Perceptions of E-learning among undergraduates and academic staff of higher educational institutions in north-eastern Nigeria

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Abstract

While most higher educational institutions (HEIs) in Nigeria have not yet adopted e-learning, there is a rapidly growing interest in its implementation in teaching and learning processes. The current research is a systematic study aimed to predict academics' and students' intentions to use e-learning in Northeastern Nigeria's HEI's where the use of e-learning is presently scarce, by using the extended technology acceptance model (TAM) augmented by two external variables. The researchers distributed 780 questionnaires (579 of which were found to be valid) to students and academics. The data were extracted and analyzed and the results showed that, for both academics and students, the perceived ease of use (PEOU) and perceived usefulness (PU) of e-learning strongly predicted the participants behavioral intentions to use e-learning. Furthermore, the results confirmed the reliability of technology acceptance model core components. The findings from this study could be used as a basis for adopting e-learning in HEIs in Nigeria and other developing countries.

Keywords Adoption · Education · E-learning · Higher educational · Technology acceptance Model

1 Introduction

In recent years, progress in information and communication technology (ICT) has expanded in many fields, including education. E-learning and ICT are now seen as

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significant parts of a national struggle for the advancement of education in Nigeria (Ngampornchai and Adams 2016; Alone et al. 2016). By using e-learning, one can learn at his or her own pace from anywhere and at any time using ICT tools (Islam 2013; Pena-Ayala et al. 2014; Brito et al. 2014; Alone 2017).

E-Learning supports critical thinking, bridges geographical gaps, aids lifetime teaching and learning, cuts educational costs, and boosts productivity in HEIs (Alone 2017; Chang 2016). Kanwal and Rehman (2017) have observed that developing countries need to adopt e-learning to enhance the literacy rate of rural and urban dwellers in these countries. However, Alone (2017) points out that educational institutions that only partially adopt e-learning technologies will not benefit from their investment as much as they might anticipate.

The main impediments to the adoption of e-learning in HEIs in developing nations are out-of-date infrastructure, poor internet access, overpopulation in HEIs, and a lack of training and motivation for both learners and teachers (Islam 2013; Awidi and Cooper Awidi and Cooper 2015; McGill et al. 2014). At the moment, there is a stark difference between the acceptance of e-learning in HEIs in developing countries and that in developed countries. This gap can only be filled after the abovementioned issues have been tackled and the government, stakeholders, and institutions themselves make a firm commitment to adopt e-learning technologies (Zoroja et al. 2014).

Many studies on e-learning adoption in HEIs in both developed and developing countries have been conducted. Most researchers have concluded that the adoption of e-learning is greatly influenced by its PU, PEOU, and potential users' intentions to actually use the technology (Kanwal and Rehman Kanwal and Rehman 2017; Persico et al. 2013; Tarhini et al. 2016; Alone 2017). Previous findings regarding the adoption of e-learning largely depend on the context in which the research is conducted (Alkharang and Ghinea 2013), signifying that any results from e-learning adoption studies conducted in developed countries cannot be generalized to developing countries because of the differences in characteristics, technological advancements, cultures, etc. among developed and developing nations. In addition, even in the realm of developing countries, these factors can differ from country to country and from institution to institution.

Despite the recent extensive adoption of e-learning in both developed and developing countries, most HEIs in Nigeria have not yet adopted e-learning, though interest in its adoption is currently growing. Researchers have attempted to study the adoption of e-learning in some HEIs in Nigeria. For example, Yakubu and Dasuki (2018) conducted a study on the factors affecting the adoption of e-learning technologies among higher education students in Nigeria. Their findings reveal several factors hampering the adoption of e-learning and they were able to state guidelines that will enhance the acceptance of educational technologies in developing countries. Similarly, Oyelere et al. (2016) investigated the challenges hindering the implementation of e-learning in Nigerian universities based on the experiences of developed countries. They found that the biggest challenges were inadequate funding of education, poor electricity supply and lack of awareness, training and motivation. The research entitled "Analytical Study of e-learning Resources in National Open University of Nigeria" affirmed the progress that the open university has made in adopting e-learning (Ajegbomogun et al. 2016). Overall, research on e-learning adoption in HEIs in Nigeria is scarce (Yakubu and Dasuki 2018). The current research aims to tackle the issue of the scarcity

of studies predicting academics' and students' intentions to use e-learning in HEIs in north-eastern Nigeria.

The current research aims to tackle the issue of the scarcity of studies predicting academics' and students' intentions to use e-learning in HEIs in north-eastern Nigeria. This study will be valuable in the context of Nigeria and other developing countries embarking on e-learning.

The rest of this paper is organized as follows: Section 2 (Literature Review) presents a review of related work regarding e-learning adoption in developing countries, e-learning in Nigeria specifically, challenges hindering e-learning adoption in Nigeria, future prospects of e-learning and Research hypotheses. These all contribute to the theoretical framework for the study, which is also given in Section 2. Section 3 (Research Method) presents the data collection and modeling methodology. Section 4 (Results and Discussion) consists of the results and discussion. Section 5 (Conclusions and Recommendations) comprises a conclusion and recommendations for future research.

2 Literature review

E-learning, in a fundamental sense, is learning using ICT tools. Several studies define e-learning as the integration of new technologies into teaching and learning practices (Ru-Chu 2013; Al-Rahmi et al. 2018; Wolfe and Cedillos Wolf and Cedillos 2015). Oyelere et al. (2016) theorize that e-learning fosters enthusiasm, inspiration, motivation, and a willingness to learn by using current technologies. Furthermore, Yakubu and Dasuki (2018) state that e-learning has created a shift from traditional to technological modes of teaching and learning. In their study which examined several barriers to introducing ICT into educational systems in developing countries, Khan et al. (2012) state that using ICT promotes lifelong learning, motivates learners, and gives students access to educational resources that they would not otherwise have.

