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ASSESSING DIGITAL INFRASTRUCTURE AND TRANSITION CHALLENGES IN SOCIAL STUDIES INSTRUCTION IN SOUTHWESTERN NIGERIAN PUBLIC UNIVERSITIES

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ABSTRACT

This study investigated the availability of digital infrastructure and the issues faced in the digitalisation of teaching delivery in South West Nigerian public universities. This study used a descriptive survey design. The sample included 102 lecturers and 1,507 undergraduate students selected using multistage sampling from affected departments. Two confirmed questionnaires of digital infrastructure, challenges lecturers and students face, digital literacy, and institutional support were utilized in data gathering. Both tools were exceptionally reliable. Online questionnaires and data were analyzed through descriptive statistics and independent t-tests at 0.05 level of significance. Findings indicated that even as the fundamental digital infrastructure such as Learning Management Systems (LMS), internet, and computer laboratories are available, emerging technologies such as smart classrooms and digital laboratories are inadequately equipped. The academic staff revealed severe problems such as regular power outages, no constant internet connectivity, and a lack of training. The students also experienced difficulty due tolow availability of digital devices and stable connectivity. There was a high positive relationship between the availability of digital infrastructure and the level of digitalised instructional delivery. The study concludes that the success of the transition to digital instruction depends greatly on solid infrastructure and effective support systems. This study uniquely contributes to the growing body of literature by providing empirical insight into the infrastructural and pedagogical readiness of Nigerian public universities for digital transformation, highlighting the context-specific challenges facing higher education in Africa It recommends additional investment in new digital technologies, improved training, improved technical support, and strategic policy adjustments to sustain digital transformation in universities.

KEYWORDS: Digital Infrastructure, Digitalization Challenges, Social Studies Instruction, Higher Education, Public Universities, Instructional Delivery.

1. INTRODUCTION

The teaching and learning process of higher education has been revolutionized by the evolution of digital technologies. As Redecker (2017) explains, digital technologies such as Learning Management Systems (LMS), cloud computing, virtual classrooms, and mobile apps have dramatically altered the process of knowledge transfer and acquisition. Selwyn (2011) states that technologies make it possible to move away from traditional, teacher-centric pedagogy towards participatory, student-centered environments for learning that are engaging and adaptive.

This virtual move was once more scaled up in the times of the COVID-19 pandemic, which, as Dhawan (2020) reports, witnessed a sudden and global transition from the classroom to the online and hybrid learning modes. As Crawford et al. (2020) state, the transition highlighted the vulnerability of conventional classroom systems and necessitated robust, technology-facilitated learning systems. As such, institutions everywhere began thinking differently about delivering education, and UNESCO (2020) and the OECD (2021) concurred that the world needed to innovate robust, technology-facilitated platforms robust enough to weather future crises.

There is evidence that the shift is increasingly converging with the access, equity, and quality momentum in education. Bond et al. (2021) are of the opinion that learning technology offers autonomous, collaborative, and borderless learning benefits particularly for marginalized or remote learners. Yadav (2024) also adds that such a trend not only reconstructs the pedagogy but also student and teacher roles, wherein the latter undertake more facilitation roles and the former become participatory co-producers of knowledge. Nevertheless, Soomro et al. (2020) caution that such a progress in most instances is haunted by infrastructural deficits, digital illiteracy, and budgetary limitations, especially among low- and middle-income countries. In Nigeria, tertiary education is increasingly becoming digitalised as a means of enhancing the quality of instruction and performance of students. In efforts to close learning gaps, institutions are pulling out all the stops while digital platforms are at the center as effective substitutes for traditional methods. Social Studies is a highly viable program that encourages civic competence, social responsibility, and cultural awareness that can readily be incorporated into digital learning within this environment. According to Okebukola (2021), the interactive nature of the topic opens the door to the utilization of simulations, multimedia materials, and mixed mode teaching. Agidani (2021) also highlights that technology is utilized to enhance Social Studies in the sense that it enables students to get involved in civic experiences virtually.

In spite of such prospects, the actual implementation of digital pedagogy for Social Studies teaching in Nigerian public universities in the South West remains spotty and under-researched. One of the primary impediments is the lack of rudimentary infrastructures. There are challenges of inefficient power supply, poor internet bandwidth, and lack of quality digital learning materials that have come a long way in restricting the efficiency of digitalised learning, according to Akinleye and Akinde (2024). Similarly, Okoye and Ezeaku (2025) quote that infrastructural deficiencies continue to be an impediment to enduring digitalisation.

