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Mobile Learning via Mobile Devices in Nigeria Higher Education: Usage Analysis Based on Utaut Model

Olumuyiwa Alaba
Tai Solarin University of Education, Ijagun, olumuyiwaalaba@gmail.com

Olalere Abass
Tai Solarin University of Education, Ijagun, olaabas@gmail.com

Ebenezer Igwe
Tai Solarin University of Education, Ijagun, igweebenezerndubuisi@gmail.com

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ABSTRACT

The recent influx of various technologies has affected all sectors of the human life including education. Mobile learning has emerged with the evolution of mobile devices that has enhanced knowledge sharing via distance education systems. In Nigeria, it has been observed that under-utilization of the technology in higher education institutions (HEIs) is still prevalent. This study investigated the factors hindering the use of mobile devices for mobile-learning by students. Four research questions were formulated based on UTAUT model with nine variables and 391 survey questionnaires were administered on the students in two institutions in Ogun State. Data obtained were analyzed using two multiple regression and path analysis on SPSS 23. Findings showed that the facilitating factor of the mobile device leads other variables on direct effect on the attitude of students towards usage of mobile devices for m-learning. The management of HEIs should provide technical infrastructure supports on the use of mobile devices

KEYWORDS

mobile-learning, HEIs, attitude, knowledge sharing, technology, UTAUT

INTRODUCTION

Information and communications technology (ICT) is changing the way businesses are conducted including education and it continues to expand the boundaries of higher education using wireless networks, mobile communications and personal computing devices. ICT also presents new channel where students access classroom information and communicate with peers, teachers and faculty members to alter the concept of the classroom (Jain, 2006). Recently, there have been global widespread applications of mobile phones and wireless networks in different human endeavours and higher institutions exploit these technological innovations for distance learning and management. As a result, educational institutions adopt mobile phones and wireless network to deliver and support mobile learning. The intersection of online learning and mobile computing - called m-learning - holds the promise of offering frequent, integral access to applications that support learning, anywhere, anytime (Tatar, Roschelle, Vahey and Penuel, 2003). M-learning can be described as a type of learning that takes place via mobile devices. The evidence of mobile penetration is irrefutable: cell phones, PDAs, MP3 players, portable game devices, tablets and laptops abound (Wagner, 2005). These mobile devices are Wireless Application Protocol (WAP) enabled. WAP is an application and a set of communication protocols for wireless devices designed to enable technology-independent access to Internet and advanced telephony services.

M-learning which emerged with the evolution of mobile devices has extended the reach of e-learning and distance education systems by allowing educators and students to teach and learn anywhere, anytime and on the move (Negas and Ramos, 2011; Wang and Shih, 2009). M-learning would help the development of the knowledge society. The objective is towards a society with access to knowledge and learning for everyone (Lytras and Sicilia, 2005). In M-learning era, learners carry multiple heterogeneous wearable and handheld devices and interact in unrestricted manner with other learners, hardware and software resources in their neighbourhood or in remote locations. The learners are able to learn continually wherever they are moving without any mobility, time and other restrictions. This paradigm shift in educational experience, however, presents new challenges for both instructors and IT departments as they determine optimal mixes of technology and pedagogy. According to Jain (2006), the educational goal is not to incorporate technology for technology’s sake but to create a meaningful learning experience for the students, and IT departments must support such initiatives accordingly. Though M-learning presents innovative opportunities but its obvious challenges cannot be overemphasized.

Despite the rapid development of m-learning in Nigerian higher education, universities are yet to formally acknowledge and integrate this technology into their learning system. This is because of not having a uniform or standardized m-learning platform for adoption by both the students and staff. This becomes very difficult because

students and staff (lecturers) all have different m-learning devices. This is really an issue for higher institutions to implement interoperable m-learning system like perceived complexity of different devices and other factors.

Consequently, the main motivation of this paper stems from the fact that despite recent influx of web-enhanced mobile devices among students in higher education in Nigeria, it has been observed that under-utilization of the technology in teaching and learning is still prevalent. This study provides further understanding of the factors hindering acceptance of mobile devices for m-learning by students of tertiary institutions and determines whether the students in higher education institutions in Ogun State of Nigeria are ready to embrace m-learning with its associated features. The paper was also an effort on the part of the authors in response to the call made by Sharma and Kitchens (2004) that it is high time that the students learn about and adapt to the changing environments and effectively facilitate m-learning.

The remaining parts of this paper are organized as follow: Section 2 delves with review of literatures on mobile learning concepts, application of m-learning in higher education, and related works. Section 3 shows the methodology of the research work. Section 4 details on the results and discussions while conclusion is done in Section 5.

