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HARNESSING GENERATIVE ARTIFICIAL INTELLIGENCE FOR PEDAGOGICAL INNOVATION IN BUSINESS EDUCATION: AN EMPIRICAL STUDY OF TERTIARY INSTITUTIONS IN SOUTHWEST NIGERIA

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Article Info

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Abstract

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Abstract

Generative artificial intelligence (GenAI) is increasingly regarded as a disruptive force in higher education, yet its pedagogical promise in polytechnic business education in Sub-Saharan Africa remains largely untested. This study examined the extent to which GenAI supports teaching and learning in Nigerian polytechnics, identified the determinants of its effectiveness, and highlighted the associated barriers and governance issues. A cross-sectional mixed-methods design was adopted across six polytechnics in Southwest Nigeria. Data were collected from 420 students, 80 lecturers and 24 administrators using a structured questionnaire built on Technology Acceptance Model (TAM), Technological Pedagogical Content Knowledge (TPACK) and Unified Theory of Acceptance and Use of Technology (UTAUT) constructs, a performance rubric, and a semi-structured interview guide. Quantitative data were analysed using descriptive statistics, t-tests, ANOVA and multiple regression, while qualitative data were analysed thematically. Perceptions of GenAI were positive, but its use in the classroom was only moderate owing to infrastructural deficiencies such as poor connectivity, unreliable power supply and limited ownership of hardware and software. Students in GenAI-integrated classes significantly outperformed those in non-integrated classes in English and quantitative reasoning ($p < .01$). Regression analysis identified frequency of GenAI use ($\beta = 0.39$), lecturer AI competence ($\beta = 0.31$) and internet access ($\beta = 0.27$) as significant predictors of improved performance. The qualitative findings underscored the pedagogical value of GenAI alongside risks to academic integrity, with the absence of institutional policy and capacity-development mechanisms emerging as the principal governance concerns. Scaling up GenAI will require investment in ICT infrastructure, subsidised access to devices, professional development of lecturers in AI literacy, and governance mechanisms that ensure responsible use.

Keywords: Generative artificial intelligence, pedagogy, business education, polytechnics, Nigeria

Introduction

The global expansion of generative artificial intelligence (GenAI) is redefining teaching and learning in ways that would have been inconceivable only a few years ago. Unlike earlier waves of educational technology, which primarily digitised static instructional content, GenAI introduces a qualitatively different level of interactivity: it generates human-like text, performs data analysis,

develops simulations and produces multimodal output capable of supporting higher-order learning. Recent evidence suggests that the educational potential of GenAI is especially great in low-resource contexts, where it can serve as an inexpensive and scalable supplement to overstretched teaching staff. In a Nigerian pilot study, for instance, AI-assisted tutoring offered as an after-school programme substantially improved students' performance in English, digital skills and overall subject achievement, with gains that persisted for up to a year on conventional pen-and-paper examinations (World Bank, 2023). These results echo a growing global consensus that regards AI as a catalyst for personalised instruction and the democratisation of learning (Nguyen & Pham, 2022; UNESCO, 2023).

Despite this promise, deep structural constraints continue to limit the integration of GenAI into mainstream education in developing countries. In Nigeria, rural and semi-urban communities still suffer infrastructural deficiencies such as erratic power supply, inadequate internet connectivity, insufficient access to ICT equipment and low levels of digital proficiency among instructors. Adedokun, Adesina and Fagbemi (2022) contend that such deficiencies perpetuate an entrenched digital divide that can undermine equity in educational innovation. Similarly, Okeke and Oladipo (2022) point out that many polytechnics and colleges remain ill-equipped for sustained technology-enhanced learning because of chronic underfunding, weak policy implementation and inadequate professional development of lecturers. In such circumstances, introducing GenAI without addressing these systemic constraints risks widening rather than closing existing inequalities, as better-resourced students in urban centres are positioned to take full advantage of AI while rural students continue to be left behind.

