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Exploring the Financial Implications on University e-learning in Nigeria

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ABSTRACT

The emergence of e-learning in Nigerian universities has revolutionized higher education by enabling flexible, accessible learning and to suggest sound policy solutions to the problems the investigation found. However, implementing and sustaining e-learning systems come with significant financial implications for universities, students, and other stakeholders. This study explores the financial aspects associated with e-learning in Nigerian universities, focusing on infrastructure costs, internet access affordability, and funding challenges. The study used a descriptive research design and a quantitative methodology, data was collected from university administrators, faculty, and students to understand their financial experiences and perceptions. A questionnaire survey was distributed to university administrators, faculty, and students. Data were analyzed using descriptive statistics in order to understand the usage of e-learning and Persons correlation to understand the degree of the relationship between the study variables. The findings reveal that high initial costs for infrastructure, recurring expenses for internet services, and inadequate funding hinder the effective adoption of e-learning, there was a severe lack of power. Some academic staff members lacked adequate e-learning platform training, and students noted that e-learning eased communication between students and lecturers, whereas Internet subscription and acquisition of mobile devices were expensive. Recommendations include increased government investment, affordable internet policies, and partnerships with technology providers to ensure financial sustainability and inclusivity in e-learning initiatives.

Keywords: E-learning, Financial implications, Digitalization in universities, Information and communications technology and University education.

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Introduction

E-learning has become a transformative force in global education by providing learners with flexible access to instructional content beyond the physical classroom. In Nigeria, the adoption of e-learning in universities gained significant momentum during the COVID-19

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pandemic, which compelled institutions to adopt alternative modes of teaching and learning.

Notwithstanding its immense potential, the effective implementation of e-learning continues to be constrained by financial limitations affecting institutions, students, and academic staff. Globally, educational institutions increasingly deploy diverse digital media, including interactive technologies, television, radio, and online platforms, to deliver learning content (Eton & Chance, 2022). However, although many Nigerian universities have introduced e-learning platforms, traditional face-to-face teaching methods still dominate instructional delivery.

Efforts to expand access to higher education have driven a gradual shift toward e-learning systems, although early perceptions framed e-learning as an elite and cost-intensive practice. In the contemporary digital era, progressive educational policies, increased access to digital services, widespread mobile internet connectivity, and improved digital literacy have become essential drivers of educational advancement (Trucco & Palma, 2020). Despite these developments, significant inequalities remain in the availability and affordability of digital infrastructure and learning resources, limiting the ability of many students to fully benefit from digital education platforms (ECLAC, 2019).

Furthermore, the utilization of e-learning platforms in many Nigerian universities remains suboptimal, as some students demonstrate reluctance toward digital learning due to challenges such as poor internet connectivity, high data costs, and limited technical skills (Al-Khasawneh & Obeidallah, 2019). To ease the financial burden associated with online access, internet service providers have introduced zero-rated educational platforms and subsidized data packages for students and academic institutions. These initiatives have helped reduce access barriers, improve student participation, and enhance the overall reach and effectiveness of university education (Joosub, 2020).

This study sought to evaluate the challenges encountered by university students in the utilization of e-learning methodologies, examine the financial implications associated with e-learning adoption, and analyze the relationship between the use of e-learning techniques and their cost burden on students. Prior to and during the early stages of the COVID-19 pandemic, e-learning remained largely underexplored by many universities in Nigeria. However, the pandemic significantly accelerated the adoption of digital learning approaches, often without adequate consideration of the associated financial costs to students.

The findings of this study are expected to provide valuable insights for university administrators and policymakers in formulating effective strategies and regulatory frameworks to strengthen e-learning implementation. By addressing both the operational challenges and financial constraints, stakeholders can enhance access, affordability, and sustainability, thereby positioning e-learning as a practical and inclusive educational model for a wider segment of university students.

Statement of Problem

The integration of e-learning into higher education has transformed instructional delivery globally by enhancing flexibility, expanding access, and supporting continuity of learning beyond the traditional classroom environment. In Nigeria, the adoption of e-learning gained significant momentum following the COVID-19 pandemic, which compelled universities to adopt digital platforms as an emergency response to disruptions in conventional academic activities. Although this shift marked a critical milestone in educational digitalization, the financial implications of implementing and sustaining e-learning systems remain a major concern for universities, students, and academic staff.

Despite the perceived cost-effectiveness of e-learning, Nigerian universities continue to face serious financial and infrastructural challenges, including limited funding, inadequate digital infrastructure, high costs of software licensing, procurement of digital devices, and unreliable internet connectivity. These challenges are further compounded by the rising cost of data subscriptions and electricity, which impose additional financial pressure on both institutions and learners. Consequently, many students—particularly those from low-income households—struggle to actively participate in online learning, thereby deepening educational inequalities.

