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Barriers and Enablers of E-Learning Technology Adoption and Diffusion Among Nigerian Undergraduate Students: An Evaluative Analysis

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Abstract: The implementation and flow of e-learning technologies play a crucial role in enhancing the digital learning experience and academic outcomes. This evaluative study examined the barriers and enablers affecting the adoption and diffusion of e-learning technologies among Nigerian undergraduate students. Descriptive statistics indicated that only 36% of Nigerian tertiary institutions had structured e-learning systems, with less than 20% of students reporting consistent digital access. Correlation analysis revealed significant positive relationships between perceived usefulness ($r = 0.62$, $p < 0.01$), perceived ease of use ($r = 0.58$, $p < 0.01$), and students' attitudes toward e-learning adoption, while infrastructural challenges such as poor internet access and unreliable power supply negatively correlated with adoption rates ($r = -0.54$, $p < 0.01$). Multiple regression analysis identified perceived usefulness ($\beta = 0.45$), institutional support ($\beta = 0.32$), and digital literacy ($\beta = 0.27$) as significant predictors of e-learning adoption ($p < 0.05$), collectively explaining 48% of the variance in adoption behaviour ($R^2 = 0.48$). The findings highlight that despite persistent infrastructural and socio-economic barriers—including erratic electricity, high data costs, and digital illiteracy—enablers such as mobile device penetration and improving institutional readiness significantly promoted adoption. The study drew on the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) to contextualise these factors, emphasising the importance of content quality, interactivity, and facilitating conditions in enhancing student engagement. This study provides one of the first comprehensive empirical analyses of e-learning adoption in Nigeria, utilising the TAM and UTAUT frameworks to offer context-specific insights from a developing country perspective. The study provided empirical evidence to guide policymakers, educators, and technology designers in developing targeted strategies to improve e-learning accessibility, effectiveness, and sustainability in Nigerian higher education.

Keywords: e-learning adoption, technology diffusion, higher education, barriers and enablers, digital learning in Nigeria.

Introduction

The inclusion of e-learning technologies in the system of higher education has revolutionised the world educational process and provided brand new opportunities in knowledge acquisition, skill development, and educational activity. This digital transformation is significant in developing countries, such as Nigeria, as it presents an opportunity to overcome traditional obstacles to education delivery, including geographical limitations, infrastructural imbalances, and a shortage of qualified tutors (Akwene, 2024; Al-Mushasha, 2013). Flexibility and accessibility of e-learning infrastructure, such as mobile learning management systems (LMS), MOOCs, and blended learning systems, foster versatility, as well as a variety of learning resources, which could improve the process of teaching and learning (Akwene, 2024; De Lima Guedes et al., 2022; Gao & Liu, 2025).

The adoption and diffusion of e-learning technologies in Nigerian universities have not been efficient or uniform, given the numerous sociotechnical and infrastructural impediments that affect

them. Limits to broad-scale utilisation include the absence of proper digital infrastructure, weak internet penetration, unreliable power supply, and faculty-unfavourable readiness (Audrey et al., 2024; Joseph & Uzondu, 2024; Linjawi & Alfadda, 2018; Lwoga & Sangeda, 2018). Furthermore, individual-based variables such as perceived usefulness and perceived ease of use, which form the core of the Technology Acceptance Model (TAM) proposed by Davis (1989), also influence their readiness to use e-learning systems. This is further enhanced by the Unified Theory of Acceptance and Use of Technology (UTAUT), proposed by Venkatesh et al. (2003), which combines critical constructs – performance expectancy, effort expectancy, social influence, and facilitating conditions – to understand user behaviour in technology design.

