



Educational quality and technological complexity on recognition of enhanced learning platform in developing countries using PLS-SEM in a post COVID era

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Abstract

The e-learning platform provides a new teaching-learning channel in which instructors provide information to learners irrespective of method used to access the platform. The purpose of this study is to examine instructors' acceptance of e-learning in Nigerian universities. The study adopted a quantitative approach, with a total of 299 questionnaires collected from instructors. The result was analyzed using PLS-SEM. The study results indicate the factors affecting instructors' adoption of e-learning platforms and the subsequent impact on instructors' behavioral intention, and consequently, an impact on the acceptance of the e-learning platform in Nigeria. Based on the study, self-efficacy, educational quality, and ease of use, perceive usefulness, and behavioral intention were found to be predictors for instructors' acceptance of the e-learning platform in Nigeria. Also, the results drawn from the study revealed that there are individual challenges that come from the use of the e-learning platform. We discussed both theoretical and educational implications.

Keywords Enhanced-learning · Instructors · Self-efficacy · Technology acceptance · Teaching-learning process

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Introduction

Developing countries no doubt, have made credible developments in the adoption of digital learning platforms, especially the extensive use of e-learning in the teaching and dissemination of information. The introduction of digital platforms into education has indeed shown credibility in its potential toward teaching and learning (John, 2015; Benali et al., 2018). Therefore, digital competency development should be an educational priority for digital platforms in a learning environment (Blayone et al., 2018). Many researchers have advocated the need to develop helpful digital assessment tools that facilitate learner comfort through e-learning (Jillian et al., 2018; Jirgensons & Kapenieks 2018; Dawson et al., 2019; Abubakar & Adeshola, 2019). Nevertheless, the success of e-learning depends on its implementation and proper integration with traditional face-to-face teaching and learning (Tarus et al., 2015).

The recent advent of the global COVID-19 pandemic has further compounded the need for e-learning systems by all-and-sundry institutions. Forcing teaching and learning to no longer be a full face-to-face scenario, but combined with virtual classes and/or blended learning (Natasia et al., 2022; Nácher et al., 2021). Although the term e-learning has been viewed by many scholars as electronic or digital learning, in this study, we examined e-learning to enhanced learning facilitated by the use of electronic media and information and communication technologies, including all forms of educational technology providing either electronic or technological support to abet teaching and learning.

In the adoption of e-learning, many misconceptions arise regarding the implementation and continuity of e-learning. These misconceptions are the reasons for challenges faced by e-learning communities (Frimpon, 2012; Vinner, 2018; Unwin et al., 2010) attributed teachers' challenges in ratifying e-learning to their inadequate understanding. According to Kisanga and Ireson (2015), teachers' approval of e-learning is primarily based on their understanding, the inherent benefits of the e-learning platform, and individuals' resistance to evolution, which are considered personal factors in the adoption of e-learning (Nihuka & Vogot, 2012; Sanga et al., 2013; Aldowah et al., 2018). Aldowah et al. (2019) also highlighted that course, contextual, technological, and individual challenges are pre-existing for productive use of e-learning by instructors.

Nigerian teachers encounter challenges when attempting to utilize e-learning platforms. These include inadequate technical support, poor Internet connectivity, cost-effectiveness, high costs of technology, accessibility, and flexibility, which present substantial challenges for Nigerian educational institutions (Obakhume, 2011; Yakubu & Dasuki, 2018).

Other generic issues, as mentioned by Tawalbeh (2018), include negative attitudes and perceptions towards the e-learning platform and familiarity with the system features and functionalities that affect teachers. The reduced level of interaction techniques, mastering challenging tasks, trust, and absence of a reward system hinder the use of educational technology in Nigerian universities (Adewale & Ghavifekr, 2019; Yakubu & Dasuki, 2019) stated that Western African countries such as Nigeria, are still under-researched in terms of e-learning adoption. Instructors' psychological challenges with the use of e-learning typically create a more significant challenge towards its implementation, as instructors are obligated to use e-learning to instruct students.

To ensure proper implementation of e-learning technology, it is necessary to identify the factors that contribute to instructors' acceptance of e-learning at Nigerian universities, as existing studies have indicated little research on the factors responsible for instructors' adoption of e-learning in Nigerian academic environments.

