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Evaluating the Long-Term Impacts of E-Learning Adoption at Bayero University, Kano: A Post-Pandemic Perspective

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***Abstract*—The rapid shift to e-learning during the COVID-19 pandemic forced institutions across Nigeria to adopt digital education platforms with little preparation. Bayero University, Kano (BUK), responded by deploying a range of e-learning tools to sustain academic continuity. This study examines the long-term impacts of this adoption, focusing on student outcomes, instructor engagement, infrastructural evolution, and policy reforms post-pandemic. Employing a mixed-methods approach comprising surveys, interviews, and platform usage data, the research captures both the persistent challenges and institutional advancements since the peak of the pandemic. Findings reveal gradual improvements in digital literacy, investment in infrastructure, and shifts in teaching strategies. However, issues such as unequal access, lack of sustained funding, and insufficient pedagogical adaptation continue to hinder progress. This paper proposes strategic recommendations to strengthen e-learning sustainability at BUK and similar institutions, offering insights for future educational resilience in Nigeria.**

***Keywords*—E-Learning Adoption, Post-Pandemic Education, Digital Divide, Higher Education in Nigeria, Educational Technology**

I. Introduction

The COVID-19 pandemic triggered an unprecedented shift in the global education landscape, forcing institutions at all levels to abruptly pivot from traditional in-person instruction to digital modalities (UNESCO, 2023). This shift triggered a historic transformation in educational delivery, exposing both the potential and limitations of digital learning. While high-income countries transitioned more smoothly due to pre-existing digital infrastructure, the experience in low- and middle-income countries, including Nigeria, was markedly different, characterized by infrastructural deficits, policy inertia, and social inequities (Eze, Sefotho, Onyishi, & Eseadi, 2021).

Bayero University Kano (BUK), like many other institutions in the country, had to deploy e-learning platforms almost overnight to maintain academic continuity. While WhatsApp, Zoom, and Google Classroom became improvised lifelines for instruction, their adoption was often constrained by limited internet penetration, high data costs, and inconsistent electricity supply (Adeoye, Adanikin, & Adanikin, 2020). Despite these challenges, the pandemic served as an inflection point, compelling Nigerian universities to experiment with, and in some cases institutionalize, e-learning practices.

Early research on the transition predominantly focused on the immediate challenges of distance learning and short-term solutions. However, there is

a growing need to evaluate the enduring impacts and the sustainability of these digital education practices (Bozkurt & Sharma, 2021). Several years after the initial shift, it remains essential to examine the extent to which BUK has institutionalized digital practices, the long-term effects of e-learning adoption, and how students and instructors have adapted in the post-pandemic academic environment. This study aims to evaluate the long-term impacts of e-learning adoption at BUK. It investigates the evolution of digital education at the university, the persistence of challenges, the adaptability of stakeholders, and the institutional reforms that have taken place since the pandemic's onset.

A. Research Questions

1. How has e-learning evolved at BUK since the pandemic?
2. What long-term benefits and drawbacks have emerged for students and instructors?
3. What strategies have been implemented or neglected to support sustainable digital education?

B. Research Objectives

1. To examine the evolution of e-learning at Bayero University Kano (BUK) since the COVID-19 pandemic.
2. To identify the long-term benefits and drawbacks of e-learning for students and instructors at BUK.
3. To evaluate the strategies implemented or neglected in supporting sustainable digital education at BUK.

II. Literature Review

A. Global Perspectives on Post-Pandemic E-Learning

The pandemic-induced shift to remote education has prompted a rich body of scholarship analysing the global e-learning landscape. In the initial stages, the term "emergency remote teaching" (ERT) was coined to distinguish hastily implemented solutions from planned online learning (Hodges, Moore, Trust, & Bond, 2020). Subsequent research has examined the transition from ERT to sustainable online education, noting variations across countries based on economic capacity, technological infrastructure, and institutional readiness (Daniel, 2020).

In high-income nations, investments in learning management systems (LMS), and instructor development programs enabled more structured and effective online learning environments (OECD, 2021). Conversely, many institutions in developing countries faced persistent digital divides, compounded by socio-economic inequalities and policy fragmentation (Czerniewicz, et al., 2020). A recurring theme in post-pandemic literature is the unevenness of digital education outcomes, particularly regarding learner engagement, assessment credibility, and quality assurance (Bozkurt & Sharma, 2021).

Emerging studies suggest that institutions that treated the pandemic as a catalyst for digital transformation rather than a temporary disruption are more likely to have successfully embedded online learning into their academic frameworks (Means & Neisler, 2021). These findings underscore the importance of strategic planning, instructor support, and student-centred design in building resilient e-learning ecosystems.