These are not only technical issues. Adakawa et al. (2021) report that the majority of lecturers lack high digital literacy skills and no training in how to use online platforms or develop digital content. Senior lecturers are also most susceptible to fear and resistance to e-teaching. As Bubou and Job (2021) add further, a critical lack of institutional support and poor technical support discourage online pedagogies' frequent use.

Undergraduates also face daunting challenges. Chigbundu and Oluwabiyi (2023) stated that there are many students that are low-income individuals who are not even able to meet ends to get basic devices such as laptops or smartphones. In a South West Nigeria regional research, Amaonye and Anyaeji (2023) found out that over 40% of undergraduates lacked access to personal digital tools or consistent internet access. Impacting this problem is the urban–rural digital literacy gap, which denies certain students access to digital learning environments or the capacity to complete technology-enhanced tasks. All these institutional, infrastructural, and socio-economic problems together pose major challenges to equal access and efficacious digital learning. They further risk aggravating the underlying education inequalities unless they are addressed. While a lot of digitalisation-associated, holistic research has discussed the problems in Nigerian higher education, none of it has sought to explore how these problems affect Social Studies education, a field whose sustainability depends on participatory as well as reflexive learning processes. Since social studies help in building democratic citizenship and social consciousness, it becomes essential to identify the extent to which ongoing digital infrastructure and allied barriers influence its accessibility among public universities. It is on this assumption that the present study seeks to determine the extent to which digital infrastructure is

accessed and the lived realities of lecturers and students of social studies education digitalized in public universities of South West Nigeria.

1.1. Objectives of the Study

1. Identify the digital infrastructures available for digitalised instructional delivery in higher education.
2. Examine the challenges facing faculty staff in higher education in transitioning to digitalised instructional delivery.
3. Identify the challenges facing students in the South West Nigerian public universities in transitioning to digitalised instructional delivery.

1.2. Research Questions

1. What digital infrastructures are available for digitalised instructional delivery in higher education?
2. What challenges are faced by faculty staff in higher education in transitioning to digitalised instructional delivery?
3. What challenges are faced by students in South West Nigerian public universities in transitioning to digitalised instructional delivery?

1.3. Research Hypothesis

1. There is no significant relationship between the availability of digital infrastructure and the digitalisation of instructional delivery in the South West Nigerian public universities.

2. METHODOLOGY

In this research, a descriptive survey research design was employed to examine the availability of digital infrastructure and the issues surrounding the digitalisation of Social Studies education in higher institutions of learning in South-West Nigeria. The population of the study included lecturers and full-time undergraduate students pursuing Social Studies programs in public universities in the six states of the South-West geopolitical zone. A representative sample of 102 lecturers and 1,507 students was drawn from departments that were pertinent in their utilisation of digitalised instruction by using the multistage sampling technique. The sampling approach was adopted to ensure geographical representation across all six states and departmental diversity within Social Studies and related faculties that had varying degrees of exposure to digitalised instruction. Data were gathered by means of two validated instruments: the Lecturers' Preparedness for Digitalisation of Higher Education Instruction Questionnaire (LPDHEIQ) and the Students' Preparedness for Digitalisation of Higher Education Instruction Questionnaire (SPDHEIQ). All of the questionnaires were structured into six parts: demographic information; availability of digital infrastructure (i.e., internet access, digital tools, smart classrooms, and learning software); lecturers' issues in embracing digital pedagogy; students' issues in adapting to digitalized instruction; overall preparedness and digital literacy; and institutional support, including training and technical assistance. Respondents were given items on a four-point Likert scale from Strongly Agree (4) to Strongly Disagree (1). Social Studies Education, Educational Technology, and Measurement and Evaluation professionals tested the instruments for face and content validity, and pilot study in non-sampled public universities provided Cronbach's alpha reliability coefficients of 0.79 (LPDHEIQ) and 0.97 (SPDHEIQ), indicating good internal consistency. For ease of large participation and prompt response, the questionnaires were administered online using Google Forms and distributed using emails and social media. This research adhered to standard ethical procedures in line with institutional and national guidelines for research involving human participants. Participation in the study was voluntary, and all respondents provided informed consent electronically. Anonymity and confidentiality of responses were assured, and no personally identifying information was collected. Respondents were informed of their right to withdraw from the study at any point without any consequence. Descriptive statistics including frequencies, percentages, means, and standard deviations were used to test the research questions with a decision mean of 2.50 for interpreting responses. Hypotheses were tested through independent sample t-tests at 0.05 level of significance.