Furthermore, while e-learning is often promoted as a sustainable alternative to traditional classroom instruction, its deployment is associated with substantial hidden costs such as staff training, technical support, platform maintenance, and cyber security systems. These financial obligations are frequently overlooked in institutional planning, resulting in poorly implemented platforms, low adoption rates, and compromised quality of learning delivery. As a result, the effectiveness, accessibility, and long-term sustainability of e-learning programmes in Nigerian universities remain questionable.

Although several studies have examined the adoption and effectiveness of e-learning in Nigerian higher institutions, limited attention has been given to the financial burden associated with its implementation from the perspectives of both students and institutions. The

lack of comprehensive empirical evidence on the cost implications of e-learning limits the ability of policymakers and university administrators to design appropriate funding models, formulate supportive policies, and implement cost-effective digital learning strategies.

Against this backdrop, this study seeks to investigate the financial implications of e-learning adoption in Nigerian universities, examine the challenges students face in utilizing e-learning platforms, and assess how these financial constraints influence access, participation, and the sustainability of digital learning. Addressing these issues is critical to ensuring that e-learning evolves into an inclusive, affordable, and effective model of higher education in Nigeria.

Research Questions

1. What are the financial requirements for e-learning implementation in Nigerian universities?
2. How do financial factors affect the accessibility and effectiveness of e-learning for students?
3. What strategies can be adopted to mitigate financial challenges associated with e-learning?

Research Objectives

1. To examine the financial requirements for implementing e-learning systems in Nigerian universities.
2. To assess the cost burden of e-learning on students and faculty.
3. To propose strategies for reducing financial barriers and ensuring sustainable e-learning adoption.

Significance of the Study

This study is significant to several stakeholders including students, university administrators, policymakers, researchers, and digital service providers due to its focus on the financial implications of e-learning adoption in Nigerian universities.

For students, the findings will provide insight into the financial challenges associated with participating in e-learning, such as the cost of internet data, digital devices, and other related expenses. This knowledge will help students make more informed decisions regarding online learning and advocate for affordable digital education solutions.

For university administrators and management, the study will serve as a valuable guide for understanding the cost structure of e-learning systems, including infrastructure, software licensing, maintenance, training, and cybersecurity. The findings will support evidence-based planning, budgeting, and the formulation of sustainable digital learning strategies that improve efficiency while minimizing unnecessary financial burdens.

For government agencies and policymakers, particularly the Federal Ministry of Education, National Universities Commission (NUC), and other regulatory bodies, the study will provide empirical evidence to support the development of policies and funding frameworks aimed at promoting affordable, accessible, and sustainable e-learning in Nigerian universities. It may also inform decisions on public-private partnerships and targeted interventions to bridge the digital divide.

For telecommunication companies and digital service providers, the outcomes of the study will highlight the data and connectivity needs of university communities, guiding the design of subsidized education data plans, zero-rated learning platforms, and improved network infrastructure that can enhance students' access to online learning.

Finally, for scholars and future researchers, this study will contribute to the growing body of literature on digital education and e-learning finance in developing economies. It will also serve as a reference point for future empirical studies on digital learning adoption, cost-benefit analysis, and educational sustainability.

Literature Review

Conceptual review

Overview of E-Learning in Higher Education

E-learning, also referred to as electronic learning, involves the delivery of educational content and instruction through digital technologies such as the internet, learning management systems, software applications, and multimedia tools. It represents a major shift from conventional face-to-face instruction to technology-enabled learning environments. E-learning may take place through synchronous platforms, which involve real-time interaction between learners and instructors, or asynchronous platforms, which allow self-paced learning at the convenience of the user. This flexibility makes e-learning particularly suitable for expanding educational access in resource-constrained settings such as Nigeria (Singh & Thurman, 2019; Nafiu, Orugun & Enimola, 2023).

Globally, e-learning has become a central feature of modern educational systems, significantly redefining how education is delivered and accessed. Governments and educational institutions across the world increasingly leverage emerging digital technologies to enhance learning outcomes and promote inclusive education. In Nigeria, several national initiatives have been introduced to integrate e-learning across all levels of education, with emphasis on capacity building for educators, digital content development, and institutional readiness. These initiatives aim to strengthen the adoption and effective use of digital learning platforms in higher education institutions.

In the European Union (EU), e-learning has witnessed substantial growth and now plays a strategic role in promoting transnational collaboration among higher education institutions (Hodgson, 2002; Uyar, 2023). A core policy objective within the EU is the establishment of best practices in education, training, and distance learning, enabling citizens to actively engage in the global knowledge economy (Zenios & Steeples, 2003). The Commission of the European Communities (2000) further recognizes e-learning as a fundamental driver of sustainable development, innovation, social inclusion, and economic competitiveness in the digital age.

Looking ahead, e-learning is expected to remain a cornerstone of higher education due to its adaptability and capacity to support lifelong learning. Its continued relevance lies in its ability to provide flexible, inclusive, and demand-driven educational opportunities in an increasingly digital world. To fully harness its potential, universities must invest in robust digital infrastructure, institutional policy frameworks, and continuous capacity building for staff and students. Addressing challenges related to funding, digital inequality, and technological readiness is essential to achieving sustainable and effective e-learning systems in higher education (Falola et al., 2022; Mbaidin, 2024).

