Adoption and Use of Mobile Learning in Higher Education: The UTAUT Model

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ABSTRACT

This paper evaluates the adoption of mobile learning in Nigerian Educational institution a non-Western country with the use of the UTAUT model. This study re-evaluates the relationships among the human factor measures of the UTAUT model in assessing its applicability to a cultural context of a different country. The data for this study were obtained through a self-administered survey of Nigerian University students and the model was estimated using structural equation modeling framework. The findings of this study confirmed and contradicted some UTAUT relationships. This shows that country's level of cultural differences to a large extent moderates the interactions of the UTAUT effects as such direct application of information system models validated by other cultures might be detrimental as vital relationships determining the adoption of such of technology might not be revealed. The finding of this study provides policy makers of educational institutions and industry practitioners with an appropriate model that can be used to assess the level of adoption of mobile learning and other learning technologies in Nigeria and similar countries of the same cultural context.

CCS Concepts

Applied computing→Education→E-learning

Keywords

Mobile device; Mobile learning; Higher education; UTAUT2

1. INTRODUCTION

Rapid changes in Technological advancement have led to the evolution of mobile devices which have proved to be of immense importance in the learning environment leading to the emergence of mobile learning [22, 24, 31]. Mobile learning is an extension of

the e-learning platform, making teaching and learning between educators and students to extend beyond the classroom setting to include learning on the move [19, 14].

With the high rate of acceptance and penetration of mobile devices, institutions of educational learning have begun to explore the opportunities of mobile learning especially in the western culture but its adoption is slow and fragmented in other culture of the world as it is still an emerging field in educational institutions in most African culture [5, 9, 11, 32]. Several challenges have been associated to the slow pace of adoption such as lack and cost of infrastructural support systems (access to mobile internet services, hardware and software systems), lack of trained educators in using mobile learning in communicating to the students[6, 15].

Studies in the literature have shown numerous opportunities of learning innovation presented by mobile learning. Despite the advantages presented by mobile learning, the attitude, skills and culture of the user constitute a determining human factor to the success of mobile learning [26].

Several information systems theories such as theory of reasoned action [8], "technology acceptance model (TAM) [7], Theory of Planned Behavior (TPB) [1], Innovation Diffusion Theory (IDT) [23] the unified theory of acceptance and use of technology (UTAUT)" [30]) among others have been used in assessing the impact of human factors on the rate of adoption of mobile learning in mostly western countries. Thus, this study focuses on evaluating the adoption of mobile learning in Nigerian Educational Institutions (a non-western country) using the unified theory of acceptance and use of technology (UTAUT) in assessing whether the given relationships among measures can be affected by culture and country variables [26].

2. LITERATURE REVIEW

2.1 Development of the Unified Theory of Acceptance and Use of Technology (UTAUT) Model

The Unified Theory of Acceptance and Use of Technology (UTAUT) model constitute one of the frequently used model in the field of information technology users' adoption modeling

which was developed by [30]. Studies [18] have shown that UTAUT model have the capacity of explaining over 65% of technology acceptance behaviour of users. UTAUT model consists of four key dimensions namely; "Performance Expectancy (perceived usefulness), effort expectancy (perceived ease of use), social factors and facilitating conditions" having a direct influence on intention to use the technology along with moderating variables" gender, age, experience and voluntariness" which moderate the relationship in the model [30] as indicated in Figure 1.

UTAUT was developed by integrating elements across 8 crucial competing technology acceptance models. The eight models [8] consist of the "theory of reasoned action (TRA), Technology Acceptance Model (TAM) [7]; Theory of Planned Behavior (TPB) [1]; Model of PC Utilization (MPCU) [27] Motivation Model (MM) [7]; Innovation Diffusion Theory (IDT) [23], Combined TAM and TPB [25] and Social Cognitive Theory (SCT)" [3]. The UTAUT model posits that intention of users to use a particular information system, technological device and subsequent usage behaviour is dependent on "performance expectancy, effort expectancy, social influence and facilitating conditions of the user".