B. E-Learning in the Nigerian Context

In Nigeria, the response to the educational disruption caused by COVID-19 was shaped by structural and infrastructural limitations that predated the pandemic. With internet penetration hovering around 40% and significant disparities in connectivity between urban and rural areas (NCC, 2022), digital education efforts encountered formidable barriers. Public universities, including BUK, struggled due to inadequate funding, outdated curricula, and low digital literacy among instructors

and students (Agyei & Voogt, .2021) (Azubuike, Adegboye, & Quadri, 2020).

Despite these constraints, several Nigerian institutions including BUK adopted various digital platforms to deliver instruction. WhatsApp emerged as a popular low-bandwidth tool for student engagement, while platforms like Zoom and Google Classroom facilitated synchronous and asynchronous learning activities (Olapiriyakul & Scher, 2006). However, these tools were often deployed without systematic training or institutional frameworks for quality assurance, leading to inconsistent learning experiences. Studies also revealed that while some private universities were relatively prepared, most public universities faced major challenges, including limited internet access, inadequate training, and unreliable electricity supply (Jibrin, 2025) (Azubuike, Adegboye, & Quadri, 2020).

Governmental bodies such as the National Universities Commission (NUC) and the Nigerian Communications Commission (NCC) have since initiated digital inclusion policies, including grants for e-learning development and public-private partnerships for broadband expansion (NUC, 2022). While these efforts mark progress, their impact on learning outcomes and long-term educational equity remains under-researched.

C. Theoretical Frameworks

This study is grounded in three complementary theories that offer insight into the long-term adoption and impact of e-learning at BUK: the Technology Acceptance Model, the Digital Divide Theory and the Constructivist Theory.

D. Technology Acceptance Model (TAM)

Proposed by (Davis, 1989), TAM explains how perceived usefulness and perceived ease of use influence individuals' decisions to adopt technology. TAM provides a lens to understand the extent to which students and instructors are willing to continue using digital learning platforms following the COVID-19 pandemic. It also helps explain varying degrees of engagement across faculties and user types.

E. Digital Divide Theory

This theory by (Norris, 2001) explains disparities in access to technology and digital literacy, especially across socio-economic, geographical, and institutional lines. This framework is essential for evaluating how issues of equity influence students' ability to participate fully in online education at BUK, especially in light of limited infrastructure and varying digital competencies.

F. Theoretical Framework

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G. Constructivist Learning Theory

Constructivism emphasizes active, learner-centred approaches where knowledge is constructed through experience. It argues that while well-implemented, e-learning platforms can support constructivist practices through collaborative tools, multimedia content, and formative assessments. However, without intentional design, digital platforms can revert to didactic models that undermine student engagement (Jonassen, 1999).

H. Gaps in the Literature

Most Nigerian studies on e-learning adoption during COVID-19 focused on immediate implementation challenges and short-term effectiveness. There is a notable scarcity of longitudinal research that evaluates:

1. The institutionalization of e-learning practices.
2. Instructors' adaptation to digital pedagogy.
3. The sustainability and effectiveness of hybrid learning models.

4. Impact assessments using performance and usage data.

III. Research Methodology

As a product of scientific research, this study adopts a mixed-methods approach to comprehensively explore the long-term impacts of e-learning at BUK. This approach combines quantitative data from structured surveys with qualitative insights from semi-structured interviews. By triangulating data sources, the study aims to provide both breadth and depth in understanding how students, lecturers, and institutional systems have adapted to e-learning since the pandemic.

A. Study Population and Sampling

Different sampling strategies were employed based on the nature of each subgroup. For the student population, a stratified random sampling approach was utilized. This method allowed for proportional representation across different faculties and academic levels, thereby capturing a more accurate picture of student engagement and experience with e-learning. In contrast, the sampling of academic staff and ICT administrators was carried out using purposive sampling. This intentional selection focused on individuals with direct experience in the planning, delivery, or coordination of e-learning, thus ensuring the inclusion of informed and relevant perspectives.

B. Sample Size

The study aimed to survey a total of 400 undergraduate students. This figure was determined using Cochran's formula for sample size calculation, which is appropriate for large populations. From this sample, an estimated 350 responses were expected to be valid and usable for analysis, accounting for potential non-responses or incomplete submissions. For the academic and administrative stakeholders, the qualitative component of the study planned for 15 to 20 in-depth interviews. This range was deemed sufficient to achieve thematic saturation, where no new insights are likely to emerge with additional interviews.