The Technology Acceptance Model (TAM) by Davis (1986), was developed to explain user's motivation to adopt the technology based on five key constructs: perceived usefulness, perceived ease of use, attitude, behavioral intention, and usage intention. Plus, information systems (IS) success framework by DeLone and McLean's (2003) was developed to explain quality and functionality of an IS based on six key constructs namely: three technological quality factors (service quality, information quality, and system quality), intention to use, user satisfaction and benefits. The study also showed a positive outcome, with limited research on the quality factors of instructors' adoption of e-learning. Extensive reviews on the adoption of e-learning technologies in Nigeria by a few researchers (Yakubu & Dasuki, 2018; Abdallah et al., 2019; Yakubu et al., 2020) have shown limited studies on the adoption of e-learning in Nigerian universities. In particular, the instructors' motivational factors for e-learning adoption were examined. Hence, this serves as a knowledge gap that focuses on investigating instructors' e-learning motivational factors in Nigeria. The principal purpose of this study is to identify the factors that facilitate instructors' motivation to adopt e-learning based on a new conceptual framework. The conceptual study model adopts constructs drawn from the TAM and the motivational factors of e-learning adoption that contribute to the present knowledge by examining the motivational factors that influence instructors' adoption of e-learning in Nigerian universities.

Review of literature

Yakubu and Dasuki (2018) emphasized that there has been significant growth in the use of e-learning as a driver for effective e-learning operations in developing countries. This assertion is supported by a study conducted in Oyo State, Nigeria, on the influence of teachers' information needs on ICT use in schools. The authors discovered that teachers used projectors, multimedia boards, computers, scanners, telephones, photocopiers, and internets (Obakhume, 2011).

Tunmibi et al. (2015) stated that e-learning implementation had a direct effect on both learners and teachers. This study examined the impact of e-learning on secondary school students and instructors in Lagos, Nigeria. It was found that the imposition of e-learning not only promoted teaching, but also motivated teachers and boosted students' interest in learning.

Similarly, a study conducted by Afolabi (2015) in a university in southwestern Nigeria revealed that even though e-learning tools are available in the university, people fail to put them into practice. In addition, the quality of e-learning systems, inadequate training, epileptic power supply, and limited resources are other challenges facing the successful adoption of e-learning systems in Nigeria (Okpechi et al., 2018). Furthermore, they identified several issues that could be categorized in line with technological issues, psychological factors, financial issues, policies, and inadequate personnel training.

Moreover, Zamani et al. (2016) highlighted the issues facing the acceptance of e-learning in developing countries. Issues were grouped into the following categories: individual barriers associated with habits, internal characteristics, physiognomies, and "attitudinal inhibitors" associated with interior constructs related to users' attitudes towards and viewpoints on e-learning. The latter category is the "contextual inhibitors" associated with exterior constructs consisting of a lack of organizational backing and inadequate e-learning competence regarding the usage of e-learning technologies. While the adoption of e-learning is no longer a new subject in developed countries, Nigeria is still battling its adoption

and sustainable implementation (Al-Azawei et al., 2016; Eze et al., 2018; Yakubu & Dasuki, 2019). In addition to the disadvantages of e-learning, the overall challenges include inadequate training of users, inadequate Internet facilities, ineffective policies, technological challenges, pedagogical challenges, users' attitudes, and organizational challenges (Tarus et al., 2015; Eze et al., 2018).

According to Scherer et al. (2019), there are various models and constructs to explain the acceptance of technology in education, notably, the TAM. The TAM, introduced by Davis (1986), has resulted in other theories that have evolved over the years. These theories include the theory of reason action (TRA), theory of planned behavior (TPB) and decomposed theory of planned behavior (DTPB) (Momani & Jamous, 2017). However, the TAM core concept is centered on users' motivation to examine their attitudes and perceptions of information systems. The TAM has been tested, validated, and expanded over time due to its precise ability at predicting the adoption and usage intention of information systems (Liu et al., 2010; Mohammadi 2015; Al-Azawei et al., 2017).

Conversely, the popularity of TAM has shown many inadequacies, especially when used for the conceptualization of technology integration. In addition, TAM does not specify the area or knowledge needed by instructors to teach and learn technology for effective integration (Wang et al., 2008; Scherer et al., 2019). Wang et al. (2008) suggested that, TAM requires some specific additional variables in order to provide a sturdier model. In Nigeria, few studies have examined instructors' acceptance of e-learning systems in Nigeria. In contrast, few studies have adopted the TAM model, and other models have based their influence on students' behavioral intention to use e-learning in Nigeria (Yakubu & Dasuki, 2018, 2019; Yakubu et al., 2020). To the best of our knowledge, no study on the adoption of e-learning studies in Nigeria universities has examined the motivational factor of the instructor's efficacy, technological complexity, and educational quality on the technology acceptance of e-learning in Nigeria. Therefore, this study addresses this research gap and proposes a model that examines the three significant factors contributing to the adoption of e-learning among Nigerian instructors.