Cultural attitudes, the degree of digital literacy, and institutional support mechanisms also emerge as key factors in e-learning success in the Nigerian setting (Al-Mushasha, 2013; Oluyinka & Endozo, 2019; Sanpanich, 2021). Faculty beliefs about e-learning and institutional competence in undergoing a digital transformation also mediate the best practices to adopt in terms of integrating e-learning technologies in academics (Ansong et al., 2016; Eveline, 2022; Kriplani et al., 2023). Additionally, the pedagogical aspects of technology integration have been theorised alongside learner satisfaction, as it is noted that gamification, content design, and interactivity contribute to learner retention (Davis et al., 2022; York, 2024).

Since the expansion of digital education tools in the African higher education institutions is fast and uneven, there is an urgent need to identify the supporters and barriers that influence the spread of e-learning. The issue that is critically reflected in this study is the factors that determine the success rate of adoption and diffusion of e-learning technologies among undergraduate students in Nigeria. Based on theoretical concepts such as TAM and UTAUT, and enriched by empirical evidence from both local and global contexts, the study aims to uncover the barriers and opportunities that condition policy, instructional design, and strategic investments in educational technologies. With this knowledge of the dynamics, universities in Nigeria can better leverage to improve the results of the digital learning process and also contribute to the global knowledge economy.

Research Problem

Although there are sporadic adoptions of e-learning technologies in the global education system, the use and proper adoption of these platforms by undergraduate students in Nigeria remain irregular and, in many cases, suboptimal. The trend towards digital learning tools has accelerated across Nigerian higher education institutions, especially following the disruptions caused by the COVID-19 pandemic. According to the National Bureau of Statistics (2023a; 2023b), only 36% of tertiary institutions in Nigeria have implemented some form of structured e-learning, and less than 20% of students report consistent access to learning via digital platforms. Furthermore, a survey by Sawyerr-George et al. (2023) revealed that only 31.8% of university students in Nigeria had access to personal digital devices suitable for online learning, and just 17.6% had access to stable internet suitable for real-time virtual learning.

Several infrastructural, socio-economic, pedagogical, and cultural issues have served as disincentives to the expected mass adoption and long-term sustainability of these technologies. Challenges such as erratic electricity supply, high internet data costs, inadequate digital infrastructure in institutions, and digital illiteracy persist. Additionally, many students come from low-income households, with the Nigerian Living Standards Survey (2023) indicating that over 40% of the population lives below the poverty line, making sustained e-learning engagement economically burdensome.

At the same time, enabling factors—including high mobile penetration (with over 50% smartphone ownership among youths, according to GSMA (2024), improving student digital literacy, and emerging institutional support—appear to facilitate e-learning in specific pockets. However, despite these developments, empirical clarity is lacking on which factors most significantly influence adoption—either as barriers or enablers—from the student's perspective.

The socio-economic significance of this issue lies in the fact that equitable access to education, particularly in a digitally driven economy, is a fundamental requirement for reducing youth unemployment, closing the skills gap, and achieving national development goals such as Sustainable Development Goal 4 (Quality Education). A digitally competent graduate workforce is essential to Nigeria's participation in the global digital economy.

From a scientific standpoint, this study fills a critical gap in the existing literature by systematically identifying, measuring, and analysing the most influential factors shaping students' e-learning adoption. It moves beyond anecdotal or institution-centred perspectives to student-centred empirical data. This contribution is valuable to educational technologists, policy-makers, instructional designers, and researchers developing adaptive, context-specific digital learning environments. By providing grounded evidence on the real barriers and facilitators to e-learning in Nigeria, the study aims to inform data-driven strategies for the scalable and sustainable adoption of e-learning across tertiary education systems in Africa.

Research Focus

The proposed research, therefore, aims to identify the significant obstacles and facilitating factors that affect the current adoption and diffusion of e-learning technologies among undergraduate students in Nigeria. The study aims to understand the perceptions, experiences, and challenges that students face when using digital learning platforms in selected institutions. The study clarifies the nature of the impeding and enabling factors that could be barriers as well as facilitators to successful implementation of mobile technology in teaching and learning, including access to the internet and devices, institutional policies, training opportunities, motivation, and usability, which aims to give practical suggestions to educators, policymakers, and technology designers. The ultimate goal is to inform strategic interventions that have the potential to enhance the reach, effectiveness, and inclusivity of e-learning within the context of Nigerian tertiary education.

