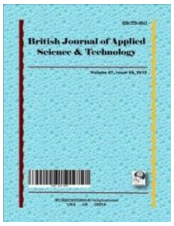

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Adoption of eLearning Technology in Nigerian Tertiary Institution of Learning

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Authors' contributions

This work was carried out in collaboration between with authors OO, FAO and OAS. Author OO designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript and managed literature searches. Authors OAS and FAO manage the administration of the questionnaire and coding. All authors read and approved the final manuscript.

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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 universities 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, it is well established that the latent variables significantly explain the Venkatesh model.

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Keywords: eLearning; UTAUT models; pedagogical; web-based course management system; traditional teaching and learning; asynchronous; constructivist.

1. 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" [1,2,3]. 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 [4,5,6,7]. Many practitioners have recognized elearning as online courseware or etraining that has replaced or be adopted alongside with the traditional classroom training [8,9,10].

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 types. 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 [11].

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 [12].

The continuous development of information and communication technology has enabled elearning to become a new form of student's training in the schools [8,13]. 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 [14]. 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 [15]:

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. [16] 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. [17] 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 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 in [18] 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. ELEARNING MOODLE IN NIGERIA UNIVERSITY

Over the past several years [19], 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. 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 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 [20]. 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 [20]. 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 [21]. 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. Moodle is a Course Management System (CMS) is an Open Source Software (FOSS) for producing web-based courses [21]. The features in Moodle support a philosophy of learning and teaching style of constructivism, constructionism, social constructivism, and connected and separate.

3. 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 [22]. 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, [23] 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 [24]. It was established in [23] that the applicability of UTAUT in different cultural settings needs further investigation and to address these deficiencies, the study [23] 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.

[25] 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 [26] 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 [27] 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.

[28] explore the conventional UTAUT model to analyzed the adoption of biometric technology in a developing country from an institutional point of view. The study suggested that job positions could influence perceptions of innovation characteristics in the decision to adopt biometrics. Also, the unified organizational analyses indicate that ease of use, communication, size and type of organizations have significant impacts on the decision to adopt biometrics. [29] examine the use of UTAUT to determine the readiness of Public servants on the adoption of e-government in Nigeria.

4. 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 [18,30]

The UTAUT model is one of the most comprehensive, robust, and powerful models that is up-to-date. [18] 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. Fig. 1 presents the UTAUT structure model as in [18]

The UTAUT model which aims to explain technology acceptance, is based on eight technology acceptance theories or models [31]. 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

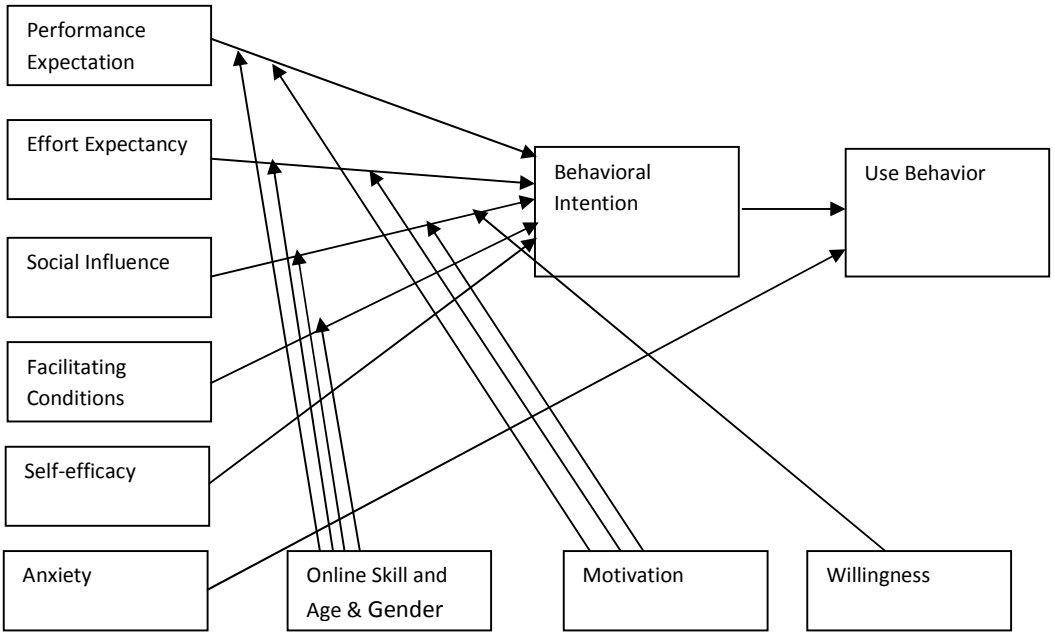

Fig. 1. Modified version of UTAUT

Personal Computer Utilization, the Innovation Diffusion Theory and the Social Cognitive Theory [18]. At the core, the UTAUT model uses behavioral intention as a predictor of the technology use behaviour. 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 Fig. 1.