While e-learning has advanced continually in developed countries, developing nations like Nigeria are still struggling to adapt to technological advancements. Kisanga and Ireson (2015) have identified several obstacles blocking the adoption of e-learning in Tanzanian learning institutions: infrastructural problems, insufficient government support, and a lack of e-learning awareness. Other studies have shown that, in addition to these factors, scanty internet access, slow ICT growth, and inadequate training for teachers hinder the growth of e-learning in developing nations (Alsmadi et al. 2017; Ansong et al. 2017; Kanwal and Rehman 2017). Furthermore, Boateng et al. (2016) have assessed potential determinants of e-learning acceptance among students in developing countries and have found that students' attitudes towards e-learning technologies are influenced by social and behavioral factors, suggesting that the adoption of e-learning is not dependent solely on the technology itself. Alone (2017) posits that the technology adoption models used in the higher education systems of advanced countries will not acclimate to institutions in developing nations because of the vast technological gap between developed and developing nations in addition to other factors that directly affect developing nations.

Hussein (2017) has revealed that a student's intention to take advantage of e-learning is influenced by their attitude, not by PU or PEOU. This view is shared by

other researchers (Al-Rahmi et al. Al-Rahmi et al. 2018; Adewole-Odeshi 2014; Kanwal and Rehman Kanwal and Rehman 2017). Conversely, Adewole-Odeshi (2014) affirms that PU is a reliable indicator of a student's intention to adopt e-learning and that self-efficacy and e-learning content are also related to a student's willingness to accept e-learning. Adewole-Odeshi (2014) in his research used the TAM to determine students' PU and PEOU regarding e-learning; the results revealed that the accessibility of e-learning fosters positive attitudes towards it. Mohammadi (2015) conducted research on users' perceptions of e-learning by integrating TAM and IS (information systems) success models in public universities. According to the results, users' satisfaction with and intention to use e-learning is greatly influenced by the quality of the content, information, and design of the e-learning technology; these factors create interest in learners to learn on their own terms. It was also found that learners are stimulated by audio clips, videos, and images. Finally, the researcher posited that the educational quality of e-learning has no effect on a user's intention to use the technology but that it does positively affect a user's satisfaction with the technology.

Previous studies have indicated that technological tools have a positive impact on the adoption of e-learning (Solomon 2017; Kisanga and Ireson 2015). Durodolu (2016) contends that technology acceptance can forecast access to new information and boost people's confidence in technological changes. The rejection of technology can lead to concerns which might weaken decision-making in general. It has become a necessity for both learners and academics to have all the necessary technological tools for effective teaching and learning processes. These tools can also boost learners' confidence in their ability to learn on their own.

Several researchers have explored the effect of personal factors on the use of ICT in e-learning. The research reveals that adopting e-learning requires performance enhancements and confidence on the part of both instructors and learners (Kim and Park 2017; Olasina 2018; Alsmadi et al. 2017). The acceptance of the new technologies that are needed to improve e-learning in HEIs also requires time, training, social influence, and the willingness of institutions to adopt the new technologies. Interestingly, Persico et al. (2013) found that new technologies alone cannot produce the educational changes being sought; human investment in continual training is also needed.

Developing countries like Nigeria face numerous challenges in the adoption of e-learning in their educational systems. Perhaps most prominent among these challenges is poor or obsolete infrastructures, sparse internet access, and a generally low computer literacy level (Bugi 2012; Tarus et al. 2015; Bharuthram and Kies 2012; Kisanga and Ireson 2015). For the adoption of e-learning in HEIs to be successful in any country, it should be integrated with that country's educational reforms, and the necessary attention should be given to its acceptance (Tarus et al. 2015). Wholeheartedly accepting e-learning in HEIs is crucial for its successful adoption and continued use.

According to Acharya and Lee (2018), the internet is one of the primary tools needed for the adoption of e-learning systems. Other studies have shown that internet access is significant to educational systems because it avails academics and students with up-to-date information and contributes to the development of e-learning (Alsmadi et al. 2017; Solomon 2017; Al-Rahmi et al. 2018). According to Internet World Stats (2018), Nigeria's estimated population stood at 195,875,237 with 98,391,456 internet users as of December 31st, 2017. Internet growth in Nigeria between 2000 and 2017

was 49.096%, with a penetration of 50.23%, revealing that 50.904% of Nigeria's population does not use the internet.

Brito et al. (2014) have highlighted several benefits of ICT on e-learning. For one, students can access resources from virtually anywhere at any time. Also, e-learning allows for a high degree of flexibility and individualization. Moreover, teachers have expressed positive attitudes and experiences using ICT. However, the researchers also discovered some negative impacts of ICT on e-learning. For instance, the technology tends to use poor-quality audio. In addition, teachers find it difficult to respond to students' queries in a timely manner. Teachers have also noted that they have run into technical problems which they cannot resolve because they have not been given enough training. Teachers have furthermore complained that e-learning can offer too many resources, leading to an overall sense that e-learning systems are disorganized.

Tarus et al. (2015) aimed to demonstrate the benefits of e-learning in Kenyan universities despite its numerous challenges. Their study revealed that e-learning is vital to the widespread accessibility of higher education. According to this research, the major benefits of e-learning in higher education are cost reductions, user-friendliness, and the freedom students are given to learn based on their own schedules from wherever they are most comfortable learning.

E-learning has improved the way students and academics interact in the learning and teaching process. E-learning has the capacity to improve teaching and learning even though it is just beginning its evolution in Nigeria's educational system (Obuekwe and Eze 2017).

