

Original Research Article

Adoption of eLearning Technology in Nigerian Tertiary Institution of Learning

Abstract

Recent development in the telecommunication industry in Nigeria has brought about an unprecedented upsurge in the use of Information Technology for teaching and learning in tertiary institutions of most part of the developed countries of the world. However, the adoption and implementation of web-based course management and learning tool (Moodle) in most developing countries like Nigeria is still in the infancy. In this paper, we utilize the modified versions of the unified theory of acceptance and use of technology (UTAUT) model in explaining elearning adoption in higher education in a developing country and evaluate the size and direction of the impacts of the UTAUT factors on behavioral intention and use behavior to adopt elearning in higher education. The data were obtained through a web survey of students of two university in Nigeria and the models are estimated in a structural equations modelling framework using Lisrel 8.8. The entire UTAUT construct with their relationships are confirmed using the confirmatory test statistics. The results suggest that ~~technology access and willingness not use elearning technology moderate the UTAUT construct effect positively.~~ It is well established that the latent variables significantly explain the Venkatesh model.

Keywords: elearning, UTAUT Models, Pedagogical, Web-Based Course Management System, Traditional Teaching and Learning, asynchronous, constructivist

1.0 Introduction

The EU elearning action defines elearning as “the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration” (Carvalho, 2003; eEurope, 2005, p.2). Alternatively, elearning could be seen as a web-based learning tool that utilizes web-based communication, collaboration, knowledge transfer and training to benefit individuals and organizations. It involves the delivery of teaching materials via electronic media, such as Internet, intranets, extranets, satellite broadcasting, audio/video tape, interactive TV, and CD-ROM and it could use Internet technologies to deliver a broad array of solutions that enhance knowledge and performance (Khan, 2001; Rosenberg 2001; Kelly & Bauer 2004 and Engelbrecht, 2005). Many practitioners have recognized elearning as online courseware or elearning that has replaced or be adopted alongside with the traditional classroom training (Rosenberg, 2006).

Elearning is facilitated by different types of communication technologies where, especially the use of online access of the Internet, provide unique possibilities to deliver elearning across space and support interaction-based learning type. elearning has makes it possible to extend the reach of educational and training systems into new areas, thus it can be applied in the public schools, colleges, universities, etc., as well as for vocational training (Falch & Nicolajsen, 2008).

The success with regards to the adoption of elearning is dependent on stakeholders’ support as well as student adoption of the elearning services. Learning Management System (LMS) as a component of elearning technology is an important and popular course management software application in higher education providing a number of learning tools, including an online discussion board, course content management, a course calendar, information announcement, electronic mail, review, auto-marked quizzes and exams, navigation tools, access control, grade maintenance and distribution, student progress tracking, etc. With the use of LMS learning, student stands to benefit high level of interactivity, reflectivity and collaborative learning, a great level of enthusiasm, and high level of satisfaction (Seamus & Kay, 2003).

The continuous development of information and communication technology has enabled elearning to become a new form of student's training in the schools (Rosenberg, 2006). Elearning provides students with a different opportunity to learn regardless of where they are and when they are available. In elearning, students are able to participate in self-faced and interactive learning that is otherwise impossible. The learner-centered approach further makes elearning a powerful training tool for students as well as one that influences them to change their learning behaviors within their study environments (Bandura, 2002). Such changes in the training contexts of organizations have highlighted the need for understanding and incorporating students' acceptance on elearning in order to facilitate the elearning implementation processes.

There are various potential objectives for implementing an elearning program, as suggested by (Kim, 2007):

- a. Increased learning effectiveness for the students or lecturer, over either pure traditional classroom learning or pure elearning.
- b. Increased convenience for the students or lecturer. In the case of students, the elearning component of a learning program can make it easier for the lecturer when on field trips or high priority lectures or practical come up to prevent them from attending scheduled in class training.
- c. Enhanced image for the school or the corporation. The progressive image may be projected both internally to own students or lecturer and externally the general public, customers, the government, news media, the financial analysts, etc.
- d. Cost savings for the school or the Government. The cost savings may result from possibly reducing the number of instructors, which are usually scarce.
- e. Classroom space savings for the school or the institution. The elearning component of a learning program can help ease the classroom space needed by having students and lecturer learn more from outside the classrooms. The freed-up classroom space can potentially be used for other purposes.
- f. Reduced traffic and parking congestion on the campus coursed by students, lecturers and visitors.

With the advent of elearning, especially on-line learning, new paradigms for teaching and learning about complex issues are emerging. A wide range of opportunity is being developed and implemented in the vocational, academic, and continuing education and training arena to support life-long learning. Formal education has been slower to embrace the concept of on-demand, on-time learning for students. As new crops of dynamic teachers enter the profession, elearning is becoming an accepted and effective form of professional development. Increasingly, teachers are using elearning to acquire new knowledge and skills that they can integrate into their classroom practices. Wheeler et.al (2003) opined that elearning as a means to delivery of instruction and content to individual and groups via the internet. Universities and colleges, corporations, non-governmental organization (NGO), government agencies and individual are using elearning courses. Collision et.al (2010) presented some of the current elearning models as the On-line supplement to a face-to-face course which may contain a syllabus, homework assignments, recommended Web sites, and perhaps a discussion board and dedicated Web site. The On-line self-paced course is the second model that is similar to correspondence courses that provide a series of structured experiences for the student to complete his or her assignment at own pace. The On-line lectures which are courses that are based on the traditional lecture hall through the use of video and audio delivery over the internet and some type of real-time feedback. The Guided collaboration is a type similar to a well-run seminar where students learn through conversation and collaboration with each other with the aid of a teacher skilled in on-line facilitation, and finally, the Digital game-based learning and simulations.