REVIEW OF LITERATURE

Mobile Learning Concepts

M-Learning can be viewed as a type of e-Learning, a method for distance learning through wireless mobile devices. According to Deegan and Rothwel (2010), M-learning is defined as "Learning with the aid of a Mobile device". In this definition, a mobile device is simply a computer that is not restricted to a specific stationary environment or location. Specifically, mobile devices can be used in multiple environments, anytime, anywhere. (Deegan and Rothwell, 2010). Deegan and Rothwel (2010), investigated M-learning from a usability perspective and put forward a classification of M-learning applications based on Usability. Usability is defined by the ISO as "*the effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in particular environments.*" (ISO 9241, 1998). A usable system should be easy to use (utility) and easy to learn (learnability) (Shraim, 2014). In recent years, the notion of 'ease of use' has been applied to usability where the general philosophy is based on making things 'easy' for the user.

Mobile Learning Characteristics

M-learning comes with diverse characteristics and these have been incorporated into the development of the technology. Imtinan, Chang, and Issa (2013) identified the follow M-learning characteristics.

a. *Usability* relates to the ease of using mobile devices for learning purposes in respect to screen size, battery life, size, weight, memory, processing power, compatible applications and user interface.
b. *Collaboration* demonstrates the level of communication and interaction between the learner and the teacher as well as among other learners.
c. *Context* refers to the physical environment of the learner or where the learning takes place..
d. *Control* refers to the amount of grip a teacher or a learner has on the learning process for smooth continuity and best outcomes. In M-learning environments, it is quite crucial to decide how autonomous a learner should be so that the best learning outcomes can be achieved. Therefore, it is important to consider the level of control when designing M-learning environments.
e. *Connectivity*, in respect of mobile technologies, refers to how mobile devices can connect wirelessly using a variety of cellular and wireless access technologies such as GPS, EDGE, GPRS, GSM, 3Gs, 4Gs, WiMAX, WiFI, WLAN.
f. *Mobility* is the ease of accessing learning material and collaborating with peers regardless of time and space.
g. *Blended learning* is a ubiquitous learning solution which combines the benefits of various learning domains such as M-learning, e-learning, face-to-face learning and contextual learning.

h. *Content* refers to the learning resources for students in a format compatible with mobile devices. M-allows learning activities such as accessing information remotely, file sharing, taking photos, recording and playing audio and video files; and sharing these files remotely and creating collaborative content online.
i. *Technical support* makes M-learning seamless learning opportunity for teachers and students. However, lack of appropriate technical and administrative support is one of the biggest factors influencing teachers' adoption of M-learning.
j. *Cost* is a major factor in acceptance of M-learning, most especially in developing countries. M-learning design and implementation produce heavy costs for institutions, and learners may need to pay for the mobile data usage.

Dyson, Raban, Litchfield, and Lawrence (2009) point out that the cost of M-learning adoption is a considerable hindrance for many education providers. Dyson et al. (2009) have divided the cost of mobile technologies for learning into four main categories as costs are incurred by (i) the education providers and the students in various areas including usage charges, (ii) mobile hardware costs, (iii) mobile software costs; and (iv) cost of accessing networks by education providers. These charges are quite high and expensive for students even in many developed countries (Scornavacca, Huff and Marshall, 2009).

Applications of Mobile Devices in Higher Education

M-learning refers to using of mobile and handheld information technology devices, such as Personal Digital Assistants (PDAs), mobile telephones, laptops and tablet PC technologies, in teaching and learning (Alsaadat, 2009). It is obvious that computer and Internet are now essential tools for education and technology has become more mobile, effective and seemingly affordable and easy to use. Mobile devices such as phones and PDAs are much more affordable than desktop computers, and therefore represent a less expensive access to the Internet despite the higher cost of the connection (InfoDev, 2010). The introduction of the Tablet PC can now access mobile Internet with much functionality than desktop computers. Quality Improvement Agency (2008) pointed out that most mobile devices are useful in the field of education as mentioned.

a. It can be beneficiary to instructors since they can access services and interact with students while on the move.
b. Learners can interact with each other and with the practitioner instead of hiding behind large monitors.
c. It is much easier to accommodate several mobile devices in a classroom than several desktop computers.
d. PDAs or tablets holding notes and e-books are lighter and less bulky than bags full of files, papers and textbooks, or even laptops. Handwriting with the stylus pen is more intuitive than using keyboard and mouse.
e. It is possible to share assignments and work collaboratively; learners and practitioners can e-mail, cut, copy and paste text, pass the device around a group, or beam the work to each other using the infrared function of a PDA or a wireless network such as Bluetooth.
f. Mobile devices can be used anywhere, anytime, including at home, on the train, in hotels - this is invaluable for work-based training.
g. These devices engage learners including young people who may have lost interest in education.
h. Mobile technology may contribute to combating the digital divide, as this equipment (for example PDAs) is generally cheaper than desktop computers.
i. Mobile devices can be used in conjunction with wireless broadband and video-call services like Skype to facilitate communication between teachers and mentors.
j. It supports self-assessment where video cameras can be used to record lessons, allowing teachers to reflect on their teaching practice and identify specific areas for improvement.
k. Mobile technologies can be used in teacher education programs to challenge teachers to think creatively about mobile learning and develop the confidence to try new ideas.