2.1 E-learning adoption in Nigeria

The integration of ICT in educational systems has clearly improved the learning process and has presented learning opportunities to those who could not have otherwise received a formal education (Ajegbomogun et al. 2016). The National ICT Policy attempted to integrate ICT into the educational system in Nigeria. However, this was unsuccessful. Hence, a renewed attempt to insert ICT into Nigeria's educational system is now being made through the Nigeria ICT Roadmap 2017–2020 (National ICT Roadmap, 2017-2020). The proposed end result of this is to bridge the ICT gap in the educational systems in primary, secondary, and tertiary institutions in the country by 2020 (FMoC 2017).

Presently, Nigeria does not have an official e-learning policy or framework. The last policy forum on e-learning in HEIs in Nigeria took place on May 4th, 2017, with the Vice President Prof. Osinbajo in attendance. As a result of this forum, both government and private stakeholders concluded that a collaboration aimed at solving all challenges facing the adoption of e-learning in Nigeria is needed so that effective policies can be created to overcome these challenges (Egbedi 2017).

King and Boyatt (2014) postulate some key factors that aid the adoption of e-learning in HEIs: the availability of required infrastructures; confidence on the part of the academics in adopting new technologies; and students' and academics' attitudes, perceptions, and expectations of the new technology. These should be considered in the development of a national policy in support of adopting e-learning.

2.2 The challenges of e-learning adoption in Nigeria

In Nigeria's educational system, both academics and students are faced with numerous challenges when it comes to adopting e-learning. These challenges range from the profound diversity in cultural backgrounds and languages among Nigerian citizens to the government's current lukewarm commitment towards improving education by using ICT. Furthermore, unlike the traditional mode of learning, e-learning requires some technological skill on the part of both the teachers and learners, which is grossly lacking at all levels of education in the country. In northeastern Nigeria, the menace of Boko Haram, ethnic crises, and clashes between herdsmen and farmers over the years have made the region the poorest and weakest in the country in terms of educational literacy.

According to previous research, there is currently little or no harmonization in the process of merging new technologies with the traditional method of teaching and learning in HEIs (Awidi and Cooper Awidi and Cooper 2015; Banday et al. 2013). This is one of the numerous issues bedeviling e-learning adoption in developing countries. However, the magnitude of this issue and its effects differ from country to country and from institution to institution.

Researchers claim that a lack of finance for the adoption and continued use of e-learning is a major challenge stopping the adoption of e-learning (Awidi and Cooper Awidi and Cooper 2015; McGill et al. 2014). Other deterrents include inadequate internet access, outdated technology, an overall tepid attitude toward implementing e-learning among educators, overpopulation in institutions, and a lack of motivation on the part of both academics and students to use e-learning (Islam and Slack 2015; Awidi and Cooper Awidi and Cooper 2015; McGill et al. 2014, Bhalalusesa et al. 2013).

Developing countries still experience problems accessing computers and technological infrastructures, especially when compared to developed nations. The academics and students in most HEIs in developing countries still require professional training to enable them to adapt to new changes brought by e-learning (McConnell 2017). Likewise, Kim and Park (2017) state that, even if one has the required skills and knowledge to use e-learning, one still needs specific technological skills for the use of e-learning to be permanent. Table 1 shows previous studies on the challenges of e-learning and their findings.

2.3 Theoretical framework

This study adopted the TAM, which is seen as the most widely used model of technology acceptance (Cakır and Solak 2015; Park 2009; Adewole-Odeshi 2014), though some studies have used other adoption models, such as the modified theory of the acceptance and use of technology (UTAUT), theory of reasoned action (TRA), theory of planned behavior (TPB), task-technology fit (TTF), and diffusion of innovation theory (DOI) (Olasina 2018; Abdullah et al. 2016; Ali et al. 2018; Al-Rahmi et al. 2018; Alsmadi et al. 2017; Chu and Chen Chu and Chen 2016). Consequently, Alkis et al. (Alkıs et al. 2014) state that no technology adoption model has been explicitly used to analyze e-learning adoption.

According to previous research, technology adoption in e-learning has numerous frameworks, consisting of the TPB, UTAUT, TTF, and DOI (Olasina 2018; Abdullah et al. 2016; Ali et al. 2018; Al-Rahmi et al. 2018; Alsmadi et al. 2017; Chu and Chen 2016).

Table 1 Studies on the challenges of e-learning

Author(s)	Participants	Methodology	Case study institution	Focus	Findings
Bugi (2012)	Undergraduate	Quantitative	NOUN Kaduna centre	Challenges of e-learning	Challenges include poor power supply, internet connectivity and cost problems, service providers Effectiveness, cost of computer system and other accessories and internet operation deficiency
Tarus et al. (2015)	Academic, non-academic and ICT support staff	Qualitative	Three public universities in Kenya	E-learning challenges in public universities	The challenges are learning style and cultural challenges, pedagogical challenges in the field of e-learning, the technological challenges, the challenges of the technical training and time management
Kisanga and Ireson (2015)	E-learning experts	Qualitative	Open university of Tanzania and University of Dar es Salaam	Barriers of adopting e-learning and solutions	Challenges of e-learning implementation are inadequate ICT and e-learning infrastructure, financial constraints, expensive and inadequate internet bandwidth, a lack of operational e-learning policies, inadequate technical skills content development, interest and commitment among teachers
Bharuthram and Kies (Bharuthram and Kies 2012)	Undergraduates,Staff, and stakeholders	Qualitative	University of Western Cape, South Africa	Potential benefits and challenges of e-learning	The major barriers are infrastructural problems, insufficient government support and e-learning awareness
Alkharang and Ghinea (2013)	Academics and Stakeholders	Qualitative	6 HEIs in Kuwait	Barriers to e-learning adoption in HEIs	The major impediments are lack of awareness and support from the management, technological barrier and language barrier

Initially proposed by Davis (1989), the TAM (Fig. 1) is known for explaining technology behavior in reasonably simple terms (Kim and Shin 2015; Tarhini et al. 2014). The TAM hypothesizes that the PU and PEOU of a new form of technology determine users' intent to adopt that technology. PU is defined as "the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context," while PEOU is defined as "the degree to which the prospective user expects the target system to be free of effort" (Davis 1989). PU simply measures the degree of users' reliance on new technology; PEOU depicts users' beliefs regarding how easy the new technology will be to use (Althunibat 2015; Mugo et al. 2017; Abdullah et al. 2016). This model gives a broad context to the acceptance of new technologies and users' attitudes towards and behaviors exhibited when using new technologies (Kurt and Tingöy 2017).