In addition to behavioral intention and use behavior, the UTAUT model consists of four constructs four moderating variables: age, gender, education and voluntariness of use. The constructs includes:

- 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. [18] believe that, consistent with the logic developed here, use behavior of using technology will have a direct or interactive influence on behavioral intention.

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 [18].

Although, attitude which refers to the individuals' feelings (positive or negative) towards the use of the technologies in [32] is an important component of the TRA and the TAM, it is not explicitly included in the UTAUT model. According to [18], 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.

4.1 Hypotheses

The study was carried out in two Universities (FUTA and NOUN). The NOUN student enrollment stood at 77,759 students while FUTA enrolment stood at about 12,000. 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. METHODOLOGY

5.1 Sampling Scheme

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 questionnaire variables includes age, gender, computer literacy, type of smart system, technology access, online skills and relationship, motivation, foreseen reasons for not willing to use elearning tools and the basic UTAUT constructs [18,33,34]. 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 [35,36] 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 System	45.3%

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.

The descriptive statistics in Table 2 provide statistics on such issues as the use the eLearning system to increase chances of performance (μ = 4.07, σ = 1.047), the eLearning system is easy to use (μ = 3.86, σ = 1.044), the organization support for the use of eLearning system (μ = 3.09, σ = 1.181), The eLearning system compatibility with other systems (μ = 4.67, σ = 1.030), the built-in help facility for assistance (μ = 3.68, σ = 1.125), the overall perception that using eLearning system is a good idea (μ = 3.93, σ = 1.026).

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 χ^2 = 1079.962, which is an indication of sample adequacy and the suitability of exploratory factor analysis.

5.4 Model Validation

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 [37]. The total coefficient of determination for observed variables is an estimate of the reliability of the overall instrument.

In Table 4, the reliability for the various construct using the Cronbach's Alpha [38] and Chi Square are presented. For comparing items in a construct, alpha values greater than or equal to 0.7 are regarded as satisfactory [39]. 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 2. Descriptive statistics (factor affecting usage)

Items of UTAUT model construct	Descriptive statistics	
	Mean (μ)	Std. deviation (σ)
Performance expectancy	4.07	1.047
Effort expectancy	3.09	1.181
Social influence	4.67	1.030
Facilitating condition	3.68	1.125
Behavioral intention	3.93	1.026
Usage behavior	3.93	1.026

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.

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.

5.5 Test of the UTAUT Model

5.5.1 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 [40]. 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 [36] 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 [41].

Table 3. UTAUT construct factor analysis

Latent variable	Item	Est.	S.E	ERR	R^2	χ^2	Df	AGFI	GFI
Performance	PE1	0.87	0.56	0.040	0.58	54.13	2	0.79	0.96
expectancy	PE2	0.91	0.20	0.032	0.81				
(PE)	PE3	0.89	0.24	0.033	0.77				
	PE4	0.83	0.33	0.034	0.68				
Effort expectancy	EE1	0.83	0.42	0.036	0.62	68.40	2	0.75	0.95
(EE)	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	SI1	0.64	1.22	0.051	0.25	55.12		0.79	0.96
(SI)	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	FC1	0.80	0.55	0.04	0.54	106.57	2	0.61	0.92
condition	FC2	0.74	0.49	0.037	0.53				
(FC)	FC3	0.80	0.34	0.035	0.65				
	FC4	0.84	0.33	0.036	0.68				
Behavioral	BI1	0.80	0.92	0.049	0.41	53.26	2	0.80	0.96
intention	BI2	0.67	0.94	0.047	0.32				
(BI)	BI3	0.87	0.32	0.039	0.71				
	BI4	0.76	0.50	0.040	0.54				
Use behavior	UB1	0.93	0.93	0.035	0.75	1.72	2	1.00	0.99
(UB)	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				