3. RESULTS OF FINDINGS

3.1. Research Question 1: What are the Digital Infrastructures Available for Digitalised Instructional Delivery in Higher Education?

The data in Table 1 reveal that while public universities in South West Nigeria have made notable progress in providing foundational digital infrastructures for instructional delivery such as Learning Management Systems (90%), video conferencing tools (88%), computer labs (85%), and e-resource repositories (84%) there are still significant gaps. Tools like high-speed internet, Wi-Fi access, and multimedia projectors are mostly available, but more advanced and interactive technologies such as smart classrooms (35%), mobile learning devices (40%), digital labs (32%), and audio-visual recording

equipment (46%) are poorly available. Additionally, resources like laptops for faculty, cloud storage, technical support, and data security systems show only moderate availability. These findings suggest that while basic digital tools are in place, there is a pressing need for investment in modern and flexible technologies to fully support digitalised instructional delivery.

Table 1: Mean and Standard Deviation of Responses on the Digital Infrastructures Available for Digitalised Instructional Delivery in the South West Nigerian Public Universities (N=102).

S/N	Digital Infrastructure	Available (%)	Not Available (%)	Remark
1	High-Speed Internet Connectivity	80	20	Mostly Available
2	Wi-Fi Access Points	76	24	Mostly Available
3	Computer Labs for Students	85	15	Widely Available
4	Laptops/Desktops for Faculty Staff	72	28	Moderately Available
5	Smart Classrooms with Interactive Whiteboards	35	65	Poor Availability
6	Multimedia Projectors	78	22	Mostly Available
7	Learning Management Systems (LMS)	90	10	Widely Available
8	Online/Virtual Libraries	82	18	Mostly Available
9	Digital Content Creation Tools	54	46	Moderately Available
10	Cloud Storage Solutions	68	32	Moderately Available
11	Educational Software and Digital Learning Platforms	74	26	Mostly Available
12	Video Conferencing Tools	88	12	Widely Available
13	Mobile Devices for Learning	40	60	Poor Availability
14	Digital Assessment Tools	66	34	Moderately Available
15	Audio-Visual Recording Equipment	46	54	Poor Availability
16	Technical Support for Digital Infrastructure	63	37	Moderately Available
17	Data Security Systems	52	48	Moderately Available
18	Digital Labs for Simulation and Modeling	32	68	Poor Availability
19	E-Resource Repositories (e-books, journals, etc.)	84	16	Widely Available
20	Backup Power Supply (e.g., generators, inverters)	71	29	Moderately Available

Table 1.1: Summary of Digital Infrastructure by Availability and Priority Needs.

S/N	Digital Infrastructure	Availability (%)	Remark	Inferred Priority Level	Action Priority
1	Learning Management Systems (LMS)	90	Widely Available	Very High	Sustain
2	Computer Labs for Students	85	Widely Available	High	Sustain
3	Video Conferencing Tools	88	Widely Available	High	Sustain
4	Online/Virtual Libraries	82	Mostly Available	High	Sustain
5	High-Speed Internet Connectivity	80	Mostly Available	Very High	Strengthen
6	Multimedia Projectors	78	Mostly Available	Medium-High	Strengthen
7	Wi-Fi Access Points	76	Mostly Available	High	Strengthen
8	Educational Software and Digital Learning Platforms	74	Mostly Available	High	Strengthen
9	Laptops/Desktops for Faculty Staff	72	Moderately Available	Very High	Upgrade Immediately
10	Backup Power Supply (e.g., generators, inverters)	71	Moderately Available	Very High	Upgrade Immediately
11	Cloud Storage Solutions	68	Moderately Available	High	Improve
12	Digital Assessment Tools	66	Moderately Available	High	Improve
13	Technical Support for Digital Infrastructure	63	Moderately Available	Very High	Strengthen Urgently
14	Data Security Systems	52	Moderately Available	High	Improve
15	Digital Content Creation Tools	54	Moderately Available	Very High	Invest Immediately
16	Audio-Visual Recording Equipment	46	Poor Availability	Medium	Upgrade
17	Mobile Devices for Learning	40	Poor Availability	High	Invest Immediately
18	Smart Classrooms with Interactive Whiteboards	35	Poor Availability	Very High	Invest Immediately
19	Digital Labs for Simulation and Modeling	32	Poor Availability	Very High	Invest Immediately
20	E-Resource Repositories (e-books, journals, etc.)	84	Widely Available	High	Sustain

