



Qualitative Assessment on Digitalization of ... Adeoye, K. F., Et. al. (2026)

Qualitative Assessment on Digitalization of Instructional Pedagogy among Higher institutions of Learning in Bauchi State, Nigeria

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Abstract

Digitalization of instruction is no longer a contingency measure but a fundamental pedagogical requirement for higher institutions. This study adopts a mixed conceptual-empirical approach to examine digitalization as an imperative pedagogy for teaching and learning in Nigerian universities, polytechnics and colleges of education. Conceptually, the paper develops a model positioning digitalization as the integration of digital tools, pedagogy, and institutional culture to enhance access, personalization, and relevance. Empirically, a survey of 160 lecturers and students across three higher institutions in Bauchi assessed digital tool usage, digital literacy, and perceived impact on instruction quality. Findings reveal that while 68% of respondents agree digitalization improves access and feedback, only 42% report adequate digital literacy, and infrastructure deficit remain the top bottlenecks. The study concludes that digitalization is an indispensable pedagogy, meanwhile, its success depends on aligning National Information Technology Development Agency's [NITDA] Digital literacy policy, National University Commission [NUC] and National Board for Technical Education [NBTE] curriculum integration, and teacher capacity building. Recommendations are provided for policies designer and components of institutions.

Keywords: Digitalization, Digital Pedagogy, Tertiary Education, Instruction, Nigeria, NITDA, 3D Framework.

Introduction

Quality Education is among the fundamental Sustainable Development Goals of the 2030 Agenda of the United Nations and it goals to insure inclusive and equitable quality education and embrace lifelong learning opportunities for all, United Nations Educational, Scientific and Cultural Organization (UNESCO), (2015). Establishing the objectives of this goal requires digitalization among other things. Digitalization is a series of deep and cultural preservation, workforce and technology shifts that entails new educational and operating framework and transform an institution's business structure, strategic directions, and value proposition (Grajek S. & Reinitz B., 2019). Digitalization provides higher education institutions (HEIs) with opportunities to propel access to quality education and the essential tools and skills that contribute to ensuring equity in tertiary institutions (Kaputa V., Loucanova E. & Tejerina-Gaite F.A., 2022). The higher institutions sector has well-noted the substantial benefits of technological development for the growth of society and the provision of equitable quality higher education regardless of learners' foundations (Chankseliani M., Qoraboyeva E, & Gimranova D., 2021). That is why most higher education institutions globally are striving to adopt digital transformation as core component of their institutional strategic plan (Jensen T., 2019). Digitalization refers to the application of digital technologies to transform instructional processes, not just digitizing notes and assessments. As a pedagogy, it is not about replacing lecturers with screens, it redefines the teacher's task through redesigning instruction to leverage digital tools for

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personalization, feedback, access, communication and involvement. The 21st century knowledge economy demands graduates who can think critically, engaged digitally, and adapt to rapid technological transformation. Obviously, traditional lecture-based instruction in many Nigerian tertiary institutions still dominant over application. In Nigeria, the Federal Ministry of Education has affirmed that, the future is technology-driven and artificial intelligence is now key to success, and without digital literacy thriving becomes a challenge, National Newspaper (2024).

Statement of Problem

Despite policy formulated by National Information Technology Development Agency's [NITDA], National University Commission [NUC] and National Board for Technical Education, to integrate digitalization as pedagogy in Nigerian higher institutions. Implementation remains fragmented and unrealistic. Recent investigations report low lecturer digital competence, students' negative perception and infrastructure inadequacy. Meanwhile, students are rapidly adopting generative artificial intelligent [AI] tools at rates above the global average. This creates a pedagogical gap, underscore the need for rapid policy implementation on adoption of technology as core pedagogy in higher institutions.

Objectives of Study.

1. Conceptually frame digitalization as an imperative pedagogy using the 3D Pedagogy structure.
2. Empirically assess the current state, perceived impact, and barriers of digitalized instruction in Nigerian higher education.

Research Questions

1. What conceptual framework analyzed digitalization as pedagogy?
2. Assess how digital tools and pedagogy are used for instruction?
3. What impact and barriers do lecturers and students aspire?