Self-efficacy (SE)

In this context, self-efficacy is regarded as the ability of an individual to effectively use technology independently without assistance (Byker et al., 2018). Studies have shown that self-efficacy is predicted by associated behavioral accomplishments such as effectiveness, motivation, and optimistic attitudes (Chang et al., 2017). Consequently, we propose the following hypotheses:

H1 Self-efficacy positively affects perceived ease of use.

H2 Self-efficacy positively impact perceived usefulness.

Educational quality (EQ)

Educational quality is considered a crucial construct in this study because of its relevance to the adoption of Information System (IS) technologies (Hassanzadeh et al., 2012). EQ has been defined by Kim et al. (2012) as "the extent to which an IS makes available a tranquil setting for users to have collective learning." However, in the context of instructors, EQ can be stated as instructors' prove of e-learning platform usage that enhances the

quality of education (Chang et al., 2017). Hence, EQ has a substantial direct influence on users' perceived ease of use and perceived usefulness. Therefore, we propose the following hypotheses:

H3 Educational quality positively influence perceived ease of use.

H4 Educational quality positively influence perceived usefulness.

Technological complexity (TC)

According to Chin and Lin (2016), technological complexity is defined as the user's perceptions of the effort to understand the innovative technology or system. Inadequate professional skills, access, and difficulties associated with the understanding of recent systems and the various interrelating technologies have been stated to represent a significant limitation to instructors' acceptance of e-learning platforms (Wang et al., 2008; Chin & Lin, 2016). However, studies have shown that technology has an emerging impact on the development of technology acceptance, especially in learning environments (Gyamfi, 2016). Hence, we propose the following hypotheses:

H5 Technological complexity positively affects perceived ease of use.

H6 Technological complexity positively affects perceived usefulness.

Perceived ease of use (PEOU) of the e-learning platform

Perceived ease of use is a significant part of TAM, and as defined by Davies (1986), it is the extent to which a person believes that adopting a particular technology would be free of effort. Several studies have confirmed that ease of use of technology increases users' acceptance of using technology or platforms (Davies, 1986; Edmunds et al., 2012; Bashir & Madhavaiah, 2015). This study defined perceived ease of use as the extent to which an instructor's use of an e-learning platform is perceived as easy or effortless. It is suggested that ease of use represents a strong construct that motivates users' intention to accept and use e-learning (Cheng, 2012). Therefore, the following hypothesis are stated:

H7 Perceived ease of use positively affects perceived usefulness.

H8 Perceived ease of use positively affects intention to use.

Perceived usefulness (PU) on behavioral intention (BI)

Perceived usefulness has been defined as the extent to which a user thinks utilizing a particular technology comes with certain advantages in relation to performing tasks (Davis, 1986). The relationship between PU and user's behavioral intention has been assessed in many studies (Sarraf et al., 2016). Thus, this study extend it to the relationship between instructors' PU and behavioral intention of technology adoption. Therefore, the study hypothesized that:

H9 Perceived usefulness positively affects behavioral intention to use.

Research methodology

The conceptual model of this study is shown in Fig. 1. Accordingly, TAM is one of the most used theories to examine the factors of technology adoption among instructors. In the context of e-learning, this study use factors such as “self-efficacy,” “educational quality,” and “technological complexity” with the concept of TAM to contribute to the adoption of e-learning among instructors. Based on the previous studies, Fig. 1 shows the relationship between self-efficacy, educational quality, and technological complexity, and the TAM.

Data collection and measurement scales

This study examines the factors affecting instructors’ adoption of e-learning platform in Nigeria during Covid-19 pandemic. The samples were collected from instructors of three private schools using e-learning platforms from three geopolitical zones (south-south, south-west, and north-central) in Nigeria. Nigerian states are grouped into six distinctive geopolitical zones and federal capital territories: southeast, south-south, southwest, northeast, northwest, and north-central. Hence, the study population was chosen based on prior attempts at schools and the current use of e-learning technologies to disseminate knowledge. Currently, instructors in these schools use projectors, interactive boards, computers, scanners, telephones, photocopiers, and the internet to teach and send homework to students. Other forms of e-learning platforms currently used by schools for teaching and teacher-person interactions include WhatsApp, Facebook, and dedicated specialized software.