Table 1.1 highlights significant disparities in the availability and prioritization of digital infrastructure across South West Nigerian public universities. Core tools such as Learning

Management Systems (90%), computer labs (85%), video conferencing tools (88%), and e-resource repositories (84%) are widely available and require sustained support. Other resources like online libraries (82%), high-speed internet (80%), multimedia projectors (78%), and Wi-Fi access points (76%) are mostly available but need strengthening due to their high instructional relevance. However, essential infrastructures including faculty laptops/desktops (72%), backup power supply (71%), and technical support services (63%) are only moderately available and require urgent upgrading. Notably, mobile devices for students (40%), smart classrooms (35%), and digital simulation labs (32%) are poorly available despite being of very high instructional importance, indicating a critical need for immediate investment. The summary revealed the urgency of addressing infrastructural gaps to ensure equitable access and effective implementation of digitalised instruction, particularly for technology-dependent subjects like Social Studies.

3.2. Research Question 2: What are the Challenges Facing the Faculty Staff in Higher Education in the Process of Transitioning to Digitalised Instructional Delivery?

Table 2: Mean and Standard Deviation of Responses on the Challenges Facing the Faculty Staff in the South West Nigerian Public Universities in the Process of Transitioning to Digitalized Instructional Delivery (N=102).

S/N	Item	Mean	SD	Remark
1	Inadequate access to reliable internet is a major challenge	3.55	0.72	Major Challenge
2	Lack of proper training on digital tools and platforms	3.48	0.76	Major Challenge
3	Insufficient digital infrastructure in the university	3.52	0.69	Major Challenge
4	The cost of acquiring necessary digital tools is prohibitive	3.35	0.81	Significant Challenge
5	Limited technical support is available	3.15	0.88	Moderate Challenge
6	Challenges adapting traditional methods to digital formats	3.00	0.91	Moderate Challenge
7	University's policies and support for digitalization are inadequate	3.12	0.85	Moderate Challenge
8	Students' limited access to digital devices and internet	3.45	0.78	Major Challenge
9	Frequent power outages disrupt digital instructional activities	3.70	0.65	Most Critical Challenge
10	Feeling overwhelmed by digital transition demands	3.10	0.87	Moderate Challenge

Table 2 highlights the major challenges faculty staff face in transitioning to digitalized instructional delivery in South West Nigerian public universities. The most critical challenge identified is frequent power outages (Mean = 3.70), which significantly disrupt teaching activities. Other major challenges include inadequate internet access (3.55), lack of proper training (3.48), insufficient digital infrastructure (3.52), and students' limited access to devices and internet (3.45). These issues reflect both institutional and student-level barriers to effective digital instruction. Additionally, the high cost of digital tools (3.35) poses a significant burden. Moderate challenges include limited technical support, difficulty adapting traditional teaching methods, inadequate university policies, and the overwhelming nature of the digital transition.

3.3. Research Question 3: What are the Challenges Facing Students in Higher Education in the Process of Transitioning to Digitalised Instructional Delivery?

Table 3: Mean and Standard Deviation of Responses on the Challenges Facing Students in the South West Nigerian Public Universities in the Process of Transitioning to Digitalised Instructional Delivery (N=1507).