Financial Challenges in E-Learning

The successful implementation of e-learning in higher education depends largely on the availability of adequate financial resources. In Nigeria, universities, students, and policymakers face significant financial constraints that continue to limit the effectiveness, accessibility, and sustainability of digital learning systems. These challenges manifest primarily in the form of high institutional costs, substantial financial burdens on students, and persistent funding gaps.

1. ***Institutional Costs***

Universities incur considerable expenses in the acquisition, installation, and maintenance of e-learning platforms, digital tools, and information technology infrastructure. These institutional costs include investments in learning management systems, servers, broadband infrastructure, cybersecurity frameworks, software licensing, staff training, and continuous technical support. Beyond initial setup costs, institutions must also bear recurrent expenditures related to platform upgrades, maintenance, electricity, and data storage. Although these financial commitments represent strategic investments in the future of education, their magnitude often exceeds the financial capacity of many Nigerian universities. Without proper financial planning and sustained funding, these institutional costs can undermine the quality, scalability, and long-term sustainability of e-learning initiatives.

2. ***Student Costs***

Students also face significant financial challenges in accessing e-learning platforms. The high cost of internet connectivity, regular data subscriptions, and the acquisition of suitable digital devices such as smartphones, tablets, and laptops constitutes a major barrier to participation in online learning. These costs are particularly burdensome for students from low-income households, thereby deepening existing inequalities in access to higher education. Beyond direct expenditures, students also encounter indirect costs such as unreliable power supply, limited digital skills, and psychological stress associated with adapting to online learning environments. While e-learning offers flexibility and expanded access, these associated costs can substantially limit students' ability to benefit fully from digital learning opportunities. Hence, targeted financial interventions are essential to promote inclusiveness and equity in e-learning participation.

3. ***Funding Gaps***

Funding gaps represent one of the most critical obstacles to the successful deployment of e-learning in Nigerian universities. These gaps arise when government allocations and internally generated revenues are insufficient to support the development, implementation, and continuous improvement of digital learning systems. Inadequate funding often leads to poor infrastructure, outdated platforms, limited technical support, and inconsistent service delivery. Furthermore, funding shortfalls restrict institutions' ability to subsidize student access to data services, digital devices, and training programmes. As a result, funding gaps perpetuate disparities in access to quality digital education and hinder the transformative potential of e-learning. Addressing these gaps requires a coordinated, multi-stakeholder

approach involving government agencies, educational institutions, private sector partners, telecommunication companies, and international development organizations (Okafor, 2023; Tonukari & Anyigba, 2023).

Opportunities in Financial Investment for E-Learning

Investment in e-learning presents significant opportunities for long-term cost efficiency, improved scalability, and enhanced student engagement. Unlike conventional classroom-based systems that require continuous physical expansion, e-learning platforms allow institutions to reach a larger population of learners with relatively lower marginal costs. This makes digital education an attractive and sustainable area for financial investment.

The rapid advancement of digital technologies and the growing global acceptance of online education have further expanded the investment landscape in e-learning. Opportunities exist across multiple segments of the e-learning ecosystem, including digital infrastructure development, learning management systems, mobile learning applications, cloud-based platforms, digital content development, and technical support services (Idika, Obiagu & Ibe, 2024). These areas continue to attract both public and private capital due to their strong growth potential and expanding user base.

Collaborative funding models involving governments, universities, telecommunication firms, and technology companies offer viable pathways for easing financial constraints associated with e-learning implementation. Through public–private partnerships, institutions can access modern digital infrastructure, subsidized data services, and advanced platforms at reduced costs. Such collaborations not only improve financial sustainability but also enhance the quality and reliability of digital learning environments.

Moreover, financial investments in e-learning offer strong prospects for attractive returns in a rapidly expanding digital education market. Beyond profitability, these investments contribute to social development by widening access to education, reducing geographical barriers, and promoting digital inclusion. Strategic investment in e-learning therefore represents a dual opportunity: generating economic value while simultaneously supporting educational transformation and human capital development (Omotayo & Haliru, 2020).

E-Learning Methodologies

Increasing attention has been directed toward the role of digitalization in university education, with stakeholders emphasizing the need for professionals and educators to effectively integrate information and communication technology (ICT) into teaching and service delivery

while addressing emerging technological challenges across disciplines (Bond et al., 2018). The systematic application of digital technology to teaching and learning processes is commonly described as the digitalization of e-learning within higher education institutions (Kopp et al., 2019).