Research Questions

1) What are the barriers hindering the adoption and diffusion of e-learning technology among students?
2) What are the key enablers that facilitate the effective integration of e-learning platforms in higher education?
3) How do these barriers and enablers relate to students' attitudes toward e-learning?
4) What institutional strategies can be recommended to enhance e-learning adoption and create an environment that enables digital learning?

Literature Review

Theoretical Foundations of Technology Acceptance

The integration of e-learning technologies is a widely researched phenomenon worldwide, and a significant aspect of the investigation concerns not only the factors that promote or hinder the successful introduction of such systems into educational institutions, but also the various reasons why the use of e-learning technologies is feasible. Vijayan (2024) viewed the ease of use and the usefulness as essential factors that indicate technology adoption. The Unified Theory of Acceptance and Use of Technology (UTAUT), formulated by Venkatesh et al. (2003), suggests that performance expectancy, effort expectancy, social influence, and facilitating conditions are key determinants of technology acceptance.

In the context of developing countries, research indicates that poor infrastructure, limited internet connectivity, and inadequate technical support are among the key challenges that hinder the adoption of e-learning (Baker & Xu, 2017). On the contrary, enablers involve the support of an institution, the preparedness of students, and the suitability of the e-learning platforms to the curriculum's needs (Al-Mushasha, 2013). Nevertheless, whereas there has been increased research on adoption in developed countries regarding e-learning, little literature exists on the peculiarities of adoption, as well as the empowering factors of e-learning in the Nigerian environment. Such a difference suggests that further research is needed on the determinants of e-learning implementation and adoption among students in Nigeria.

E-Learning Barriers in Developing Countries

E-learning technology faces several technological barriers, which are closely connected to financial, infrastructural, and institutional ones, and restrict its widespread use. The barriers are particularly high in institutions of higher learning and among emerging economies, where the integration of e-learning systems is critical but fraught with challenges. Key technological obstacles include a deficient technological foundation, inadequate technical assistance, and insufficient policy and institutional support. All these are compounded by financial challenges, which in turn hinder the

establishment and maintenance of a healthy e-learning platform. The following are the key technological barriers identified in the research papers.

Access to quality internet and hardware is a significant obstacle in the technological framework; poor infrastructure is a common scenario in developing countries, particularly in Africa (Lwoga & Sangeda, 2018). The absence of well-developed features in technology and platforms is an obstacle to the successful integration of e-learning (Al-Mushasha, 2013). On the same note, technical support and expertise have revealed that inadequate technical support to both teachers and students has been a problem, as it also affects the smooth operation and troubleshooting of e-learning systems (Lwoga & Sangeda, 2018). It lacks skilled human resources to direct and match e-learning technologies, without which it would be challenging to implement successfully (Lahwal et al., 2023). When considering policy and institutional support, there is a lack of adequate policy frameworks and institutional support that inhibit the strategic deployment of e-learning technologies (Lwoga & Sangeda, 2018). When there are no specifications or enhancements to educational facilities, irregular usage and adoption of e-learning systems may occur (Karoui, 2025).

The budgetary constraints also limit the capacity of institutions to finance their technological needs and maintenance (Lwoga & Sangeda, 2018). The capacity to support and train educators and learners is also subject to budget constraints (Satvik & Naik, 2024). These barriers are high, but it is necessary to consider that, due to the development of technology and the growth of global connections, some of these difficulties are being overcome. To eliminate these obstacles, efforts must be made to enhance the infrastructure, provide technical assistance, and organise effective policy frameworks in the sphere of e-learning.