Owing to the distance between geopolitical zones, data collection was initiated from March 3rd to August 4, 2021. Initially, all the participants were invited to complete the

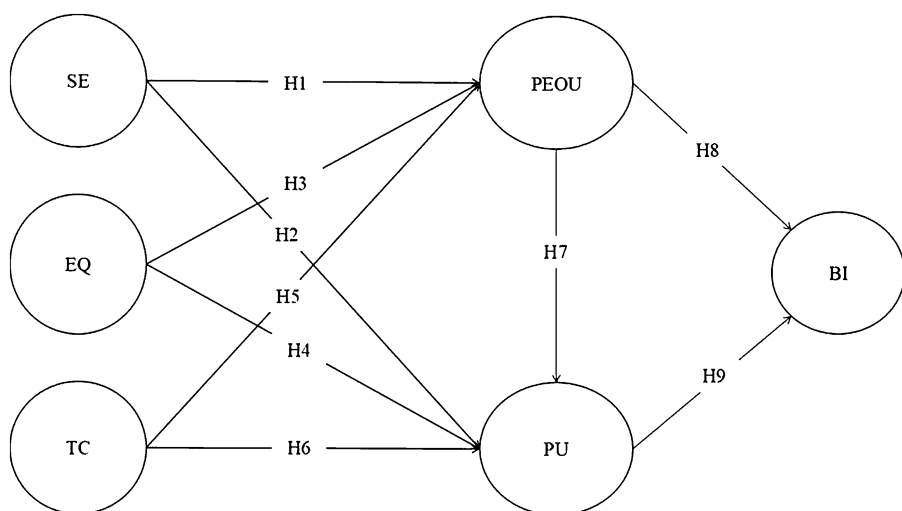


Fig. 1 Research conceptual model

questionnaire. The questionnaires, including a cover letter, were distributed to participants in their respective schools/offices. The participants were clearly intimated by the need to voluntarily respond to the questionnaire and their responses were treated confidently. The questionnaire, however, was based on previous studies and the theoretical literature undertaken from numerous studies on the subject matter in which indices were selected, as shown in Table 1. On the first page of the questionnaire, The instructors were asked to confirm whether they understood and were currently using e-learning applications for teaching. This confirms the relevance of their responses to the research. The study population comprised 1, 106 instructors; 330 instructors were selected purposefully and the questionnaire was physically administered to them. A total (110) questionnaires were assigned to each school, and of the 330 questionnaires distributed to the instructors, 299 were returned for both internal and external reasons.

Yamane (1967) proposed sample size calculation was engaged to calculate the needed sample size. Characterized as: Sample size $(n) = \frac{N}{1+N(e)^2}$ where n =is the sample size, N =is the population size, e =is the marginal error. This study assumes 95% confidence level and an error margin $(e)=0.05$. In substituting $N=1,106$ and other parameters in the sample size calculation formula, minimum sample size (n) of 294 is to be selected for the survey. In total, 330 instructors were selected from these schools. The study utilized the purposive sampling method as a result of the distinct requirements of the present study, and the selection process of schools/participants was considered adequate to provide the necessary information centered on knowledge or practice (Idoga & Kissi, 2020). Furthermore, the research methodology used a well-structured questionnaire to collect data using a five-point Likert scale for perceived usefulness. The perceived ease of use was adopted from Davies (1986), Liu et al. (2010), Mohammadi (2015). Self-efficacy, educational quality, and technological complexity were taken from Mohammadi (2015), Mokhtar et al. (2018), Hassanzadeh et al., (2012). In addition to the behavioral intentions of Davies (1986), Li et al. (2012) and Mokhtar et al. (2018). Of the 330 questionnaires distributed, 316 received 17 incomplete responses. In total, 299 respondents (90.60%) were included in this study. First, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used to examine the nature of the relationships between latent constructs (Anderson & Gerbing, 1988; Wongpakaran et al., 2018). EFA and CFA approaches were used to evaluate various hypotheses regarding relationships within factors, latent variables and observed variables. The second step was model fit. A structural model was used to estimate and assess the overall model fit of the hypothesized relationships, using standardized regression coefficients (β) and p -values.

Data analysis

In measuring the data, an exploratory analysis such as convergent and discriminant validity and scale reliability must be examined based on Fornell and Larcker (1981) criteria. First, the study applied a preliminary test for the common method bias to determine the multicollinearity among the variables, and the result of Variance inflation factors (VIF) varies from 1.246 to 3.168, which is less than 3.3 recommended by Kock (2015). Second, the study examined the reliability, convergent validity, and discriminant validity of the model, this study adopted the suggestion by Hair et al. (2010). The convergent validity is the extent to which different measures of the same construct must be strongly correlated with one another, while discriminant validity statistically measures two different factors from each other (Anderson & Gerbing, 1988; Engellant et al., 2016). The convergent validity is