Literature Review

Global studies confirm digitalization enhance flexibility and outcomes when pedagogy leads technology. Digitalization of education is a core area of transformation for this industry (Olha P., 2021). It is said that changes associated with the application of digital technology in all aspects of human society are referred to as digitalization. Recently, the world is seeing an increasing influence of digital technology in professional and educational institutions. The rapid advancement of information and communication technology has changed the nature of many facets of public life, particularly the industrial revolution did in the 19th century (Fenwick T. & Edward R., 2016). The technical training of a contemporary expert includes the digitalization of education as a essential component. The significance and crops of information have been increasing rapidly and there are more multi-disciplinary studies and initiatives as a result of these advancements. In Nigeria, researchers identifies both prospects and challenges associated with digital transformations. Vanguard news (2025), study found pedagogic, technological, administrative, and socio-economic benefits of artificial intelligence integration, but also low awareness and infrastructure deficit. The application of digital technologies in teaching and learning has been accelerated globally over the last few decades. Emerging pandemics records, major cyber risks are caused by people's actions as well as failures of systems and technology (Wang L. & Alexander A.C., 2021). Competent technologies include 5G, blockchain, telemedicine, big data, cyber-attacks and cyber risks. Blockchain assisted for to reduced risks of pandemics, advanced the privacy and security of health systems, COVID-19 created new challenges in cybersecurity (Manalu E.P. & Gaffar J., 2020).

Digitalization of Tertiary Education

Three historical levels exist regarding the incorporation of Information and Communication Technologies (ICT) in higher education settings. First, is the extensive use of computers in accounting and office automation. Furthermore, is the advancement of highly specialized and certified software and their application in almost all other academic operations. Finally, there is a widespread use of communication software and Learning Management Systems (LMS) (Chong H. & Woo S., 2022). The use of Information and Communication Technologies in tertiary institutions was a gradual process which happened without much systematic need assessment nor any long-term strategy.

Pedagogical strategies for programming education

Explorations of key pedagogical strategies in programming education which encompassed collaboration, cognitive load management and the teacher's facilitative task. By evaluating designed collaboration and scaffolding, along with tools like



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augmented reality. It underpins approaches that support student skill development, engagement, inclusive and effective learning in programming.

Flipped learning

Flipped learning create students with video lectures and other learner complement materials structure to teach and guide students outside of the classroom. This enable and promote valuable class time to be spent on more engaging and collaborative activities. Research by (Graziano K. J. & Hall J.D., 2017) considered flipped learning for newly arrived English language learners in mainstream public high schools in the U.S. The aim of the study was to unravel whether flipped algebra instruction affects the students' math's learning outcomes. The results indicates that there was no statistically significant difference in the academic performance of learners enrolled in algebra with flipped instruction compared to students enrolled in the same course with non-digital instruction.

Artificial intelligence and learning analytics

Artificial intelligence and learning analytics redefine education through personalised feedback, formative assessment and targeted interventions. Artificial intelligence tools such as intelligent tutoring systems and natural language processing, enable immediate feedback, mitigate teacher workload and promote student engagement. Learning analytics assists identify students at risk, enabling prompt interventions. Artificial intelligence enhanced collaborative tools support balanced group engagement and communication. Artificial intelligence applications also promote inclusivity, offering tailored accommodations for learners with disabilities.

Digital literacy in education

Digital literacy is the capability to locate, evaluate, use and create information using digital tools, platforms and frameworks. It includes several interconnected proficiencies essential for the effective use of technology in educational contexts. Technological comprehension is key, as it enables teachers and learners to effectively understand and use digital tools to achieve their goals.

Conceptual Framework: Digitalization as Imperative Pedagogy

Digitalization in Instruction.

Digitalization as pedagogy means instruction is intentionally redefined around digital accessibility. It moves beyond PowerPoint lectures to include adaptive learning, simulations, data-driven feedback, flipped classrooms, digital tools, digital content and digital pedagogy to establish learning objectives. NCCE's (2026) redesigned of the NCE curriculum now integrates artificial intelligence awareness, ethical use of emerging technologies, digital literacy and adaptive digital pedagogy.