Previous research using the TAM suggests that the TAM's is easy to use and is a robust predictive tool (Lee et al. 2014; Al-Gahtani 2016; Tarhini et al. 2014; Fayad and Paper 2015). Previous research also upholds the notion that the TAM is more reliable than other similar models; thus, we have adopted the TAM in the current study. The TAM has been used in numerous studies involving e-learning, m-learning, Virtual reality and learning management system (LMS) to predict the usage of these technologies (Althunibat 2015; Ali et al. 2018; Mohammadi Mohammadi 2015; Hussein Hussein 2017; Camille et al. 2019; Acharya and Lee 2018).

3 Methodology

3.1 Questionnaire

This study uses mixed descriptive research design because it is both quantitative and qualitative in nature and employs administering questionnaire and interview for data collection.

Questionnaire was constructed to collect data for this research work. The questionnaire used was adapted from TAM original measurement scales (Davis 1989). A total of 780 questionnaires were administered with 600 questionnaires administered to students during class hour and 180 administered to Academics in 6 different public higher institutions. An introductory letter was attached to the questionnaire sent to each institution explaining the significance and relevance of the study, pledge of anonymity and option to either participate in the study or decline at will.
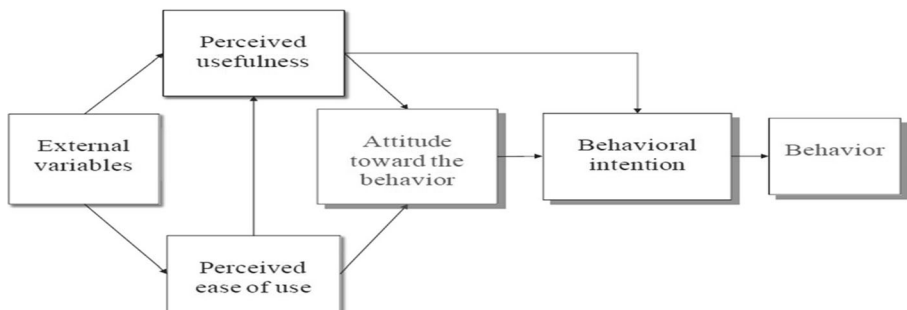

Fig. 1 The TAM (Davis Davis 1989; p. 985)

This research consisted of five major sections. The third section gathered data on the demographic information of the respondents, access to computer and internet and experience in using e-learning. The original TAM constructs were used to collect all the data needed to conclude this research work. The TAM constructs measure PEOU (7 items), PU (6 items), ATU (3 items) and BIU (2 items). Likert 7-point scale was used to rate respondent's perception, attitude and behavior on the adoption of e-learning ranging from 1 = strongly agree, 2 = moderately agree, 3 = slightly agree, 4 = neural, 5 = slightly disagree, 6 = moderately disagree, and 7 = strongly disagree. The items of the questionnaire were adopted from previously validated instruments (Davis 1989).

As discussed previously, Section II of the questionnaire (see Table 2), measures the TAM constructs we adopted we this research work. As seen in Tables 3, 18 items are to be measured in based on the research model adopted. Items measured comprise PEOU

Table 2 Questionnaire sections II, III, IV AND V

Item	Scale	Supporting Literature
Section II: PEOU		
PEOU1	I would find e-learning to be easy to use	Adapted from Davis (1989)
PEOU2	I would find it easy for me to get e-learning to do what I want it to do	Adopted from Davis (1989)
PEOU3	My interaction with e-learning would be clear and understandable	Adapted from Davis (1989)
PEOU4	I would find e-learning to be flexible to interact with	Adopted from Davis (1989)
PEOU5	It would be easy for me to become skillful at using e-learning	Adopted from Davis (1989)
PEOU6	Learning to operate e-learning would be easy for me.	Adapted from Davis (1989)
PEOU7	My ability to determine e-learning's ease of use is limited by my lack of experience	Adopted from Davis (1989)
Section III: PU		
Item	Scale	Supporting Literature
PU1	Using e-learning would enable me to accomplish learning my tasks more quickly	Adapted from Davis (1989)
PU2	Using e-learning would improve my learning performance	Adapted from Davis (1989)
PU3	Using e-learning would improve my productivity in learning	Adapted from Davis (1989)
PU4	Using e-learning would enhance my effectiveness in learning	Adapted from Davis (1989)
PU5	Using e-learning would make learning easier	Adapted from Davis (1989)
PU6	Using e-learning would be useful in my learning	Adapted from Davis (1989)
Section IV: ATU		
Item	Scale	Supporting Literature
ATU1	It is a good idea to use e-learning	Adapted from Davis (1989)
ATU2	I like the idea of using e-learning	Adapted from Davis (1989)
ATU3	Using e-learning is a positive idea	Adapted from Davis (1989)
Section V: BIU		
Item	Scale	Supporting Literature
BIU1	In the future I plan to use e-learning	Adopted from Davis (1989)
BIU2	Assuming I have access to e-learning, I intend to use it	Adapted from Davis (1989)

Table 3 Interview questions

Questions
1. Are you an academic or a student?
2. What is your highest qualification?
3. What are the challenges you experienced in the traditional system of learning?
4. Do you have a computer?
5. How do you connect to the internet?
6. Does your institution have internet provision for academics and students?
7. Does your institution have provision for e-learning?
8. Have you ever used any platform for e-learning?
9. If "Yes" to the above question, how was the experience?
10. Are you willing to study/teach in an e-learning environment?