E-Learning Implementation Enablers

Several technological drivers facilitate the seamless integration of educational institutions into e-learning platforms. Such enablers enhance interactivity, accessibility, and control over educational assets, ultimately providing a better learning experience for both students and teachers. One of the main technological elements that supports such integration is Open-Source Architecture. Open-source architectures and their development enable the enhancement of different educational assets in different Learning Management Systems (LMS) (Mendez Gijon et al., 2025). These types of architectures incorporate Content Management Interoperability Services (CMIS), allowing users to access and manage content across multiple repositories simultaneously. Similarly, both blended learning and gamification models help implement the classical face-to-face learning practice augmented with online elements, which results in increased engagement and personalisation (Gao & Liu, 2025). The application of gamification methods involves adding dynamic content by incorporating game elements to enhance learner motivation and interaction, thereby achieving compelling learning experiences. On the same note, the spread of multimedia devices has led to increased accessibility of LMSs, making it possible to learn continuously at both formal and informal settings (Akwene, 2024). These systems help teachers and students to interact with each other in

real-time, which is essential in continuing education even in the face of a crisis such as the COVID-19 pandemic.

Similarly, external tools were previously integrated into the educational process, such as virtual campuses; however, the integration now involves a wide range of e-learning tools, including MOOCs and serious games, which bring additional value to the educational environment (De Lima Guedes et al., 2022). The integration is beneficial in accommodating multiple learning styles and enhances the learning process by incorporating an integrated platform that facilitates learning activities. Although these technology enablers play a significant role in facilitating the e-learning integration process, issues such as the digital divide and varying technological infrastructures can negatively impact their performance, particularly in underprivileged areas (Joseph & Uzondu, 2024).

Attitudes of students towards e-learning can be improved by optimising the various key factors that influence their attitudes towards e-learning. Laws are essential issues to be understood by educational institutions that are willing to enhance the degree of student interaction and enjoyment of studying in online conditions. The latter is primarily the usefulness and ease of use, whereby students are more likely to use e-learning when they perceive it as valuable and easy to use. The studies show that the influence of perceived usefulness on student intentions to use e-learning networks is the strongest (Karoui, 2025). The other reason is content design, where the grade and appearance of online material significantly influence students' attitudes. Great learning can be achieved through well-coordinated and engaging tasks (Raja et al., 2025; Yan, 2025). The technological and institutional support is also considered a key factor, as the presence of sufficient digital infrastructure and institutional support is crucial. The acceptance of e-learning is primarily determined by technical support, digital literacy, and administrative policies (Karoui, 2025; Sanpanich, 2021). Therefore, attitudes are also influenced by individual factors, including personal computer skills, motivation, and self-efficacy. E-learning yields more positive results among students who are more receptive to using technology and innovative methods (Karoui, 2025; Ostrovska, 2025).

To maximize the strategies of e-learning to gain practical impact we must always be ready to enhance digital literacy since an institution needs to engage in training to boost the digital abilities of the students so that they can conveniently leverage the e-learning platforms (Oluyinka & Endozo, 2019), by making good quality content whereby they should focus on the online design as well as interactivity of courses that can have a good effect on the student learning outcome and satisfaction (York 2024), by passing an effective support system by providing firm technical It is observed that these are the key aspects that will develop positive dispositions regarding e-learning. It is also necessary to understand that not every student is willing to accept new ways of studying, which is why social interaction and practical experience might make some students choose old learning

systems. Striking a balance between the two modalities might suit various learning styles and enhance the current state of education.

