were found to significantly influence students' acceptance of Mobile Device for learning, surprisingly perceived ease of use and student attitude was statistically insignificant in determining student acceptance to use MD for learning..

Keywords: *Mobile devices, Technology Acceptance Model, Student acceptance*

INTRODUCTION

The rapid advancement of emerging technology has increased the functionality of mobile communication devices in the contemporary world. In the recent time, mobile phone such as smart phone, cell phone and personal digital assistant (PDAs) are built with functions that allows different application, which enable connectivity and some other internet applications (Sek, Lau,Teoh, Law & Parun, 2010). Some of the function of the cell phone can be equated with that of personal computer (Cui & Wang, 2008). Due to additional features of the mobile phone and its capability to carry out function just like that of personal computer, the rate of it use is growing rapidly among all ages everywhere in the world.

The prevalence of mobile phone ownership and its popularity of its adoption and use among the present generation of students have attracted the attention of educators and researchers in information and communication technology field. Most especially, educators all over the world are exploiting the device beyond mere utilizing it for communication alone to its use for teaching and implementing curriculum. This is because it is perceived as the most acceptable medium to teach the present students (Tai & Ting, 2011).

The adoption of mobile device as a new learning tool is growing exponentially in the advance world. Its use for mobile learning is becoming a new development in e-learning and distance education. According to Sife, Lwoga and Sanga (2007), mobile learning is an innovative way of utilizing handheld computer, internet-enable cell phone for the delivery of instruction and learning content to students. Keegan (2003) opined that there is increase in the use of wireless technologies in education and that wireless technologies such as cell phone are transforming and changing educational landscape so much so that teaching and learning can take place anywhere, everywhere and anytime thereby creating a new innovation in learning process known as mobile learning. Barker, Krull and Mallinson, (2010) also point out the paradigm change in teaching and learning process with the use of mobile devices.

> Wireless technologies are revolutionizing education, transforming the tradition ways of learning and teaching into "anytime" and particularly "anyplace" education thereby creating advantage of promoting and supporting group work or project among students as well as engaging learning in learning related activities despite their diverse location. (pg 1)

Motiwalla's (2007) explain that the utilization of mobile phone for learning cannot be underestimated because the study on its use revealed that students found it to be a complementary tool in learning. Also, it uses enable continuous learning outside the four wall of the classroom. Al-Fahad (2009) study on student attitude and perception toward mobile learning at King Saud University, Saudi Arabia reveal the advantage of mobile learning and that it would enhance student communication and enrich learning experience of the learners. Keegan (2002) reported that the quality and capability of handheld mobile device is increasing steadily, because of the advancement in technology, which enable miniaturization as well as breakthrough in wireless technology. Roschelle's (2003), and BenMoussa (2003) study on mobile device for learning enumerated the following advantage of using wireless devices in learning environment. These include the following:

- It can augment physical space
- It leverage topological space
- It aggregate coherent across all student individual contribution
- Can conduct and enhance classroom performance, and
- Turning students' act to become artifact
- It enable users to filter and control information flow
- It enable connectivity, either personalized or individualized connectivity
- It improved collaboration via real-time or instant interactivity which leverage better decision making
- It enhance user orientation or direction which invariably useful in learning environment

Furthermore, Churchill and Churchill (2008) explained that handheld devices have the following usefulness in education. These are: Portability, user can take it anywhere. Social interactivity, it can be use for collaboration.Text sensitivity, it can be use to gather real or simulated data. Connectivity, it enables a connection to data collection devices and network devices, lastly individuality, it can provide scaffolding which give clue to learner investigation and assist them in construction of knowledge

Research study has revealed the growing use of mobile phone for teaching and learning process, yet, there appear to be little empirical study as to what promote student acceptance of this new phenomenon in e-learning, most especially in the developing world like Malaysia and Nigeria. It is in realization of this gap that this study is conducted in order to understand the reasons why students may or may not adopt mobile device for their learning using a theoretical approach. It was reported by Corbeil and Valde-Corbeil in (2007) that ownership of mobile phone with internet application by students may not guarantee their acceptance to use it when it come to teaching and learning function.