Table 1 Research instrument

Construct	Question	Source	Indicator	Factor loadings
Self-efficacy	I feel confident making e-learning platform as online instruction to assist my teaching	Mohammadi (2015), Mokhtar et al. (2018), Hassanza-deh et al. (2012)	SE1	0.78
	I feel confident using the e-learning platform.		SE2	0.85
	I am confident of using e-learning platform even if I have never used such a system before		SE3	0.78
Educational quality	E-learning platform provides the possibility of evaluation	Mohammadi (2015), Mokhtar et al. (2018), Hassanza-deh et al. (2012)	Equation 1	0.81
	The E-learning platform is appropriate for my teaching style.		Equation 2	0.81
Technological complexity	E-learning platform provides a collaborative approach.	Mohammadi (2015), Mokhtar et al. (2018), Hassanza-deh et al. (2012)	Equation 3	0.77
	I interact with the e-learning platform without much mental effort		TC1	0.92
	E-learning platform does not require much time to learn		TC2	0.91
Perceived usefulness	E-learning platform have flexible features	Liu et al. (2010) and Mohammadi (2015)	TC3	0.85
	I believe using e-learning helps to improve my performance		PU1	0.79
	I believe using the e-learning platform is effective and efficient.		PU2	0.75
	I believe using an e-learning platform as instruction is useful for teaching.		PU3	0.81
Perceived ease of use	I believe using E-learning platform is easy to use	Liu et al. (2010) and Mohammadi (2015)	PEOU1	0.80
	I believe using E-learning platform is easy to access		PEOU2	0.77
	I believe using E-learning platform is convenient to use		PEOU3	0.80

Table 1 (continued)

Construct	Question	Source	Indicator	Factor loadings
Behavioral intention	I intend to use the e-learning platform in the future	Li et al. (2012) and Mokhtar et al. (2018)	BI1	0.80
	Based on my experience, I am very likely to use the e-learning platform.		BI2	0.76
	I will recommend that other people use the e-learning platform.		BI3	0.74

Table 2 Discriminant validity

Construct	SE	BI	PEOU	PU	EQ	TC
SE	0.806					
BI	0.208	0.767				
PEOU	0.237	0.373	0.791			
PU	0.150	0.335	0.266	0.708		
EQ	0.359	0.253	0.253	0.2367	0.797	
TC	0.509	0.226	0.239	0.1381	0.4413	0.896

Bold values indicate the square root of AVE

Table 3 Exploratory analysis result and VIF

Construct	Indicator	VIF	Loading	AVE	CR	(α)	R ²
Self-efficacy	SE1	1.397	0.78	0.647	0.846	0.726	
	SE2	1.726	0.85				
	SE3	1.411	0.78				
Educational quality	Equation 1	1.373	0.81	0.636	0.840	0.714	
	Equation 2	1.489	0.81				
	Equation 3	1.362	0.77				
Technological complexity	TC1	3.168	0.92	0.802	0.924	0.876	
	TC2	2.834	0.91				
	TC3	1.944	0.85				
Perceived usefulness	PU1	1.328	0.79	0.610	0.824	0.680	0.337
	PU2	1.276	0.75				
	PU3	1.380	0.81				
Perceived ease of use	PEOU1	1.392	0.80	0.627	0.834	0.702	0.317
	PEOU2	1.331	0.77				
	PEOU3	1.387	0.80				
Behavioral intention	BI1	1.340	0.80	0.589	0.811	0.651	0.468
	BI2	1.252	0.76				
	BI3	1.246	0.74				

measured by Average Variance Extracted (AVE) values and Composite Reliability (CR). As shown in Table 2, all factor loading are greater than 0.4, which satisfied the requisite recommended by Bagozzi (1981) stating that all factor loading must exceed 0.50. Moreover, the value of AVE ranged from 0.589 to 0.802. Therefore, the AVE value is acceptable, and the AVE value of all items exceeded 0.50 (Chin, 1998). Cronbach alpha (α) values vary between 0.651 and 0.876, which is reasonable (Taber, 2018). More so, all CR (the degree to which items are free from arbitrary error and provide consistent results) exceed 0.6 as recommended by Henseler et al. (2009), which shows a standard result from Table 3.

Also, the R² for perceived usefulness is 0.337, which is proven to be substantial. Besides that, perceived ease of use, with an R² of about 0.317 is also proven to be the significant and behavioural intention, with an R² of about 0.468 is moderate (Chin, 1988). Therefore, the predictive power of perceived ease of use (32%) and perceived usefulness (34%) both proved to be a strong predictor of behavioral intention (47%) of instructors' adoption of the

e-learning platform. Furthermore, as shown in Table 2 above, the test of the discriminant validity for each construct is higher than 0.50 and this complied with (Fomell & Larcke, 1981) which stated the square root of the AVE of each construct should be much larger than the correlation of the specific construct with any of the other constructs. Therefore, the result indicates a satisfactory discriminant validity.