Contemporary students exhibit a heightened dependence on digital technologies, with younger generations displaying significantly greater ICT proficiency than earlier cohorts who had limited exposure to digital tools and often struggled to adapt (Anthony et al., 2022). E-learning, as defined by Singh and Thurman (2019) and Afolabi and Shaw (2024), refers to synchronous and asynchronous learning experiences delivered through internet-enabled devices such as computers, tablets, and smartphones. These platforms enable students to participate in real-time virtual lectures, engage in interactive discussions, and receive immediate feedback from instructors.

In recent years, universities have recorded a gradual decline in physical classroom attendance, particularly among working adults who prefer e-learning due to its convenience and flexibility (Seaman et al., 2018). While students largely value e-learning for its accessibility, flexibility, and technological appeal, disparities persist in access, especially among rural learners who often face challenges related to inadequate broadband connectivity (Muthuprasad et al., 2021).

According to Turnbull et al. (2021), the adoption of e-learning offers numerous advantages, including improved quality of information delivery, greater flexibility in learning schedules, enhanced digital literacy, and better learning outcomes. To remain competitive in an era of rapid ICT advancement, both learners and instructors must be continuously motivated to acquire and adapt new digital competencies (Omotayo & Haliru, 2020). Furthermore, e-learning challenges the misconception that online learners require less academic support, as it actively promotes learner autonomy, self-reliance, and confidence in problem-solving and task completion (Beneyene et al., 2020).

Advancements in ICT have also expanded opportunities for teaching and research within universities, as access to vast digital information resources has become faster and more efficient (Agostini & Nosella, 2020). Consequently, e-learning methodologies continue to redefine knowledge delivery, learner engagement, and academic productivity in higher education institutions.

Financial Implications of E-Learning Methodologies

The transition from traditional face-to-face instruction to modern e-learning systems imposes significant financial demands on universities, students, and governments. Universities must invest heavily to adapt knowledge delivery to digital formats, develop human capital, create learning materials, and establish robust technological infrastructure (Darling-Hammond et al., 2020; Affouneh et al., 2020). Designing user-friendly e-learning platforms that are both navigable and sustainable further adds to these costs (Alshurafat et al., 2021).

For students, e-learning often entails substantial expenses, including purchasing internet-enabled devices, covering high data costs, and paying tuition fees, which may be higher than traditional in-person programs (Griffin & McGuire, 2017; Nwokike, Abasili, & Ezeneme, 2024). These financial demands disproportionately affect students from low-income backgrounds, potentially exacerbating educational inequalities and limiting access to digital learning opportunities.

Budgetary constraints at the government level further compound these challenges. In several countries, education budgets have been reduced in response to the rising costs of establishing e-learning infrastructure (Walson, 2024). Such cuts have affected instructor salaries, classroom equipment procurement, and overall service delivery, contributing to slightly lower e-learning adoption and university enrollment rates (Jackson et al., 2018; Al-Samarrai et al., 2019; Egielewa et al., 2022). The economic recession of 2020 also influenced household spending on education, affecting students' ability to access necessary e-learning tools such as computers and smartphones (World Bank, 2020).

The reduction in government funding for higher education has slowed service delivery and economic recovery, further complicating efforts to implement and sustain e-learning programs (World Bank, 2018; Falola et al., 2022). Low enrollment and tuition fee collection challenges limit universities' capacity to finance the development of effective e-learning initiatives.

Despite these financial constraints, e-learning presents significant opportunities for improving educational access and reducing disparities. Its flexibility and effectiveness make it a critical tool for democratizing higher education (Maphalala & Adigun, 2021). Scholars have emphasized that targeted funding for e-learning, such as subsidies for devices and data plans, could reduce dropout rates and enhance student engagement, thereby supporting equitable and sustainable access to digital education (Shomoye et al., 2023).

Challenges Faced by University Students in Using E-Learning Methodologies

University students face numerous challenges when engaging with e-learning methodologies, particularly in contexts with limited infrastructure. High-bandwidth connectivity remains a significant barrier, especially in rural areas, affecting the effectiveness and reliability of online learning (Nyemike Simeon et al., 2022). Although mobile internet has expanded access to digital education, excessive reliance on smartphones raises concerns about potential health issues and may limit engagement with more comprehensive learning platforms.

Other institutional challenges include under-equipped computer laboratories, limited opportunities for online engagement, inadequate IT skills among both students and faculty, and insufficient licensing for pre-existing e-learning platforms and teaching materials (Salaam, Shaibu & Okoh, 2024). These limitations impede the ability of students to fully benefit from the flexibility and advantages of e-learning. Poor internet connectivity and weak Wi-Fi infrastructure further exacerbate these issues, often leading to missed learning opportunities when access to online services is unavailable (Dhawan, 2020).

E-learning's flexibility, while beneficial, can reduce face-to-face interactions, weakening the student-instructor relationship and impacting collaborative learning (Joshi et al., 2020). Additionally, the readiness of both lecturers and students to effectively utilize e-learning management systems remains low, as the approach is still relatively new in many educational contexts (Adeniyi et al., 2024). Academic staff have often been underprepared to navigate e-learning platforms effectively, hindering teaching quality despite institutional efforts to integrate ICT and provide equitable learning opportunities (Ugwu, 2024).