Therefore, the main objective of this study is to understand the determinant of mobile phone adoption in educational setting in developing economic like Nigeria and Malaysia most especially when existing research finding indicated that mobile device use for learning is still at its infancy. In doing this, the study employedTechnology acceptance model(TAM) as a theoretical framework of the study and extend it with some factor from (UTAUT).

Theoretical Background

The determinant of new innovation and emerging technology adoption in education is increasingly attracting information system and educational technology researchers' attention in the contemporary world. Study of new innovation has keep pace with rapid technology advancement and development in educational field. Understanding the reason why users accept or reject to adopt and use different emerging technology in teaching and learning process has been study through several theories. One of the prominent theory used in most of this study is Technology acceptance theory (TAM) developed by Davis in 1985. Prior to the development of TAM, the theory of reason action (TRA) and theory of planned behavior (TPB) were postulated (Fishbein & Ajzen, 1975).

The theory of reason action (TRA) was use to explain acceptance to use IS based on the users positive or negative attitude toward a target behavior and the perception of the individual about what the people that are most important to him/her would think if he/she exhibit a certain behavior (Fishbein & Ajzen, 1975). On the other hand, theory of planned behavior (TPB) was an extension of (TRA) with addition of a factor known as perceived behavioral

control, which represent the ease or difficulty that a user may encounter when performing a target behavior (Ajzen, 1991).Similarly, Rogers (1985) postulated that adoption of new innovation is a function of the following five (5) factors, compatibility, observability, triability, perceived complexity, and relative advantage.

According to King (2006), perceived usefulness and perceived ease of use in TAM has been extensively use in predicting IT acceptance across several technology. Similarly, Ahmad, Basha, Marzuki, Hisham and Sahari (2010) corroborated the predictive power of these two construct and the robustness of TAM in explaining the acceptance and use of new innovation in education. As new innovation come into existence factor that are not consider before are now becoming importance determinant for accepting IS among different level of users, hence, the extension of TAM (Shittu, 2011).Moreover, review of literature has shown that TAM is mostly used theory in model development of a specific user acceptance of emerging technology. Nonetheless, attempt has also been made to extend the theory.

Prior to this study, several factor and theories have been used in previous research. For instance, Phuangthong and Malisawan (2005) developed a model on Mobile learning adoption. In that study, student attitude to M-learning was influenced by perceived enjoyment. Also, Ju et al. (2007) study revealed that PU has a strong impact on users' attitude and thereby affect intention of them to adopt M-learning. This study tries to understand acceptance of mobile device for learning from theoretical point of view of TAM and extend it with few factors inunified theory of acceptance and use of technology (UTAUT). Below in figure (1) is the propose model for the study