Table 4. Reliability analysis with Cronbach' alpha

	Performance expectancy	Effort expectancy	Social influence	Facilitation condition	Behavioral intention	Use behavior
Cronbach's alpha	0.901	0.904	0.801	0.857	0.787	0.860

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

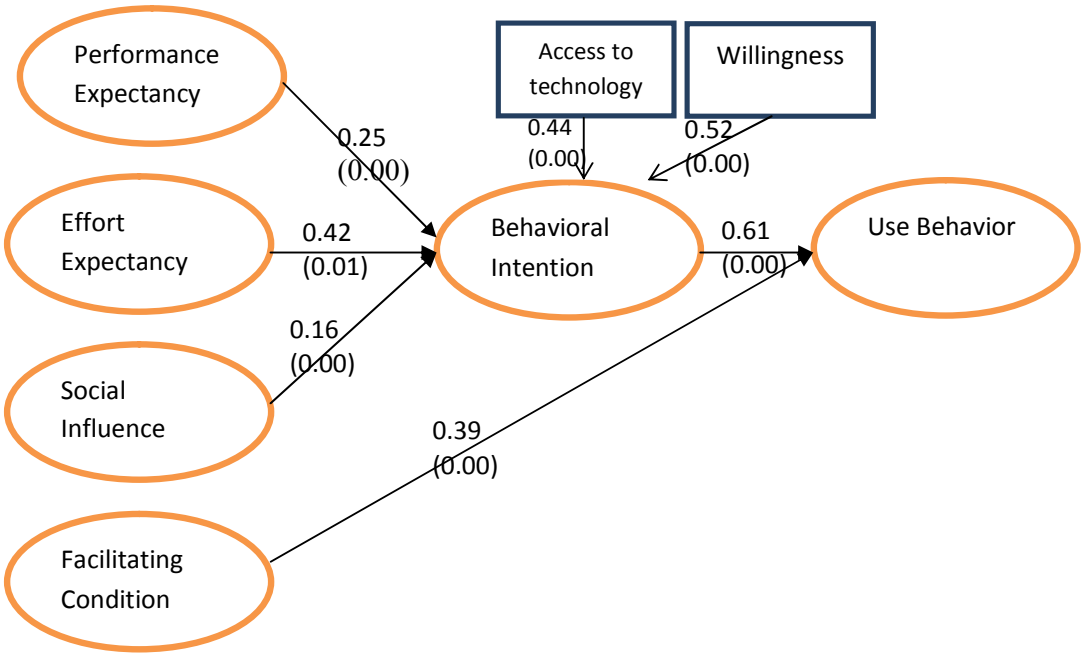

Fig. 2. Model of elearning technology adoption

Table 6. Structural equation model

Model	Independent variable	Predictor						
		PE	EE	SI	FC	BI	WT	TA
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)

Key: Performance expectancy (PE), Effort expectancy (EE), Social influence (SI) Facilitating condition (FC) and Behavioral intention (BI)

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 (χ^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 [18], 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 were established. It is important to note that based in the UTAUT model proposed by [18], 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 (χ^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 (χ^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 except for 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 intention towards the elearning technologies.

Model 4(H_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.

With the inclusion of the technological access and the foreseen reason not to use elearning technology to Model 3, the model again readjusted but fits the data well with (χ^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

Table 7. Confirmed test of the UTAUT models

Path	χ^2	Df	P	RMR	GFI	AGFI	CFI
Model 1	527.27	98	0.00	0.064	0.90	0.87	0.97
	1243.50	160	0.00	0.069	0.83	0.78	0.96
Model 2	338.17	51	0.00	0.066	0.92	0.87	0.97
Model 3	1455.08	237	0.00	0.067	0.84	0.79	0.97
Model 4	1983.01	467	0.00	0.065	0.84	0.81	0.96

(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 [18]

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.