The transition from traditional classroom-based learning to digital platforms requires students, educators, and administrators to adapt to new pedagogical and technological frameworks (Ribeiro, 2020). Students may encounter difficulties accessing course materials, understanding content modules, and completing online assessments (Bovill, 2020). Research in Pakistan and Uganda has highlighted factors such as system usability, internet experience, computer self-efficacy, poor infrastructure, and inconsistent power supply as critical determinants of e-learning effectiveness (Hu & Raman, 2024; Bwire et al., 2020).

Quality control, content creation, and delivery also present persistent challenges. Certain disciplines, particularly those requiring hands-on training, such as medicine and engineering, face additional hurdles in fully implementing e-learning (Sucuoğlu & Andrew, 2022; Leszczynski et al., 2018). External students, in particular, struggle with collaborative learning tasks, group assessments, and other interactive activities that are integral to traditional classroom environments (Balogun et al., 2023).

Overall, while e-learning offers substantial opportunities for flexible and accessible education, addressing these infrastructural, technological, pedagogical, and behavioral challenges is essential to optimize its effectiveness and ensure equitable participation among all students.

Strategies to Improve E-Learning in Higher Institutions of Learning

E-learning has the potential to complement traditional face-to-face teaching, offering flexibility and expanded access to education. However, it cannot fully replace conventional in-person instruction, which remains the most widely accepted and effective teaching method (Barboni, 2019). To achieve parity with traditional learning, the quality and effectiveness of e-learning must be enhanced, ensuring its credibility and seamless integration with other instructional approaches (Palvia et al., 2018).

Universities should prioritize significant investments in e-learning infrastructure, content development, staff training, and the cultivation of a positive mindset among both students and faculty (Akpan et al., 2024). Raising awareness about the benefits of e-learning is crucial, as students and instructors must recognize its value to maximize engagement and learning outcomes (Al-Rahmi et al., 2019; Alshurafat et al., 2021). Course structures should be carefully designed to align with e-learning methodologies, facilitating smoother transitions, greater engagement, and enhanced satisfaction among learners.

Improving the quality of e-learning requires a focus on course content, instructional design, social support systems, and technological advancements (Alumalai et al., 2020). University administrations play a key role in equipping students with next-generation digital competencies, while the willingness of students to engage actively with ICT systems is critical to the success of e-learning initiatives (Almaiah & Alismaiel, 2019). Underutilization of e-learning platforms can significantly limit their benefits, highlighting the need for proactive strategies to encourage consistent engagement (Almaiah & Al-Khasawneh, 2020).

Sustainability in e-learning can be achieved by introducing hybrid instructional materials, addressing underlying challenges that prompted the adoption of digital learning, and implementing contingency plans for potential disruptions (Adedoyin & Soykan, 2020; Bao, 2020). Effective strategies should ensure the reliable delivery of instructional content, provide adequate support for both lecturers and students, and foster high-quality participation to enhance the depth and breadth of students' learning experiences.

Collaboration among stakeholders is essential for the successful implementation of e-learning. Universities must organize knowledge systematically, build trust, and engage in strategic

planning to ensure effective digital teaching and learning (Cameron & Green, 2019). ICT administrators should develop platforms that facilitate feedback from all stakeholders and provide administrative and technical support for students (Raju & Phung, 2018). Key factors, including knowledge sharing, trust, innovation, and quality, are critical for fostering student acceptance of e-learning and creating an effective learning environment (Salloum et al., 2019).

Technological factors such as speed, accessibility, usability, service delivery, and training support, alongside environmental considerations, significantly influence e-learning adoption and effectiveness (Eze et al., 2020). Students' engagement with e-learning resources is also shaped by their attitudes, skill development concerns, learning experiences, and motivation. To optimize outcomes, universities must continually update technologies, invest in staff development, and ensure educators remain proficient in current digital tools and pedagogical approaches (Eze et al., 2018; Abdullateef, 2022).

In conclusion, strategic investments in infrastructure, content, human capital, and technology, coupled with stakeholder collaboration and continuous monitoring, are fundamental to enhancing e-learning effectiveness and sustainability in higher education institutions.

Methodology

This study adopted a descriptive research design to examine the adoption and utilization of e-learning in Nigeria, using the country as a case study of a developing nation. A quantitative research approach was employed to capture the diverse experiences of students across various universities.

The study population comprised 40,000 university students, from which a sample size of 440 respondents was determined using the Krejcie and Morgan (1970) sampling table. Data were collected using a structured questionnaire developed from insights gleaned from the literature review. The questionnaire assessed two key constructs: the financial implications of e-learning, measured as the perceived cost of acquiring and utilizing digital technologies, and e-learning usage, measured by the ability to effectively apply digital tools in learning activities.