(7 items), PU (6 items), ATU (3 items) and BIU (2 items) and 2 items that is, e-learning usage experience (ELE) and Unavailability of e-learning access (ULE) as external factors.

3.2 Interview

As for the interview, a semi structured interview was carried out using the academics and students of the HEIs in this study. For this study, a total of 256 were duly interviewed. The academics and students interviewed were 45 and 211 respectively. Those to be interviewed were randomly selected. Both undergraduate and postgraduate students were interviewed with 170 and 41 respectively. As for the academics and students, we conducted interview in different departments to give each department equal chance of been represented. The result of the interview was interpreted using descriptive narration. The interview questions are similar to the questions formulated in the questionnaire distributed (see Table 3).

3.3 Participants

The participants were 180 academics and 600 students from the following six public HEIs in northeastern Nigeria:

i   Abubakar Tafawa Balewa University
j   Federal Polytechnic Bauchi
k   Open University Bauchi Study Centre
l   Federal College of Education, Gombe
m   Modibbo Adama University of Technology, Yola
n   University of Maiduguri

These HEIs were selected because they are the oldest institutions in the region, and they encompass different northeastern Nigerian states. However, according to NUC (n.d.), Open University, Modibbo Adama University of Technology and University, and the

University of Maiduguri are among the nine registered distance learning institutions in the country, hence their inclusion in this study. The participants in this study were selected from different departments in each of the institutions.

This study employed a simple random sampling method to select a probability sample. In each of the HEI selected, the academic and students used for this study were selected from different departments. This technique offers an acceptable response rate and is the most common technique used by researchers when choosing participants from a large population in which they want every member of the population to have an equal chance of being selected (Raghunath 2017; Arnab 2017).

3.4 Data collection

This research involved participants from various departments from each of the selected institutions. The survey was carried out from July 2–23, 2019. The questionnaires were paper-based and were distributed throughout the various institutions as required. Of the 780 questionnaires distributed, 610 were duly returned, 31 of which were incomplete. A total of 579 questionnaires (74.23%) were deemed valid for use in the analysis.

In addition to using questionnaires to obtain data from the participants, the authors also conducted an open-ended interview where a total number of 256 participants were interviewed comprising 45 undergraduates and 211academics. The participants for the interview comprise 88 (34.38%) females and 168 (65.62%).

3.5 Research model and hypotheses

In this study, the TAM was applied to academics and students of HEIs. The participants were assessed based on their usage of e-learning. As seen in previous studies, within the context of e-learning, PU is defined as the extent to which students and educational staff accept the idea that e-learning enhances productivity (Hussein Hussein 2017; Abdullah et al. 2016; Ali et al. 2018).

UTAUT and UTAUT2 models are obtained from the original TAM model where new features were added. However, of all these models stated, TAM has grown to become the most broadly used for technology acceptance owing to its straightforwardness, adaptability and robustness (Ahmed et al. 2020; Mousa et al. 2020; Al-Emran et al. 2018, Alkıs et al. 2014). It is obvious that TAM's PEOU and PU are not enough to predict user's acceptance of e-learning hence, recently, quite a number of researches conducted in different fields have been adopting the extended TAM which has been found be reliable and accurate (Al-Emran et al. 2018; Camille et al. 2019; Diop et al. 2019; Tsai et al. 2020; Ahmed et al. 2020; Mousa et al. 2020, Ayad et al. 2020, Manis and Choi 2018). As a result, in this paper we used an extended TAM where we added 2 additional external variables that is, ULE and ELE (see Fig. 2). The research model used in the present study (Fig. 2) consists of the TAM construct and two external variables.

As examined earlier, the TAM determines the nature of the relationships among its constructs as follows: One's attitude towards using e-learning and PU are positively affected by one's intention to use the technology; PU and PEOU are positively affected by one's attitude towards using the technology; and PEOU directly affects PU. Hence, the present study proposes the following hypotheses:
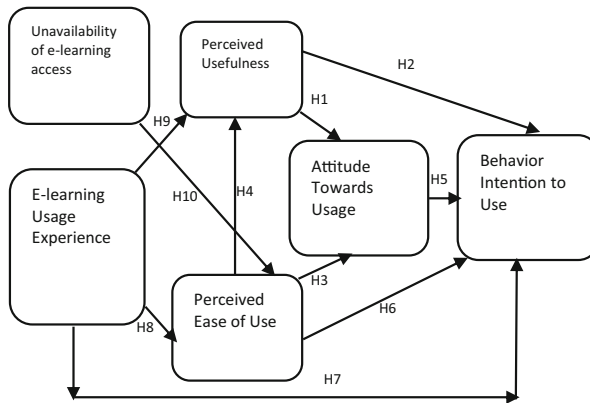
Fig. 2 Research model

H1: Perceived usefulness is positively related to one's attitude towards using e-learning.

H2: Perceived usefulness is positively related to one's intention to adopt e-learning.

H3: Perceived ease of use is positively related to one's attitude towards using e-learning.

H4: Perceived ease of use is positively related to the PU of e-learning.

H5: One's attitude towards e-learning is positively related to one's intention to adopt e-learning.

H6: Perceived ease of use positively affects one's intention to use e-learning.

H7: E-learning usage experience negatively influences one's intention to use e-learning.

H8: E-learning usage experience negatively influences the perceived ease of use of e-learning.

H9: E-learning usage experience negatively influences the perceived usefulness of e-learning.

H10: A lack of access to e-learning has a negative impact on its perceived ease of use.