As a result, the study measures the data analysis by testing the reliability and validity consist of factor loadings, Average Variance Extracted, Composite Reliability, and Cronbach's alpha (Construct Reliability) values. Next, we examine the structural model by testing the model fitness and the relationships between variables.

Measurement of model fit

Measurement of the model fit is conventionally implemented to signify multiple categories of model fit. That is, the use of Partial Least Squares (PLS) to measure the estimated value of measured variables and several latent constructs (Oluwajana et al., 2019): With the use of composite PLS, model's goodness of fit: need to be tested with the unweighted least squares discrepancy (d_{ULS}), the geodesic discrepancy (d_G), and the Standardized Root Mean Squared Residual (SRMR). A model fit is usually considered valid when the $SRMR < 0.08$ and the squared Euclidean distance (d_{ULS}) of the saturated model $<$ bootstrapped HI 95% of d_{ULS} estimated model and d_G of the saturated model $<$ bootstrapped 95% of d_G of the estimated model. Therefore, the results from Table 4 show that $SRMR < 0.08$, $d_{ULS} \text{ sat} < \text{est}$, and $d_G \text{ sat} < \text{est}$ which satisfied the requisite recommended by (Quintana & Maxwell, 1999; Henseler et al., 2016).

The second step is to estimate the model fit, and we employed the structural equation modeling using ADANCO 2.0.1 to test the proposed model. ADANCO represents an advanced analysis of composites. It is used for variance-based structural equation modeling and tests of the model fit. As listed in Table 5, among the factors influencing instructors acceptance of e-learning, the study result indicates instructors' self-efficacy shows a positive impact on perceived ease of use of the e-learning platform ($\beta = 0.210$, $p < 0.01$); instructors educational quality shows a positive impact on perceived ease of use ($\beta = 0.272$, $p < 0.01$) and instructors' educational quality shows a positive impact on perceived usefulness ($\beta = 0.299$, $p < 0.01$) Thus, H1, H3, and H4 are empirically supported. However, instructors' self-efficacy and perceived usefulness ($\beta = 0.074$), instructors' technology complexity and perceived ease of use ($\beta = 0.158$), and technology complexity and perceived usefulness ($\beta = -0.054$). Thus, H2, H5, and H6 show an insignificant effect in this regard. Finally, instructors' perceived ease of use shows a positive impact on perceived usefulness of the e-learning platform ($\beta = 0.356$, $p < 0.01$) and instructors' perceived ease of use shows a positive impact on behavioral intention to

Table 4 Overall model fit

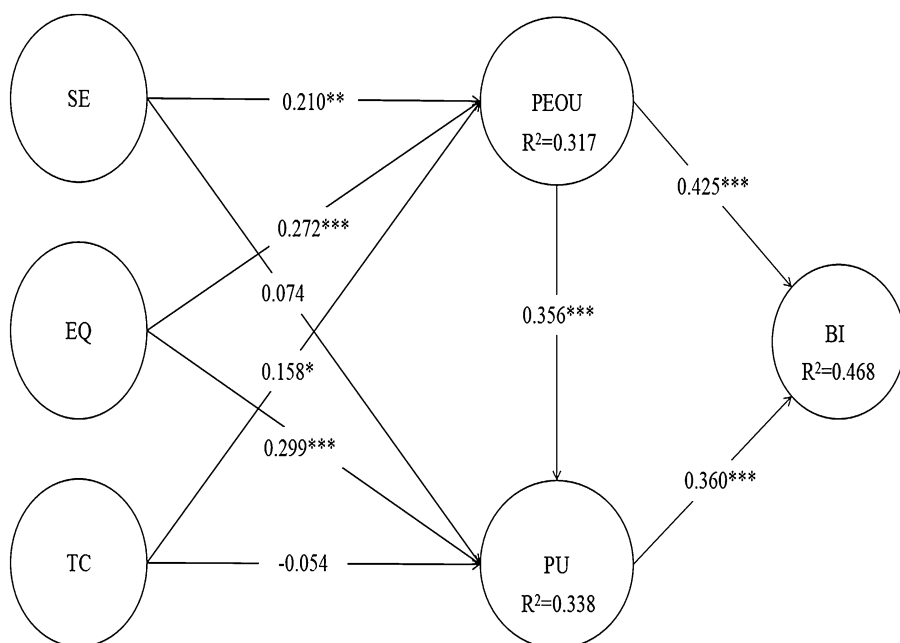
	Saturated (sat)				Estimated (est)			
	Value	HI95	HI99	Outcome	Value	HI95	HI99	Outcome
$SRMR < 0.08$	0.068	0.054	0.056	Supported	0.075	0.059	0.063	Supported
$d_{ULS} \text{ sat} < \text{HI95}$	0.791	0.507	0.539	Supported	0.954	0.601	0.684	Supported
$d_G \text{ sat} < \text{HI95}$	0.344	0.305	0.317	Supported	0.354	0.309	0.320	Supported