To ensure data quality, the study emphasized both validity and reliability. The reliability of the questionnaire was evaluated using Cronbach's alpha, yielding a coefficient of 0.877 across 45 items. This result indicates high internal consistency, demonstrating that the instrument reliably captured data on e-learning usage and its financial implications. Items assessing e-learning adoption and financial impacts exhibited particularly strong internal stability, while

items relating to challenges faced during e-learning showed slightly lower, yet acceptable, reliability. The clarity, precision, and comprehensibility of the questionnaire items contributed significantly to their effectiveness in capturing relevant data.

Data analysis involved descriptive statistics to summarize respondent characteristics and experiences, as well as Pearson's correlation analysis to examine the relationship between e-learning adoption and its associated financial implications. Reliability statistics for the study instruments are presented in Table 1.

Findings and Discussion

The demographic analysis of participants reveals notable trends in gender, age, ICT experience, and educational background. Males constituted the majority of respondents (60.2%), while females represented 39.8%, reflecting persistent gender disparities in Nigerian university enrollment. Age distribution indicated that most participants were under 20 years old (47.6%), followed by 42.5% aged 20–24 years. Regarding ICT proficiency, only 17.7% of students reported very strong ICT skills, whereas the largest group (36.4%) described their skills as moderate, suggesting varying levels of digital readiness among students. Educationally, the majority of respondents were bachelor's degree students (58.8%), with Ph.D. candidates accounting for 13.6% and diploma students for 6.1%.

In terms of accessing e-learning materials, 48.3% of students primarily used laptops, while 41.2% relied on mobile devices, underscoring the growing importance of mobile technology in higher education. Internet connectivity emerged as a significant challenge, with 49.9% reporting very slow connectivity and only 13.3% enjoying good internet access. Assignment submission methods revealed limited adoption of learning management systems (LMS), as 51% of students used email, 29.9% relied on LMS platforms, and 19% accessed assignments via university websites. These findings indicate that professors and institutions have yet to fully integrate e-learning management systems into routine academic processes.

The study further assessed students' ability to effectively use digital technology, reflecting the extent of e-learning adoption. Findings summarized in Table 2 indicate that 74.8% of participants recognized the practicality and benefits of e-learning systems, highlighting universities' efforts to promote digital learning. E-learning facilitated improved communication between students and lecturers and provided flexibility for self-paced learning. Despite this, only 22.1% of students reported having the necessary hardware to fully implement e-learning programs, with high costs and procurement difficulties cited as primary barriers.

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To examine the financial implications of e-learning, the study introduced the concept of the "perceived cost of acquiring digital technology." Analysis using statistical measures such as the coefficient of variation (CV), standard deviation (SD), and mean (Table 3) revealed substantial variability in students' financial capacity to engage with e-learning platforms. These findings emphasize that while e-learning adoption is growing, financial constraints—particularly the affordability of devices and internet access—remain critical challenges limiting equitable participation in digital education.

Overall, the findings suggest that e-learning adoption in Nigerian universities is progressing but remains hindered by infrastructural limitations, uneven digital skills, and financial barriers. Addressing these challenges is essential for maximizing the benefits of e-learning and ensuring its sustainability as a complementary educational approach.

Table 1. Reliability statistics

Variable	Cronbach's alpha	N of items
E-learning usage	0.842	17
Financial implication	0.871	14
Challenges of e-learning adoption	0.702	14
Overall	0.877	45

Source: Field data, 2024

Table 2. E-learning techniques

Variables list;N=332	D NS	A
1.E-learning is very practical	17.1	9.1 81.4
2. I easily communicate with my lecturers during e-learning sessions	24.2	6.1 8.01
3. With e-learning, I have the flexibility to learn at any time that suits me.	21. 8	8.8 8.01
4. Web-based learning materials are easily accessible.	19.7	11.3 70.5
5. I possess the necessary software to operate e-learning programs.	20.7	10.9 70.8
6. With e-learning, I can study from any location of my choice.	18.0	13.5 70.8
7. I find it convenient to interact with other students during e-learning sessions.	22.1	10.9 70.6
8. I find it straightforward to engage with lecturers during e-learning sessions.	18.9	14.9 70.9
9. My device operates at the necessary speed to support e-learning programs.	26.4	9.1 71.1
10. I can easily access the digital content required to meet my learning needs.	20.7	14.7 71.1
11. Participating in an e-learning session is easy for me.		