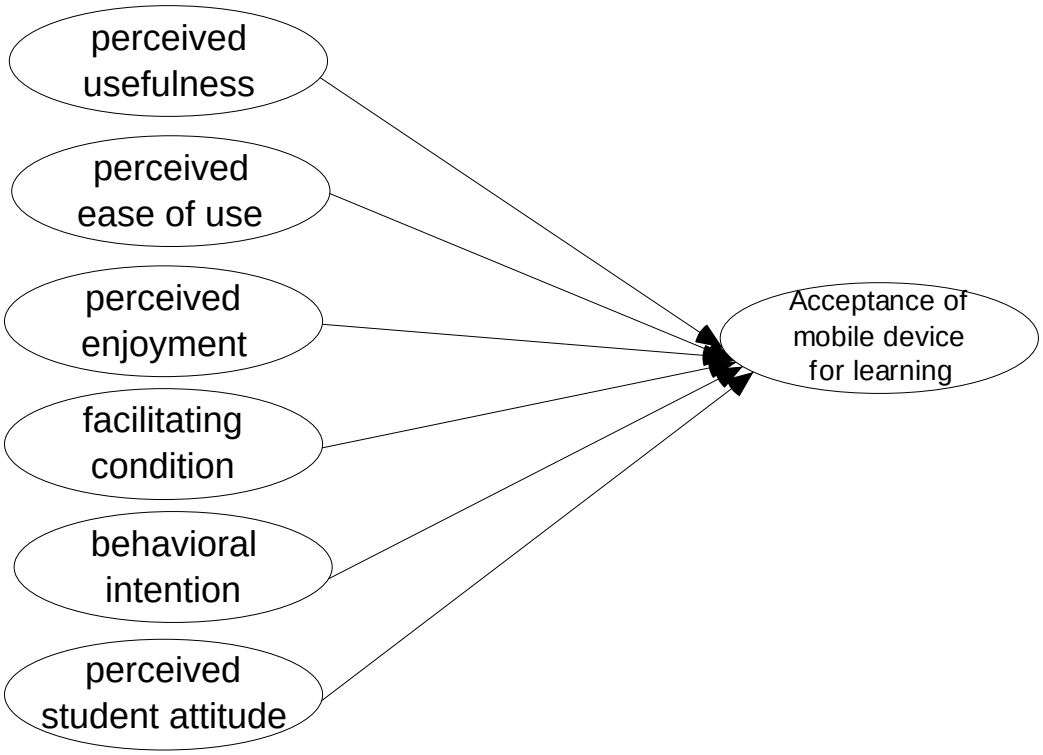

Fig: 1 Proposed Model of the study

Perceived Usefulness, Perceived ease of use, and Behavioral Intention

Technology acceptance model developed by Davis (1989) is a theoretical model used in several study and it has been found to be a robust and parsimonious framework for understanding user intention to accept to use IS. The model consists of Perceived usefulness (PU), and perceived ease of use (PEOU). The model was later extended by Venkatesh et al. (2003) and the extended model of TAM was unified theory of acceptance and use of technology (UTAUT). In many literature reviewed for this study behavioral intention have been found to be a strong determinant to students perceive usefulness and ease of use of emerging technology especially social media (Shittu et al. 2011).

Facilitating Condition

According to Venkatesh et al. (2003), facilitating condition is defined as the "degree in which an individual believes that an organizational and technical infrastructure is provided to support the use of a system". Venkatesh et

al. (2003) concluded that facilitating condition is a strong predictor of actual use of technology and information system. Wang and Shih (2008) also reported that facilitating condition has a significant effect on the use of IS. Morris (2008) corroborated the finding and reported that age and experience are a moderating factor on FC. The study further reported that effect on usage will increase steadily as age and experience of users' increases.

Perceived Enjoyment

Perceived enjoyment is defined as the "extent to which the activity of using a system is perceived to be enjoyable in its own right, apart from any performance consequences' that may be anticipated". Perceived enjoyment, fun, and playfulness are example of intrinsic motivation which Davis, Bagozzi, and Warsaw (1992) explain as a strong determinant indicated by user for accepting to use IS. The study on adoption of mobile learning in developing world by Iqbal and Qureish (2012) revealed that perceived enjoyment does not influence student intention to adopt mobile learning.

Attitude to adoption of mobile device for learning

Research study has shows that attitude of users' is germane to adoption of technology. Positive or negative attitude are developed by users' toward the use of IS. According to Akerlind and Trevitt (1999) individual differences in attitude, belief, skills and potential of user always have an impact on acceptance and final use of computer system. Even some study revealed that demography variables such as age, students' background, and their specialization contribute in no small way to student attitude to emerging technology adoption in education (Bouhnik & Marcus, 2006; Liaw, 2008)

Research questions and hypotheses

This study aims at understanding factors determining mobile device acceptance for learning among the undergraduate students in developing world. The study sets to answer the following questions and carry out analysis on the hypotheses based on the underline theory used to understand the phenomenon under study.

Questions:

Q1: Is there any significant difference among male and female students 'acceptance of mobile device for learning?

Q2: Is there any significant difference in sciences and non-science students' acceptance of mobile device for learning?