6. 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 descriptive statistics reports on issues such as the use the eLearning system to increase chances of performance with μ = 4.07 and σ = 1.047, the eLearning system is easy to use with μ = 3.86 and σ = 1.044 while issue on the organization support for the use of eLearning system gave μ = 3.09 and σ = 1.181), The eLearning system compatibility with other systems with μ = 4.67 and σ = 1.030, the built-in help facility for assistance μ = 3.68 and σ = 1.125, the overall perception that using eLearning system is a good idea with μ = 3.93 and σ = 1.026. The factor analysis of the data was carried out with the KMO measure of 0.938, while the Bartlett's test of sphericity has p = 0.000 and χ^2 = 1079.962, which is an indication of sample adequacy and the suitability of exploratory factor analysis. Confirmatory factor analysis which estimate the reliability of individual items as well as factors and the overall instrument estimate the reliability of the observed variables (items) with R-square values above 0.49. The reliability for the various construct using the Cronbach's Alpha and Chi Square gave alpha values greater than 0.7, thus satisfactory while the χ^2values of all the items in the construct are significant, thus showing that there is an association between the items of each construct.

The test of model on the effects of performance expectancy, effort expectancy and social influence on behavioral intention indicate that the model fits the data well with (χ^2_{98} = 527.27, RMSEA = 0.084, CFI = 0.97. This model explains approximately 54% of the variance on behavioral intention and the structural regression paths are significant. Thus confirming the first three hypotheses were accepted. The second model tests the effect of facilitating condition and behavioral intention on use behavior. The model fits the data well with χ^2_{51} = 338.17, RMSEA = 0.095, CFI = 0.97. It explains approximately 63% of the variance in behavioral. This suggests that the facilitating condition and behavioral intention have direct effect on use behavior, hence H_4 is accepted. The third model tests the effect of performance expectancy, effort expectancy, social influence and facilitating conditions and behavioral intention on use behavior. This model fits the data with χ^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. This model explains approximately 64% of the variance in use behavior. However, all the items of the construct suggest that students with positive perceptions about all the constructs have a positive attitude towards the use of elearning technologies except for the social influence with negative influence. These results confirm each of the hypotheses about the effects on use behavior except for social influence that is negatively affected. Finally when the technological access and the foreseen reason not to use elearning technology is introduced to Model 3, the model readjusted but fits the data well with χ^2_{467} = 1983.01, RMSEA = 0.072, CFI = 0.96. This model explains approximately 65% of the variance in use behavior. 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 [18].

In summary, we found that the UTAUT constructs were a useful tool in studying the attitude and behaviour of students of tertiary institution on the behavioural intention and user behaviour of eLearning technology. Based on the Unified Theory of Acceptance and Use of Technology, this study proposes a model for explaining the student's behavioural intention and user behaviour on eLearning technology. The model incorporates the explanatory variables from the UTAUT (performance expectancy, effort expectancy, social influence, and facilitating conditions) as the main drivers of the intention an use of eLearning system. We estimate the structural equation model on the UTAUT construct that performance expectancy, effort expectancy and social influence impact directly on behavioural intention, which is in agreement with [18]. However, the effect of the facilitating condition which is not usually considered in UTAUT model is established. The inclusion of the facilitating condition to the model made the performance expectancy, effort expectancy and social influence to have a negative influence on behavioural intention, thus, the students believes that the organizational and technical infrastructure that exists to support use of the eLearning system has a negative contribution on its adoption. We also find out that facilitating condition and behavioural intention has direct effect on use behaviour.

On the effect of performance expectancy, effort expectancy, social influence and facilitating conditions and behavioural intention on use behaviour is examined. We observed, performance expectancy, effort expectancy and facilitating conditions have significant positive effects on behavioural intention and consequently on use behaviour. It follows that, students with more positive perceptions about the usefulness of the elearning technologies for learning, who find them easier to use, and students with more positive views of the facilitating conditions have more positive behavioural intention, tends to have a positive attitude towards the use of elearning technologies and to the contrary, the social influence does not predict attitude towards the use of the technologies. Finally, we observed that performance expectancy, effort expectancy and behavioural intention are positively related to use behaviour but are moderated by technological access and foreseen willingness not to use elearning technology. However, social influence and facilitating conditions are negatively associated with use behaviour, which agrees with the negativity believe of [18]. It is my opinion that tertiary institution tried to improve the technological infrastructures in their school for student to adoption eLearning technology. Moreover, there is the need for student to develop the willingness to use this technology because it will go long way to assist them to complete their assignment, enhance teaching and learning. Moreover, overall benefit is good performance.

7. FURTHER STUDY

An area of further study is to look at the effect of culture and the effect of social media on the adoption of eLearning technology in the Nigerian tertiary institutions.

ETHICAL ISSUE

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

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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