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26.8	13.9	71.6	
12. Web-based learning materials are user-friendly and easy to navigate			
27.0	14.3	69.2	
13. I possess the necessary hardware to operate e-learning programs			
72.8	6.2	22.7	
Average			
25.9	11.2	64.9	
Note(s)= D disagreement; NS= not sure; A= agreement			

Table 3. Financial implication

Variables list;N=332	Mean	set deviation	CV(%)
1.Computer software	4.212	0.881	21
2.Computer equipment	4.073	0.978	24
3.Internet subscriptions	3.917	0.981	26
4.Mobile devices	3.911	1.021	27
5.Acess to digital materials	3.909	1.017	28
6.Staff training	3.909	0.991	26
7.Internet accessories	3.823	0.993	27
8.Installation of software	3.821	1.090	29
9.Computer laboratory equipment	3.820	1.181	31
10.Online data security	3.732	1.193	33
11.Computer training	3.688	1.096	30
12.E-library resources	3.531	1.317	36
Average	3.800	1.011	27

Source(s): Field data, 2024

The findings presented in the table highlight the costs associated with e-learning resources among university students. Computer software emerged as the most expensive resource, with a mean score of 4.212 and a coefficient of variation (CV) of 21%, followed closely by computer equipment, which had a mean score of 4.073 and a CV of 24%. These results indicate that software and hardware represent the highest financial burden for students engaging in e-learning. Internet connectivity and mobile device purchases were also perceived as costly, largely due to importation costs and associated taxes.

In contrast, e-library resources were identified as the least expensive component of e-learning, with a mean score of 3.531 and a CV of 36%. The lower cost can be attributed to universities providing institutional access to digital libraries, allowing students to access a wide range of materials without incurring additional fees, provided they had valid login credentials. The coefficients of variation further underscore that computer software imposes the greatest financial burden, whereas e-library resources remain the most cost-effective.

The analysis also examined challenges encountered by students in utilizing e-learning systems, summarized in Table 4. Accessing e-learning resources was rated as the most challenging aspect, with a mean score of 3.953 and a CV of 27%. Difficulties were primarily linked to poor internet connectivity, high data costs, and limited electricity supply. Additionally, lecturers were often underprepared for online instruction, further compounded by inadequate resources at e-learning centers and insufficient support from institutional e-learning staff.

Conversely, the process of adopting e-learning itself was perceived as relatively manageable, with a mean score of 2.110 and a CV of 17%, suggesting that institutional support, including the provision of necessary infrastructure and software, mitigated adoption difficulties. While mean scores indicated that access to e-learning resources posed the greatest challenge, the coefficient of variation analysis revealed that the financial cost of materials—particularly internet bundles—remained the most significant barrier for students.

Table 4. Challenges of adopting e-learning

Variables list;N=332	Mean	deviation	CV(%)	set
1.Difficulty accessing e-learning material s	3.953	0.998	27	
2.Unprepareedness of lecturers	3.932	1.095	29	
3.Limited Power supply	3.922	0.992	26	
4.Insrfficnt interaction online	3.954	1.181	32	
5.Lack of practicality in learning	3.782	1.0.62	29	
6.Inadquate information and technology skills	3.761	1.131	30	
7.Poorly equipped computer laboratories	3.731	1.137	33	
8.Bandwidth connectivity	3.721	1.123	33	
9.Infrastructure	3.719	1.118	35	

10.5281/zenodo.17824743

10.Internet connectivity	1.125	38		3.727
11.Addition to smartphones	1.137	41		3.734
12.Inadequate digital tools	1.141	42		3.712
13. Cost of adopting e-learning	0.421	17		2.110
Average	1.012	30		3.631

Source(s): Field data, 2024

The purpose of the study was to examine the relationship between the financial implications of e-learning and its usage among university students. The results are summarized in Table 5.

Dependent Variable: Financial Implication

Table 5. Regression coefficients

	Understand			
	Coefficients			Standardized coefficient
	B	Std. error		Beta
	T	sig.		
(Constant)	1.891	0.174		
	11.974	0.000		
Adoption of e-learning	0.733	0.066		0.783
	12.942	0.000		
R	0.732			
R2	0.431			
Adjusted R2	0.432			
Std. The error in the estimate	0.531			
Note(s): (Constant), Adoption of e-learning				

The findings indicate a strong positive correlation between the financial implications of e-learning and its usage among university students, with a correlation coefficient of r=0.732r = 0.732r=0.732 and a p-value less than 0.05. This suggests that as the financial burden associated with e-learning increases, students are more likely to engage with its tools and platforms. The statistically significant p-value confirms the presence of a linear relationship between e-learning usage and its financial impact.

Further analysis reveals that approximately 43.1% of the variation in the financial impact experienced by students can be explained by their engagement with e-learning (R2=0.431R^2 = 0.431R2=0.431), indicating that additional factors also influence students' ability to manage tuition and related costs in Nigerian universities. The beta coefficient (β=0.783\beta =

0.783β=0.783) demonstrates that a one-unit increase in the adoption of e-learning methods is associated with an estimated 78.3% increase in the financial impact for students, assuming the variables are measured in comparable units. These results highlight the significant influence of financial considerations on e-learning adoption, underscoring the need for strategies to mitigate cost barriers and enhance accessibility for students.