The process of e-learning penetration in educational organisations is influenced by a combination of various factors that can be strategically leveraged to create a supportive environment for digital learning. The following are the significant factors to consider: institutional infrastructure, faculty attitudes, and organisational culture that will determine the success of e-learning programs. It is given that the technological resources and support systems of the institutional infrastructure are reasonably sufficient. To facilitate e-learning, institutions must secure internet connectivity and a robust learning management platform (Eveline, 2022). Among the technology factors that have a significant influence on e-learning adoption, faculty attitude and skills are not overlooked. A supportive learning environment is fostered with the assistance of educators who possess positive attitudes and adequate technical skills (Ansong et al., 2016; Kriplani et al., 2023). It is essential to understand how students perceive the value of e-learning tools and how useful they find them. Schools are supposed to assess the readiness of students and provide the necessary training to enhance their engagement level (Bari & Abualkibash, 2022; Eveline, 2022). Similarly, a culture that promotes innovation and collaboration among faculty members can stimulate the use of e-learning technologies. It is crucial to empower teachers so that they can become part of the decision-making process (Ansong et al., 2016). It is a crystal-clear fact that these parameters are critical to the success of e-learning implementation; vulnerabilities, such as resistance to change and varying digital literacy rates among faculty and students, slow down the processes. It is crucial to address these obstacles to cultivate a more inclusive digital learning environment.

Materials and Methods

This study adopts a quantitative research design to explore the barriers and enablers of e-learning adoption among Nigerian undergraduate students. A structured questionnaire was designed to collect primary data from a representative sample of students.

Sample and Participants

A total of 350 undergraduate students from seven Nigerian universities participated in the study. These universities were selected to ensure a diverse representation of students from various regions and academic disciplines. The sample size was chosen based on statistical power analysis to ensure adequate representation for the generalisability of the findings using a stratified sampling technique.

Table 1

Demographic Characteristics of Selected Universities

S/N	Universities	Sample Randomized
1	Lagos State University of Education- LASUED	50

2	Lagos State University- LASU	50
3	University of Lagos-UNILAG	50
4	Lagos State University of Science and Technology-(LASUSTECH)	50
5	National Open University of Nigeria- (NOUN)	50
6	Yaba College of Technology	50
7	Lagos State College of Health Technology	50

Source: Author's development.

Instruments and Procedures

Data was collected using a structured questionnaire administered through Google Forms. The questionnaire was designed to assess students' perceptions of various enablers and barriers to the adoption of e-learning. The survey was administered over one academic semester to ensure enough time for students to complete and respond to the questionnaire.

Data Analysis

The validity of the research instrument was assessed through content validity and face validity. Content validity was ensured by reviewing the questionnaire with experts in the field of educational technology. Face validity was confirmed through a pilot test with a small group of students. The Cronbach's Alpha coefficient of 0.889 was obtained, demonstrating high internal consistency and reliability of the instrument.

Results

Data was analysed using SPSS software. Descriptive statistics, such as mean scores and standard deviations, were used to summarise the responses. Inferential statistical techniques, such as regression analysis, were used to assess the relationships between perceived enablers and barriers to e-learning adoption.

Descriptive Statistics

Table 2

Descriptive Statistics Table

Variable	N	Mean	Std. Deviation	Interpretation
Access to the Internet	350	3.92	0.87	High Enabler
Availability of Learning Devices	350	3.75	0.95	High Enabler
ICT Skills	350	3.60	0.90	Moderate Enabler
Institutional Support	350	3.40	1.05	Moderate Enabler
Poor Network Connectivity	350	3.95	0.98	High Barrier
Lack of Motivation	350	3.65	1.00	Moderate Barrier

Cost of Data	350	3.88	0.92	High Barrier
Lack of Training	350	3.50	1.02	Moderate Barrier
E-learning Adoption Score	350	3.70	0.89	Moderate Adoption

Source: Author's development.

(Scale: 1 = Strongly Disagree, 5 = Strongly Agree)

Table 2 summarises students' responses to items measuring enablers and barriers.

Reliability Statistics

Table 3

Reliability Statistics Table

Scale	Number of Items	Cronbach's Alpha
Enablers of E-learning	4	0.873
Barriers to E-learning	4	0.859
Overall Questionnaire Scale	8	0.889

Source: Author's development.