The stakes are particularly high in business education in polytechnics. Business programmes in Nigeria are designed to be application-oriented, with emphasis on accounting, finance, entrepreneurship, communication and decision-making competencies. The ability to apply conceptual knowledge to real-world situations remains central to employability. GenAI can potentially enhance such instruction by supporting the development of case studies, providing instant feedback on business reports, simulating organisational scenarios and preparing students for analytical reasoning tasks. Nevertheless, empirical studies that assess the actual effect of GenAI on business education in Nigerian polytechnics are almost non-existent. Although research on ICT and e-learning adoption has grown considerably (Eze et al., 2021; Mensah & Boateng, 2021), it has focused mainly on general digital tools and online learning environments, with few studies addressing GenAI. Consequently, there remains a critical gap in knowledge on how GenAI can be used for context-appropriate pedagogical innovation in Nigerian polytechnics.

Beyond infrastructural and curricular considerations, the introduction of GenAI into educational institutions raises pressing ethical, epistemological and governance questions. Researchers have noted that AI models are prone to hallucinations, biased outputs and opacity in their decision-making processes (Floridi & Chiriatti, 2020). In Nigeria, Oyeniran, Oni and Olaleye (2023) warn that unregulated use of AI in higher education may undermine academic integrity, facilitate

plagiarism and compromise the validity of assessments. These issues highlight the need for carefully designed institutional mechanisms that balance innovation with ethical safeguards, so that AI enhances rather than diminishes educational quality. UNESCO (2023) further stresses that the use of AI in education should be governed by norms that emphasise fairness, accountability, transparency and inclusivity, particularly where deep-seated inequalities exist within education systems.

This study is motivated by the urgent need for empirical evidence on how GenAI can be harnessed to transform business education instruction in polytechnics in Southwest Nigeria. Despite the transformative potential of GenAI, little systematic evidence exists on its impact in Nigerian technical and vocational education and training (TVET) settings, especially on students' learning processes, academic performance and employability skills. Accordingly, the study pursued four objectives: first, to examine the availability and patterns of use of GenAI among students and lecturers in business programmes; second, to determine the extent to which GenAI-supported instruction influences students' performance and competency acquisition; third, to examine the facilitating factors and barriers, such as infrastructure, lecturer competence and institutional policy, that shape adoption; and fourth, to propose actionable recommendations for scaling GenAI in ways that are pedagogically effective, ethically sound and feasible within the local context.

Arising from these objectives, the study was guided by the following research questions: What GenAI tools are available and accessible in polytechnic business programmes in Southwest Nigeria, and how are students and lecturers currently using them? To what extent does GenAI-supported instruction improve students' performance and skills over and above conventional instruction? What institutional, infrastructural and pedagogical factors mediate the effect of GenAI on learning outcomes? Finally, what risks and governance concerns accompany GenAI use, and how can stakeholders mitigate these risks while maximising its benefits? The study offers a timely and long-overdue contribution to the emerging body of research on AI and pedagogy in Sub-Saharan Africa. It seeks to provide empirical evidence that not only measures outcomes but also interrogates the processes and contexts that shape them. In doing so, it aims to inform institutional planning and broader policy frameworks for the responsible uptake of GenAI, so that innovation in Nigerian polytechnics advances the global goal of accessible, equitable and high-quality education for all.

Literature Review

Generative artificial intelligence (GenAI) refers to AI systems, often built on large language models (LLMs) or multimodal architectures, that create new content such as text, images, code, audio or video in response to input prompts (Berkeley AI Teaching & Learning, 2025). GenAI therefore moves beyond earlier AI tools by supporting creative, generative and dialogic activities, with potentially far-reaching implications for education (Cornell University, 2023). In the instructional context, GenAI can assist educators in curriculum design, content scaffolding, test

and assessment design, formative feedback, prompt-chaining activities for students and personalised support (Harvard University, 2023).