Furthermore, findings from study conducted by Kennedy, Dalgarno, Bennett, Terry-Judd and Chang (2008) showed that mobile devices allow users to conduct nine activities in higher education such as:

a. send pictures or movies to colleagues,

b. use mobile phone as MP3 player,
c. access information or services on the web,
d. make video calls, (e) to take digital photos or movies,
e. send or receive email,
f. use mobile phone as a personal organizer, e.g. diary, address book,
g. send or receive SMS to colleagues, and
h. to call the colleagues or others. M-learning provides an opportunity for the new generation of people with better communication and activities without taking into account the place and time. However, it is observed from literature that mobile devices come with varying features that also affect users' intention to use m-learning in higher education environment.

Requirements of Mobile Technology for Learning

Furthermore, there are baseline requirements that must be in place for mobile technologies that support learning outside of school setting. These requirements, according to Mehdipour and Zerehkafi (2013) are:

a. *Highly portable*: The technology is available whenever the user needs to learn.
b. *Individual:* The technology can be personalized to suit the individual learner's abilities, knowledge and learning style, and is designed to support personal learning rather than general office work.
c. *Unobtrusive:* The learner can capture situations and retrieve knowledge without the technology becoming overly noticeable or imposing on the situation.
d. *Available:* The learner can use the technology anywhere, to enable communication with teachers, experts and peers.
e. *Adaptable:* The technology can be adapted to the context for learning and the learner's evolving skills and knowledge.
f. *Persistent:* The learner can use the technology to manage learning throughout a lifetime, so that the learner's personal accumulation of resources and knowledge will be immediately accessible despite changes in technology.
g. *Useful:* The technology is suited to everyday needs for communication, reference, work and learning.
h. *Easy to use:* This means **t**he technology is easy to comprehend and navigate by people with no previous experience using it.

Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology (UTAUT) is an extension of Technology Acceptance Model (TAM) formulated by Venkatesh and other models on "User acceptance of information technology: Toward a unified view" (Venkatesh, Morris, Davis and Davis, 2003). The UTAUT aims to explain user intentions to use an information system and subsequent usage behaviour. The theory was developed through a review and consolidation of the constructs of eight models:

a. Theory of Reasoned Action (TRA) proposed by Fishbein and Ajzen (1975).
b. TAM proposed by Davis (1989),
c. Motivational Model (MM) proposed by Davis, Bagozzi and Warshaw (1992)
d. Theory of Planned Behaviour (TPB) proposed by Ajzen (1991).
e. Combined Theory of Planned Behaviour and TAM (C-TPB-TAM) proposed by Taylor and Todd (1995).
f. Model of Personal Computer Use (MPCU) proposed by Thompson, Higgins and Howell (1991).
g. Innovation Diffusion Theory (IDT) proposed by Rogers (1995).
h. Social Cognitive Theory) proposed by Bandura (1986). Subsequent research validation by Venkatesh et al. (2003) of UTAUT in a study found it to account for an impressive 70% of the variance in Behavioural Intention to Use (BI) and about 50% in actual use.

According to Ahmad (2014), the theory was established on four theoretical independent constructs representing determinants of Intention to Use (ItU) or Usage Behaviour (UB), which play essential roles as surrogates of

technology acceptance. These constructs are: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). In addition to these variables, the theory considers other *gender*, *age*, *experience*, and *voluntariness of use* (VU) as moderating factors that have impact on the four key constructs on usage intention and behaviour.

Performance expectancy (PE) is "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al., 2003). They declared that PE remains significant and is the strongest construct as a predictor of Intention among TAM and theories. There are five key variables derived from TAM match Performance Expectancy according to (Venkatesh, et al, 2003): (i) *Perceived Usefulness*, (ii) *Extrinsic Motivation* (iii) *Job-Fit* which is the level of believes that using a technology can enhance job performance. (iv) *Relative advantage* which is the degree of perceiving innovation as being better than its precursor; (v) *Outcome Expectations of the use of technology*.

Effort Expectancy (EE) is the degree of ease associated with the use of the system. According to Venkatesh et al. (2003), there are three key variables derived from TAM that match Effort Expectancy. These are: (i) *Perceived Ease of Use*, is the degree to which the prospective user expects the target system to be free of effort, (ii) *Complexity*, which is the perception level on the relative difficult to understand; and (iii) *Ease of use*, which is the perception level on difficult to use the innovation. However, gender and age were expected to moderate the relationship between EE and ItU (Ahmad, 2014).

Social Influence (SI) is the extent at which an individual perceives important to use the new system. Venkatesh et al. (2003) opined that there are three key variables derived from TAM matching Social Influence: (i) *Subjective norm* focus on technology users perception that most people who are important to them think that such innovation be used or not. (ii) *Social Factor* deals *with* individual's consideration of culture and specific interpersonal agreements before using the technology; and (iii) *Image*, is the level at which use of an innovation is viewed as enhancing the image or status in a social system.