Inferential Statistics

Table 4

Regression Analysis Table

Model	Unstandardized Coefficients (B)	Std. Error	t	Sig.
(Constant)	1.230	0.241	5.102	0.000
Enablers Composite Score	0.453	0.065	6.969	0.000**
Barriers Composite Score	-0.312	0.058	-5.379	0.000**

Source: Author's development.

Table 4 shows that enablers significantly predict higher adoption; barriers predict lower adoption.

Table 5

Model Summary and ANOVA for the Regression Analysis

Model	R^2	Adjusted R^2	F	df	p-value
1	0.48	0.47	69.80	(2, 347)	< 0.001

Source: Author's development.

$R^2 = 0.48$, Adjusted $R^2 = 0.47$, $F(2, 347) = 69.80$, $p < 0.001$.

The model includes two predictors. $R^2 = 0.48$ indicates that the independent variables explain 48% of the variance in the dependent variable. The F-statistic of 69.80 (df = 2, 347) is statistically significant at $p < 0.001$, indicating that the overall regression model is a good fit for the data.

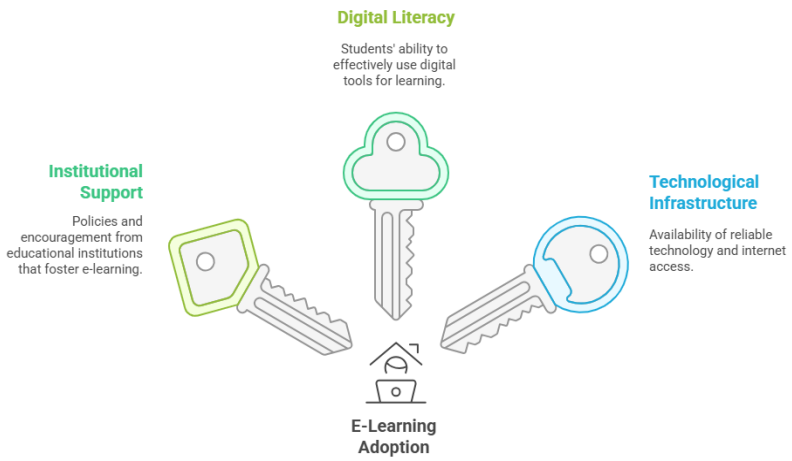
The internal reliability of the questionnaire was high, i.e., 0.889. The results of the descriptive statistics reveal a strong correlation with facilitators, such as Internet access, and a considerable disadvantage, including network problems. With the help of regression analysis, it appeared that Enablers have a positive and significant effect on the adoption of e-learning ($p < 0.001$). In contrast, Barriers have a negative and significant impact on adoption ($p < 0.001$).

The model accounts for 48% of the variability in adoption scores. Several major facilitators of e-learning among students in Nigeria were identified in the study. Students stated that encouragement and policies portrayed by the institution significantly contributed to their use of the e-learning platform, which made them succeed. The ability of students to use e-learning tools was positively correlated with their desire to utilise the technology. Therefore, access to modern computers and a good internet network was mentioned as one of the key facilitators, as posited by the institutions (see Figure 1). Nonetheless, various obstacles were also detected, like the students of rural regions complaining of frequent disturbances caused because of low quality internet links, some of the students said that they did not want to accept e-learning technologies, and wanted to use the old traditional learning techniques in face-to-face learning, and last but not the least lacking sufficient support services of the e-learning platform to solve different problems was a significant barrier in some of the students (See Figure 2).

To make it all the sweeter, regression analysis results showed that institutional support and digital literacy were the two highest determining factors in the adoption of e-learning. In contrast, the lack of reliable internet connectivity and resistance to change were the most common inhibitors.