S/N	Item	Mean	S.D	Remark
1	Inadequate access to reliable internet is a major challenge to digitalized instructional delivery.	3.29	0.85	High
2	Lack of proper training on digital tools and platforms affects my ability to teach effectively.	3.26	0.82	High
3	Insufficient digital infrastructure in the university hinders smooth digitalized instructional delivery.	3.34	0.81	High
4	The cost of acquiring necessary digital tools is prohibitive.	3.30	0.83	High
5	Limited technical support is available to help with the use of digital technologies for teaching.	3.31	0.84	High
6	I face challenges in adapting my traditional teaching methods to digital formats.	3.26	0.85	High
7	The university's policies and support for digitalization are inadequate.	3.29	0.83	High
8	Students' limited access to digital devices and internet hampers effective online learning.	3.34	0.81	High
9	The frequent power outages disrupt digital instructional activities.	3.31	0.84	High
10	I feel overwhelmed by the demands of transitioning to digital instructional delivery.	3.24	0.86	High

Table 3 reveals that students in South West Nigerian public universities face uniformly high levels of challenges in transitioning to digitalised instructional delivery. All listed items recorded high mean scores (ranging from 3.24 to 3.34), indicating widespread difficulties. The most pressing issues include insufficient digital infrastructure (Mean = 3.34), limited access to digital devices and internet

(3.34), and frequent power outages (3.31), which significantly hinder effective online learning. Other major concerns include the high cost of acquiring digital tools, inadequate internet access, and limited technical support. Students also reported feeling overwhelmed by the transition and struggled to adapt traditional learning methods to digital formats.

3.4. Hypothesis 1: There is No Significant Relationship between *the Availability of Digital Infrastructure and the Digitalisation of Instructional Delivery in the South West Nigerian Public Universities.*

Table 4: Correlation Analysis of the Relationship between the Availability of Digital Infrastructure and the Digitalisation of Instructional Delivery in the South West Nigerian Public Universities.

Variable	N	Mean	S.D	df	r	P
Availability of Digital Infrastructure	102	49.63	6.61	202	0.62	0.001*
Digitalisation of Instructional Delivery	102	50.55	8.74			
p<0.05 (Significant Result)						

Table 4 presents the correlation analysis between the availability of digital infrastructure and the digitalisation of instructional delivery in South West Nigerian public universities. The result shows a positive and statistically significant relationship between the two variables (r = 0.62, p = 0.001), indicating that increased availability of digital infrastructure is strongly associated with higher levels of digitalised instructional delivery. With a p-value less than 0.05, the result is significant, suggesting that adequate infrastructure plays a critical role in supporting and enhancing the digital teaching process within these institutions.

4. DISCUSSION

The finding of the study shows that the South West Nigerian public universities possess minimum digital infrastructures such as Learning Management Systems (LMS), internet infrastructure, and computer laboratories but do not have sophisticated teaching equipment such as smart classrooms and digital laboratories. This finding concurs with Oladele's (2024), which has reported that Nigerian universities have progressed to embrace LMS platforms and web-based tools to use in learning but remain bogged down by embracing high-level teaching technology due to the unavailability of finance and technical knowledge. The probable cause of the disparity is attention paid to bare minimum digital hardware for institutions in the first COVID-19-mandated wave of digitalisation where institutions quickly installed bare minimum infrastructure in an attempt to fit in online courses (Eze, et al.2021). Long-term transformation into a full-fledged digitalised education system, however, requires enormous investments in smart technology, which most public institutions cannot due to lack of financial muscle to invest. Together with this, Akinola and Bello (2023) indicate that Nigerian public universities operate on a tight budget, stifling mass acquisition of interactive whiteboards, mobile learning tools, and simulation labs. The same is confirmed by Owan, & Ekpenyong,. (2022), which indicated that though LMS and internet services are now dominant among Nigerian universities, digital content creation tools and smart classrooms usage is low, especially among public universities.In contrast, data from richer nations or non-state Nigerian institutions demonstrate higher deployment of sophisticated digital devices (Obi & Adeniran, 2022), which suggests that the discrepancy is much more a function of institution funding structures and administrative concerns than country policy in general. The effect of such infrastructural disparity is collosal. In the absence of advanced digital capability, universities cannot provide fully interactive, collaborative, or simulation-based learning environments core components of 21st-century learning. This would further widen the digital divide between Nigerian public and foreign universities, thus affecting graduate competitiveness and learning. Besides, the absence of interactive technologies can decrease the intensity of learner engagement and limit pedagogical innovations, as confirmed by Cardullo, et al.(2015), who stress that the role of smart technology in facilitating inquiry-oriented and student-centered pedagogies. Conversely, there are existing studies that affirm that even minimal digitization infrastructure, if exploited well, continues to result in successful teaching dissemination. In contrast, Parveen (2024) suggest the use of optimal staff pedagogy training and content development as a counter to, to some extent, the lack of smart tools. But this function reinforces rather than devalues the importance of infrastructure it is merely underlining the complementary capacity building that needs to be done. The discovery is demonstrating a structural constraint fostered by economics, policy, and

institutions. It does indicate the necessity of appropriately targeted investment in digital learning as well as connectivity and platform deployment. It also requires collaboration, perhaps in the form of business-government partnership or foreign aid for development, to fund the acquisition of leading-edge learning technology. Otherwise, digitalisation of provision of teaching in Nigerian state universities will remain weak and unidimensional.