Hypotheses:

The hypotheses are generated for this study based on the underline theory employed.

H1: Perceived usefulness will has a positive influence on acceptance of mobile devices for learning

H2:Perceived ease of use will has a positive influence on acceptance of mobile devices for learning

H3:Facilitating condition will has a positive influence on acceptance of mobile devices for learning

H4: Perceived enjoyment will has a positive influence on acceptance of mobile devices for learning

H5:Student behavioral intention will has a positive influence on acceptance of mobile devices for learning

H6: Student attitude will has a positive influence on acceptance of mobile devices for learning

METHODS

Sample

The data for the study were collected through an adapted and modified survey questionnaire administered to undergraduate students of International Islamic University Malaysia, Al-Hikmah University, Ilorin, and University of Maiduguri Nigeria. A hundred (100) survey instrument were distributed to each of the three university involve in the study, totalling three hundred questionnaires (300) were administered out of which two hundred and seventy-two were found usable for the study. The participants in the study consist of one hundred and twenty three (123) male undergraduate students representing 45% and one hundred and forty nine (149) female undergraduate students representing 55%.

Research Instrument

The survey instrument used for collecting the data of the study consist of thirty four (34) items used for measuring the seven (7) construct of the study. Perceived usefulness (PU) was measure with six (6) items, perceived ease of use (PEOU) was measure with five (5) items, perceived enjoyment (PE) was measure with six (6) items, facilitating condition (FC) was measure with four (4) items, behavioral intention (BI) was measure with four (4) items, attitude towards use (ATT) was measure with four (4) items, and acceptance to use mobile device (ACCPT) was measure with four (4) items. A five point likert measuring scale of 1 to 5 with one (1) being strongly disagree (SD) and five (5) being strongly agree were the options presented to the responded.

Instrument Validity and Reliability

Prior to the administration of the instrument, construct validity and the reliability of the instrument was ascertained. Factor analysis was conducted to validate the instrument of the study. Principal Component Analysis was used for extraction and Varimax used as the rotation method. The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) value of the data was 0.76 which is greater than 0.6 (Pallant, 2007). This shows that the sample is adequate. The Barllet's Test of Sphericity value was significant (p=0.000), the Eigen value was greater than one and the variance explained was 78.5%. Seven factors were finally generated for the study. To ascertain the reliability of the instrument, Cronbach's Alpha was employed and the result show values above 0.7, which indicated good internal consistency reliability. The table (1) below presents the 34 items used in the study, their correspondent loading and cronbach alpha.

Table 1: Valid items and their corresponding loadings and Alpha Values

Perceived Usefulness Loading	
PU 1: Using mobile phone would make it easier for me to learn	0.77
PU2: It would improve my learning performance	0.76
PU3: Mobile phone would improve my effectiveness in studying	0.74
PU4: It would improve my efficiency in studying	0.72
PU5: Using mobile phone would give me total control inmy learning process	0.74
PU6: I would find mobile devices suitable for online learning	0.70
Total Reliability: 0.75	
Perceived ease of use	
PEO1: Using mobile phone for learning would be easy for me	0.86
PEO2:I would find it easy to use mobile phone to upload and download materials from the internet	0.81
PEO3: My interaction with mobile phone for learningwould be clear and understanding	0.80
PEO4:It is easy to be skillful in using mobile phone for learning	0.79
PEO5: It would be easy to access all learning materialfrom mobile phone	0.74
Total Reliability: 0.76	
Attitude toward use of mobile devices `	
Att1:Using mobile phone for learning would be very good idea	0.88
Att2:In my opinion it would be very desirable for me to usemobile phone for learning	0.86
Att3:I would promote the idea of using mobile phone for learning	0.84
Att4:It would be undesirable for me to use mobile phone formy learning	0.80
Att5:Using mobile phone for my learning would be a bad idea	0.80
Total Reliability: 0.80	