The 3D Pedagogy Model, we propose three interlocking dimensions

1. Digital Tools D1: The infrastructure and software. This includes Moodle, artificial intelligence tutors, video platforms and simulation software. NBTE (2025), is deploying decentralised artificial intelligence and machine learning centers that run on intranet so universities, polytechnics and colleges of education with poor internet can still access uniform technology tools.

2. Digital Pedagogy D2: Applicable teaching methods. Examples include flipped classrooms, microlearning, adaptive assessment and prompt engineering for artificial intelligence. uLesson's digital homework assist now gives personalised learning, the artificial intelligence feature navigates responses to each student's individual needs.

3. Digital Culture D3: The educational mindset, policy, and ethics. NITDA's draft National artificial intelligence Strategy 2024 envisions responsible, ethical and inclusive innovation. NUC and NITDA held a national dialogue in 2024 to formulate consensus guidelines for responsible, ethical and safe use of artificial intelligence in Nigerian tertiary institutions.

Proposed Conceptual Framework

Inputs: Digital infrastructure + Digital literacy + Policy support.

Process: Digital pedagogy in classroom design, delivery and assessment.

Outputs: Improved access, engagement, learning outcomes and 21st-century skills. The model argues that digitalization only becomes imperative pedagogy when all three inputs are present. Perhaps, when D1 + D2 + D3 are aligned.

Deficiency in any dimension undermines the others.

Imperativeness of Digitalization

Drivers that make it non-negotiable:



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1. Scale: One lecturer cannot give effective feedback to 200 students. Digital tools are efficient in this aspect.
2. Relevance: Employers demand digital fluency and proactiveness. NITDA notes spectrum of employees still lack the digital skills required to use modern systems.
3. Access: Digital tools extend and navigate learning beyond physical lecture theater walls. During COVID, uLesson saw 70% month-on-month growth as students adapted to remote education.
4. Personalization: Adaptive systems adjust content difficulty per student, addressing Bloom's 2-sigma problem of needing individual tutoring and effective problem solving.

The study is anchored on these relevant theories

Cognitive load theory

Cognitive Load Theory as explained by (Sweller J.P., Ayres S. & Kalyuga S., 2011), examines how the human brain processes information, emphasising the deficiency of working memory when learning new material. This theory provides a model for understanding how mental effort is allocated during learning and how it can be optimised to enhance knowledge acquisition and retention. Cognitive Load Theory is particularly relevant in the context of digital education, where the structure of digital tools and learning climate can significantly influence cognitive load.

Motivational theory

Motivational theory particularly self-determination theory equivalence, although is not the prime focus. Relevancies of digitalisation relating to motivation in education. This theory described motivation through three basic psychological needs: autonomy, competence and relatedness. When these needs are established, students are more likely to experience intrinsic motivation and engage in learning for their immediate benefits rather than external recognitions.

Methodology

Mixed method approach was adopted, comprises descriptive survey design and Quantitative data tested the 3D Framework propositions of design was adopted in Bauchi, North-East Nigeria. The population comprised students and academic staff from selected tertiary institutions. (Using Trek's formula 1994), 160 respondents were sampled from a population of 410. Questionnaires distributed physically and via Google Forms using a five-point Likert scale. Data analyzed using SPSS v27. Descriptive statistics: frequencies, percentages, mean. Decision mean = 2.50. Inferential: t-test to compare lecturer vs student perceptions.

Population: Total population of one hundred and sixty [160] lecturers and undergraduate students in three higher institutions comprises Abubakar Tafawa Balewa University Bauchi, Federal Polytechnic Bauchi and Adamu Tafawa Balewa College of Education Kalgere.

Sample: One hundred and sixty [160] respondents via stratified random sampling. Sixty [60] lecturers and one hundred [100] students. Margin of error 4.8% at 95% confidence.

