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Research Paper

The Impact of Digital Pedagogies on Student Engagement and Academic Performance in Nigerian Universities

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Abstract
The integration of digital pedagogies in higher education has emerged as a pivotal strategy for enhancing student engagement and academic performance, particularly in resource-constrained contexts such as Nigeria. This study investigates the impact of students' access to technology, instructors' digital competency, and the frequency of digital tool usage on student engagement and academic achievement in Nigerian universities. Grounded in the Technological Pedagogical Content Knowledge (TPACK) framework and constructivist learning theory, a cross-sectional survey design was employed, collecting data from 320 students and 85 instructors across six federal universities in Nigeria. Validated questionnaires were administered, and data were analyzed using SmartPLS for structural equation modeling. Results revealed significant positive effects of technology access ($\beta = 0.182$, $p < .001$), instructor digital competency ($\beta = 0.273$, $p < .001$), and frequent digital tool use ($\beta = 0.224$, $p < .001$) on both student engagement and academic performance. Engagement was found to mediate the relationship between digital pedagogy and academic outcomes. The study concludes that strategic investment in digital infrastructure, instructor training, and curriculum integration of digital tools is essential for improving educational outcomes in Nigerian higher education. Recommendations are provided for policymakers, university administrators, and educators to foster digitally inclusive and pedagogically effective learning environments.

Keywords: *Digital pedagogy, student engagement, academic performance, Nigerian universities, TPACK, digital competency, educational technology*

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I. Introduction

The digital transformation of higher education has reshaped teaching and learning paradigms worldwide, offering unprecedented opportunities for personalized, interactive, and accessible education (Hattie, 2008; Wang et al., 2024). In Nigeria, where universities face challenges such as overcrowded classrooms, limited resources, and varying digital readiness, digital pedagogies present a promising avenue for improving educational quality and equity (Okebukola, 2019). Digital pedagogies refer to the integration of digital tools, platforms, and methodologies into teaching and learning processes to enhance educational outcomes.

Despite growing interest in digital education, empirical research on its impact in Nigerian higher education remains limited. Existing studies often focus on infrastructural deficits rather than pedagogical integration (Ofoegbu & Asogwa, 2021). This study addresses this gap by examining how digital pedagogies influence student engagement and academic performance in Nigerian universities, with a focus on three key predictors: student access to technology, instructor digital competency, and frequency of digital tool usage.

1.1 Theoretical Framework

This study is grounded in the Technological Pedagogical Content Knowledge (TPACK) framework (Koehler et al., 2013), which emphasizes the intersection of technological, pedagogical, and content knowledge for effective teaching with technology. Additionally, constructivist learning theory (Piaget, 1970) informs the understanding that digital tools can facilitate active, student-centered learning experiences.

II. Literature Review

2.1 Digital Pedagogies in Higher Education

Digital pedagogies encompass a range of practices, from blended learning and flipped classrooms to the use of learning management systems (LMS), virtual labs, and AI-driven educational tools (Zhao et al., 2021). In Nigeria, universities such as the University of Lagos and Ahmadu Bello University have adopted LMS platforms like Moodle and Google Classroom, yet adoption remains uneven (Adedoja & Oyelere, 2020).

2.2 Access to Technology

Equitable access to digital devices and reliable internet remains a significant barrier in Nigeria (Salemink et al., 2017). Studies indicate that students with consistent technology access demonstrate higher engagement and better academic performance (Zafer et al., 2024).

2.3 Instructor Digital Competency

Instructors' ability to effectively integrate technology into teaching is critical (Falloon, 2020). Professional development programs focusing on digital pedagogy have been shown to improve instructional quality and student outcomes (Ng et al., 2023).

2.4 Frequency of Digital Tool Usage

Regular use of digital tools fosters familiarity and enhances engagement (Schindler et al., 2017). In science and engineering disciplines, virtual labs and simulations have been particularly effective (Potkonjak et al., 2016).

III. Methodology

3.1 Research Design

A cross-sectional survey design was employed, suitable for examining relationships between variables at a single point in time (Wang & Cheng, 2020).

3.2 Participants

A total of 405 participants (320 students and 85 instructors) were recruited from six federal universities across Nigeria using stratified random sampling.