[30] defined the UTAUT factors as follows: "performance expectancy is the degree to which an individual believes that using the system will help to attain certain level of gains in job performance; effort expectancy is the degree of ease associated with the use of the system; social influence is the degree to which an individual perceives that people who are important to him believe that he or she should use the new system; facilitating conditions is the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system; behavioural intention is the person's subjective probability that he or she will perform the behaviour in question" [30].
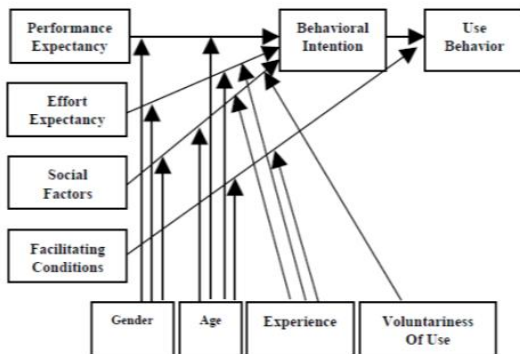

Figure 1: The Unified Theory of Acceptance and Use of Technology (UTAUT) Model

Source: [30]

2.1.1 The UTAUT Relationships
Studies in the literature reveal that the UTAUT relationships have shown many inconsistencies over the years. Some studies found "positive effect of performance expectancy on behavioural intention to use mobile learning" [12, 20, 26, 32], while some studies (Birch and Irvine, 2009, 2, 13] did not find such effect. More Studies seems to hold a more general consensus on the positive effect of effort expectancy on behavioural intention to use mobile learning [13, 12, 16, 20, 26, 32]. Some studies have reported a positive effect of social factors on behavioural intention

to use [13, 12, 32] while [2, 20] finds no such effect. In the UTAUT relationships, [30] also stated that for social factors to have a significant effect on behavioural intention, the interaction terms of gender, age, experience and voluntaries must be present. In the light of this, some studies confirmed this [2] but the report from some studies contradicted this and they discovered that social norms have positive impact on behavioural intention to use mobile learning without the use of interactions [13, 20, 26].

Further review of the literature showed that some studies assessed the impact of facilitating conditions on behavioural intention. "This aspect of relationship was omitted in the UTAUT model because it was expected that facilitating conditions will have a non-significant impact on behavioural intention if combined with both performance and effort expectancy in a model" [30]. Report from some "studies (12, 26, 32, 33] supported this claim as against the findings of [13] who reported a positive significant relationship of facilitating conditions on behavioural intention". Contrary to [30] notion on the impacts of attitude on behavioural influence being spurious, some researchers [13, 20, 26] investigated this relationship and reported that with the inclusion of performance expectancy and effort expectancy in the model, attitude has significant impacts on behavioural intention to use mobile learning".

2.2 Research Framework and Hypotheses
Within the educational context, mobile learning systems and applications are used to conduct learning activities, making the m-learning system an Information Technology phenomenon and device that lends itself to the UTAUT model. Studies from the literature [28, 29, 30] have provided empirical evidence in demonstrating that information Technology/ technology device use behaviour can be well explained by the UTAUT model and voices have been let out to encourage other researchers to validate and test the model in different context and environment.

This study adopted the UTAUT model and incorporates two additional constructs (Device characteristics and Activity-based usage) in the model in other to account for the characteristics and differences in technology context. [21] identified that adoption of information and technology models by researchers may call for the need for modification and extension of such models when they are applied to different context and situation such as mobile learning in educational systems. All the constructs found in UTAUT model, were included in this study except for the moderators of age, gender, experience and voluntariness of use which were omitted in the study model. The condensed model could cover the explanation of student attitude towards mobile learning in this context. The research framework is shown in figure 2.
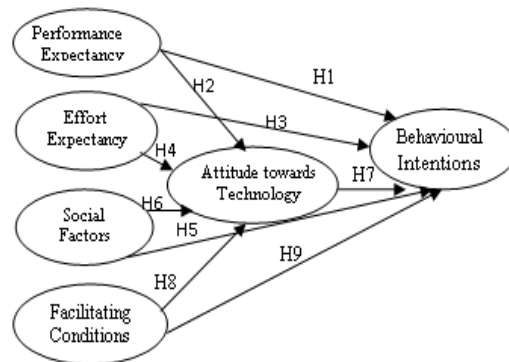

Figure 2: Research Model

2.2.1 Research Hypotheses

H1: Performance expectancy has significant positive influence on behavior intention to use.