It has been observed that some of the factors that can influence the adoption of elearning may include the demographic variable such as technology access and the foreseen reason for willingness not to use elearning tools. It is my opinion that this two decision factor will be considered a key driver on technology adoption and therefore may improve the predictive ability of UTAUT models. This study therefore provide formation models of elearning intention which may include the basic explanatory variables from the UTAUT model of performance expectancy, effort expectancy, social influence, facilitating conditions, behavioral intention and use behavior, as well as the direct and moderating influences of Technology access and the for foreseen reason for willingness not to use elearning tools

on intention formation. In conclusion, this study aims to contribute the following to elearning literature:

The present study adopts the Unified Theory of Acceptance and Use of Technology (UTAUT) model proposed by Venkatesh et al. (2003) to define various constructs that would describe the adoption of elearning technology of students of tertiary institution in Nigeria and then assess their reliability, assess the degree of relationship between the defined constructs and statistically test their significance, establish the association between constructs of the UTAUT model and identify students of tertiary institution in Nigeria foreseen reasons for not willing to use elearning system. Ascertain whether the significant determinants of UTAUT constructs are associated within themselves and the moderating factors of technology access and willing not to use elearning system that influence the intention to use elearning system.

2.0 Elearning Moodle in Nigeria University

Over the past several years Marchewka et.al (2007), institutions of higher education have increasingly invested in course management software to provide a virtual learning environment designed to enhance student learning and to assist in the administration of the course itself. In addition, the need for integration of education, practice, and information technology is growing. University lecturers and other instructors are often encouraged to find ways to help their students improve their learning skills both inside and outside of the classroom. On this gesture, the Federal University of Technology, Akure (FUTA) and the National Open University (NOUN) are committed to this development. They have embraced elearning alongside with traditional learning method. Moodle learning management system was adopted in the two targets University

The NOUN was initially established on 22 July 1983 as springboard for open and distance learning in Nigeria. At takeoff of the university, pioneer student enrollment stood at 32,400. In 2015 NOUN had 77,759 students. The NOUN of Nigeria operates from its Administrative Headquarters in Lagos, Nigeria, with study centres throughout the country. It offers over 50 programmes and 750 courses. NOUN does not provide lectures to students in normal classroom settings but by distance learning and elearning in recent times. The Federal University of Technology Akure (FUTA) was founded in 1981 under a drive by the government of Nigeria to create universities that specialized in producing graduates with practical as well as theoretical knowledge of technologies. It is located in Akure, Nigeria. It is a top ranking University of technology in Nigeria. The university has grown tremendously, stretching its academic disciplines and research across six different schools and over thirty academic departments. The Federal University of Technology has moved up on the Webometric Ranking of Universities in the world once again according to the latest ranking released on 10th February, 2015 to number 8 nationwide.

In the Nigerian educational policy, youth are the primary targets of novel educational policies, methodologies and technologies, because, they are naturally accustomed with computers, iPad, tablets, phones and other sophisticated technical devices, usually with greater success than their parents or teachers at school. Having developed new behavior, Siozos and Palaigeorgiou (2008) collectively identified them as the "net generation". They prefer to learn through practice, exploration and trial by error. They prefer acting to listening, fast and multimodal interactions and communications to text and reading and frequent changes to stability. Generally speaking, these

young learners have shown a preference for socializing with peers, participating in group activities and working in groups which are good characteristics of readiness for elearning participation.

~~Elearning technologies can be categorized according to the delivery media, viz: web based training (WBT), online learning, distributed learning, computer based training (CBT), mobile learning, etc. This new method of teaching has come at the right time to fulfil the contemporary learning needs and expectations of her youth (Olabode and Rao, 2012). Today, elearning starts from the process of gaining admission into the tertiary institution. New intake are required to write a CBT JAMB and Post UTM examinations. On admission, elearning continues till graduation.~~

The transformation in the telecommunication industry, power sector and the developmental trend of information communication technology in Nigeria has brought a significant change in the behavior of

educational institution on the use of elearning. The elearning programme at FUTA and NOUN have supported and enhanced the learning processes and through a process of technological syncretism particular characteristics of the "net generation", the traditional educational structures and practices has been blended with the new technologies. This has offered a multitude of opportunities for the development of pedagogical practices and the enhancement of learning (Siozos and Palaigeorgiou, 2008). In traditional classroom training, mass teaching is directed toward the average student and the time that can be devoted to each student's needs is limited. Elearning, on the other hand, opens bright prospects for the differentiation and adaptation of teaching and learning to individual needs. It is compatible with various pedagogical methods, such as self-paced or directed learning, individual or collaborating learning, individual or group teaching, synchronous or asynchronous collaboration, and so forth (Siozos and Palaigeorgiou, 2008). Elearning enhances the flexibility and accessibility at all levels of education and training. Learners are able to take courses and use learning material whenever they have the time and in the mood for it. This characteristic is particularly valued by the growing number of adult learners, distant, part time and regular students in Nigeria. The educational use of new technologies has increased the attention, concentration and motivation of learners. The presentation of the learning material through various media enhances retention, while the use of novel tools that technology places at our disposal facilitates communication and collaboration among learners. Elearning technologies in Nigeria Universities have allowed the creation of active learning environments, by providing learners with opportunities to assess their knowledge, to reflect upon their progress and to make decisions regarding the learning strategies to deploy. Various elearning configurations provide significant opportunities for learner control. Learners may be allowed to adjust the selection, sequence, pace and presentation of the learning material according to their needs which may have positive effects on learner engagement, creativity, autonomy and self-efficacy.

Recent development in the telecommunication industry in Nigeria has brought about an unprecedented upsurge in the use of mobile technology. Mobile technology are computational devices that is growing very fast for it is very portable, cheap and very efficient. Their complementary use for supporting learning activities has open up various prospects. M-learning which is elearning through the use of portable appliances and wireless networking has transform the way students learn, providing continuous access to learning material, learning activities and communication tools and facilitating collaborative interaction. Mobile computational devices may take a variety of forms and have several capabilities, ranging from specialized devices, like response pads, graphical calculators and electronic dictionaries, to more generic devices, such as mobile telephones, PDAs, portable computers and Tablet PCs. Also the entertainment devices such as the mp3& mp4 players, ipods, portable video game consoles, etc. have capabilities to support communicative and multimedia operations for the purpose of learning. These devices can capture and handle multimedia, connect to the Internet, and even locate their position through geographical positioning system (GPS). Mobile computational devices allows learners and teachers to make use of their spare time, while travelling or commuting in order to finish homework or to get prepared for a course, it constitute ideal companions for field working and learning, can enable the design and implementation of mobile collaborative learning activities. It also encourages the natural social interaction and learners can move freely in space, cooperating and interacting with peers. While learners communicate and interact face to face, they participate simultaneously in artificial collaborative networks that support electronic communication with other students or the teachers sitting in their office. Both Universities have adopted the Moodle course management system.