Facilitating Conditions (FC) is the level at which an individual believes that there exists organizational and technical infrastructure supports to use the system. Venkatesh, et al. (2003) further state that there are other key variables derived from TAM matching FC. These are: (i) *Perceived Behavioural Control* reflects on behaviour to adopt innovations based on perceptions of internal and external constraints which include self-efficacy, resource/technology facilitating conditions; and (ii) *Compatibility* is the degree of perceiving innovation to be consistent with the existing values, needs, and past experiences of user.

Attitude towards Using Technology (AtUT) is user's emotional reaction towards innovation. Four key variables derived from TAM that favour AtUT.

a. *Attitude Toward Behaviour* which is user's individual favourable or unfavourable feelings about performing the target behaviour on the new system.
b. *Intrinsic Motivation* deals with user's perception want to perform an activity without apparent reinforcement apart from performing the real activity.
c. *Affect towards Use* is the feelings of either pleasure (joy) or displeasure (hate) associated by an individual with the use of innovation.
d. *Affect* which deals with user's likeness for a exhibiting a particular behaviour like computer use.

Behavioural Intention (BI): This is a dependent variable in UTAUT construct. Venkatesh, et al. (2003) suggest that there is a significant positive effect of BI on the use of technology. Since then numerous studies either empirically validate or theoretically contribute to the theory. Some of them empirically validate the theory. Others theoretically contribute to UTAUT by either proposing new constructs, or moderating factors, or even extending and integrating the theory with other models.

Related Work on UTAUT

Koivimäki, Ristola and Kesti (2008) applied UTAUT to study the perceptions of 243 individuals in northern Finland toward mobile services and technology and found that time spent using the devices did not affect consumer perceptions, but familiarity with the devices and user skills did have an impact.

Eckhardt, Laumer and Weitzel, 2009) applied UTAUT to study social influence of workplace referent groups (superiors, colleagues) on intention to adopt technology in 152 German companies and found significant impact of social influence from workplace referents on information technology adoption.

Curtis, Edwards, Fraser, Gudelsky, Holmquist, Thornton, and Sweetser (2010) applied UTAUT to the adoption of social media by 409 United States non-profit organizations. UTAUT had not been previously applied to the use of social media in public relations. They found that organizations with defined public relations departments are more likely to adopt social media technologies and use them to achieve their organizational goals. Women considered social media to be beneficial and men exhibited more confidence in actively utilizing social media.

Verhoeven, Heerwegh, and De Wit (2010) applied UTAUT to study computer use frequency in 714 university freshmen in Belgium and found that UTAUT was also useful in explaining varying frequencies of computer use and differences in information and communication technology skills in secondary school and in the university.

Liebenberg, Benade and Ellis (2018) used UTAUT model to investigate the acceptance of ICT among South African 738 ICT students to clarify the factors that are influencing students' intention to make use of tow digital technologies (an eBook and Specialised Learning Management System). From the results, performance expectancy, facilitating condition and effort expectancy showed high practically significant relationship with behavioural intention, self-efficacy attitude towards using technology as moderator of the model used but gender as moderator did not reflect the original findings of UTAUT.

Attuquayefio and Addo (2014) worked on using the UTAUT model to analyze students' ICT adoption among 400 students of Methodist University College, Ghana. The results revealed that EE significantly predicted BI to use ICT, while SI and PE were statistically insignificant, as was BI on Use Behaviour (UB). However, FC significantly influenced UB.

Wang, Wu and Wang, (2009) added two constructs (perceived playfulness and self-management of learning) to the UTAUT in their study of determinants of acceptance of M-learning in 370 individuals in Taiwan and found that they were significant determinants of behavioural intention to use m-learning in all respondents.

Wang and Wang (2010) extended the UTAUT in their study of 343 individuals in Taiwan to determine gender differences in mobile Internet acceptance. They added three constructs – perceived playfulness, perceived value, and palm-sized computer self-efficacy to UTAUT and chose behavioural intention as a dependent variable. They omitted use behaviour, facilitating conditions, and experience. Also, since the devices were used in a voluntary context, and they found that most adopters were ages 20–35, they omitted voluntariness and age. Perceived value had a significant influence on adoption intention, and palm-sized computer self-efficacy played a critical role in predicting mobile Internet acceptance. Perceived playfulness, however, did not have a strong influence on behavioural intention, but this may have been due to poor service or network communication quality issues during the study.

Research Questions

For the purpose of this study, four research questions were stated to determine contributory factors toward acceptance and usage of m-learning in Ogun State institutions. The research questions are:

RQ_1: Will the pattern of relationships (correlations) in the study's path model consisting of the nine variables in the model be statistically significant?

RQ_2: Will the nine variables in the model (CS, NI, SF, MF, FC, EE, BI, PE and AT) have a model fit?

RQ_3: What are the direct, indirect and total effects among the variables?
RQ_4: What is the relative importance of the independent variables on Attitude towards mobile device usage?