Table 5 Structural model

	Effect	Original coefficient	t-value	p-value	Outcome
H1	SE → PEOU	0.210	2.660	0.008	Supported
H2	SE → PU	0.074	0.999	0.318	Not-supported
H3	EQ → PEOU	0.272	3.385	0.001	Supported
H4	EQ → PU	0.299	4.461	0.000	Supported
H5	TC → PEOU	0.158	1.956	0.051	Not-supported
H6	TC → PU	− 0.054	− 0.662	0.508	Not-supported
H7	PEOU → PU	0.356	5.934	0.000	Supported
H8	PEOU → BI	0.425	9.225	0.000	Supported
H9	PU → BI	0.360	7.232	0.000	Supported

use e-learning platform ($\beta=0.425$, $p<0.01$); instructors' perceived usefulness shows a positive impact on behavioral intention to use e-learning platform ($\beta=0.360$, $p<0.01$). Thus, H7, H8, and H9 are empirically supported. Therefore, all paths except H2, H5, and H6 are unsupported.

An analysis of the structural model shows that all direct effects are significant, except H2, H5, and H6. This study used one-tailed and resultant p-values (2-sided) for statistical inferences following the guidelines suggested by Henseler et al. (2016). Therefore, all hypotheses are confirmed, and the result is established in Fig. 2.

**Fig. 2** Proposed research model

Discussions

Many researchers have studied various external variables concerning the extension of this acceptance model to overcome educational development factors, particularly the use of e-learning platforms in the education sector (Abdullah & Ward, 2016; Chien, 2012). Accordingly, this study used structural equation modeling (SEM) to examine the factors affecting instructors' acceptance and adoption of e-learning platforms as new educational technology tools in the Nigerian education sector. The study used the TAM-perceived usefulness, perceived ease of use, and behavioral intention to use e-learning platforms-to reveal factors affecting instructors' adoption and use of e-learning. Additionally, we considered self-efficacy, technology complexity, and educational quality as factors that enhance technology acceptance to better understand the determinants of instructors' adoption of e-learning platforms. However, the results indicated that the model was satisfactory. That is, the measures of reliability, convergent validity, and Cronbach's alpha were satisfactory, and the discriminant validity was also satisfactory. Consequently, all the hypotheses were valid, and the relationships among the variables were positive with a high level of significance, except for H2, H5, and H6. The new era in the use of e-learning applications among instructors for teaching and other social activities in the learning environment.

This study measured self-efficacy, educational quality, and technological complexity as the factors needed to improve productivity and efficiency in teaching e-learning environments. Therefore, this study cannot accurately state if e-learning platforms are fully utilized or underutilized in developing countries. However, the study outcome shows that instructors' perception of the application's use shows that self-efficacy has a significantly positive effect on instructors' perceived ease of use in adopting and using the e-learning platform, which is in line with Chen and Tseng (2012) and Scherer et al. (2019). This result suggests that Nigerian instructors believe that e-learning platforms motivate users to use them for online instruction, thereby assisting them in their teaching. In addition, as part of global development, universities in developing countries should encourage computer usage among instructors to develop self-efficacy, motivation, and attitudes towards use (Bhuasiri et al., 2012).

The study also showed that self-efficacy had an insignificant effect on instructors' perceived usefulness of adopting and using e-learning platforms. This explains why Nigerian instructors' have low self-efficacy towards the use of e-learning platforms within this context; the users' judgment would be either "difficult to use" or "less useful" (Alshammari et al., 2016). Moreover, educational quality plays a key role in supporting perceived ease of use and usefulness of e-learning platforms. The results indicate that educational quality has a significant positive effect on instructors' perceived ease of use and usefulness of adopting and utilizing e-learning platforms. Therefore, the findings are consistent with those of similar studies (Hassanzadeh et al., 2012; Al-Azawei et al., 2017), which show that Nigerian instructors' are highly qualified, grade appropriately for teaching, and assess the e-learning platform in Nigerian universities.