Discussion of Results

This study examined university students' use of e-learning methodologies and revealed that the majority perceived these methods as highly practical. E-learning relies extensively on information and communication technology (ICT) tools for accessing, participating in, and managing learning sessions, highlighting its utility in modern education. However, students lacking essential ICT skills faced notable challenges, potentially impeding their engagement with e-learning platforms. These findings corroborate Orlando and Attard (2015), who reported that increasing digitalization has produced a new generation of learners proficient in ICT, in contrast to earlier cohorts who struggled to adapt to emerging digital tools.

Despite the clear advantages for students, gaps in ICT proficiency among academic staff were evident. Several faculty members lacked the requisite skills to implement e-learning effectively, supporting Rucker and Downey (2016), who highlighted that limited ICT competencies among instructors hindered the successful integration of digital learning methods. These findings underscore the importance of targeted training and capacity-building programs for university staff to enhance the effectiveness of e-learning initiatives.

E-learning was also found to facilitate improved communication between students and instructors, enabling flexible, convenient learning. Its accessibility through basic devices such as smartphones further simplified student engagement, aligning with Singh and Thurman (2019), who noted that smartphones alone can suffice for participating in online learning. Through these platforms, students could attend real-time lectures, interact directly with instructors, and receive immediate feedback, thereby enhancing the overall learning experience.

The study further revealed that computer software and hardware constitute the most significant financial burden for students adopting e-learning. These findings are consistent with Affouneh et al. (2020), who emphasize the substantial investment required to acquire and maintain the technological infrastructure necessary for effective e-learning. Similarly, the OECD (2013) reported rising costs associated with establishing e-learning systems. Financial constraints, particularly for low-income students, exacerbate access issues. Snilstveit et al.

(2015) suggest that providing grants to educational institutions can alleviate the cost burden of e-learning tools, thereby reducing dropout rates.

Access to e-learning materials emerged as the most significant challenge for students, primarily due to poor internet connectivity and high costs. This is consistent with ECLAC (2019), which emphasizes that, despite expanded mobile connectivity, significant access barriers persist. Bovill (2020) further notes that students often struggle to access platform materials and comprehend online module content, complicating the learning process.

While some countries have successfully reduced internet subscription costs and introduced student-specific data packages (Joosub, 2020), many students in developing contexts still face high connectivity expenses. The financial implications of e-learning extend beyond tuition to include the cost of personal devices, internet access, and stable power supply, disproportionately affecting students from underprivileged backgrounds. Almaiah et al. (2020) and Griffin and McGuire (2017) highlight that tuition differences between face-to-face and e-learning courses, coupled with the additional expenses of devices and connectivity, create significant barriers to equitable access. Consequently, some students must travel to areas with better infrastructure, incurring further financial strain. These findings underscore the critical need for universities and policymakers to implement strategies that reduce cost barriers, improve digital infrastructure, and provide support to ensure that e-learning is both accessible and sustainable for all students.

Conclusion and Recommendations

The findings of this study highlight the pressing need to address the financial barriers hindering the effective adoption of e-learning in Nigerian universities. While significant investments have been made in digital infrastructure, inadequate funding and limited affordability restrict the full potential of e-learning systems. Strategic interventions, including public-private partnerships and targeted financial aid programs, can help mitigate these challenges and promote broader accessibility.

E-learning holds significant promise for expanding educational opportunities in Nigeria. However, financial constraints faced by universities, students, and faculty continue to undermine its effectiveness. A multi-stakeholder approach is required to ensure that e-learning becomes both accessible and sustainable. The rapid digitalization of education has attracted students with strong ICT skills, yet the assumption that all users are proficient in e-learning is flawed. This study reveals that some academic staff lack the necessary digital competencies, limiting their ability to engage students effectively and slowing the overall adoption of online

learning. While this does not directly affect financial costs, it reinforces reliance on traditional in-person teaching methods.

Financial challenges are particularly acute for students. The high cost of computer hardware and software often forces low-income students to rely on smartphones as their primary access device. The need for affordable, fast, and reliable internet connectivity further exacerbates these challenges, limiting equitable participation in e-learning. These findings raise critical questions about the future of digital education and equitable access to learning in Nigeria. Urgent reforms are required to provide students with the necessary resources to fully engage with e-learning systems.

Based on the study, the following recommendations are proposed:

1. Government Interventions: Increase budget allocations for e-learning infrastructure and maintenance, and collaborate with internet service providers to subsidize connectivity costs for students and faculty.

2. University Strategies: Develop partnerships with technology firms to lower costs of hardware, software, and training. Implement cost-sharing models to reduce the financial burden on individual students.

3. Support for Students and Faculty: Provide financial aid, grants, or loan programs for students to acquire digital devices and internet services. Offer incentives and training programs for faculty to enhance their digital competencies and participation in e-learning.

4. Innovative Solutions: Expand the use of low-cost, mobile-friendly e-learning platforms and develop open educational resources (OERs) to minimize content acquisition expenses and improve accessibility.

By implementing these measures, stakeholders can ensure that e-learning becomes a viable, inclusive, and sustainable mode of education in Nigerian universities, fostering equitable access and enhanced learning outcomes.

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