Figure 1

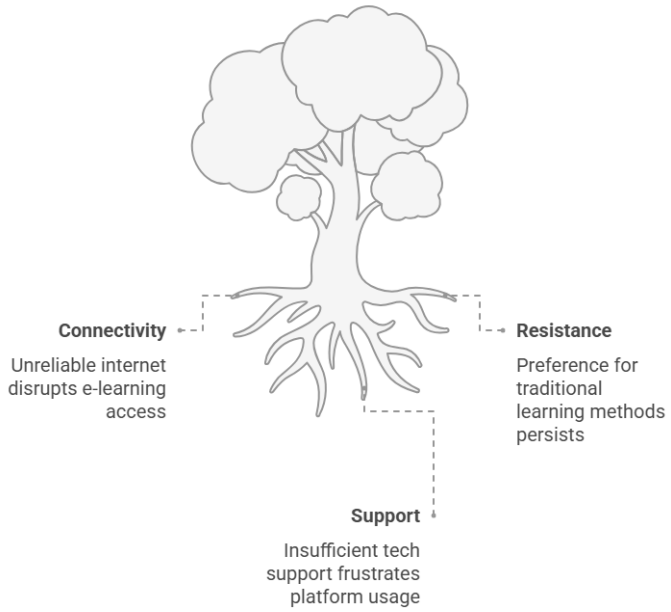
Showing Enablers of e-Learning Adoption



Source: Author's development.

Figure 2

Showing Hindrances of E-Learning Adoption



Source: Author's development.

Figures 1 and 2 show both enablers and hindrances of e-learning adoption in Nigerian institutions of learning.

Discussion

The descriptive statistics, reliability analysis, and regression analysis results help understand the desirable factors and obstacles to the adoption of e-learning among students, as well as their relationships in predicting adoption behaviours. The following results are addressed in the available literature below, along with their references to the relevant tables and literature sources.

The resulting descriptive statistics table (Table 1) presents the critical enablers and barriers to the adoption of e-learning, as reported by the students (N = 350). Of all the enablers, Access to the Internet (M = 3.92, SD = 0.87) and Availability of Learning Devices (M = 3.75, SD = 0.95) were scored as high enablers, indicating that strong digital infrastructure is an essential facilitator of e-learning in this environment. These results are consistent with Satvik and Naik (2024), who emphasise the importance of an online learning procedure in lower-income countries, facilitated by digital infrastructure. Nonetheless, the ICT Skills (M = 3.60, SD = 0.90) and the Institutional Support (M = 3.40, SD = 1.05) were seen as the moderate enablers, which aligns with Awais et al. (2024) and Joseph & Uzondu (2024) that the digital divide could not be overcome easily in the e-learning situation in Nigeria.

Among the barriers, poor network connectivity (M = 3.95, SD = 0.98) and the cost of Data (M = 3.88, SD = 0.92) were recorded as high barriers, indicating the factors of infrastructure that restrict the use of e-learning. Such results support Audrey et al. (2024), who claim that e-learning environments are significantly affected by infrastructure constraints. Lack of Motivation (M = 3.65, SD = 1.00) and Lack of Training (M = 3.50, SD = 1.02) were considered moderate barriers, meaning that although they are not critical, they pose some problems. According to Karoui (2025), the lack of training is also identified as a significant obstacle to e-learning in developing countries, such as Pakistan, which is a similar case to the one presented in this study.

The E-learning Adoption Score (M = 3.70, SD = 0.89) indicates moderate adoption results, as although the learning process is being invested in e-learning, the situation can be improved. This aligns with the findings by Davis (1989), which suggest that perceived ease of use and usefulness are the most essential criteria for technology adoption, as identified in this paper.

The reliability statistics table (Table 2) proves the interdependence of the measurement scales employed. Enablers of E-learning scale (4 items, Cronbach Alpha = 0.873) as well as Barriers to E learning scale (4 items, Cronbach Alpha = 0.859) are equally highly reliable. This indicates that they are robust measurement constructs. The reliability of the instrument is also attested with the Overall Questionnaire Scale (8 items, Cronbach's Alpha = 0.889). These values are above the acceptable level of reliability (Cronbach's Alpha of 0.7), which is affirmed by Venkatesh et al. (2003), and therefore, the scales are appropriate in measuring constructs under consideration.