Research Model

The study adopted UTAUT model with a modification to suit the motivation of the study. Four UTAUT independent constructs and other four moderating or independent variables are used. Consequently, the model included course of study of the students and mobile device features. The research model is as shown in Figure 1.

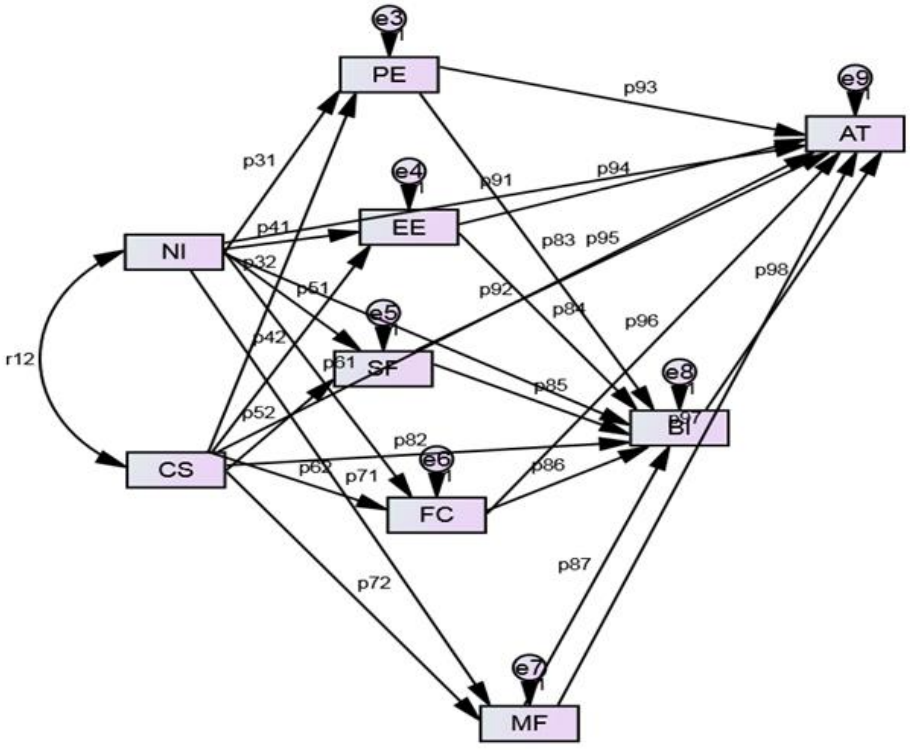

Figure 1: UTAUT-based Research Model

where NI – Name of Institution, CS – College/School, PE – Performance Expectancy; EE – Effort Expectancy; SF – Social Factors; FC – Facilitating Conditions; AT – Attitude towards Usage; BI – Behavioural Intention; MF – Mobile Features.

METHODOLOGY

Research Participants

Students from two independent higher institutions were used as population of the study. The institutions are Tai Solarin University of Education (TASUED), Ijagun Ogun State and Tai Solarin College of Education (TASCE), Omu-Ijebu, Ogun State with student enrolment of over 9,000 and 3,600 respectively. The former institution has 5 Colleges (Vocational and Technical Education, Science & Information Technology, Specialized Education; and Social and Management Sciences) while the latter has 5 Schools (Science, Arts & Social Science, Vocational and Technical Education). However, only science and arts based respondents were considered to address *course of* study construct in the research model.

Research Instrument

The data for this study were collected using survey questionnaire on Mobile Learning via Mobile Devices in Higher Education tagged "QMLMDHE". Study participants were selected based on availability and willingness to participate. The targets of the respondents were 250 and 150 in TASUED and TASCE respectively with the supports of lecturers in each institution in the administration of the questionnaires. The questionnaire has three sections. Section 1 focuses on demographic information of the respondents; Section 2 contains information on the use of various mobile devices while Section 3 is on the UTAUT measurements. Five-point Likert scales ranging from strongly agree, agree, neutral, disagree and strongly disagree were used. Before the administration of the questionnaires on the respondents, the instrument was tested on pilot group of 20 students. At the end of the administration of the questionnaires, 391 filled questionnaires were collected from the two institutions for analysis.

Validity and Reliability of Instrument

Three experts in the Tests and Measurement field checked the Likert scales items in Part B for their content validity. The construct reliability is known as the internal consistency of the model. The construct reliability measures the degree to which items of the constructs have no random error and they produce consistent results. The internal consistency in the current study was assessed through Cronbach alpha. To determine the reliability and validity of the study each of the UTAUT factors was determined using Cronbach Alpha. The Cronbach Alpha results from the SPSS 23 platform output obtained were 0.8231 and individual items were considered highly correlated with each other thus the researchers were highly confident in the reliability of the entire scale (Creswell, 2012). In ensuring validity of UTAUT model, the items of the questionnaire were modelled against a review of related literature on M-learning adoption. To determine the convergent validity in this study, Average Variance Extracted (AVE) was loaded. The results of Cronbach alpha are as displayed in Table 1.