Behavioral intention

BI1: I intend to use mobile phone for learning	0.78
BI2:I intend to use mobile phone whenever it is possible	0.74
Bi3: I intend to use mobile phone in the future for learning	0.70
Bi4: I would adopt mobile phone for learning	0.70

Total Reliability: 0.73

Facilitating condition

FC1: I have the resources necessary for using mobile phonefor learning	0.77
FC2 : I have knowledge and skill that is necessary for using mobile phone for learning	0.75
FC3: In my university my lecturer have been helpful in the use of mobile phone for learning	0.73
FC4: I general my college has supported the use of mobile phone for learning	0.70

Total Reliability: 0.70

Perceived Enjoyment

PE1: I would find mobile phone enjoyable to use for learning	0.88
PE2: I would find mobile phone exciting to use for learning	0.84
PE3: I would find mobile phone pleasant to use for learning	0.78
PE4: I would find mobile phone very interesting to use	0.70
PE5: I would find mobile phone boring to use for learning	0.66
PE6: I would find mobile phone disgusting to use	0.60

Total Reliability: 0.77

Acceptance to use mobile phone

ACPT1: I would accept to use mobile devices for learning	0.87
ACPT2: I would engage in collaborative learning with mobile devices	0.86
ACPT3: I would enjoy my other school social group to use mobile devices for learning	0.84
ACPI4: I would enjoy my peers to use mobile devices for learning	0.80

Total Reliability: 0.81

Analysis of Students' Use of Mobile Device to Support Learning

The analysis shows that sixty percent (60%) of the students indicated to use MD every day for learning. Twenty eight percent (28%) use it between 2-3 times a week in their study. Ten percent (10%) use it between 2-3 time in a month, while less than five percent (5%) of them use it once in a month. Overall result indicated that greater percent of the student use it almost every day for learning related activities.

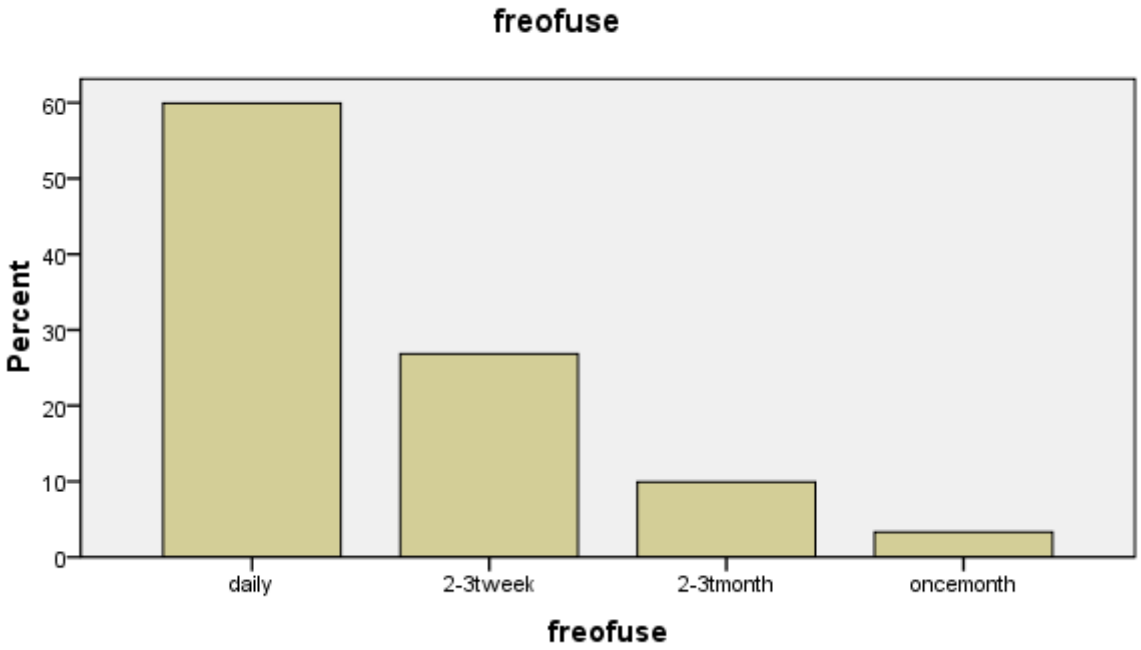

Fig2: The frequency use of mobile device by student for learning related activities