The regression analysis (Tables 3 and 4) provides insights into the predictive relationships between enablers and barriers, as well as e-learning adoption. The model $R^2 = 0.48$ and Adjusted $R^2 = 0.47$ imply that the Enablers Composite Score and Barriers Composite Score explain 48% of the variance in the total score of learning Adoption ($F(2, 347) = 69.80$, $p < 0.001$). A significant positive coefficient of enablers ($B = 0.453$, $t = 6.969$, $p < 0.001$) indicates that the greater the perceptions of enablers, including access to the internet and availability of devices, the higher the adoption of e-learning. Alternatively, the high negative coefficient associated with barriers ($B = -0.312$, $t = -5.379$, $p < 0.001$) indicates that barriers, including the lack of a good connection network and the high price of data, lower the adoption rates.

These results are also similar to those of Eveline (2022), who concluded that e-learning adoption is greatly influenced by institutional support and the preparedness of students in Malaysian universities. Similarly, Oluyinka and Endozo (2019) emphasise the importance of both individual and institutional factors in influencing African university students' acceptance of e-learning, thereby confirming the positive impact of enablers. The adverse effects caused by barriers are consistent with Satvik and Naik (2024), who mention this phenomenon in the context of Pakistan, specifically the technical barriers to e-learning, which implies that infrastructure problems are widespread in developing settings.

The findings indicate that, although prerequisites to e-learning take the form of enablers (such as networked facilities and device availability), barriers (such as network connectivity and prohibitive data costs) are critical concerns that place downward pressure on the adoption of e-learning. The observed findings are particularly relevant in the context of developing countries, where limited infrastructural conditions are common (Al-Mushasha, 2013). The findings regarding the moderate ratings of ICT skills and institutional support suggest the need to implement specific interventions, including training and increased institutional support, as proposed by Linjawi and Alfadda (2018). The moderate change adoption score is also important to note, as it encompasses both imperatives to resolve and inhibitors to improve the uptake of e-learning, reinforcing the claim by Baker and Xu (2017) that adequate e-learning online could be achieved only after considering the barriers and drivers of change.

The results of the regression analysis also indicate the dual nature of enablers and barriers as the factors that determine the adoption of e-learning. To alleviate the barrier, policymakers and educators should focus on enhancing digital infrastructure and reducing the cost of data, while also deploying training and institutional support as enablers. These measures may be part of the institutional change scheme proposed by Ansong et al. (2016) to promote the implementation of e-learning.

Conclusions and Implications

In conclusion, the results indicate that the adoption of e-learning is at a moderate level, influenced by the high availability of strong enablers, such as internet connectivity and access to devices, and weak barriers, including poor network connectivity and high data pricing. These conclusions are well-founded on the solid measurement scales and strong regression model. Having previously identified barriers and addressed them further to strengthen enablers, institutions can increase the adoption level of e-learning, which also aligns with the general objectives of integrating educational technologies in higher education (Akinbode et al., 2024).

Suggestions for Future Research

The research work highlights the key issues that influence the adoption and diffusion of e-learning technology among undergraduate students in Nigeria. The study supports the assertion that greater institutional assistance and superior digital literacy education should be implemented, which entails increased investment in technology infrastructure to overcome the identified obstacles. The recommendations focus on the obstacles and capitalise on the enablers detected during the study to increase the implementation of e-learning. Institutions that can create a more conducive environment for e-learning by enhancing infrastructure, developing ICT skills, providing institutional support, addressing motivational issues, and implementing enablers and policy transformations will be able to make changes to the environment. These measures align with the existing literature on educational technology and are suitable for addressing the challenges encountered in the developing world, thereby facilitating the sustainable development of e-learning.

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