Moodle is a Course Management System (CMS) for producing web-based courses. It is a Free and Open Source Software (FOSS), which means, it is free to use, modify, and redistribute. Many of the features in Moodle are carefully chosen to support a philosophy of learning, called social constructionist pedagogy. Simply stated, this style of learning and teaching is based on four concepts, which are constructivism, constructionism, social constructivism, and connected and separate. As Moodle is designed around a well-defined educational philosophy, its user interface is very consistent. You interact with each activity in moodle, your classmates, and the teacher in a consistent way, whether it's in the chat room, a forum, or by leaving feedback on a workshop.

3.0 Literature Review

Extensive work has been done on the use of UTAUT to determine the association between constructs and the behavioral Intention and use behavior of information technology, among them is the work of Gruzdt, Staves and Wilk (2012). They explore the conceptual framework of the unified theory of acceptance and use of technology (UTAUT), a widely adopted technology acceptance theory used to explain why some people are more or less likely to adopt and use a particular information technology. The paper contributed a new knowledge to methodological discussions as it is the first known study to employ UTAUT to interpret scholarly use of social media. Recommendations about how UTAUT can be expanded to better fit examinations of social media use within scholarly practices were offered.

Acceptance of elearning by employees is critical to the successful implementation of elearning in the workplace. To explain why employees might accept the elearning technology, Yoo, Han, & Huang, (2012) consider motivational factors. Moreover a recent study in users' acceptance towards technology revealed that the predictability of UTAUT might vary when applied in different cultural settings (King & He, 2006). It was established in Yoo, Han & Huang, (2012) that the applicability of UTAUT in different cultural settings needs further investigation and to address these deficiencies, the study of Yoo, Han, & Huang, (2012) examined two separate categories of motivators (intrinsic and extrinsic) and their effects on employees' intentions in adopting elearning in the workplace. Furthermore, the study was situated in the South Korean context, to investigate UTAUT's feasibility in a different cultural context. The findings revealed that intrinsic motivators (effort expectancy, attitudes, and anxiety) affected employees' intention to use elearning in the workplace more strongly than did the extrinsic motivators (performance expectancy, social influence, and facilitating conditions). Furthermore, the effects of intrinsic motivators mediated the effect of extrinsic motivators.

Maldonado, Khan, Moon and Rho (2011) carried out a study on elearning motivation and educational portal acceptance in developing countries. The objective of the work is to empirically validate a modified UTAUT model by adding an "elearning motivation" construct in the South American context. Findings suggest that elearning motivation and social influence had a positive influence on behavioral intention, while facilitating condition had no effect on elearning portal use. Behavior had positive influence on elearning motivation. Also established was the moderating role of "region". The purpose of Shibl, Lawley, Debus (2013) research was to develop and explore a UTAUT (Unified Theory of Acceptance and Use of Technology) based model of how and why GPs accept DSS. Insight into the reasons why GPs do not use clinical DSS combined with knowledge of why GPs use DSS will allow the development of strategies to facilitate more widespread adoption with consequent improvements across many areas. Depth interviews were conducted with 37 GPs comprising a mix of education backgrounds, experience and gender. The developed model indicated that four main factors influence DSS acceptance and use including usefulness (incorporating consultation issue, professional development and patient presence), facilitating conditions (incorporating workflow, training and integration), ease of use and trust in the knowledge base.

There is a dearth of research especially in developing countries Uzoka&Ndzing (2009) on factors influencing the adoption of biometric technology by organizations. The amount of research on biometric technology acceptance by users in developing countries is limited. This is why Uzoka&Ndzing (2009) explore the conventional UTAUT model to identify and understand the factors that are significant in explaining the intention to adopt a biometric technology in a developing country's context. The paper reports a study that analyzed the adoption of biometric technology in a developing country from an institutional point of view. The results show that job positions (managerial and operational) could influence perceptions of innovation characteristics (especially ease of use and usefulness) in the decision to adopt biometrics. However, the unified organizational analyses indicate that ease of use, communication, size and type of organizations have significant impacts on the decision to adopt biometrics.

4.0 Theoretical Framework

User acceptance and intentions to adopt technology has been a frequently studied topic in different disciplines for instance in Psychology & Information Systems. In the past several decades, many studies have been made to explain, predict, and enhance user acceptance of different information

system technologies. These studies were based on a modified version of UTAUT theoretical approaches (Venkatesh & Davis, 2000; Venkatesh et al., 2003).

Elearning technology adoption is partly a technological issue, environmental issue, persons issue and partly a cost issue, which has organizational foundation and environmental influences. Cooper and Zmud (1990) divide technology adoption into six broad phases: initiation, adoption, adaptation, acceptance, routinization and infusion. It is believed that elearning technology adoption in Nigerian Universities is at the initiation or adoption stage, with many tertiary institutions lagging in the adoption.

The UTAUT model is one of the most comprehensive, robust, and powerful models that is up-to-date. Venkatesh et al. (2003) identified seven constructs that appeared to be significant direct determinants of intention or usage in one or more of the individual. Of these models, they theorize that four constructs will play a significant role as direct determinants of user acceptance and usage behavior: performance expectancy, effort expectancy, social influence, and facilitating conditions, also included the behavioral intention and use behavior of students to elearning. Author has theorized this two construct not to be direct determinants of intention. The labels used for the constructs describe the essence of the construct and are meant to be independent of any particular theoretical perspective. Figure 1 presents the UTAUT structure model as in Venkatesh et al., (2003).