In addition, instructors' perception of technology complexity exerts a positive influence on perceived ease of use but an insignificant effect on the perceived usefulness of adopting the e-learning platform. Ursavaş and Reisoglu (2017) found that the perceived technological complexity of e-learning is negatively related to perceived usefulness as instructors perceive that complex technologies may not be useful or will not improve their performance when used in their respective work. This result also explains the various complexities faced by instructors, such as their mental state, motivational issues, accessibility, and cognitive

factors, in the perceived usefulness of e-learning platforms (Hammouri & Abu-Shanab, 2018). Furthermore, the results confirm the existing hypotheses based on perceived usefulness and perceived ease of use, with a positive and significant effect on behavioral intention and perceived ease of use and a positive and significant effect on perceived usefulness. Accordingly, this research model contributes to the existing evidence on the use of e-learning platforms (Davis, 1986; Venkatesh 2000; Motshegwe & Batane, 2015; Dueñas-Rugnon et al., 2010; Zamani et al., 2016). Educational technology in developing countries has significantly improved to a high degree through research and development (R&D) by stakeholders in the educational field. However, performance is based on the adoption of e-learning platforms in developing countries before equating to the same level as modern countries in the modern educational system. Given the context of the factors affecting Nigerian instructors, this study provides a more successful and explicit picture of the three determinants of instructors' adoption of the integrated e-learning model in the TAM.

Implication for educational practice

This study presents two theoretical implications for educational practices and contributes to the TAM. Our model combines the TAM of Davis (1986) with factors affecting instructors in adopting e-learning platforms (Pursel & Xie, 2014). Second, this model validates an aspect of this research that focuses on instructors' determinants and the extension of TAM. The purpose was to develop a rigid model in a more modernized context to focus on the factors affecting Nigerian instructors' acceptance of e-learning platforms in institutions that may, therefore, be considered significant contributors to the Nigerian educational system. The practical implications of this study indicate that designers and providers have distinct views of the potential effects of e-learning systems in educational settings.

One implication of this study is that Nigerian instructors perceived e-learning platforms as complex technologies for teaching, communicating, and collaborating, which are core values of the e-learning system process (Cidral et al., 2018). According to our findings, Nigerian instructors will benefit if designers and providers consider ways to minimize the complexity of content, collaboration, and communication processes within platforms. Instructors should be able to enjoy animation, web management, one-on-one mentoring, and digital-area audio/video capture (Aparicio et al., 2016). Instructors perceive that a simple-to-use e-learning platform will facilitate communication between instructors and students, thereby influencing behavioral intention, and institutions should design various ways of improving instructor self-efficacy through seminars, training, and other ways of improving their competence levels in developing countries which can be recommended for subsequent research.

Limitations and suggestions for future work

Although this study provides progressive perspectives on both theoretical and real-life factors affecting instructors' adoption of e-learning platforms in Nigeria, it also has several limitations. First, researcher bias may have occurred because of the sampling technique employed. Second, the results indicate that the dimensions of the external variables are insufficient to adequately capture the TAM's influence on e-learning. Therefore, our study contributes to the advancement of theoretical development and serves as a basis for future research. Future research could focus on other universities through a comparative analysis of e-learning platforms and instructors' perceptions of their

technological complexity. Future research should compare e-learning platforms across developing countries. Other research areas can focus on evaluating instructors' attitudes towards e-learning environments using gamification as a mode of instruction and a paradigm for using e-learning platforms (Urh et al., 2015). Gamification promotes a higher degree of personalization in e-learning, communication and collaboration.

Conclusion

Generally, an e-learning platform is an effective solution for teaching-learning process. It is important to examine instructors' motivations when using e-learning platforms in education during Covid-19 pandemic. Technology acceptance of e-learning platforms can be added to existing traditional methods to improve the learning process and enhance the instructors' acceptance of e-learning platforms. This research has helped understand the different factors affecting instructors' acceptance of e-learning platforms in Nigeria. This study used the TAM as a theoretical framework to examine the factors affecting instructors' acceptance of educational technology, especially e-learning platforms during Covid-19 pandemic.

Our findings revealed that perceived ease of use, usefulness, educational quality, technology complexity, and self-efficacy significantly contributed to users' behavioral intention to adopt e-learning platforms. Therefore, there is a need to determine instructors' self-efficacy and technological complexity, increase their awareness of the use of e-learning platforms, and provide instructors with adequate training on various services offered by e-learning platforms. These include a user-friendly instructor's guide, means of communication, a new method of the teaching-learning process, and many more on the e-learning platform. In conclusion, the results indicate a need to develop strategic plans and provide guidelines for instructors' technology complexity and self-efficacy acceptance to improve modern driving factors to meet the educational goal of using e-learning platforms.

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Data availability All data generated or analyzed during this study are included in this manuscript [and its supplementary information files].

Declarations

Conflict of interest The authors declare that they have no competing interest.

Informed consent All participants consented to the survey before the questionnaire was administered to them.

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