4 Data analysis of measurement model

Statistics for this research showed that the participants comprise 60.10% males and 39.90% females. Respondents between the ages of 18 to 40 years make up 63.39% of the participants with 77.03% and 22.97% representing student and academics used in this study (see Appendix I). Table 4 gives descriptive statistics of the TAM constructs used in this research work. As seen in Table 4, the mean value for each of the constructs used is less than 2 which clearly indicates a positive response. Cronbach's alpha was used to assess the reliability of the instrument used for this research. An assessment using SPSS version 25 revealed a high level of reliability for PU (0.907) and ATU (0.942), and satisfactory values for PEOU (0.866) and intention (0.826). Cronbach's alpha coefficients between 0.6 and 0.7 are considered to be at the lower limit and are

Table 4 Descriptive statistics

Construct	Mean	SD	Cronbach's Alpha
PEOU	1.23	0.504	0.866
PU	1.22	0.502	0.907
ATU	1.18	0.449	0.942
BIU	1.21	0.494	0.826

acceptable; however, values of over 0.8 (good) or above 0.9 (excellent) are preferable (George and Mallery 2003; Hair et al. 2010; Pallant 2011). The Cronbach's alpha values given in Table 3 indicate that the survey is reliable.

Goodness-of-fit test was carried out on the proposed TAM to ensure a good fit between the data and the model. Table 4 shows the proposed and actual measurement model values for the different fit indicators (Kline Kline 2015). Hence, the goodness-of-fit indices revealed that the data fits the structured model for this research work.

The reliability of the constructs used in this study was confirmed using Cronbach Alpha and Composite Reliability (CR). According to Hair et al. (2010), the minimum recommended level for measuring CR is 0.7 and for this research, all the constructs used have values above the benchmark of 0.7 signifying the reliability of the constructs as seen in Table 5.

Convergent validity was calculated by measuring both the CR and Average Variance Extracted (AVE). The AVE for all constructs were found to be above the recommended level of 0.5. Discriminant validity can be measured by simply finding the square root of AVE of all the given constructs and the maximum shared variance (MSV) and average shared variance (ASV) should be less than the AVE value (Fornell and Larcker 1981). The constructs used in this study showed adequate discriminant validity (Table 6).

Table 7 clearly reveal the correlation matrix of all the TAM constructs used in this research work. The table shows the correlation matrix between each of the constructs as used in the research work.

Table 5 Model fit indices

Fit index	Recommended Value	Measurement Model	Structural Model
CFI	>0.90	0.957	0.955
GFI	>0.90	0.914	0.912
AGFI	>0.80	0.878	0.878
RMSEA	<0.08	0.029	0.030
RMSR	<0.10	0.029	0.032
NFI	>0.90	0.957	0.960

Table 6 Reliability analysis results

	CR	AVE	MSV	ASV	PEOU	PU	ATU	BIU
PEOU	0.877	0.704	0.311	0.19	**0.839**			
PU	0.926	0.895	0.286	0.16	0.222	**0.946**		
ATU	0.995	0.811	0.221	0.08	0.136	0.445	**0.901**	
BIU	0.841	0.771	0.331	0.11	−0.018	0.331	0.119	**0.878**

4.1 Structural model analysis

To test the TAM constructs model created for this research, a structural model was created using smart PLS to test the relationship among the constructs. Table 4 shows the goodness-of-fit indices for the structure model which clearly reveal the recommended and measurement model values and the given values fits the structural model.

Furthermore, using the measurement model and the survey data for this research, we will now analyze the relationship between the hypothesized variables (see Table 8).

Table 8 indicates through the path coefficients that six of the hypotheses were supported while four were not supported. PU ($\alpha = 0.881$, $p < 0.001$) and PEOU ($\alpha = 0.489$, $p < 0.001$) disclosed a positive and significant influence on ATU. PU ($\alpha = 0.478$, $p < 0.001$), ATU ($\alpha = 0.789$, $p < 0.001$) and PEOU ($\alpha = 0.877$, $p < 0.001$) showed a positive and significant effect on BIU. In contrast, even though the relationship between ELE and BIU, ELE and PEOU, ELE and PU and ULE and PEOU is positive however, there is no significant correlation between them hence they are not supported.

5 Discussion of result

This study applied the extended TAM model to investigate undergraduates and academic staff perception of e-learning adoption in their institution of learning. The result obtained from this research validate prior studies that extended TAM model is a reliable and robust model that can be effectively used to investigate the intention towards the adoption of e-learning technology. A total of 10 hypotheses were tested from which 6 were accepted and 4 were rejected signifying, ELE has no significant effect on BIU, PEOU, and PU respectively. Likewise, ULE has also no significant effect PEOU as revealed in this present research. From the statistical analysis conducted, the TAM constructs used for this study clearly revealed that they are reliable and the hypotheses for the TAM constructs were seen to have a positive correlation which is significant for our research. From the result obtained, the path coefficient for PU and ATU showed that they are positively related towards the usage of e-learning similarly, PU and BIU plays an important role on one's intention to use e-learning. PEOU and ATU revealed positive attitude towards the use of e-learning by both the academics and students and PEOU and PU also disclosed that they are positively related. Our findings also discovered that ATU and BIU showed that students and academics find e-learning to be useful in the teaching and learning process. PEOU just like ATU is also found to be significantly related to the students and academics usage of e-learning. The positive