Table 1: Cronbach's Alpha

Construct	***Cronbach's Alpha***
Performance Expectancy	0.879
Effort Expectancy	0.852
Social Factors	0.810
Facilitating Conditions	0.874
Behavioural Intention	0.788
Mobile Devices Features	0.843
Course of Study	0.866
Institution Type	0.816

Source: Survey Data (2019)

It is evident from the results that alpha values of all the constructs exceeded the threshold level i.e. 0.70. With the lowest being Perceived Complexity at 0.788. Thus, the results depict the acceptable evidence of reliability and it depicts that the internal consistency exist among the items of measurement.

Method of Data Analysis

To answer the research questions earlier formulated, data sets were analysed using two multivariate analytical techniques: (i) Multiple regression and (ii) Path analysis on IBM SPSS Statistics version 23.

RESULTS

Demographic Information

Table 2: Demographic Information of the Respondents

Variables	Group	Frequency	Percentage
Institution	TASUED	244	62.4
	TASCE	147	37.6
Study Year	100L	21	5.4
	200L	116	29.7
	300L	161	41.2
	400	93	23.8
College/School	Science	246	62.9
	Humanity/Art	145	37.1
Year of phone usage	1 year	9	2.3
	2 years	18	4.6
	3 years	54	13.8
	4 years	41	10.5
	>=5 years	269	68.8
Type of phone	Nokia	26	6.6
	Tecno	151	38.6
	Infinix	133	34.0
	Others	81	20.7
Phone's Operating System	Android	348	89.0
	iOS	22	5.6
	Windows	18	4.6
	Symbian	3	0.8
Other devices	iPod	8	2.0
	Laptop	197	50.4
	MP3	17	4.3
	Smart Phone	169	43.2
Mobile device for only academic work	Yes	241	61.6
	No	150	38.4
Received course materials from mates	Yes	366	93.6
	No	25	6.4
Received course materials from lecturers	Yes	146	37.3
	No	245	62.7
Daily internet connection on mobile device	Yes	337	86.2
	No	54	13.8

Table 2 shows that 269 (68.8%) respondents have been using mobile devices for over five years even before their admission into the two institutions, Tecno phone is the most popular mobile device with 151 (38.6%) of the respondents and the android operating system is used by 348 (89.0%) respondents. Laptop and smart phones are the most rated as other mobile devices used by 197 (50.4%) and 169 (43.2) respondents. 241 (61.6%) respondents used mobile devices only for academic purposes, 366 (93.6%) received course materials from course mates, only 146 (37.3%) received course materials from lecturers and 337 (86.2%) respondents daily connect to the internet via their mobile devices.

Analyses of Research Questions

Research question 1: Will the pattern of relationships (correlations) in the study's path model consisting of the nine variables in the model be statistically significant?

Table 3: Correlation Matrix of the Relationship among the nine variables

	CS	NI	SF	MF	FC	EE	BI	PE	AT
CS	1.000								
NI	-.133**	1.000							
SF	.019	.072	1.000						
MF	.028	-.054	.183**	1.000					
FC	-.008	-.147**	.303**	.243**	1.000				
EE	-.041	.104*	.393**	.264**	.300**	1.000			
BI	-.036	.045	.395**	.453**	.385**	.495**	1.000		
PE	.038	-.114*	.432**	.255**	.363**	.543**	.413**	1.000	
AT	.073	.039	.364**	.189**	.503**	.366**	.541**	.439**	1.000

*Means significant at 0.05, **Means significant at 0.01

From Table 3, the results show that there is correlation among the nine variables but not all are significant. As indicated in the table, the values that are without asterisks do not correlate significantly. The correlations between SF and CS (0.019), SF and NI (0.072), MF and CS (0.028) BI and NI (0.045), PE and CS (0.038), AT and CS (0.073) and AT and NI are positively correlated but not at significant level (P>0.05) to determine attitude towards the usage of mobile devices in m-learning. On the other hand, the correlations between MF and NI (-0.054), FC and CS (-0.008), EE and CS (-0.041) and BI and CS (-0.036) are negatively correlated but not at significant level. Other variables are significantly correlated either positively or negatively (P<0.05). As indicated, the values with single asterisk are significant at 0.05 and those with double asterisk are significant at 0.01.

Research question 2: Will the nine variables in the model (CS, NI, SF, MF, FC, EE, BI, PE and AT) have a model fit?

To determine the model fit of the model in the study, some parameters have to be considered.

- Chi-square/df <3
- The goodness-of-fit index (GFI) - Close to 1
- RMSEA <.05
- Adjusted goodness-of-fit index (AGFI) - Close to 1.
- Tucker-Lewis Index (TLI) values of .95 or higher

The model does not fit well according to the descriptive measures-of-fit if the above are not met.