In learning contexts, GenAI blurs the line between content presentation and content co-production. Rather than merely transmitting fixed content, a GenAI-supported classroom can enable student–AI interaction, exploratory scaffolding and iterative feedback cycles. However, this promise depends on instructional design: GenAI must be embedded within deliberate instructional architectures rather than simply grafted onto existing teaching practices (Qian et al., 2025). Moreover, several scholars caution that GenAI is not neutral: models reproduce social and cultural biases, can hallucinate, and may reduce meaningful student engagement if used indiscriminately (Bozkurt et al., 2024). A critical scoping review notes that while GenAI can strengthen student agency through personalised feedback, it also has the potential to erode learner autonomy and reinforce inequality (Roe & Perkins, 2024).

From a digital pedagogy perspective, the adoption of GenAI requires new literacies: AI literacy (understanding the affordances and limitations of models and how to design prompts), critical oversight (evaluating AI output) and prompt-engineering skills (refining prompts iteratively). Nguyen (2024) advises that teachers scaffold AI interaction by setting explicit boundaries on where AI may be used, requiring students to make their original thinking visible, and gradually withdrawing scaffolds. In sum, the conceptual literature suggests that GenAI is not a panacea but a valuable tool whose educational benefits are realised only when it is responsibly embedded in instructional design and mediated by AI-literate instructors and ethical guardrails.

To explain the adoption and sustained use of GenAI in teaching, scholars have repeatedly drawn on the Technology Acceptance Model (TAM) and its extensions. TAM posits that Perceived Usefulness and Perceived Ease of Use determine users' Attitude Toward Use and Behavioural Intention (Davis, 1989). Applied to GenAI, lecturers are likely to adopt AI-supported instruction if they perceive the tools as genuinely helpful for the task at hand (usefulness) and not overly complicated (ease of use). Recent empirical studies support this: a 2024 study of higher-education instructors found AI literacy and Perceived Ease of Use to be jointly significant predictors of intention to use GenAI (Al-Abdullatif et al., 2024). Others employ the Unified Theory of Acceptance and Use of Technology (UTAUT) as a complement, adding social influence, facilitating conditions and effort expectancy as predictors of educational technology use (Ng et al., 2025).

However, such models are often insufficient on their own in teacher education contexts, which is where the Technological Pedagogical Content Knowledge (TPACK) framework becomes relevant. TPACK holds that effective use of technology does not arise from technical proficiency alone but from the integration of technological, pedagogical and content knowledge. Researchers have recently begun to propose TPACK extensions for GenAI that link AI literacy, trust and subject-specific pedagogy (Al-Abdullatif et al., 2024). In practice, a business lecturer's ability to

craft an effective GenAI prompt for a finance scenario depends not only on knowledge of finance content but also on an understanding of how AI scaffolding interacts with pedagogy.

Constructivism (Piaget, 1972; Vygotsky, 1978) underpins many digital learning theories: learners actively construct knowledge through engagement, reflection and scaffolding. In a GenAI-supported classroom, students can co-construct knowledge through AI-generated drafts, critique, iteration and metacognitive questioning. GenAI can act as a scaffold, providing prompts, counter-arguments or extended scenarios that challenge students' thinking. Constructivism therefore offers a useful lens for exploring how GenAI-mediated learning can promote deeper inquiry rather than rote content generation. Combining TAM/UTAUT models of adoption with the pedagogical depth of TPACK and a constructivist orientation thus provides a robust conceptual framework for examining GenAI in polytechnic business education.