H2: Performance expectancy has significant positive effect on attitude towards behaviour

H3: Effort expectancy has significant positive influence on behavioural intention to use.

H4: Effort expectancy has significant positive effect on attitude towards behaviour

H5: Social factors have significant positive influence on behaviour intention to use.

H6: Social factors have significant positive effect on attitude towards behaviour.

H7: Attitude towards behaviour has significant positive influence on behavioural intention to use.

H8: Facilitating conditions have significant positive effect on attitude towards behaviour

H9: Facilitating conditions has significant positive influence on behavioural intention to use.

3. METHODOLOGY

This study adopts questionnaire survey in assessing student attitude towards mobile learning. The questionnaire consists of two sections: 1) demographic information and mobile device usage by students and 2) questions relating to students perception towards mobile learning acceptance using variables identified in the model of the study. A five point Likert Scale question ranging from strongly agree to strongly disagree, was used for the main items in the questionnaire.

A total of 700 questionnaires were distributed randomly to undergraduate students of Covenant University. Covenant University is a private institution focused on driving ICT in the delivery of educational services. In the drive of the University towards Mobile learning, the Institution provides all students with mobile Tablets equipped with mobile learning applications and configured towards enhancing educational learning. A total of 600 questionnaires were returned representing 85.7% response rate and out of which 574 was considered valid for data analysis.

The data collected for this study is presented and analyzed using descriptive and inferential analysis. Descriptive analysis using frequency was used to present demographic information and mobile device usage of the respondents. The reliability and validity of the research instruments was analyzed using cronbach alpha and exploratory factor analysis. Inferential analysis was carried out by the use of using multiple regressions to test the relationship among the constructs in the proposed model of the study.

4. FINDINGS AND DISCUSSION

4.1 Findings of Results

Frequency distribution of sampled respondents, showed both gender was well represented in the study where Male and female respondents comprise of 50.5% (n=290) and 49.5% (n=284) respectively. The analysis on respondent's age indicates that majority of the respondents (59.2%, n=340), are in the age range of 15 to 19years while ages 20-24years constitute over 35% of the respondents. Analysis of respondent's study college reveals that

majority of the respondent is from business related disciplines which constitute over 60% of the respondents.

Analysis of respondents mobile device usage behavior revealed the following as indicated in table 1. All the respondents (100%, n= 574) have access to at least one mobile device which made them eligible to participate in the study. This result supports the trend that majority of the University student have access to at least one mobile device which provides the potential for the possibility of using mobile device as a tool to implement ICT application and encourage mobile learning in Covenant University. This makes the choice of the study case suitable for the study.

Analysis on the type of mobile device used owned and used by the respondents revealed that majority of them (40.6%, n=233) own and have access to Ipads followed by mini laptops which represent 28.6% (n=164) of the respondents, followed by Tablets which represents 22%, n=126, Notepads represents 7.3% (n=42) and Ipods which represents 1.6% (n=9) respectively, which are used for educational studies and learning.

Analysis on the location usage of the mobile device reveals that majority of the respondents (40.9%, n=235) used their device for educational services and learning in the hostels followed by 28.6% (n=164) of the respondents using it in the classroom, 24.2% (n=139) of the respondents using it in the library and 6.3% (n=36) use it in other places. This reveals that majority of the respondents use their mobile device for learning mostly in the hostel, classrooms and library.

4.1.1 Reliability and Validity Assessment

The internal consistency and construct validity was assessed by computing the Cronbach's alpha coefficients for each construct and Exploratory factor analysis using Principal Axis Factoring with Varimax rotations on SPSS. The internal reliability of each construct was measured with the use of Cronbach's alpha coefficients. Cronbach's alpha coefficients range from 0.745 to 0.913 which is greater than 0.70 as recommended by [10] as shown in Table 2. From the Cronbach alpha result, it can be concluded all the measurement scale for the construct in this study are considered reliable and consistent.