Table 4: Goodness of fit indices for the model in the study

Model	$\chi 2$	**Df**	$\chi 2$/Df	**P**	**GFI**	**AGFI**	**TLI**	**RMSEA**
Reduced model	375.975	22	17.09> 3	.000	.784	.559	.283	.203

The estimates for the model were calculated alongside with the goodness of fit. The first model did not meet the above criteria, so all the insignificant paths were trimmed, and the estimates were calculated with the new model. The second model also did not meet the criteria above with the estimates despite the significant paths. Therefore, it can be concluded that the model did not fit well. See the two models below.

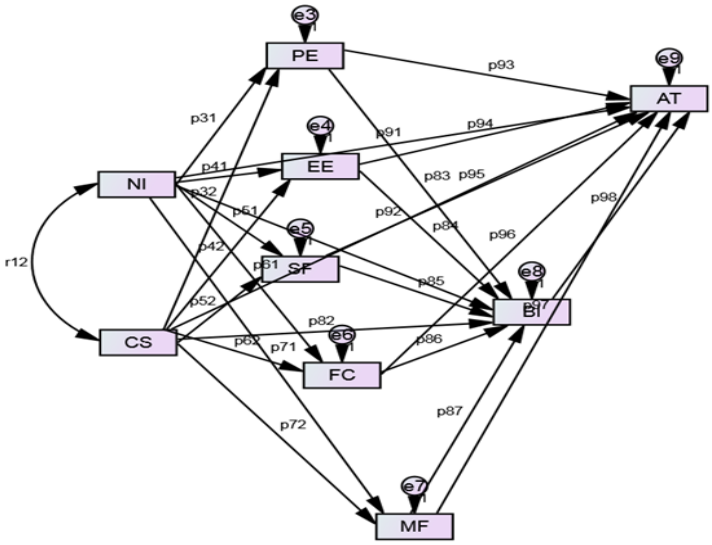

Figure 2: Initial Model for the Nine Variables

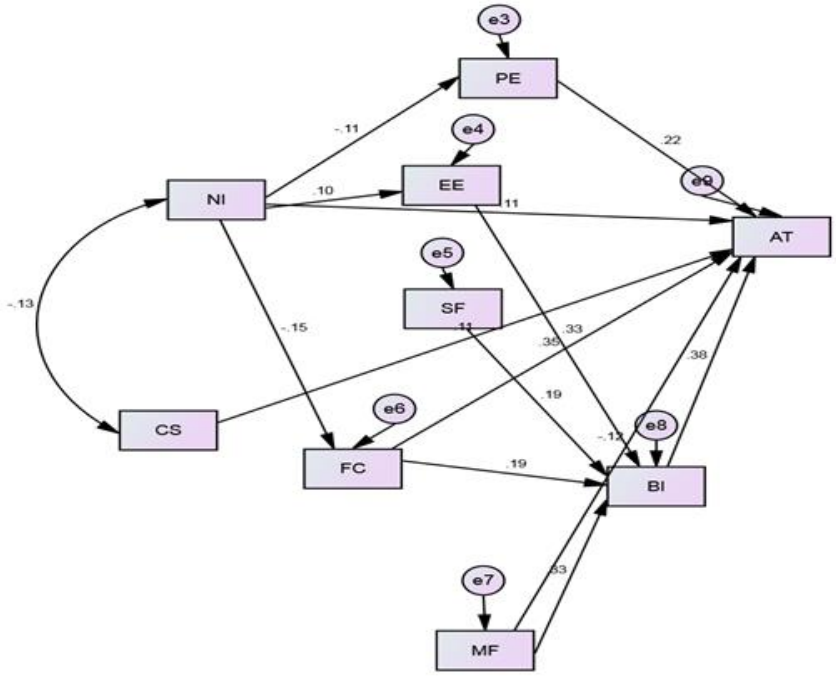

Figure 3: Reduced and model with goodness of fit

Research question 3: What are the direct, indirect and total effects among the variables?

Table 5: Standardized Direct Effects

	CS	NI	SF	MF	FC	EE	BI	PE
FC	.000	-.147	.000	.000	.000	.000	.000	.000
EE	.000	.104	.000	.000	.000	.000	.000	.000
BI	.000	.000	.189	.333	.188	.329	.000	.000
PE	.000	-.114	.000	.000	.000	.000	.000	.000
AT	.106	.107	.000	-.122	.354	.000	.375	.215

Table 5 reveals the direct effect of each of the endogenous variables. From the table, only NI has direct effect of -0.147 on FC. This implies that FC decreases by 0.147 for every one standard deviation increase in NI. Only NI has direct effect of 0.104 on EE. It follows then that for every one standard deviation unit increase in NI, there is an increase of 0.104 in EE. Also, SF, MF, FC, and EE respectively have 0.189, 0.333, 0.188 and 0.329 increases in BI for every one standard deviation unit change in each of them. Only NI has 0.114 decrease in PE for every one standard deviation unit change in NI. All the variables except SF and EE have direct effect on AT. From the table, CS, NI, FC, BI and PE respectively have 0.106, 0.107, 0.354, 0.375 and 0.215 increases on AT while MF has 0.122 decrease in AT for every one standard unit change in each of them.