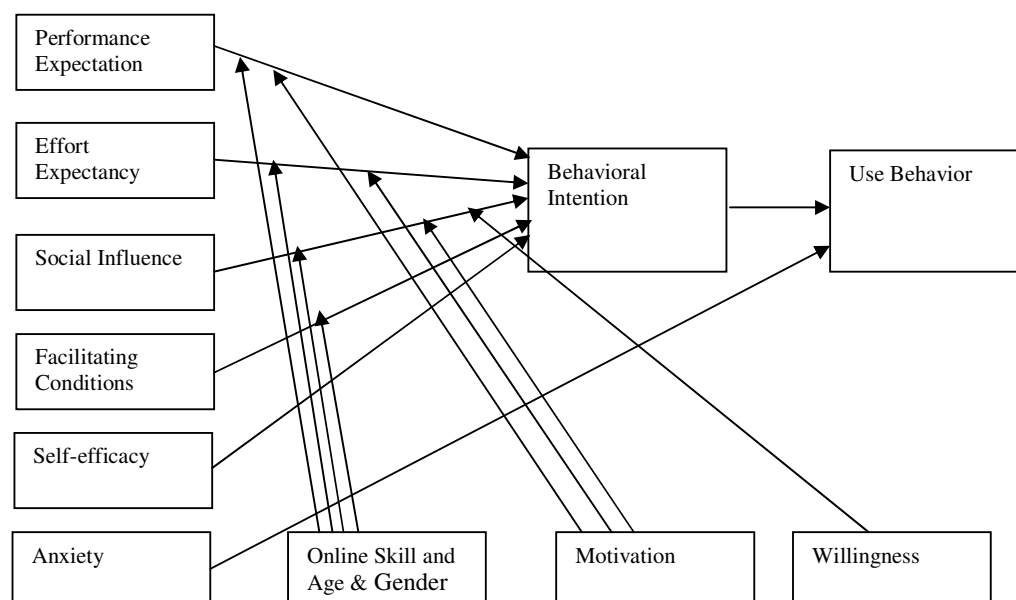


Figure 1 Modified version of UTAUT

The UTAUT model which aims to explain technology acceptance, is based on eight technology acceptance theories or models (Troy et.al 2013). In particular, the UTAUT draws on the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model, the Theory of Planned Behavior (TPB), the combined TAM and TPB, the model of Personal Computer Utilization, the Innovation Diffusion Theory and the Social Cognitive Theory (Venkatesh et al. 2003). At the core, the UTAUT model uses behavioral intention as a predictor of the technology use behavior. The included predictors of behavioral intention are based on the components the eight technology adoption models reviewed. The basic form of the UTAUT model is shown in Figure 1.

In addition to behavioral intention and use behavior, the UTAUT model consists of four constructs:

- **Performance Expectancy**: The degree to which the individuals believe that the use of the technologies will result in performance gains. This may also be viewed as the **perceived usefulness** of the technologies.
- **Effort Expectancy**: The ease of use of the technologies.
- Social influence: The extent to which the individuals believe that important others believe that they should use the technologies.
- Facilitating Conditions: The perceived extent to which the organisational and technical infrastructure required for the **support of** the technologies exists.
- Behavioral intention to use the system: Behavioral intention consistent with the underlying theory is perceived to hold for all of the intention models. It is expected that behavioral intention will have a significant positive influence on technology usage.
- Use behavior of using technology: an individual's overall affective reaction to using a system. Given that we expect strong relationships in UTAUT between performance expectancy and behavioral intention, and between effort expectancy and behavioral intention, Venkatesh et al.(2003) believe that, consistent with the logic developed here, use behavior of using technology will have a direct or interactive influence on behavioral intention.

The model also includes four moderating variables: age, gender, education and voluntariness of use.

In the UTAUT model, performance expectancy, effort expectancy, and social influence have direct effects on behavioral intention, which along with facilitating conditions have direct effects on use behavior. The effects of interactions of each of performance expectancy, effort expectancy and social influence with each of age and gender; interactions of experience with each of effort expectancy and social influence; and an interaction of voluntariness of use and social influence on behavioral intention are also included. Finally, there are effects of interactions of age and facilitating conditions and experience and facilitating conditions on use behavior (Venkatesh et al.2003).

Although, attitude which refers to the individuals' feelings (positive or negative) towards the use of the technologies Fishbein&Ajzen(1975) is an important component of the TRA and the TAM, it is not explicitly included in the UTAUT model. According to Venkatesh et al. (2003), the effect of attitude on behavioral intention is spurious and it emerges only when performance expectancy and effort expectancy are omitted from the model. This means that attitude towards the use of the technologies does not provide enough unique information beyond that which is already provided jointly by performance expectancy and effort expectancy.

Hypotheses

This study was conducted at the **Federal University of Technology, Akure, Nigeria and National Open University, Nigeria**. We expect to statistically confirm the basic form of the UTAUT model. However, we advance the following hypotheses, which are consistent with the projections based on the UTAUT model.

Model 1

Hypothesis 1: Performance expectancy is positively related to behavioral intention.

Hypothesis 2: Effort expectancy is positively related to behavioral intention.

Hypothesis 3: Social influence is positively related to behavioral intention.

Model 2

Hypothesis 4: Facilitating conditions and behavioral intention are positively related to use behavior.

Model 3

Hypothesis 5: Performance expectancy, effort expectancy, social influence and facilitating conditions and behavioral intention are positively related to use behavior

Hypothesis 6: Performance expectancy, effort expectancy, social influence and facilitating conditions and behavioral intention are positively related to use behavior moderated by technological access and foreseen willingness not to use elearning technology.

5.0 Methodology

5.1 Sampling Scheme

~~A well structured questionnaire was developed based on the modified version of the UTAUT model developed by Venkatesh et al. (2003). The research subjects were accessible students of the Federal University of Technology, Akure and the Nigerian Open University, Nigeria. These students were selected based on their commitment. Email was sent to their respective email boxes to indicate their willingness to participate in the survey. Questionnaire was formulated and pre-sample survey was carried out. The questionnaire was reviewed by experts in statistics and the followed by a proper purposeful sample survey. The 627 students participated in the survey included 296 males and 181 females from the Federal University of Technology, Akure, while 108 males and 42 females were from the Nigerian Open University, Nigeria. The students of the two universities were selected based on accessibility and commitment. The questionnaire was web based and it was compulsory for respondents to completely fill all questions in the questionnaire before such respondents' responses can be accepted. The questionnaire consists of two parts. In Part I, questions are related to age, gender, computer literacy level, type of smart system and level of power supply. Part II consists of questions relating to technology access, online skills and relationship, motivation, foreseen reasons for not willing to use elearning tools and the basic UTAUT constructs. The respondents' responses were measured on a five-point Likert scale (extending from 1 (completely disagree) to 5 (completely agree). Data was collected from January 2014 to August 2014.~~