The Purpose of Using Mobile Device Indicated By Students

Fifty-five students representing (20.2%) indicated to use mobile device for research related activities. Eight students representing (2.9%) use it for entertainment purposes. Fifty-five students representing (20.2%) use it for educational activities. Ninety students representing (33.1%) use it for communication related activities and sixty-four students representing (23%) indicated to use for social interaction.

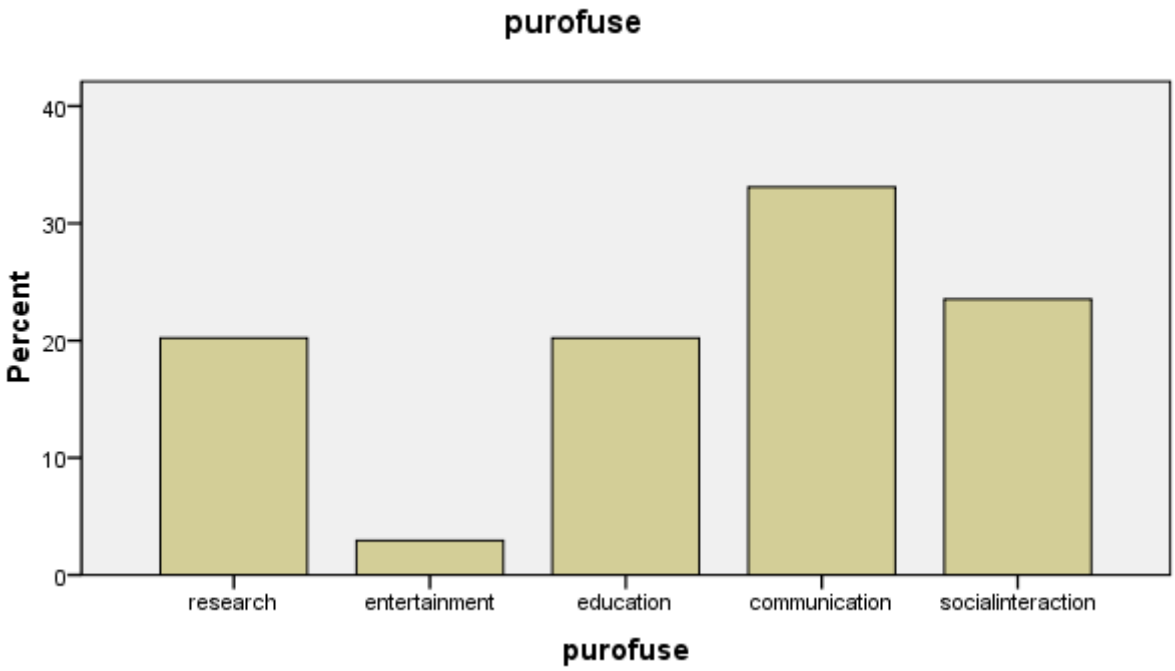

Fig2: The purpose of use of mobile device by students

Table 2: Analysis of mean of Male and Female students' acceptance to use mobile device in learning

	sex	N	Mean	Std. Deviation	Std. Error Mean
Total acceptance to use	male	123	15.6504	2.82258	.25450
	female	149	15.9732	2.78739	.22835

	F	Sig	t	df	Sig (2tail)	Mean Difference	Std error diff	95% confidence Lower	95% confidence upper
Equal variance assumed	2.37	.125	-.945	270	.345	-.32275	.34132	-.9951	.3496
Equal variance not assumed			-.944	259.085	.346	-.32275	.34193	-.9961	.3506

t-test of mean of male and female students' acceptance of mobile device for learning

An independent sample t-test was conducted to compare acceptance of mobile device for learning among male and female students. Prior to analysis the data was screen for outlier and offending estimate, which the data was free from. The finding shows that there was no significant difference in responses of male and female. The mean and standard deviation for male is M (15.65), SD(2.82) and the mean and standard deviation for female group is M(15.97), SD(2.79). The mean difference is -.3228, 95% Confidence interval: -.99 to .35.