Empirical research on GenAI applications in education is still emerging but expanding rapidly. A recent review in *TechTrends* examined pedagogical applications of GenAI across higher education, highlighting uses such as automated summarisation, augmented peer review, prompt chaining and adaptive generative feedback for diverse learners (Qian et al., 2025). The authors note, however, that effect sizes in controlled studies have been modest and strongly moderated by teacher scaffolding and alignment with learning objectives. In a 2025 longitudinal study, Ng et al. demonstrated that GenAI can function as an "instructional co-designer", helping educators to design instruction, create diagrammatic illustrations or propose alternative assessment items, to the particular benefit of instructors with limited capacity (Ng et al., 2025). The study also reported, however, that adoption is hindered by gaps in institutional policy and technical preparedness. At the intersection of technology-adoption models, a study combining TAM, TPACK and UTAUT in an emerging economy found that teachers' continuance intention to use technology was strongly influenced by their pedagogical and technological competence, underscoring the need for comprehensive readiness rather than mere exposure (Al-Abdullatif et al., 2024). In Africa, Mtetwa (2025) explored AI-based learning applications among South African undergraduates and concluded that although students value the efficiency and guidance these tools offer, concerns about trust, accuracy and over-reliance need to be resolved. Together, these studies indicate that the educational promise of GenAI is genuine but contingent on context, support and governance.

The ethical dimensions of GenAI integration are of considerable importance at the tertiary level. Corrigan et al. (2023) argue that AI ethics, including bias, transparency, privacy and fairness, should be embedded within institutional policy and curricula rather than treated as ad hoc additions. Similarly, Guadu (2024) emphasises the need for culturally appropriate safeguards and non-discriminatory policies to ensure that AI does not entrench existing inequalities. In Africa specifically, Sangwa et al. (2025) examined the state of AI governance in tertiary institutions and found that although Nigeria, South Africa and Rwanda have been early adopters of AI policy, many institutions remain at an aspirational stage, constrained by inadequate infrastructure and human capacity. Compliance with AI regulations remains weak and often tokenistic, which poses

significant governance and policy-implementation challenges for polytechnics in Southwest Nigeria as they adopt GenAI. Taken together, the empirical and ethical evidence indicates that GenAI can transform pedagogy, but the scope, direction and long-term sustainability of such change will depend heavily on institutional readiness, policy development, lecturer competence and a commitment to ethical and transparent use.

Methodology

This study adopted a cross-sectional mixed-methods design, combining quantitative and qualitative components, to assess the contribution of generative artificial intelligence (GenAI) to the transformation of business education pedagogy in polytechnics in Southwest Nigeria. The population comprised 3,869 students, lecturers and administrators in business-related programmes in six purposively selected polytechnics in Lagos, Ogun, Oyo, Osun, Ondo and Ekiti States. Using Yamane's (1967) formula at a 95% confidence level and a 5% margin of error, a sample of 420 students, 80 lecturers and 24 administrators was drawn through a multistage sampling procedure: institutions were selected purposively, departments were stratified by discipline, and students and lecturers were selected randomly, while lecturers and administrators were purposively recruited for the interviews.

Three instruments were used for data collection: a structured questionnaire based on TAM, UTAUT and TPACK constructs, rated on a four-point Likert scale, which measured the perceived usefulness and ease of use of GenAI, lecturer competence, ethical concerns and perceived effects on learning; a performance rubric for assessing students' case studies, reports and quantitative reasoning assignments before and after GenAI-supported instruction; and a semi-structured interview guide that explored contextual experiences, benefits, risks and governance practices. The validity of the instruments was established through expert review and a pilot study in a non-sampled polytechnic, while reliability was confirmed with Cronbach's alpha coefficients above 0.80. Ethical approval was obtained from a recognised research ethics committee, and the principles of informed consent, voluntary participation and confidentiality were strictly observed.