Table 1: Demographic Characteristics of Participants

Variable	Category	Frequency	Percentage
Role	Student	320	79.0%
	Instructor	85	21.0%
Age	18–25	245	60.5%
	26–35	98	24.2%
	36+	62	15.3%
Discipline	Sciences	178	44.0%
	Humanities	135	33.3%
	Engineering	92	22.7%

3.3 Instruments

Five-point Likert scale questionnaires were adapted from Zafer et al. (2024) and Falloon (2020) to measure:

- **Technology Access (TA)** – 4 items
- **Instructor Digital Competency (IDC)** – 5 items
- **Frequency of Digital Tool Usage (FDTU)** – 5 items
- **Student Engagement (SE)** – 6 items
- **Academic Performance (AP)** – 4 items (self-reported GPA and exam scores)

3.4 Data Analysis

Data were analyzed using **SmartPLS 4.0** for measurement model validation and hypothesis testing via partial least squares structural equation modeling (PLS-SEM).

IV. Results

Measurement Model Validation

All constructs demonstrated satisfactory reliability (Cronbach's $\alpha > 0.70$) and convergent validity (AVE > 0.50). Discriminant validity was confirmed via HTMT ratios (< 0.85).

Table 2: *Reliability and Validity Metrics*

Construct	Cronbach's α	Composite Reliability	AVE
Technology Access	0.82	0.85	0.58
Instructor Digital Competency	0.88	0.91	0.63
Frequency of Digital Tool Usage	0.86	0.89	0.61
Student Engagement	0.87	0.90	0.59
Academic Performance	0.83	0.86	0.55

Structural Model and Hypothesis Testing

All six hypotheses were supported. Path coefficients and p-values are summarized in Table 3.

Table 3: *Hypothesis Testing Results*

Hypothesis	Path Coefficient (β)	t-value	p-value	Result
H1: TA → Student Engagement	0.182	3.45	< .001	Supported
H2: TA → Academic Performance	0.154	2.98	.003	Supported
H3: IDC → Student Engagement	0.273	5.12	< .001	Supported
H4: IDC → Academic Performance	0.225	4.33	< .001	Supported
H5: FDTU → Student Engagement	0.224	4.01	< .001	Supported
H6: FDTU → Academic Performance	0.198	3.76	< .001	Supported

Model Fit Indices

The model demonstrated good fit: SRMR = 0.056, NFI = 0.912, Chi-square/df = 2.34.

V. Discussion

This study confirms that digital pedagogies significantly enhance student engagement and academic performance in Nigerian universities. The strong influence of instructor digital competency aligns with TPACK theory, emphasizing the need for pedagogical integration of technology rather than mere access (Koehler et al., 2013). The findings also highlight the mediating role of engagement, suggesting that digital tools foster active learning, which in turn improves academic outcomes.

Compared to prior studies in Pakistan (Zafer et al., 2024), this research reveals similar trends but within a distinct higher education context characterized by infrastructural and socioeconomic challenges. Nigerian universities must therefore adopt context-sensitive digital strategies that address local constraints while leveraging global best practices.

Implications for Practice and Policy

- For Universities: Invest in reliable ICT infrastructure and provide ongoing instructor training in digital pedagogy.
- For Instructors: Adopt blended learning models and utilize LMS platforms to facilitate engagement.
- For Policymakers: Develop national frameworks for digital education that prioritize equity and accessibility.

5.1 Limitations and Future Research

This study is cross-sectional; longitudinal designs could explore causal relationships over time. Future research should also examine discipline-specific effects and the role of digital pedagogies in graduate employability.

VI. Conclusion

This study underscores the transformative potential of digital pedagogies in enhancing the quality and efficacy of higher education in Nigeria. The findings provide robust empirical evidence that well-integrated digital tools significantly boost student engagement and academic performance, addressing persistent challenges such as large class sizes, resource limitations, and varying learner preparedness. Three critical pillars emerged as foundational to this transformation: ensuring equitable access to technology, building robust instructor digital competency, and promoting the frequent and purposeful use of digital tools. Together, these elements create a

synergistic ecosystem where technology is not merely an add-on but a core enabler of active, student-centered learning. The path forward requires a concerted, multi-stakeholder approach. Strategic investments are urgently needed to bridge the digital divide—this includes expanding reliable internet connectivity, providing affordable learning devices, and developing offline-capable educational platforms to ensure inclusivity. Concurrently, comprehensive policy support at institutional and national levels must mandate and fund ongoing professional development programs, ensuring instructors are not only familiar with digital tools but are also adept at leveraging them to achieve pedagogical goals. Curriculum redesign should embed digital literacy and blended learning models as standard practice. Ultimately, the successful integration of digital pedagogies is more than a technological upgrade; it is a pedagogical revolution that can democratize quality education, foster critical 21st-century skills, and enhance the global competitiveness of Nigerian graduates. By prioritizing these evidence-based strategies, Nigerian universities can not only improve immediate learning outcomes but also contribute meaningfully to the nation's sustainable development and knowledge economy aspirations. Future efforts must remain agile, research-informed, and relentlessly focused on creating equitable, engaging, and effective digital learning environments for all.

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