C. Data Collection Instruments

Questionnaire (Quantitative)

The student survey instrument is composed of four sections:

1. Demographic data (age, gender, level, faculty)
2. E-learning usage (platforms used, frequency, perceived ease)
3. Perceptions and impacts (effectiveness, motivation, performance)
4. Sustainability indicators (continuation post-pandemic, recommendations)

The data collection instrument employed in the study consisted of a combination of Likert scale items and multiple-choice questions. The Likert scale, ranging from 1 to 5, was used to measure respondents' attitudes, perceptions, and levels of agreement with various statements related to the research themes. To enhance accessibility and streamline the response process, the questionnaire was administered electronically using Google Forms. This mode of distribution was chosen to facilitate ease of participation, especially given the widespread familiarity and accessibility of the platform among the university community.

Semi-Structured Interviews (Qualitative)

Two interview guides were designed:

1. For faculty: Topics include platform adoption, training received, engagement strategies, challenges, and perceptions of student performance.
2. For ICT staff/admins: Focused on infrastructure, funding, policy shifts, technical support, and long-term plans.

Interviews were conducted online or in person, depending on availability.

D. Data Analysis Techniques

The quantitative data analysis for the study was carried out using both descriptive and inferential statistical methods. Descriptive statistics, including frequencies, means, and standard deviations, were

used to summarize and present the basic features of the data, offering a clear overview of the participants' responses. To derive deeper insights into the relationships between variables, inferential statistics were employed, specifically, chi-square tests and analysis of variance (ANOVA). These techniques were used to examine potential associations and differences between demographic factors and various e-learning outcomes. The analysis was conducted using SPSS software, with Microsoft Excel also utilized for data organization and preliminary computations.

The qualitative data were analysed using thematic analysis, guided by (Braun & Clarke, 2006) framework. Coding was carried out both manually and with the aid of NVivo software, allowing for the identification of key patterns, themes, and narratives that emerged from the interview transcripts.

E. Ethical Considerations

Informed consent was obtained from all participants prior to their involvement in the study. Anonymity and confidentiality were rigorously upheld to protect participants' identities and personal information. Ethical approval for the research was formally sought and granted by BUK. Additionally, all data collected were stored in accordance with the university's policies on research data protection.

F. Limitations

As a case study centred on a single institution, the findings may have limited generalizability to other universities in Nigeria. Additionally, the reliance on self-reported data introduces the possibility of response bias, as participants may not always provide accurate or objective answers. Another potential limitation is the varying levels of internet accessibility, which could influence survey response rates particularly among students residing off campus.

IV. Findings and Discussion

This section presents the results of the data analysis and discusses their implications in light of existing literature and the study's objectives. It is divided into three thematic areas aligned with the research questions: student experience, faculty adaptation, and institutional transformation.

A. Student Experiences with E-Learning Post-Pandemic

Survey responses indicated that while students became increasingly comfortable with digital learning platforms over time, significant barriers to effective online education remained. Approximately 65% of respondents reported moderate satisfaction with platforms such as Zoom and Google Classroom, attributing this to improved interface familiarity and more structured virtual class delivery. However, persistent challenges were evident: 40% of students experienced regular internet disruptions, and 32% lacked personal devices, relying instead on shared or borrowed equipment as in Fig 1. These findings align with those of (Azubuike, Adegboye, & Quadri, 2020), who identified poor connectivity and limited affordability as primary obstacles to e-learning in the Nigerian context.

Table 1 shows that the key dimensions such as effectiveness (M = 2.51) and motivation (M = 2.52) scored considerably lower, indicating that although students were able to connect, their learning experience often fell short of expectations. Notably, technical issues were widespread, with a mean score of 4.03, suggesting that internet reliability and digital infrastructure were significant barriers. Furthermore, training received to navigate digital learning platforms was limited (M = 2.52), reinforcing the perception that the transition to e-learning was more reactive than strategically planned.

TABLE 1
CORRELATION ANALYSIS

Indicator	Mean	Std Dev	Min	Max	Interpretation
Improved Access	3.65	1.09	2	5	Generally positive; students agree e-learning improved access.

Ease of Following	3.53	1.14	2	5	Moderate ease of following e-learning sessions.
Effectiveness	2.51	1.11	1	4	Perceived effectiveness is low on average.
Technical Issues	4.03	0.81	3	5	Significant technical problems widely experienced.
Motivation	2.52	1.09	1	4	Low motivation observed in most students.
Training	2.52	1.10	1	4	Many students report insufficient training.