Surveys and assessments were administered under researcher supervision to two groups: an experimental group taught with GenAI tools (AI-generated feedback, case simulations and prompt-driven learning) and a control group taught with conventional methods. Interviews were conducted, recorded, transcribed and coded. Quantitative data were analysed with the Statistical Package for the Social Sciences (SPSS, version 27): descriptive statistics summarised access, availability and perceptions, while inferential analyses comprising t-tests, ANOVA and multiple regression were used to determine the predictors of performance, such as frequency of tool use, lecturer competence and facilitating conditions. Hierarchical linear modelling (HLM) was used to account for class-level clustering. The qualitative transcripts were analysed thematically following Braun and Clarke's (2021) six-phase framework, and the results were triangulated across data

sources to establish convergence, strengthen empirical support and provide contextual depth for the interpretation of the findings.

Results and Discussion

Table 1: Descriptive Statistics of Access to and Use of Generative AI Tools among Polytechnic Business Students (n = 420)

Variable	Mean (M)	Std. Dev. (SD)	Rank
Awareness of GenAI tools	3.12	0.86	1st
Frequency of classroom use	2.54	0.97	6th
Frequency of out-of-class use	2.83	0.91	4th
Perceived usefulness	3.05	0.78	2nd
Perceived ease of use	2.89	0.84	3rd
Access to stable internet	2.21	1.02	7th
Access to personal devices	2.64	0.95	5th

Note: Four-point Likert scale (1 = lowest, 4 = highest).

The findings show a fairly high level of awareness of GenAI tools (M = 3.12), but actual classroom use remains modest (M = 2.54), reflecting infrastructural and policy constraints. Out-of-class use was higher (M = 2.83), probably because students rely on personal smartphones, which corroborates earlier findings that students use technology extensively outside formal classes (Okeke & Oladipo, 2022). Perceived usefulness (M = 3.05) was rated above ease of use (M = 2.89), consistent with the TAM proposition that perceived usefulness is a strong driver of behavioural intention (Davis, 1989). Nevertheless, poor internet connectivity (M = 2.21) and limited access to personal devices (M = 2.64) remain significant barriers, in line with Adedokun et al. (2022), who reported that infrastructural gaps significantly constrain ICT use in Nigeria.

Table 2: Comparison of Academic Performance between GenAI-Integrated and Non-Integrated Groups

Group	English (Mean %)	Math/Quantitative (Mean %)	SD (English)	SD (Math)	t-value	p-value
GenAI-Integrated (n = 210)	64.3	61.8	8.2	7.5	5.94	< .001***
Non-Integrated (n = 210)	55.7	51.2	7.6	8.1	–	–

***p < .001

The mean scores show that students in GenAI-integrated courses significantly outperformed their counterparts in both English (64.3% vs. 55.7%) and quantitative reasoning (61.8% vs. 51.2%). Independent-samples t-tests confirmed that these differences were statistically significant ($p < .01$). This is consistent with evidence that AI-supported scaffolding can boost student achievement when it is embedded within instruction (Qian et al., 2025). The results also support constructivist views, as GenAI tools helped students to engage deeply and interactively with learning material. Notably, the improvement is also consistent with the Technology Acceptance Model, since students who perceived the tools as useful were more likely to achieve better results, supporting the model's predictive validity (Al-Abdullatif et al., 2024).

Table 3: Regression Analysis of Predictors of Student Performance in GenAI-Supported Courses

Predictor Variable	Beta (β)	Std. Error	t-value	p-value
Frequency of GenAI use	0.39	0.08	4.87	< .001***
Lecturer AI competence	0.31	0.07	4.42	.001**
Internet connectivity access	0.27	0.09	3.02	.003**
Device ownership	0.18	0.06	2.74	.008**
Gender (male = 1, female = 0)	−0.06	0.05	−1.21	.224

***p < .001, **p < .01

The regression results indicate that frequency of GenAI use ($\beta = 0.39$, $p < .001$) was the strongest predictor of improved performance, suggesting that regular use yields significant gains. Lecturer

AI competence ($\beta = 0.31$, $p < .01$) was also significant, highlighting the importance of instructor preparedness for maximum impact, in line with the TPACK framework, which emphasises the integration of technological, pedagogical and content knowledge. Internet connectivity and device ownership were significant but weaker predictors, confirming infrastructure as an enabling condition. Gender was not a significant predictor, which is consistent with Mensah and Boateng's (2021) finding that technology-supported learning benefits male and female students equally where access is evenly distributed. These findings indicate that both human factors (lecturer competence) and infrastructure mediate the effectiveness of GenAI deployment, supporting UTAUT's emphasis on facilitating conditions (Ng et al., 2025).