Table 6: Standardized Indirect Effects

	CS	NI	SF	MF	FC	EE	BI	PE
FC	.000	.000	.000	.000	.000	.000	.000	.000
EE	.000	.000	.000	.000	.000	.000	.000	.000
BI	.000	.007	.000	.000	.000	.000	.000	.000
PE	.000	.000	.000	.000	.000	.000	.000	.000
AT	.000	-.074	.071	.125	.071	.123	.000	.000

From Table 6, the indirect effects on each of the endogenous variables can be observed. None of the variables has indirect effect on FC and EE. Only NI has indirect effect of 0.007 on BI. This means that for every one standard deviation unit change in NI, there is 0.007 increase in BI. None of the variables has indirect effect on PE. CS, BI and PE have no indirect effect on AT. NI has -0.074 indirect effect on AT which means that for every one standard deviation unit change in NI, there is 0.074 decrease in AT. SF, MF, FC and EE respectively have 0.071, 0.125, 0.071 and 0.123 increases in AT for every one standard deviation unit change in each of them.

Table 7: Standardized Total Effects

	CS	NI	SF	MF	FC	EE	BI	PE
FC	.000	-.147	.000	.000	.000	.000	.000	.000
EE	.000	.104	.000	.000	.000	.000	.000	.000
BI	.000	.007	.189	.333	.188	.329	.000	.000
PE	.000	-.114	.000	.000	.000	.000	.000	.000
AT	.106	.033	.071	.003	.424	.123	.375	.215

Table 7 reveals that only NI has total effect of 0.147, 0.114, decreases on FC, PE respectively and 0.104 increase for every one standard deviation unit change in NI. NI, SF, MF, FC AND EE have total effect on BI and they respectively have 0.007, 0.189, 0.333, 0.188 and 0.329 increase on BI for every one standard deviation unit change in each of them. All of the variables have total effect on AT. CS, NI, SF, MF, FC, EE, BI and PE respectively have 0.106, 0.033, 0.071, 0.003, 0.424, 0.123, 0.375 and 0.215 increase in AT for every one standard deviation unit change in each of them.

Research question 4: What is the relative importance of the independent variables on Attitude towards mobile device usage?

The last row in Table 7 shows the total effects of all the eight independent variables on attitude towards mobile device usage for m-learning. These are determinants of the relative importance of the independent variables on attitude towards usage. The highest is the most important etc. From the table, facilitating condition (FC) of mobile device is the most important variable on the attitude towards usage of mobile devices for m-learning with total effect (TE) of 0.424, followed by BI (TE = 0.375), PE (TE = 0.215), EE (TE = 0.123), CS (TE = 0.106), SF (TE = 0.071), NI(TE= 0.033) and MF (TE = 0.003) the least important.

DISCUSSION OF FINDINGS

From the results of analyses, type of institution (NI) has indirect effect of 0.007 on behavioural intention and by extension on attitude towards usage of mobile devices for m-learning. That is, the status of the institution indirectly is a determining factor on mobile devices usage. The facilitating factor leads other four top variables with total effect on the attitude towards usage of mobile devices for m-learning in Nigeria's HEIs. This is in accordance with Attuquayefio and Addo (2014) and Liebenberg et al. (2018) that facilitating condition is a moderator towards using technology. Behavioural intention also ranks as one of the top moderators of attitude towards usage of mobile devices in m-learning as equally supported by Liebenberg et al. (2018). Following BI is the performance expectancy (PE) as variable that favours the usage of mobile devices. Efforts expectancy also stands as one of the leading variable that determines the usage of mobile devices in HEIs in Nigeria. Attuquayefio and Addo (2014) showed that using the UTAUT model, EE significantly predicted BI and actual usage of ICT support this finding. Additionally, course of study has moderate influence on the use mobile devices in m-learning. That is, the course of study determines behavioural intention and actual usage of mobile devices.

Moreover, social factor or influence has insignificant effect on the attitude towards using mobile devices. This finding is contrary to Eckhardt et al. (2009) there exist social influence of workplace on intention and attitude to adopt technology. Furthermore, the types of institution and mobile device features have little total direct effects on the behavioural intention and attitude towards usage of mobile devices in m-learning.

CONCLUSION

In last few decades where the influx of various technologies has affected various sectors of the human life. In this period, the education sector has undergone a clear predominant pattern of acceptance and adoption of mobile devices to facilitate knowledge sharing. Despite the usefulness of application of mobile devices in learning, various factors determine the behavioural and attitudes toward their usage in HEIs in Nigeria. This study affirmed that facilitating factor is the major standardized total effect that will enhance adoption and usage of mobile devices in HEIs. This implies that the management of HEIs should work towards technical infrastructure supports on the use of mobile devices, improve the perceived behavioural control and the degree of perceiving innovation to be consistent with the existing values, needs and experiences of the users or learners. The managements of HEIs also need to encourage lecturers to adopt the use of mobile devices purposely for mobile learning to step up the number of lecturers making available the course materials to their students.

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