5.2. Research Methods

~~Confirmatory factor analysis was used in the study. It involves the specification and estimation of one or more putative models of factor structure, each of which proposes a set of latent variables (factors) to account for covariance among a set of observed variables. LISREL 8.8 (Joreskog and Sorbom 2006) was used to describe and to test the fit of each hypothesized model against the sample data. Model specification was accomplished by fixing or constraining elements in three matrices that are analogous to the factor pattern matrix, factor correlation matrix, and communalities from a common factor.~~

~~In this study, the analysis proceeds as follows. First, based on logic, theory and previous studies, plausible alternative models of underlying data structure are proposed. Using several goodness-of-fit indexes, confirmatory factor analysis is used to compare data-model fit and examine evidence for a higher-order construct. One model is selected as best representing the underlying factor structure in the sample data. Second, confirmatory factor analysis is used to assess the reliability and validity of the factors and items in the selected model.~~

5.3 Presentation of Data analysis

A descriptive statistics of the sample data was carried out. The frequency score of response on each item on the questionnaire is as presented in Table 1.

Table 1: Characteristics of the sample (N=627)

Demographic variables	Attribute	Measure
School: FUTA	Male	47.2%
	Female	28.9%
NOA	Male	17.2%
	Female	6.7%
Age	Median	18-25

Computer literacy level	Very low	2.6%
	Low	15.9%
	Medium	35.9%
	High	28.7%
	Very High	16.9%
Type of Smart system	None	5.1%
	Smart Phone	49.6%
	Computer	45.3%
	System	

Table 1 presents the demographic characteristics of the 627 respondents. There were about 47.2% males and 28.9% females from the Federal University of Technology, Akure, while 17.2% males and 6.7% females were from the Nigerian Open University, Nigeria. The median age group was 18-25 years, with all the respondents below the age of 35 years. More than 64% of the respondents were computer literate. About 95% of the respondents had either a computer system or smart phone or both systems for eLearning access. In the subsequent analysis of data, of the four demographic variables, gender, age, motivation to use eLearning and foreseen reason for willingness not to use elearning technology will be associated with the eLearning readiness of the students in higher institutions.

Table 2 Descriptive statistics (factor affecting usage)

Items of UTAUT model construct	Descriptive Statistics		
	Symbols	Mean (μ)	Std. Deviation (σ)
Performance expectancy1	PE1	4.02	1.151
Performance expectancy2	PE2	4.07	1.010
Performance expectancy3	PE3	4.08	1.013
Performance expectancy4	PE4	4.11	1.014
Effort expectancy1	EE1	3.93	1.054
Effort expectancy2	EE2	3.80	1.070
Effort expectancy3	EE3	3.83	1.023
Effort expectancy4	EE4	3.86	1.030
Social influence1	SI1	2.73	1.277
Social influence2	SI2	3.06	1.131
Social influence3	SI3	3.18	1.165
Social influence4	SI4	3.39	1.152
Facilitating condition1	FC1	4.09	1.090
Facilitating condition2	FC2	4.23	1.016
Facilitating condition3	FC3	4.00	.992
Facilitating condition4	FC4	3.95	1.023
Behavioral intention1	BI1	3.59	1.246
Behavioral intention2	BI2	3.33	1.175
Behavioral intention3	BI3	3.79	1.040
Behavioral intention4	BI4	4.01	1.040
Usage Behavior1	UB1	3.98	1.077
Usage Behavior2	UB2	3.97	1.005
Usage Behavior3	UB3	3.99	1.008
Usage Behavior4	UB4	3.76	1.012

The descriptive statistics in Table 5, typically gives the mean, and standard deviation of the survey responses on a five point likert scale. It could be observed from the mean values that respondents have the impression that eLearning will improve their performance in school, considering such issues as the use the eLearning system to increase chances of performance ($\mu = 4.11$, $\sigma = 1.014$), the eLearning system is easy to use ($\mu = 3.86$, $\sigma = 1.030$), the organization support for the use of eLearning system ($\mu = 3.39$, $\sigma = 1.152$), The eLearningsystem compatibility with other systems ($\mu = 4.23$, $\sigma = 1.016$), the built-in help facility for assistance ($\mu = 4.01$, $\sigma = 1.040$), the overall perception that using eLearning system is a good idea ($\mu = 3.99$, $\sigma = 1.008$).

The factor analysis was carried out using the principal axis factoring. The KMO measures the sampling adequacy. The KMO measure is 0.938, while the Bartlett's test of sphericity has $p = 0.000$ and $\chi^2 = 1079.962$, which is an indication of sample adequacy and the suitability of exploratory factor analysis.

5.4 Model Validation

Table 3: UTAUT construct factor analysis

Latent variable	Item	Est.	S.E	(ERR)	R ²	χ^2	Df	AGFI	GFI	RMSEA
Performance expectancy (PE)	PE1	0.87	0.56	0.040	0.58	54.13	2	0.79	0.96	0.204
	PE2	0.91	0.20	0.032	0.81					
	PE3	0.89	0.24	0.033	0.77					
	PE4	0.83	0.33	0.034	0.68					
Effort expectancy (EE)	EE1	0.83	0.42	0.036	0.62	68.40	2	0.75	0.95	0.230
	EE2	0.88	0.38	0.036	0.67					
	EE3	0.92	0.19	0.033	0.82					
	EE4	0.86	0.31	0.034	0.70					
Social influence (SI)	SI1	0.64	1.22	0.051	0.25	55.12		0.79	0.96	0.206
	SI2	0.95	0.38	0.041	0.71					
	SI3	0.96	0.44	0.042	0.68					
	SI4	0.84	0.63	0.043	0.53					
Facilitating condition (FC)	FC1	0.80	0.55	0.04	0.54	106.57	2	0.61	0.92	0.289
	FC2	0.74	0.49	0.037	0.53					
	FC3	0.80	0.34	0.035	0.65					
	FC4	0.84	0.33	0.036	0.68					
Behavioral intention (BI)	BI1	0.80	0.92	0.049	0.41	53.26	2	0.80	0.96	0.202
	BI2	0.67	0.94	0.047	0.32					
	BI3	0.87	0.32	0.039	0.71					
	BI4	0.76	0.50	0.040	0.54					
Use behavior (UB)	UB1	0.93	0.93	0.035	0.75	1.72	2	1.00	0.99	0.023
	UB2	0.92	0.92	0.032	0.84					
	UB3	0.86	0.86	0.033	0.73					
	UB4	0.71	0.50	0.039	0.24					

Confirmatory factor analysis (Table 3) enables us to estimate the reliability of individual items as well as factors and the overall instrument. On the first-order level of measurement models, the proportion of variance (R-square) in the observed variables that is accounted for by the latent variables influencing them can be used to estimate the reliability of the observed variables (items) with R-square values above 0.49 considered evidence of acceptable reliability. For second or higher levels, the proportion of variance (R-square) in the latent variables (factors) that is accounted for by the higher-order construct influencing them can be used to estimate the reliability of the latent factors (Bollen 1989). The total coefficient of determination for observed variables is an estimate of the reliability of the overall instrument.