Table 7 Correlation matrix

	PEOU1	PEOU2	PEOU3	PEOU4	PEOU5	PEOU6	PEOU7	PU1	PU2	PU3	PU4	PU5	PU6	ATU1	ATU2	ATU3	BIU1	BIU2
PEOU1	1	.747"	.728"	.574"	.735"	.574"	-0.001	.614"	.574"	.588"	.775"	.810"	.835"	1.000"	.816"	.810*	.753"	.728"
PEOU2		1	.716	.594"	.754"	.594"	0.021	.577"	.594"	.632"	.753"	.820"	.754"	.747"	.833"	.820*	.988"	.716"
PEOU3			1	.595"	.749"	.595"	-0.001	.539"	.539"	.603"	.761"	.778"	.749"	.728"	.797"	.791*	.706*	.716"
PEOU4				1	.599"	1.000"	-0.026	.506*	1.000"	.506"	.605"	.675"	.599"	.574"	.657	.635*	.591"	.595"
PEOU5					1	.599"	0.023	.596*	.599"	.611"	.781"	.832"	1.000"	.735"	.837"	.783*	.752"	.749"
PEOU6						1	-0.026	.506*	1.000"	.506"	.605"	.675"	.599"	.574"	.657;	.635*	.591"	.595"
PEOU7							1	0.024	-0.026	-0.031	-0.012	-0.006	0.023	-0.001	-0.008	-0.013	0.025	-0.001
PU1								1	.506"	.489"	.617"	.669"	.596"	.614"	.667"	.631*	.568"	.539"
PU2									1	.506"	.605"	.675"	.599"	.574	.657"	.635*	.591"	.596"
PU3										1	.605"	.824"	.781"	.775"	.870"	.816*	.744"	.761"
PU4											1							
PU5												1	.832"	.810"	.924"	.876*	.810"	.778"
PU6													1	.735"	.837"	.783*	.752"	.749"
ATU1														1	.816"	.810*	.753"	.728"
ATU2															1	.909*	.832"	.797"
ATU3																1	.828"	.791"
BIU1																	1	.706"
BIU2																		1

** Correlation is significance at the 0.01 level (2 tailed)

Table 8 Structural model

Hypotheses	Path Coefficient	Estimate	P value	Outcome
H1	ATU ← PU	0.881	***	Supported
H2	BIU ← PU	0.478	***	Supported
H3	ATU ← PEOU	0.489	***	Supported
H4	PU ← PEOU	0.926	***	Supported
H5	BIU ← ATU	0.789	***	Supported
H6	BIU ← PEOU	0.877	***	Supported
H7	BIU ← ELE	0.076	0.221	Unsupported
H8	PEOU ← ELE	0.066	0.315	Unsupported
H9	PU ← ELE	0.071	0.333	Unsupported
H10	PEOU ← ULE	0.067	0.161	Unsupported

***p value < 0.001

relationship revealed in this study has been found to consistent with the original proposed TAM model (Davis 1989). Both the academics and students involved in this research have showed confidence towards e-learning usage and they are determined to use e-learning in future when made available.

On the basis of the result and findings of this study, unavailability of e-learning has not affected the academics and students perceived ease of use and they are of the view that e-learning would be very easy to use. In the course of this study, it was found that gender is insignificant when compared with the original TAM constructs used in this study. Furthermore, this research has proven TAM to be a reliable model in measuring and describing both academics and students behavioural intention to use e-learning.

The personal interview results collected where compared with the results obtained from the questionnaires administered to ease interpretation and discussion of the results. Using questionnaire and interview as tools for data collection have helped to authenticate and enhance the results for broader interpretation (Tarus et al. 2015). In this study, we decided to merge the results of the quantitative and qualitative methods with the sole aim of properly interpreting and discussing the results obtained. Creswell and Plano Clark (Creswell and Plano Clark 2011) in their study, integrated the quantitative and qualitative results by first interpreting and discussing the quantitative method results and then followed by the corresponding qualitative quotes that either supports of disagree with the quantitative results.

The result from Appendix 1 show that 83.07% of the respondents agree that e-learning is useful for both the lecturers and students in the teaching and learning process. The comments from the interview questions as seen in Appendix II and stated below concurs with the result obtained from the questionnaire administered.

…e-learning can aid greatly in improving our educational system specially, in tertiary institutions….
it will assist us to study at our own comfort and make learning more interesting….

It can be observed from Appendix 1 that 51.99% of the respondents are of the opinion that their institutions do not use e-learning for teaching and learning. Majority of the respondents interviewed also reveal they do not use e-learning also. This is obvious from the respondent's response:

> At the moment, we are not engaged in any form of e-learning.
> e-learning is still a mirage in the institution and I don't see any effort towards its implementation....

Results in Appendix 1 also showed that 80.83% of the respondents are willing to either teach or study in an e-learning environment. Respondents who were interviewed also indicated their interest to learn/teach in an e-learning environment. Some of the comments from respondents are stated below:

> I will love to learn in an e-learning environment. This is something I have always wanted because of the
> skills I have using the computer.
> …it is going to be awesome using e-learning for teaching….

Furthermore, it is evident from Appendix 1 that 58.89% of the respondents said they were involved in a course where course materials and resources where delivered online.

Majority of those interviewed also said they were involved in a course where course materials and resources where delivered online as stated from given comments below:

> Yes, I have enrolled in numerous courses online and they were really well-structured modules help learning….
> It was fun and I am always curious to be online to learn.

Additionally, as seen in Appendix II, most of the participants said that the challenges they faced in traditional system of learning comprises lack of motivation, poor teaching methods, overcrowding, lack of teaching staff, exhaustion on the part of the academics, difficulty copying notes from the writing board, and lack of teaching aid. 63.28% of the participants said they browse the internet using their mobile phone while 7.03% and 29.69% stated that they browse using wireless broadband and cybercafé respectively. 65.23% of the participants said their institutions do not provide them with internet service despite the fact that some of the students revealed that they are been charged technology fee as part of their school fees. It was observed that 85.55% of the respondents said that their institution of learning does not have provision for e-learning however, 69.14% said they have done a course online mostly learning from an online platform using their phones. Surprisingly, 90.23% of the participants said they are willing and ready to study or learning in an e-learning environment while those we felt are not ready to study or learn in an e-learning environment gave their reasons as lack of access to computer or mobile phone to access the internet, poor or no internet service, insufficient knowledge of e-learning and some believe introducing the technology will increase the cost of their study because their parent might not be able to afford the cost.