Table 3: Analysis of mean of science and non-science students' acceptance to use mobile devices

	Specialization	N	Mean	Std. Deviation	Std. Error Mean
Total acceptance to use	Science	99	16.5253	2.41316	.24253
	non-science	173	15.4277	2.93569	.22320

	F	Sig	t	df	Sig (2tail))	Mean Difference	Std error	95% confidence	
								Lower	upper
Equal variance assumed	7.367	.007	3.158	270	.002	-1.09751	.347	-433	1.78
Equal variance not assumed			-3.3	237.306	.001	-1.09751	.329	-448	1.74

t-test of mean of science and non-science students acceptance of mobile device for learning.

An independent sample t-test was conducted to compare the acceptance of mobile device in teaching and learning among science and non-science students. Prior to analysis the data was screen for outlier and offending estimate, which the data was free from. The finding shows that there was significant difference in acceptance of mobile device for learning among the two groups of students. The mean and standard deviation for science student responses is M (16.53), SD(2.41) and the mean for non-science group is M(15.43), SD(2.94). The mean difference is -1.098, 95% Confidence interval: -448 to 1.75.

Table4: Multiple regression analysis of student acceptance to use MD

	Unstandardize coefficient		Standardize coefficient	T	Sig	Collinearity statistic	
	B	Std error	Beta (ß)			Tolerance	VIF
(Constant)	1.139	1.284		.887	.376		
Total PU	.271	.047	.291	5.827	.000	.689	1.452
Total PEOU	.065	.043	.075	1.494	.136	.679	1.473
Total FC	.280	.046	.272	6.104	.000	.859	1.164
Total PE	.077	.019	.172	3.997	.000	.928	1.078
Total Bi	.626	.056	.507	11.198	.000	.835	1.198
Total Attitude	.004	.018	.011	233.	.816	.839	1.192

P <0.001

HYPOTHESES TESTING

Multiple regression analysis was used to analyze the hypotheses generated for the study. Prior to multiple regression procedure, collinearity diagnostics were performed to ascertain that the data is free from multicollinearity. The result shows that the assumption of multicollearity has not been violated. A look at the VIF value shows that all the values were greater than 0.10 which is above the cut-off point for multicollinearity (Pallant, 2007). The data of the study has satisfied all the assumption for regression analysis. The results of the tested hypotheses here presented.

H1: Perceived usefulness will has a positive influence on acceptance of mobile devices for learning with beta (β=0.291) and $p < 0.05$; the hypothesis is supported.

H2: Perceived ease of use will has a positive influence on acceptance of mobile devices for learning with beta (β=.075) and $p < 0.05$; the hypothesis is not supported.

H3: Facilitating condition will has a positive influence on acceptance of mobile devices for learning with beta (β=0.272) and $p < 0.05$; the hypothesis is supported

H4: Perceived enjoyment will has a positive influence on acceptance of mobile devices for learning with beta (β=.172) and $p < 0.05$; the hypothesis is supported

H5: Student behavioral intention will has a positive influence on acceptance of mobile devices for learning with beta (β=.507) and $p < 0.05$; the hypothesis is supported

H6: Student attitude will has a positive influence on acceptance of mobile devices for learning with beta (β=.011) and $p < 0.05$; the hypothesis is not supported

Table 5: Summary of the result of the Hypotheses Tested

Hypotheses	Supported
H1: Perceived usefulness will has a positive influence on acceptance of mobile devices for learning	YES
H2: Perceived ease of use will has a positive influence on acceptance of mobile devices for learning	NO
H3: Facilitating condition will has a positive influence on acceptance of mobile devices for learning	YES
H4: Perceived enjoyment will has a positive influence on acceptance of mobile devices for learning	YES
H5: Student behavioral intention will has a positive influence on acceptance of mobile devices for learning	YES
H6: Student attitude will has a positive influence on acceptance of mobile devices for learning	NO