Table 4: Reliability Analysis with Cronbach' alpha

	Performance expectancy	Effort expectancy	Social influence	Facilitation condition	Behavioral intention	Use behavior
% of Variance	43.319	9.005	4.815	4.049	2.648	1.684
EigenValues	8.920	8.746	7.600	3.803	5.540	5.968
Cronbach's alpha	0.901	0.904	0.801	0.857	0.787	0.860

The exploratory factor analysis (Table 3) shows that twenty four variables relating to the adoption of elearning technology was loaded on six latent factors. The latent factors are indicated, including their percentage contributions to the variability of data, eigenvalues and Cronbach's alpha values indicating reliability/internal consistency of data

In Table 4, the reliability for the various construct using the Cronbach's Alpha and Chi Square are presented. For comparing items in a construct, alpha values greater than or equal to 0.7 are regarded as satisfactory (Hair, Black, Babin, Anderson, & Tatham, 2006). As in the table, most of the scales in the construct appear to have a high degree of reliability since the corresponding computed Cronbach's alpha statistics is above the value 0.7. However, it appears that the items that make up the perceived behavior control construct lack internal consistency as its test statistic falls below 0.70. However, the statement of the construct is then negated to improve its reliability. The χ^2 values of all the items in the construct are significant, thus showing that there is an association between the items of each construct.

Table 5 Model Validation

	BI	UB	PE	EE	SI	FC
BI	0.59	(0.04)	(0.06)	(0.03)	(0.04)	(0.07)
UB	0.54	0.86	(0.05)	(0.03)	(0.03)	(0.05)
PE	0.43	0.53	0.76	(0.05)	(0.05)	(0.03)
EE	0.46	0.54	0.53	0.71	(0.04)	(0.05)
SI	0.15	0.14	0.09	0.14	0.41	(0.04)
FC	0.47	0.57	0.68	0.66	0.14	0.73

Lower left half: coefficients (ϕ vector) of the construct.

Diagonal: Ave (average variance extracted)

Upper right half: standard errors of the correlations

The various statistics in Fig. 2 confirmed that the UTAUT model was supported. Performance expectancy, effort expectancy, and social influence significantly affected behavioral intention. Behavioral intention and facilitating conditions had significant effects on use behavior.

From Table 5, a confirmatory factor analysis was conducted to check the statistical validity of the constructs. As shown in Table 5, all AVE values are greater than 0.5, which indicates that the model had convergent validity. The square-root values of AVE were greater than the correlations between the corresponding constructs and the confidence intervals of the coefficients did not include 1.0, which indicated that the constructs had discriminant validity

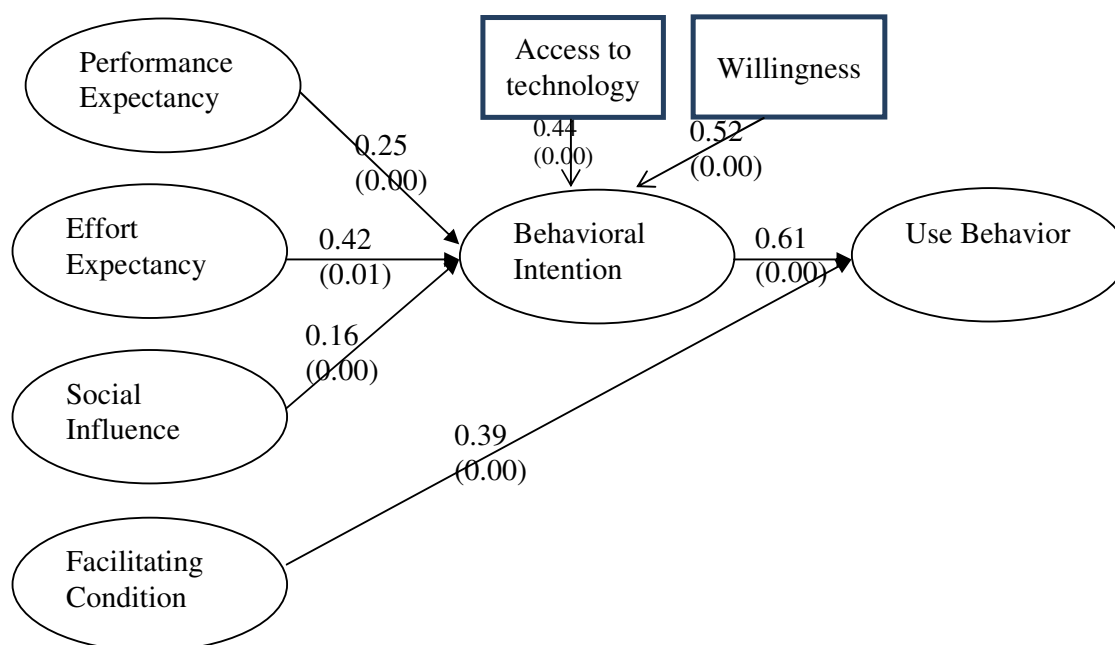


Figure 2 Model of elearning technology adoption

5.5 Test of the UTAUT Model - Criteria for Comparing Model-data Fit

The UTAUT model was tested using the entire data set for the two Universities. The criteria for comparing model-data fit to evaluate individual models in this study includes, absolute indexes of goodness-of-fit such as chi square, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI) and root mean square residual (RMSR). The GFI and AGFI are measures of the relative amount of variance and covariance implied by the data set that is jointly accounted for by the model. The AGFI differs from the GFI by adjusting for the degrees of freedom in the model. GFI and AGFI range from 0 to 1 with higher values indicating better fit (Joreskog and Sorbom, 1989). Many researchers interpret GFI or AGFI scores in the 0.80 to 0.89 range as representing reasonable fit: scores of 0.90 or higher are considered evidence of good fit. The RMSR (Joreskog and Sorbom, 1984) reflects the average residual obtained by taking the difference between the model-generated and sample variance/covariance matrices. Smaller values are associated with better fitting models with scores below 0.05 considered as evidence of good fit (Byrne, 1989).