6 Conclusions and recommendations

In this research work, we adopted TAM core constructs with a modification of the original construct to measure both academics and students' intention to use e-learning in higher educational institutions in north-eastern Nigeria. The study measures the correlation between perceived ease of use, perceived usefulness, attitude towards usage and intention to use e-learning. Moreover, two external variables that is, unavailability of e-learning and e-learning usage experience were integrated into the TAM model to enhance the findings of this study. E-learning adoption has been given little attention in Nigeria's educational system and evidence have shown that academics and students unavailability of e-learning access has a great effect on the correlation between perceived ease of use which is one the original core TAM constructs. Consequently, the unavailability of e-learning does not reflect the view of the academics and students' that e-learning is incomprehensible to use. The study also found out that both academics and students have a significant positive correlation towards e-learning adoption and usage experience in their higher educational institutions of learning. The result further reveals that out of the six higher educational institutions used in this research only three that is, Open University, Bauchi study centre, Modibo Adama University of Technology and University of Maiduguri are among the approved distance learning centres in the country however, this study would be of great advantage to both the academics and students in all the higher educational institutions used in this study in their strategies towards adopting e-learning technologies in the near future. Additionally, the results of the study cannot be generalized for the entire country because the study covers just the north-eastern region of the country. This research focuses mainly on the academics and students of the selected institutions of higher learning. Future research should also center on stakeholders and IT technicians in the institutions of learning. Finally, researchers can use this work to further enhance the adoption of e-learning in Nigeria that has received little attention from researchers.

It is obvious from this research that HEIs in Nigeria are facing numerous challenges which has hindered the adoption of e-learning. We believe that adopting e-learning could help in bridging the gap between the classroom activities and the student's/academic's life style. For successful implementation of e-learning in HEIs in Nigeria and other developing countries, it is recommended that:

i   The budgetary allocation of funds for education and HEIs should be significantly increased to take care of obsolete infrastructures needed to facilitate the adoption of e-learning.
j   Government should support and dedicate Internet service providers for all HEIs in the country with reduce cost and fast internet connectivity to access the internet.
k   Government National Information and Communication Technology (ICT) roadmap should be strengthen and focus on the implementation strategies laid down.
l   Training and retraining of academics, students and other stakeholders should be a continuous process to ease the adoption of e-learning.
m   To successfully implement e-learning, there is need to enter into partnership with independent e-learning providers.
n   Government should also engage the mobile network operators in the country on the provision of better and cheap service to facilitate mobile learning.

o The academics and students need to be motivated and enlightened on the relevance and benefits of e-learning adoption.

Data availability Data uploaded as supplementary material.

Compliance with ethical standards

Conflict of interest This manuscript was produced by two researchers who are also the authors of the manuscript. Therefore, there is no competing interest.

Appendix I

Table 9 Questionnaire

Respondents	Frequency	%
Age		
18 – 30	221	38.17
31 – 40	175	30.22
41 – 50	125	21.59
51 – 60	53	9.15
60+	5	0.86
Gender		
Male	348	60.10
Female	231	39.90
Respondent status		
Academic	133	22.97
Student	446	77.03
Educational status		
Undergraduate	251	43.35
ND	62	10.71
HND	34	5.87
NCE	77	13.30
Graduate	38	6.56
PGD	31	5.35
Master	58	10.02
Ph.D.	28	4.84
Computer and internet access		
I have access to a computer in my institution/college.		
Yes	238	41.11
No	341	58.89
I have my personal computer at home or on campus.		
Yes	234	40.41
No	324	55.96
I have been using a computer for:		

Table 9 (continued)

0-2 years	221	38.17
3-5 years	168	29.02
7-9 years	69	11.92
10+	51	8.81
Never	70	12.09
I have been using the internet for:		
0-2years	175	30.22
3-5years	212	36.61
7-9years	177	30.57
10+	100	17.27
Never	15	2.59
I connect to the internet using:		
Mobile phone	357	61.66
Wireless broadband	68	11.74
Cyber café	154	26.60
Experience using computers for learning		
E-learning is useful for both lecturers and students.		
Yes	481	83.07
No	98	16.93
Does your institution/college use e-learning for teaching and learning?		
Yes	278	48.01
No	301	51.99
Are you willing to study/teach in an e-learning environment?		
Yes	468	80.83
No	111	19.17
I was involved in a course which used:		
Discussion forum	89	15.37
Chat	123	21.24
Twitter	22	3.80
Facebook	111	19.17
WhatsApp	133	22.97
None of the above	101	17.44
I was involved in a course where course materials and resources were delivered online.		
Yes	341	58.89
No	238	41.11
I was involved in an online course where I was assessed online.		
Yes	211	36.44
No	368	63.56

Appendix II

Table 10 Interview questions

Questions	Frequency	%
1. Are you an academic or a student?		
Academic	88	34.38
Student	168	65.62
2. What is your highest qualification?		
Undergraduate	65	25.39
ND	48	18.75
HND	28	10.94
NCE	31	12.11
PGD	37	14.45
Master	26	10.16
Ph.D	21	8.20
3. What are the challenges you experienced in the traditional system of learning?		
4. Do you have a computer?		
Yes	111	43.36
No	145	56.64
5. How do you connect to the internet?		
Mobile phone	162	63.28
Wireless broadband	18	7.03
Cyber café	76	29.69
6. Does your institution have internet provision for academics and students?		
Yes	89	34.77
No	167	65.23
7. Does your institution have provision for e-learning?		
Yes	37	14.45
No	219	85.55
8. Have you ever used any platform for e-learning?		
Yes	177	69.14
No	79	30.86
9. If "Yes" to the above question, how was the experience?		
Good	159	89.83
Bad	18	10.17
10. Are you willing to study/teach in an e-learning environment?		
Yes	231	90.23
No	25	9.77

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