Table 4: Qualitative Themes from Interviews with Lecturers and Administrators (n = 24)

Theme	Illustrative Quote (Paraphrased)
Enhanced pedagogy	"GenAI helps me generate multiple case study scenarios and instant feedback for students."
Integrity concerns	"Students sometimes over-rely on AI outputs, raising plagiarism and authenticity worries."
Infrastructure challenges	"Unreliable power and internet often make consistent integration difficult."
Policy and governance gaps	"We lack institutional policies to regulate or guide ethical use of AI tools."
Lecturer capacity needs	"Many lecturers need training to know how to integrate AI responsibly."

The qualitative findings complement the quantitative results by revealing both opportunities and risks. Educators valued the pedagogical benefits of AI in producing diverse learning materials and strengthening feedback loops, which resonates with constructivist notions of scaffolded knowledge construction (Vygotsky, 1978). Integrity concerns featured prominently, with staff reporting increased plagiarism and the risk of over-dependence on AI, consistent with Oyeniran et al. (2023), who warned of ethical blind spots in Nigerian higher education. Infrastructural limitations and the absence of governance protocols emerged as recurring themes, consistent with the findings of Sangwa et al. (2025) on weak enforcement of AI policy in Africa. Above all, respondents overwhelmingly stressed the need for capacity-building initiatives to ensure effective use, corroborating Al-Abdullatif et al.'s (2024) finding that teacher competence is a key predictor of successful AI implementation.

Conclusion

This study examined the integration of generative artificial intelligence (GenAI) into business education in polytechnics in Southwest Nigeria, with the aim of evaluating its pedagogical effectiveness, infrastructural feasibility and governance implications. The findings showed that although students' and lecturers' awareness of GenAI tools was relatively high, actual classroom use remained modest because of infrastructural constraints such as unreliable network connectivity, limited access to devices and unstable power supply. However, where GenAI was consistently integrated into instruction, students performed substantially better in English and quantitative reasoning tasks, providing empirical evidence that GenAI can serve as an effective instructional tool in contexts where conventional resources are inadequate. The regression results further revealed that frequency of use, lecturer competence and internet access were the strongest predictors of improved performance, emphasising that human capacity and infrastructural readiness matter as much as the technology itself. The qualitative findings, on the other hand, raised concerns about threats to academic integrity, over-reliance on AI-generated output and organisational unpreparedness, underscoring the importance of appropriate policy frameworks and ethical guidelines. On the basis of this evidence, the study concludes that GenAI can be a transformative but conditional innovation in business education in Nigerian polytechnics. GenAI has the potential to enrich instruction, support personalised learning and strengthen students' skills, but it will succeed only if infrastructural inequalities are addressed and appropriate safeguards are put in place.

Recommendations

Based on the findings, the study recommends the following:

1. Government and polytechnic administrators should invest in strengthening infrastructure, particularly rural broadband and reliable electricity, and introduce subsidised device-access schemes for students.
2. Polytechnic management should institute structured professional development programmes on AI literacy, prompt engineering and ethical use as part of lecturers' continuing professional development.
3. Institutional leaders should establish governance frameworks that define acceptable uses of GenAI, protect academic integrity, and mitigate the risks of plagiarism and algorithmic bias.

By adopting these measures, Nigerian polytechnics can harness GenAI not merely as a technological novelty but as an agent of inclusive, equitable and high-quality education, thereby contributing directly to the achievement of Sustainable Development Goal 4.

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