Table 6: Structural Equation Model

Model	Independent Variable	Predictor					WT	TA
		PE	EE	SI	FC	BI		
1	BI ($R^2 = 0.54$) 0.038	0.25 (0.053)	0.43 (0.059)	0.19 (0.050)				
	BI ($R^2 = 0.59$) 0.040	-0.29 (0.32)	-0.13 (0.33)	0.14 (0.058)	1.04 (0.61)			
2	BI ($R^2 = 0.63$) 0.029				0.39 (0.068)	0.64 (0.083)		
3	UB ($R^2 = 0.64$) 0.029	0.34 (0.028)	0.32 (0.28)	-0.025 (0.051)	-0.25 (0.55)	0.66 (0.093)		
	UB ($R^2 = 0.65$) 0.029	0.34 (0.28)	0.33 (0.28)	-0.031 (0.051)	-0.27 (0.56)	0.64 (0.093)	0.056 (0.063)	0.034 (0.033)

Model 1 (H_1 , H_2 and H_3)

The effects of performance expectancy, effort expectancy and social influence on behavioral intention are examined.

We estimate the SEM on the UTAUT construct that performance expectancy, effort expectancy and social influence impact directly on behavioral intention in Table 6. The results indicate that the model fits the data well with ($\chi^2_{98} = 527.27$, RMSEA = 0.084, CFI = 0.97). This model explains approximately 54% of the variance in behavioral intention. This falls below the 70% suggested by Venkatesh et al. (2003), but the model still generalized the conclusion. Each of the structural regression paths are significant thus tentatively confirming the first three hypotheses is accepted (H_1 , H_2)

The effects of performance expectancy, effort expectancy, social influence on behavioral intention and in addition the effect of facilitating condition was also established. It is important to note that based in the UTAUT model proposed by Venkatesh et al. (2003), there should be no effect of facilitating conditions on behavioral intention. Performance expectation, effort expectancy and effort expectancy should influence only behavioral intention positively. The results of H_4 has shown that the addition of facilitating condition to model 1 has also made the performance and effort expectancy to have a negative influence on behavioral intention, thus accepting the H_3 .

Model 2 (H_4)

The effect of facilitating condition and behavioral intention on use behavior is determined.

The second model with H_4 determines the effect of facilitating conditions and behavioral intention on use behavior intention. This model 2 fits the data well with ($\chi^2_{51} = 338.17$, RMSEA = 0.095, CFI = 0.97). It explains approximately 63% of the variance in behavioral intention as shown in Table 6. The explained variance again falls below but very close to 70%. This shows this second model is better than model 1 because it reduces the degree of uncertainty in the prediction of behavioral intention. All the specified regression effects are significant in this model 2. The facilitating condition and behavioral intention has direct effect on use behavior, hence H_4 is accepted.

Model 3 (H_5)

The effect of performance expectancy, effort expectancy, social influence and facilitating conditions and behavioral intention on use behavior is examined.

The model 3 considered the effect of performance expectancy, effort expectancy, social influence and facilitating conditions on use behavior. This model actually fits the data well with ($\chi^2_{237} = 1455.08$, RMSEA = 0.091, CFI = 0.97). The standardized factor loadings for use behavior are 0.93, 0.92, 0.86 and 0.71 respectively which all exceed 0.7, and the construct has an average variance extracted of 0.776. The internal consistency (0.92) is also high and the square root of the average variance extracted (0.86) exceeds the correlation of attitude with each of the included factors. The measurement of this factor is therefore valid and reliable and it provides unique information in the model 3. This model explains approximately 64% of the variance in use behavior. The percentage for the construct again falls below 70%, but it is relatively high. In fact, the explained variance is substantially higher than in the first two models. Model 4 is therefore preferred for the evaluation of elearning adoption in higher education in Nigeria.

As observed, performance expectancy, effort expectancy and facilitating conditions have significant positive effects on behavioral intention and consequently on use behavior. Therefore, students with more positive perceptions about the usefulness (performance expectancy) of the elearning technologies for learning, who find them easier to use (effort expectancy), and students with more positive views of the facilitating conditions have more positive behavioral intention tends to have a positive attitude towards the use of elearning technologies. On the other hand, the social influence (social influence) do not predict attitude towards the use of the technologies. These results confirm each of the hypotheses about the effects on use behavior exceptfor social influence that is negatively affected.

Performance expectancy has the most substantial influence on behavioral intention followed by effort expectancy then by facilitating conditions. Therefore, the perceived benefit of the use of the technologies to learning is the most important determinant of behavioral intentiontowards the elearning technologies.

With the inclusion of the technological access and the foreseen reason not to use elearning technology, the model again readjusted but fits the data well with ($\chi^2_{467} = 1983.01$, RMSEA = 0.072, CFI = 0.96). The internal consistency (0.96) is also high and the square root of the average variance extracted (0.84) exceeds the correlation of attitude with each of the included factors. The measurement of this factor is therefore valid and reliable and it provides unique information in the model 4. This model explains approximately 65% of the variance in use behavior. The percentage for the construct again falls below 70%, but it is relatively high.