Instrument

Digitalization Pedagogy Assessment Questionnaire [DPAQ] with 32 items. Section A: Demographics Section B: Digital Tools usage 5-point Likert, Section C: Digital Pedagogy practices Section D: Digital Culture and policy perception. Section E: Impact and barriers.

Validity: Face and content validity by 4 experts in educational technology. Reliability: Cronbach's alpha = 0.87.

Presentation of Results

Demographics Composition

Demographics comprises of 63% students, 37% lecturers. 55% universities, 30% polytechnic, 15% college of education.

Extent of Digitalization: Digital Tools and Pedagogy

Item	Mean	Decision
My institution has a functional LMS for courses	3.21	Accepted
Lecturers share recorded lectures/notes digitally	3.05	Accepted
Use of AI tools for quizzes or feedback is common	2.28	Rejected
Interactive simulations/virtual labs are used in my course	2.14	Rejected
Instruction includes flipped classroom activities	2.41	Rejected



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Basic fundamental digitalization is been practiced in most of our higher institution. Advanced digital pedagogy is rare. Meanwhile, inadequate Infrastructures and cost implication are top barriers. Unstable power and poor internet and low digital literacy among lecturers is critical to possible implementation digital transformation policy. This supports NBTE’s need for decentralised Artificial Intelligence laboratories. Proximity 38% agreed that institution has clear policy on ethical use of digital tools. 44% consented to the fact that leadership actively supports digital teaching. This shows Digital Culture D3 is inactive in the framework or link. This is an indication that Digitalization is in place, but shallow and ineffective.

Perceived Impact

Item	Mean	Decision
Digitalization improves access to learning materials	3.52	Accepted
Digital tools make feedback faster	3.36	Accepted
Digital instruction increases student engagement	3.24	Accepted
Digitalization reduces overall teaching workload	2.33	Rejected

The results from analysis confirm the conceptual model D1 recognised at basic level such as file sharing and transferring. D2 is weak because few lecturers use adaptive technologies or flipped methods. D3 is weakest and worst, revealed policies and culture lag. This explains why workload does not reduce despite application of tool. In addition, respondents significantly and strongly agree that digitalization improves access, feedback, and engagement. This underscored uLesson and Gradely impact data showing grade-level improvements and percentile gains. But without D2 and D3, the outcome remained limited. t-test showed no significant difference between lecturer and student ratings of impact $p > 0.05$, but lecturers rated barriers higher $p < 0.05$. It is obvious, students already using Artificial Intelligence at high rates, institutions must digitalize instruction to monitor and support usage, teach ethics, and ensure relevance. If not, the classroom becomes irrelevant. Digitalization is imperative not optional.

Conclusion

This mixed study reveals that digital learning activities, which promote purposeful communication, engagement, collaboration and inclusive amongst teachers and learners, provide massive opportunities to converse in creative, innovative and meaningful ways when compared to non-digital learning activities. Digital transformation was validated as an imperative pedagogy for higher institutions. Conceptually, the 3D Pedagogy Framework indicates that policies, designs and tools alone are insufficient. Empirically, Nigerian institutions have made drastic progress on access but lag in pedagogy and culture. Without urgent and adequate implementation, these effects will continue to undermine educational and national development.

Recommendations

1. Policy Level: NUC, NBTE, and NCCE should enforce digital pedagogy courses across teacher training and faculty development programs. Accelerate NUC and NITDA plan to embed AI and digital skills in all university curricula.
2. Institutional Level: All institutions should publish a Digital Teaching and Ethics Policy in alignment with Nigeria Data Protection Act 2023 and NITDA AI guidelines. Invest in solar-powered laboratories and offline content servers like NBTE’s intranet AI center.
3. Lecturer Level: Departments should run regular micro-training on digital pedagogy skill such as creating quizzes on LMS, using AI for feedback and designing flipped lessons.
4. Future Research: Longitudinal quasi-experimental studies comparing learning outcomes of digitalized to traditional classes, using platforms like uLesson to track metrics.
5. Students Level: Exploring communicative digital tools into teaching and learning such as Facebook and discussion forums, to drive critical learning areas and digital literacy across subjects. Foster 21st century skills and embrace cultural awareness and digital citizenship.



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