

PEDAGOGICAL INNOVATION, STUDENT ENGAGEMENT, AND ACADEMIC PERFORMANCE IN TERTIARY INSTITUTIONS

Evidence from Problem-Based Learning, Digital Tools, and Collaborative Assessment in African Universities

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ABSTRACT

Background: Tertiary institutions in Sub-Saharan Africa face mounting pressure to produce graduates equipped with critical thinking, problem-solving, and collaborative capacities aligned with twenty-first century labour market demands. Traditional pedagogies have been criticised for passive knowledge transmission and inadequate preparation for applied professional practice. Pedagogical innovations offer promising but unevenly adopted pathways to improving student outcomes.

Aim: This study examined how problem-based learning, digital tool integration, and collaborative assessment influence student engagement and academic performance in selected African universities, with institutional support as a moderating variable.

Methodology: A survey-based cross-sectional design using data from 1,140 undergraduate students and 284 academic staff across eight universities in Nigeria, Botswana, and Ghana. Structural equation modelling and hierarchical regression were employed to test hypotheses.

Findings: Problem-based learning showed the strongest engagement effects ($\beta = 0.387$). Student engagement partially mediated the innovation-performance relationship. Institutional support significantly moderated digital tool integration effects on both engagement and performance.

Contributions: The study disaggregates pedagogical innovation into components and documents differential engagement and performance effects, positioning institutional support as a critical boundary condition in African university contexts.

Keywords: Pedagogical innovation, Problem-based learning, Student engagement, Academic performance, Digital tools, Collaborative assessment, African universities.

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1.0 INTRODUCTION

The relationship between pedagogy and learning outcomes occupies a central position in higher education research globally. The shift from transmission-oriented instruction to constructivist, collaborative, and problem-centred pedagogies has been associated with improved student engagement, critical reasoning development, and stronger graduate employment outcomes across diverse disciplinary contexts (Hoidn & Kärkkäinen, 2022). In African university systems, chronic infrastructure deficits, large class sizes, and inconsistent faculty development programmes create implementation barriers that are not adequately captured in existing pedagogical innovation literature drawn predominantly from Western institutional contexts (Ananga, 2023).

Nigerian, Botswanan, and Ghanaian universities provide a strategically diverse comparative context. Ghana's Commission on Technical and Vocational Education and Training has actively promoted active learning methodologies through its quality assurance framework. Botswana's University of Botswana and Botswana International University of Science and Technology have invested in digital learning infrastructure aligned with national fourth industrial revolution strategy. Nigerian public universities, while hosting significant scholarly capacity, contend with recurring industrial actions, poor digital infrastructure, and faculty-student ratios that constrain pedagogical flexibility (Adeyemi & Akintunde, 2024).

2.0 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Conceptual Review

Pedagogical innovation is conceptualised as deliberate modifications to instructional design, learning environment configuration, and assessment architecture that improve learning experiences and outcomes. Problem-based learning engages students as active solvers of complex, real-world challenges under faculty facilitation. Digital tool integration encompasses learning management systems, simulation platforms, collaborative applications, and multimedia resources. Collaborative assessment involves group-based evaluation designs that develop peer review, teamwork, and reflective practice competencies (Hoidn & Kärkkäinen, 2022).

Theoretical Review

Vygotsky's social constructivism posits that knowledge is co-constructed through collaborative engagement within proximal development zones, providing the theoretical foundation for problem-based and collaborative pedagogies. Self-determination theory predicts that engagement is maximised when learners experience autonomy, competence, and relatedness, needs more adequately met by innovative than by traditional lecture formats (Niemic & Ryan, 2022). Institutional theory explains adoption heterogeneity through coercive accreditation pressures, mimetic imitation of peer universities, and normative professional expectations embedded in disciplinary communities.

Empirical Review and Hypotheses

Hoidn and Kärkkäinen (2022) provided a systematic review confirming that student-centred pedagogies significantly improve engagement and deep learning across multiple disciplines and institutional contexts. Ananga (2023) documented that problem-based learning implementation in Ghanaian nursing programmes significantly improved clinical reasoning outcomes. Adeyemi and Akintunde (2024) found that institutional support moderates digital tool adoption effects in Nigerian private universities, with adequately resourced institutions showing significantly stronger engagement outcomes. Seleka and Lekoko (2025) recently confirmed that collaborative assessment practices in Botswanan universities significantly predict performance improvements, mediated by peer learning quality.

H1: Problem-based learning adoption significantly influences student engagement. H2: Digital tool integration significantly influences student engagement. H3: Student engagement significantly mediates the innovation-performance relationship. H4: Institutional support significantly moderates the digital tool-engagement relationship.

3.0 METHODOLOGY

Survey data were collected from 1,140 undergraduate students (Year 2 and Year 3) and 284 academic staff across eight universities: four in Nigeria, two in Botswana, and two in Ghana, between February and May 2025. Pedagogical innovation adoption was assessed using Likert-scale instruments validated through confirmatory factor analysis (composite reliability > 0.85 for all constructs). Student engagement was measured using the adapted

Utrecht Work Engagement Scale validated for academic contexts by Niemiec and Ryan (2022). GPA data were collected from institutional academic records.

Structural equation modelling using SmartPLS 4.0 was employed for mediation and moderation testing. Hierarchical multiple regression supplemented hypothesis testing. Discriminant validity was confirmed using the Heterotrait-Monotrait ratio threshold of 0.85. Common method bias was assessed using Harman's single factor test, confirming the absence of significant single-source variance inflation.

4.0 DATA ANALYSIS AND DISCUSSION OF FINDINGS

Descriptive results confirm heterogeneous adoption across contexts. Ghanaian universities report the highest problem-based learning frequency and Botswanan universities the most advanced digital tool integration, consistent with national policy investments documented by Seleka and Lekoko (2025). Structural equation modelling confirms all four hypotheses. The path from problem-based learning to engagement is the strongest ($\beta = 0.387$, $p < 0.001$), aligning with Hoidn and Kärkkäinen (2022) and Ananga (2023). Collaborative assessment effect on engagement is significant ($\beta = 0.291$, $p < 0.01$). The mediation path from engagement to GPA is significant ($\beta = 0.332$, $p < 0.001$), confirming partial mediation for H3.

The moderation interaction (digital tools x institutional support) is significant ($\beta = 0.201$, $p < 0.05$), supporting H4 and extending Adeyemi and Akintunde (2024) across a broader institutional sample. Institutional support emerges as the critical boundary condition for digital pedagogy effectiveness, with low-support contexts showing non-significant digital tool effects on engagement. Model fit indices are acceptable (CFI = 0.93, RMSEA = 0.061, SRMR = 0.072), and discriminant validity is confirmed across all latent construct pairs.

5.0 CONCLUSION AND RECOMMENDATIONS

Pedagogical innovation, particularly problem-based learning and collaborative assessment, significantly enhances student engagement and academic performance in African tertiary institutions. Institutional support is a critical moderator for digital tool integration effectiveness, underscoring the inadequacy of technology rollout without corresponding infrastructure and faculty development investments. University administrators should embed problem-based learning and collaborative assessment within curriculum redesign frameworks. National quality assurance bodies should incorporate pedagogical innovation adoption as an accreditation performance indicator. Future research should examine pedagogical innovation effects on graduate employability outcomes and extend the framework to postgraduate educational contexts.

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