Correlation analysis among key survey dimensions as seen in Fig 3 revealed little or no strong associations between most variables. For example, the correlation between motivation and training was negligible (r = –0.006), suggesting that exposure to online training alone did not necessarily foster increased enthusiasm or commitment toward digital learning. Likewise, perceived effectiveness showed weak correlations with both motivation and technical ease, implying that students' sense of online learning effectiveness may be shaped more by broader psychosocial and contextual factors than by isolated technical experiences.

Interestingly, a slight positive correlation was observed between improved access and the frequency of technical issues (r = 0.10), potentially reflecting a usage paradox: students who accessed e-learning platforms more frequently were also more likely to encounter system failures, glitches, or connectivity disruptions, thereby increasing their frustration.

B. Faculty Perspectives on E-Learning Integration (Thematic Findings)

Interviews with 15 academic staff showed that while many initially resisted e-learning due to unfamiliarity and lack of training, a gradual shift occurred.

TABLE 2
MODEL SUMMARY

a. Rapid Platform Adoption Without Preparedness

Faculty adopted platforms like Zoom, Google Classroom, and WhatsApp, primarily based on personal familiarity or peer recommendations. However, most lacked pedagogical support for designing engaging content.

"We adopted Zoom quickly, but managing student interaction or assessments online was a challenge."

This aligns with (Hodges, Moore, Trust, & Bond, 2020) who distinguish between planned online instruction and emergency remote teaching.

b. Minimal Training and Self-Learning

Only 4 out of 15 faculty members reported receiving some structured training. Most relied on informal sources such as YouTube, colleagues

"There was no workshop, no guideline. We learned as we went."

This lack of institutional preparedness is consistent with (Bozkurt & Sharma, 2021), who reported limited support across developing contexts.

c. Uneven Student Engagement

While some observed higher attendance due to flexibility, most noted reduced participation and interactivity, especially in asynchronous setups.

"Some students were online but inactive. It was like lecturing an empty class."

In line with (Moorhouse, 2020), who found that active engagement is often lacking in remote classes without deliberate design. Also, Constructivist learning theory emphasizes that engagement emerges when learners are encouraged to interact, solve problems collaboratively, and reflect on experiences. The absence of deliberate instructional design limited the potential of these platforms to support meaningful, student-centred learning.

d. Challenges - Infrastructure & Digital Divide

Poor internet reliability, lack of access to computer devices such as laptops or smartphones, inconsistent electricity supply

"Most of our classes were on WhatsApp because the students lacked data or a PC."

These mirrors (Adedoyin & Soykan, 2020), who highlight digital inequity as a major obstacle to e-learning deployment in developing countries.

e. Low Confidence in Long-Term Adoption

Only a third (5 of 15) saw e-learning as sustainable in its current form.

"It would be difficult to achieve desired success, unless the university invests in e-learning platforms."

This sentiment supports calls by (Crawford, et al., 2020) for systemic change to move beyond crisis-mode e-learning.

f. Institutional Policies and Infrastructure Evolution

Since 2020, the ICT team at BUK has reported significant improvements, including campus-wide Wi-Fi expansion, a new Learning Management System (LMS), and ICT literacy workshops. However, there are still clear gaps, especially in developing policies for mandatory digital training and securing long-term maintenance funding.

It was gathered that, students in departments with structured e-learning systems that were supported by training and incentives such as Computer Science department tended to be more active. This shows the importance of institutions to work in a coordinated way, which supports the views of (Bozkurt & Sharma, 2021), who call for a well-rounded approach to digital growth in education.

A. Conclusions

The COVID-19 pandemic acted as a catalyst for digital transformation in Nigerian higher education. At BUK, the crisis prompted a rapid shift toward e-learning platforms, with varying degrees of success. This study finds that while progress has been made, especially in digital literacy and infrastructural upgrades, significant work remains in institutionalizing inclusive, sustainable e-learning models.

By addressing gaps in policy, access, and training, BUK can serve as a model for other public universities in Nigeria. The long-term success of e-learning adoption hinges not only on technology but on strategic planning, equitable resource allocation, and a commitment to academic innovation.

5.2 Recommendations

Based on the findings, the following recommendations are proposed for BUK:

1. BUK should develop faculty-wide policies on blended learning structures, backed by pedagogical and technical support.
2. The university should partner with telecom providers for subsidized data and distribute low-cost tablets to underserved students.
3. BUK needs to institutionalize regular digital training for students and staff.
4. Analytics dashboards to track LMS engagement, student performance, and identify gaps should be implemented.

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