DISCUSSIONS

In-line with the objective of the study, the findings of the study has revealed some fundamental issues in Mobile Device (MD) acceptance for learning among students in developing world. The study shows that there is significant difference in acceptance of mobile devices for learning among male and female, while there is no significant difference in acceptance of mobile device for learning base on the area of specialization of the students. The implication of this finding is that gender issue is crucial to adoption of mobile device in learning. The findings of the study have also provided us with insight to some of the underline factors that can influence acceptance of mobile device. For instance, the study shows that perceived usefulness is a good determinant of MD acceptance for learning. This finding is in congruent with previous finding that reported the significant influence of PU on technology acceptance and mobile learning (King, 2006; Ju et al. 2007; Ahmad et al. 2010; Iqbal & Qureish, 2012). On perceived ease of use, the finding of this study shows that it does not have any significant influence on acceptance of MD, this finding contradict some previous findings which reported the significant influence of PEOU on adoption of IS (Venkatesh et al. 2003, Young-Wee et al. 2010). On perceived enjoyment as a determinant to MD acceptance, the finding of this study supported previous finding of Davis et al. (1993) which reported that perceived enjoyment as an intrinsic motivator is a strong determinant for information system adoption. However, the study of Iqbal and Qureish (2012) contradict this finding despite the fact that the two studies were conducted among student in developing country.

The finding of this study also revealed that facilitating condition is a strong determinant to adoption of mobile device for learning. This finding is in congruent with Venkatesh et al. (2003) and Wang and Shih (2008) findings that show that FC is a strong determinant indicated by users for accepting to use technology. In this study behavioral intention was found to be the strongest factor indicated by student influencing their acceptance of mobile device for

learning, this submission show that adoption of MD by student is a function of their readiness through intention be it positive or negative intention as the case may be. The finding corroborate the earlier finding of Davis (1985) and Venkatesh et al. (1993) that reported that users intention is crucial to adoption of information system. Unlike student intention which significantly influence acceptance to use MD in learning, student attitude does not have influence on acceptance of MD for learning.

Theoretical and Practical Implication

Theoretically, the findings of this study have revealed the underline reason why students may adopt or reject to use mobile device for their learning. The study show that perceived usefulness, perceived enjoyment, behavioral intention, and facilitating condition are the factors that significantly contributes to acceptance of MD by students with behavioral intention being the strongest factor, while perceived ease of use was statistically insignificant factor to MD acceptance by student. The finding is an interesting one because it shows that the student did not see ease of use as an important factor in MD acceptance for learning despite the fact that many study reported it to be an important factor to adoption of IS (Ju et al. 2007). The revelation of this study shows that the familiarity of use could likely be the reason why ease of use was statistically insignificant factor in this study. Therefore, the issue of ease of use in students learning was insignificant and irrelevant as a factor for the acceptance of mobile devices for learning. Also, student attitude was discover not to have any influence on acceptance of MD, this imply that student attitude be it negative or positive is equally not relevant as a factor to influence the use of MD in learning. Practically, the finding of the study has revealed that reasons for adoption of information system in the past may not be the same reasons why the students in the contemporary world would adopt IS. This could be due to their exposure and use of different innovation in their day to day activities.

CONCLUSIONS

The findings of this study will have important implication to all stakeholders most especially educators, software developers, and instructional technology expert on how to improve MD with additional function for teaching and learning process. E-learning educator should as a matter of necessity consider its use to support and facilitate student learning by adding it to their teaching kits. This study has contributed to existing literature on mobile device for learning. The study has also validated the explanatory power of TAM on acceptance of new innovation in teaching and learning process among the students. In conclusion, a qualitative study could be conducted for a deeper insight about MD acceptance for learning among student. Better still; a longitudinal research study could also be carried out on it for further understanding of this phenomenon.

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