Construct validity was used to examine the validity dimension of the research construct with the use of Exploratory Factor Analysis using Principal Component Analysis method as recommended by [4]. The result of factor analysis is shown in Table 2. From the table, the overall Kasier Meyer Olkin (KMO) value for all variables is 0.945 which is between 0.5 and 1.0 and exceeds the recommended value of 0.6 [17]. This indicates that the factor analysis is appropriate. The statistical test for Bartlett test of sphericity reached the statistical significant value of p=0.000; d.f. =465 which indicates a supportive correlation of the correlation matrix. Table 1 presents the factor loading scores for all the items used in this study. The factor loadings for all the constructs were greater than 0.50 as shown in table 1 as recommended by [4]. Based on the above findings from table 1, it can be concluded that measurement scales have a higher degree of validity.

Table 1: Result of Exploratory Factor Analysis

Factor Name	Variable	Factor Loading	Eigen-Value	Percentage of Variance Explained	Alpha Value
Performance Expectancy	PE 1	0.725	16.091	12.939	0.913
	PE2	0.818			
	PE3	0.767			
	PE4	0.701			
	PE5	0.705			
	PE6	0.725			
	PE7	0.645			
Effort Expectancy	EE 1	0.685	3.431	11.753	0.909
	EE 2	0.755			
	EE 3	0.745			
	EE 4	0.718			
	EE 5	0.731			
	EE 6	0.668			
Social Factors	SF1	0.761	1.725	10.411	0.745
	SF2	0.774			
	SF3	0.667			
Facilitating Conditions	FC1	0.725	1.454	8.637	0.830
	FC2	0.663			
	FC3	0.628			
Attitude	ATTD1	0.682	1.249	8.436	0.845
	ATTD2	0.769			
	ATTD3	0.664			
	ATTD4	0.725			
Behavioural Intention	BI1	0.705	1.306	7.546	0.770
	B12	0.607			
Cumulative Variance Explained (%) 65.619					
Extraction Method: Principal Axis Factoring					
Rotation Method: Varimax with Kaiser Normalization					
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: 0.945; p =0.0001 (p<0.05); d.f=465					

4.1.2 Hypothesis Testing Results

The results of hypothesis testing are depicted in Table 2. The finding reveals that "there is positive significant association between the attitude towards behavior (AT) and all the factors: a) PE, b) EE and c) FC except SFs. Hence, H2, H4, H8, are supported while H6 is not supported". The findings from table 2 also reveal that all factors: PE, b) EE and c) SFs d) FC, e) ATT have significant influence on behavioural intention to use (BI). Hence H1, H3, H5, H6 and H9 are supported. Moreover, the results indicated that all factors have positive influence on attitude towards behavior and behaviour intention to use.

Table 2: Results of Hypothesis Testing

Hypothesis	Result	Decision
H1:Performance expectancy has a significant positive influence on behavior intention to use.	Yes: Significant (Beta = 0.097, p < 0.05)	Supported
H2:Performance expectancy has significant positive effect on attitude towards behaviour	Yes: Significant (Beta = 0.075, p < 0.05)	Supported
H3:Effort expectancy has a significant positive influence on behavioural intention to use.	Yes: Significant (Beta = 0.098, p < 0.05)	Supported
H4:Effort expectancy has significant positive effect on attitude towards behaviour	Yes: Significant (Beta = 0.121, p < 0.01)	Supported
H5:Social factors have a significant positive influence on behavioural intention to use.	Yes: Significant (Beta = 0.151, p < 0.001)	Supported
H6:Social factors have significant positive effect on attitude towards behaviour.	No: Not Significant	Not Supported
H7:Attitude towards behaviour has a significant positive influence on behavioural intention to use.	Yes: Significant (Beta = 0.196, p < 0.001)	Supported
H8:Facilitating conditions have significant positive effect on attitude towards behaviour	Yes: Significant (Beta = 0.296, p < 0.001)	Supported
H9:Facilitating conditions has a significant positive influence on behavioural intention to use.	Yes: Significant (Beta = 0.171, p < 0.001)	Supported