However, the inclusion of the performance expectancy, effort expectancy, social influence construct into this model makes the social influence and the facilitating condition to have a negative influence on the use behavior, hence it negate the believe of Venkatesh et al. (2003),

Table 7Confirmed test of the UTAUT models

Path	χ^2	df	P	RMR	GFI	AGFI	CFI	RMSEA
Model 1	527.27	98	0.00	0.064	0.90	0.87	0.97	0.084
	1243.50	160	0.00	0.069	0.83	0.78	0.96	0.104
Model 2	338.17	51	0.00	0.066	0.92	0.87	0.97	0.095
Model 3	1455.08	237	0.00	0.067	0.84	0.79	0.97	0.091
	1983.01	467	0.00	0.065	0.84	0.81	0.96	0.072

The various statistics in Table 7 confirmed that the UTAUT model was supported. Performance expectancy, effort expectancy, and social influence significantly affected behavioral intention. Behavioral intention and facilitating conditions had significant effects on use behavior. The moderating effect of access to technology and willingness not to use elearning is significant.

5.6 Regression Analysis

For the purpose of testing the hypothesis, a regression analysis was carried out. In this instance, the use behavior was used as the dependent variable, while the other UTAUT construct of performance expectancy, effort expectancy, social influence, facilitating condition, behavioral intention that has the direct influence constitute the independent variables (see Table 8 and Table 9).

Table 8: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.570 ^a	.325	.303	.845

599 ~~Table 9 ANOVA~~

600

~~Model~~	~~Sum of Squares~~	~~Df~~	~~Mean Square~~	~~F~~	~~Sig.~~
~~Regression~~	~~208.577~~	~~20~~	~~10.429~~	~~14.610~~	~~.000*~~
~~Residual~~	~~432.575~~	~~606~~	~~.714~~	~~-~~	
~~Total~~	~~641.152~~	~~626~~	~~-~~		

601

602 ~~Table 8 presents the model summary, which indicates a predictive value of 0.325. The ANOVA test~~
 603 ~~as presented in Table 9 was carried out on the regression results in order to determine whether the~~
 604 ~~association between the dependent variable, elearning user behavior and the combined UTAUT~~
 605 ~~construct is statistically significant. An F value of 14.610 and a significance value of 0.000 were~~
 606 ~~generated, indicating a significant influence of the UTAUT construct on elearning usage behavior.~~

607

608 The collinearity statistics presented in Table 10 determine the levels of correlations among the factors.
 609 The results show a good tolerance level (>0.03) and variance inflation factor (VIF) [<5] for all the
 610 predictors. The t-values indicate that 5 items (SI1, FC3, BI1 BI3 AND BI4) have low statistically
 611 significant predictive capability on students ability to adopt elearning technology. The standardized
 612 beta coefficients indicate that the UTAUT construct social influence exerts the highest significant
 613 influence as presented in the Table 10. Critical analysis of the table suggests that all the hypotheses
 614 are supported since on the average, the significant value for each construct is > 0.05.

615

616 Table 10: Regression Statistics

617

Model	Unstandardized coefficients		Standardized coefficients	T	Sig.	Collinearity statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.790	.194		4.061	.000		
PE1	.048	.046	.054	1.043	.297	.412	2.430
PE2	-.029	.066	-.029	-.438	.661	.258	3.881
PE3	.041	.066	.041	.619	.536	.253	3.954
PE4	.019	.060	.020	.327	.744	.312	3.203
EE1	-.015	.058	-.016	-.257	.797	.302	3.307
EE2	.033	.054	.035	.612	.540	.348	2.877
EE3	.047	.065	.048	.735	.463	.261	3.834
EE4	-.070	.065	-.071	-1.083	.279	.257	3.892
SI1	.073	.032	.093	2.309	.021	.693	1.442
SI2	-.018	.047	-.020	-.375	.708	.408	2.451
SI3	.005	.045	.005	.103	.918	.416	2.402
SI4	.006	.041	.007	.147	.883	.507	1.971
FC1	.071	.056	.077	1.263	.207	.301	3.324
FC2	.029	.056	.029	.521	.603	.356	2.809
FC3	.139	.059	.136	2.375	.018	.338	2.962
FC4	.100	.058	.101	1.722	.086	.324	3.091
BI1	.083	.035	.103	2.360	.019	.590	1.695
BI2	-.029	.036	-.034	-.807	.420	.625	1.600
BI3	.113	.049	.116	2.318	.021	.444	2.254
BI4	.122	.048	.126	2.548	.011	.458	2.182

Conclusion

This paper has made an attempt to establish the association and strength of association of the direct determinant of the UTAUT model construct using the data obtained from the students of the Federal University of Technology, Akure and the Nigerian Open University, Nigeria.

~~The UTAUT model was tested using the entire data set for the two Universities. The criteria for comparing model data fit to evaluate individual models in this study includes, absolute indexes of goodness of fit such as chi square, goodness of fit index (GFI), adjusted goodness of fit index (AGFI) and root mean square residual (RMSR). Relative or incremental fit indexes reflecting the improvement in fit of one model over an alternative.~~

~~The GFI and AGFI are measures of the relative amount of variance and covariance implied by the data set that are jointly accounted for by the model. The AGFI differs from the GFI by adjusting for the degrees of freedom in the model. GFI and AGFI range from 0 to 1 with higher values indicating better fit (Joreskog and Sorbom 1989). Many researchers interpret GFI or AGFI scores in the 0.80 to 0.89 range as representing reasonable fit; scores of 0.90 or higher are considered evidence of good fit. The RMSR (Joreskog and Sorbom 1984) reflects the average residual obtained by taking the difference between the model generated and sample variance/covariance matrices. Smaller values are associated with better fitting models with scores below 0.05 considered as evidence of good fit. The result also show a good fit of the models and the decision to accept or reject the hypothesis in line with the Venkatesh et.al (2003). All the hypothesis were accepted with significant value <0.05.~~

The impact of the foreseen reason for willingness not to use elearning technology and access to elearning tool is significant because the value of r square increases to 65%, indication that, the dependent variables will provide more explanation to the independent variable.

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728 **Ethical issue**

729 I am a lecturer at the department of Computer Science, the Federal University of Technology,
730 Akure. The Department is responsible for the eLearning programme and the computer base
731 test and exam of the entire University. At the time of this research work, I was the Head of
732 Department. Before the survey, an introductory lecture and a sms messages were given to the
733 students to show their willingness and commitment. Only Interested students were considered
734 in this case. For the National Open University, I sorted for the permission from the University
735 administrator, who gave me the permission to carry out the survey on the students. I am also
736 an adjunct staff of the University. Aside this, my University does not have any ethical
737 department or unit to sort approval from.
738