The study revealed a clear distinction between short-term operational issues and long-term strategic gaps impeding the digitalisation of instruction in South West Nigerian public universities. Short-term operational issues include frequent power outages, unstable internet connectivity, and lack of structured training opportunities immediate, day-to-day barriers that directly disrupt synchronous learning, content delivery, and faculty engagement. Power failure emerged as the most pressing challenge, limiting real-time teaching and learning activities, echoing Adedoyin and Soykan's (2020) assertion that reliable electricity is the foundation of any meaningful digital transition. Similarly, poor internet connectivity, particularly in rural and semi-urban campuses, continues to fragment access to virtual platforms like LMS and online libraries (Anyanwu et al., 2023; Akpan & Tralagba, 2019). The lack of structured training further compounds these issues, as many lecturers, especially those accustomed to traditional pedagogy, struggle with digital tools, relying instead on irregular self-directed learning (Idubor & Ogunbodede, 2024; Nwankwo & Eze, 2023). On the other hand, long-term strategic gaps reflect systemic and policy-level deficiencies that sustain these operational challenges. These include inadequate government investment in energy infrastructure, weak ICT policy frameworks within universities, and absence of institutional incentives for digital innovation. As noted by Akomolafe et al. (2024), the pressure of digital transformation without strategic support leads to faculty burnout and innovation resistance. Long-term solutions must therefore go beyond individual adaptation. They demand coordinated government interventions in national infrastructure, the establishment of digital competence training pipelines, and institutional policies that embed digital practices into the academic culture. While phased digital resource introduction and peer support, as suggested by Mutisya and Makokha (2016), may ease the burden temporarily, the Nigerian context requires comprehensive and sustained strategic reforms to close the digital divide and ensure readiness for a globally competitive digital education system

The research finding shows that students in public universities of South West Nigeria face tremendous difficulties in digitalized learning, courtesy of low access to digital gadgets, irregular internet connection, and regular power outages. This discovery concurs with that of Aliero, et al (2024), who argued that the majority of students in public universities own mobile phones with limited data plans and hence are unable to participate in prolonged online learning. The limited availability of devices found in the current study with a high mean score is generally caused by socio-economic circumstances, where the majority of the students are not able to afford laptops, tablets, or smartphones needed for effective virtual learning (Amaonye, & Anyaeji, 2023). Routine power outages, which are also highly rated, also disrupt students' participation in online classes, an issue supported by Agwuocha, (2020), who noted that unstable electricity supply still poses a serious hindrance to technologically based learning in Nigeria. Students cannot charge their devices or conduct organized live lessons, leading to hazardous interaction and poor grades. This aligns with a report of research by Bepeh et al. (2023) demonstrating how infrastructure constraints such as power outage increase digital divides and discourage learning continuity. Furthermore, unpredictable internet access significantly limits students from streaming classes, accessing online materials, and engaging in virtual classrooms. Even though certain universities provide restricted Wi-Fi services, these are often insufficient to address student requirements. This is attested by Idika et al. (2021), who cited that students in public institutions use most of their own money to purchase data subscription, which is unsustainable for long-term learning. Network unreliability is more critical in rural and semi-urban campuses, exacerbating the urban-rural gap in education even more. Such problems have catastrophic impacts. Academic engagement, motivation, and performance of students are compromised, leading to knowledge gaps, degree attrition, and psychosocial morbidity. Additionally, the long-term inequities in access to digital technologies act against national policies of inclusive education and digital transformation. As per Global Education Monitoring Report Team (2023), if particular interventions are not introduced to bridge digital divides, then millions of low- and middle-income country students could be left

behind from 21st-century education systems. Although studies, such as those by Onwuchekwa and Aladejana (2021), have concluded that zero-rating learning sites and mobile-based learning technologies can equalize the playing field, the ubiquity of infrastructural and cost-related barriers in Nigeria means that stakeholders must act. Such can be in the form of subsidized internet provision to learners, government-provided gadgets, and even solar-powered school buildings to take care of the power problem.