The result of the regression analysis carried out on the hypothesis to assess the association between factors influencing attitude and behavioural intention to use mobile learning is presented below. Figure 3 presents the β-value for the standardised path coefficients in the hypothesized research model.
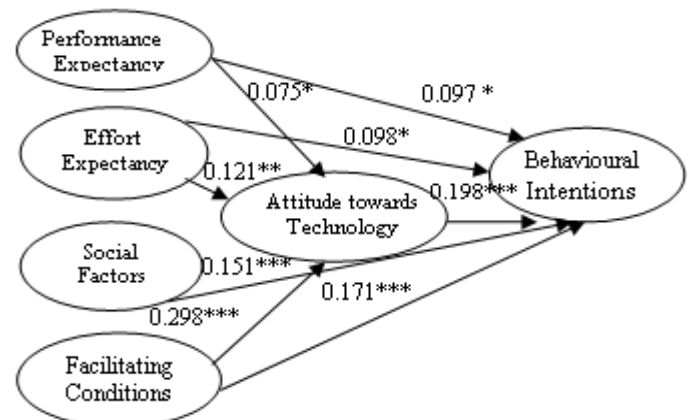

Figure 3: Standardised Path Coefficients for all Factors
* Significant at p < 0.05, ** Significant at p < 0.01, *** Significant at p < 0.001

4.2 Discussion, Implications and Conclusion

The results indicate that the proposed model adequately explains and predict student attitude towards behavioural intention to adopt mobile learning. "Performance expectancy, effort expectancy, facilitating conditions and the two suggested constructs (device characteristics and activity-based usage) all have significant positive effect on attitude towards mobile learning except for social factors which has an insignificant effect". Also, "Performance expectancy, effort expectancy, social factors and facilitating conditions all have significant positive influence on behavioural intention to adopt mobile learning".

The findings of this study on "performance expectancy having a significant positive influence on behavioural intention to use mobile learning is consistent with previous research in the area of technology acceptance to use mobile learning [6, 30, 32, 20, 26]. In other studies (13, 2) performance expectancy influence was found to be statistically insignificant on behavioural intention which contradicts the findings of this study". This implies that "student who perceive that using mobile technologies in learning will help to enhance their study performance (performance expectancy) have the possibility of accepting mobile learning compared to students not having or having a lower expectation".

Effort expectancy indicates a "significant positive influence on intention to use mobile learning [13, 16, 12, 20, 26, 32]". This finding implies that "students who perceive that mobile learning will be easy to use in their studies will require less of guidance and instructions when using it. This suggests that mobile learning technologies should be designed with ease of use functionalities and user friendly learning applications [32]".

The findings discussed above confirm "several of the relationships in the UTAUT model as proposed by [30]" used for mobile learning, but also contradicts the UTAUT model is the following ways:

a. "Facilitating conditions significantly influence behavioural intention even when the effects of performance expectancy and effort expectancy on behavioural intention are included in the model. Consistent with [13] and contradicts [2, 30, 6]
b. "Export expectancy has a significant positive effect on behavioural intention when facilitating condition was included in the relationship. This finding supports reports from several studies from developing contexts such as [13, 12 20] and contradicts reports from western context such as [30]".
c. "Social factors have significant positive influence on behavioural intention to use without the requirement of the need for interactions [consistent with 13, 20, 26] but contradicts that of [30]".
d. "Effect of various UTAUT factors on attitude and behavioural intention reveal positive relationships. Performance expectancy, effort expectancy and facilitating conditions have significant positive effects on attitude (consistent with 26, 13, 2) but contradicts [20]".
e. "Attitude impacts positively on behavioural intention with the inclusion of both performance and export expectancy which is consistent with [20, 26] but contradicts the report of [30]".

The findings above indicate that "differences in culture and country context accounts for the contradictions among the constructs in the UTAUT model of this study as opposed to the reports of [30]". This implies that in "developing countries where resources are generally limited and the adoption of mobile learning is still at the new stage, facilitating conditions with perceived effort expectancy will predicts behavioural intention to use mobile learning [12, 13, 20] but might not be a significant driver for continuous consumer technology adoption behaviour". This means that in other to ensure the "success of mobile learning adoption, strategies developed should be based on specific country contexts analysis of the people. In other to fully understand the interrelationships between constructs of human factors (attitude, skill, culture etc), it is necessary to include and analysis all constructs in the UTAUT model in other to detect all possible and spurious relationships that may exist".

This research has demonstrated that efforts and strategies should be focused on building favourable consumer attitude towards the use of information communication technologies and sufficient support services in form of facilitating conditions should be provided in other to ensure continuous adoption and success of mobile learning in Nigerian tertiary institutions.

5. ACKNOWLEDGMENTS

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