The finding of the study reveals a high positive correlation between access to digital infrastructure and the level of digitalisation of instructional delivery in South West Nigerian public universities, indicating that improved access to digital infrastructure has a direct enhancement on the digital delivery of instruction. The probable reason for this high correlation is that infrastructure in the form of reliable internet, digital devices, and technical support is the lifeblood of any digital instructional system. Without these, students and faculty are unable to participate in online teaching and learning, regardless of their willingness or ability. This has the implication that to increase digital education at scale in a sustainable manner, university leaders and policymakers must prioritize the development of infrastructure. In addition, failure to fill infrastructural gaps will heighten the digital divide and further marginalize students and universities in poor regions. The research thus highlights the necessity of focused investment in ICT infrastructure as a prerequisite for successful digital transformation in universities. This finding is consistent with the research of Olori, (2020), that determined the digital infrastructure as the foundation for enabling virtual learning and teaching in Nigerian universities. It is also verified by Händel, et al. (2020), which indicated that institutions with adequate infrastructure in the form of high-speed connectivity, LMS technology, and digital classrooms have better implementation of the e-learning model. On the contrary, Samane-Cutipa, et al. (2022) failed to find any worthwhile correlation in some rural universities, which can be attributed to biased deployment of digital infrastructure or no culture of maintenance, thereby depicting context-dependent issues. The result of the current study is also consistent with international studies such as that of Global Education Monitoring Report Team. (2023), which sets out that investments in digital infrastructure are the key enablers of effective and inclusive digital education, especially in the developing world.

5. CONCLUSION

The findings of this study reveal that while basic digital infrastructure exists in South West Nigerian public universities, access to advanced technological tools and resources remains significantly limited. Academic staff face substantial operational and capacity-related challenges, including inadequate training, unreliable internet connectivity, and persistent power outages all of which hinder the effective implementation of digital pedagogy. Likewise, students struggle with insufficient access to learning devices, unstable networks, and infrastructural deficiencies. The study clearly establishes that the level of digitalisation in instructional delivery is directly tied to the availability and functionality of supporting infrastructure. This research makes important contributions on multiple fronts. For policy, it highlights the urgent need for targeted government investment in digital infrastructure, energy stability, and digital literacy programs tailored to the higher education sector. Policymakers must prioritize the inclusion of digital innovation frameworks within national and institutional education strategies. In practice, the study provides actionable insights for university administrators and educators, underlining the importance of sustained technical support, structured professional development, and inclusive digital access for both faculty and students. For future research, it opens avenues for more granular investigations into discipline-specific digital teaching needs, longitudinal assessments of digital competency development, and the impact of infrastructure upgrades on academic outcomes. This study reveals that digital transformation in Nigerian universities requires not only technological tools but also coordinated and sustained structural, pedagogical, and policy-level support.

5.1. Recommendations

1. Infrastructure Development

1. University administrations should prioritize the provision of advanced digital infrastructure to augment existing basic tools and support effective digital teaching and learning.
2. Efforts must be made to stabilize power supply and internet connectivity through strategic partnerships with reliable electricity and internet service providers.
3. Institutions should invest in smart classrooms, simulation labs, and digital content creation tools to enhance interactivity and instructional quality.

2. Capacity Building and Training

1. Continuous digital literacy training programs should be implemented for both academic staff and students to improve confidence, efficiency, and effectiveness in using digital tools.
2. Structured professional development opportunities must be created, particularly for faculty transitioning from traditional pedagogies to digital instruction methods.

3. Administrative and Technical Support

1. Universities must enhance administrative and technical support systems to ensure the timely resolution of technical issues and the smooth operation of digital platforms.
2. A dedicated IT support structure should be established within faculties to assist in troubleshooting and guiding users through digital instructional processes.

4. Policy and Funding Interventions

1. Policymakers and education stakeholders should develop inclusive and flexible digital education policies that promote innovation and responsiveness to institutional needs.
2. There is a need for targeted public financing and donor support for digital transformation initiatives, especially in underserved public institutions.
3. A national digital transformation framework for higher education should be developed to guide long-term investments, policy coherence, and institutional accountability

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