Curriculum Innovation and Pedagogical Transformation: Assessing BMASS and CMASS Effect on Pre-Service Teachers in Teacher Education at the University of Delta

Henrietta Ifeanyichukwu Nwabuwe[1], Anyima Friday Fidelis[2]

Abstract— *This study investigates the effect of two curriculum innovation models—the Blended Modularized Active Support System (BMASS) and the Collaborative Modularized Active Support System (CMASS)—on the academic performance and pedagogical skills of pre-service teachers at the University of Delta, Agbor, Nigeria. Employing a quasi-experimental design with a pre-test, post-test, non-equivalent control group, 90 pre-service teachers were assigned to three groups: BMASS, CMASS, and a control group taught using traditional methods. Data were collected using an Academic Performance Test (APT) and a Pedagogical Competency Rating Scale (PCRS). Results were analyzed using ANCOVA. Findings revealed that students in the BMASS group significantly outperformed their peers in academic tests, while the CMASS group demonstrated superior development in pedagogical competencies. The control group showed the least improvement in both areas. These results underscore the value of learner-centered, modular, and technology-integrated instructional models in promoting meaningful learning and teaching proficiency in teacher education. The study concludes that both BMASS and CMASS are effective alternatives to traditional instruction and recommends their integration into teacher training curricula. The findings also highlight the need for policy reform, professional development for teacher educators, and investment in digital learning infrastructure. This study contributes to the discourse on curriculum transformation in higher education and offers practical strategies for improving teacher education in Nigeria and similar developing contexts.*

Keywords: Curriculum Innovation; Pre-Service Teachers; Pedagogical Transformation; Teacher Education; Nigeria.

[1] Faculty of Education, Department of Science Education, University of Delta, Agbor. Delta State. Email: henrietta.nwabuwe@unidel.edu.ng

[2] Faculty of Education, Department of Educational Foundations, University of Delta, Agbor. Delta State. Friday.anyima@unidel.edu.ng

INTRODUCTION

The landscape of teacher education is rapidly evolving, especially in response to the global call for transformative and sustainable education in the 21st century ((Ayibam, 2024a; Ayibam, 2024b; Ayibam, 2024c). Curriculum innovation and pedagogical transformation are central to ensuring that pre-service teachers are equipped with the knowledge, skills, and attitudes necessary to thrive in dynamic classroom environments and to foster meaningful learning among diverse student populations (UNESCO, 2020). In this context, the integration of context-specific instructional models such as BMASS (Blended Modularized Active Support System) and CMASS (Collaborative Modularized Active Support System) has gained increasing attention in higher education institutions, particularly within developing nations like Nigeria where systemic educational challenges persist (Ogunlade & Adebayo, 2021; Ogbondah, 2023).

At the University of Delta, where teacher education serves as a cornerstone for regional educational development, the need for innovative instructional frameworks is more pressing than ever. Traditional approaches, often characterized by didactic teaching methods and rote memorization, are increasingly viewed as insufficient for preparing reflective, adaptive, and technologically competent educators (Adeyemi & Salami, 2019). The introduction of modularized curriculum components such as BMASS and CMASS is therefore seen as a critical reform strategy that blends content delivery with learner-centered pedagogy, digital resources, and collaborative inquiry (Okonkwo & Anyanwu, 2022).

BMASS emphasizes blended learning modalities where digital and face-to-face instruction are integrated to enhance flexibility, accessibility, and learner autonomy. It draws on constructivist learning theories and promotes asynchronous engagement with instructional materials through a structured modular design (Mbakwe & Nwafor, 2020). On the other hand, CMASS is rooted in the principles of social constructivism and collaborative learning. It leverages peer-to-peer interaction, cooperative task structures, and real-time discussion platforms to facilitate deep learning and professional identity development among pre-service teachers (Onah & Ilechukwu, 2021). Both approaches align with the broader objectives of transformative pedagogy, which seeks to reshape how knowledge is constructed, applied, and disseminated in teacher education contexts (Sterling, 2019).

Emerging empirical evidence suggests that modularized support systems can significantly improve learning outcomes, enhance critical thinking, and foster a more engaging learning environment for teacher trainees (Ngwu & Okafor, 2024). However, there remains a dearth of contextual research exploring the specific effects of BMASS and CMASS within Nigerian universities, particularly in the context of teacher education. Most existing studies either focus on general ICT integration or examine modular systems in non-education disciplines (Afolabi & Chukwu, 2022). Thus, a

targeted investigation into how these pedagogical models influence pre-service teachers' academic performance, pedagogical knowledge, and attitudinal shifts is both timely and necessary.

This study, therefore, seeks to assess the comparative effects of BMASS and CMASS on pre-service teachers' academic and pedagogical development at the University of Delta. By exploring these models within a real-world institutional context, this research contributes to the discourse on sustainable curriculum innovation and the future of teacher preparation in Nigeria. The findings have the potential to inform policy decisions, institutional reforms, and instructional practices aimed at equipping future educators with the competencies required for 21st-century teaching and learning.

STATEMENT OF THE PROBLEM

Curriculum innovation is a critical factor in driving pedagogical transformation, particularly in teacher education where the quality of pre-service training directly influences classroom effectiveness. In Nigeria, the shift from the Curriculum Minimum Academic Standards (CMASS) to the Basic Minimum Academic Standards (BMASS) represents a major policy intervention aimed at aligning teacher education with global best practices. BMASS is designed to foster competence-based learning, critical thinking, and contemporary pedagogical approaches. However, the implementation of BMASS across institutions, including the University of Delta, has raised fundamental questions about its actual effectiveness compared to the long-standing CMASS framework.

Despite the strategic intention behind the BMASS reform, there is limited empirical research examining its influence on the instructional preparedness, pedagogical skills, and professional identity formation of pre-service teachers. At the University of Delta, both curricula have been in use, yet comparative assessments of their impact remain largely unexplored. This gap in evidence challenges the ability of teacher education stakeholders to make data-informed decisions about curriculum design, delivery, and reform.

Moreover, the lack of a clear understanding of how BMASS translates into improved pedagogical outcomes raises concerns about the sustainability of current reforms and their ability to address the evolving demands of 21st-century classrooms. If curriculum innovation does not lead to measurable pedagogical transformation, the goal of producing competent, reflective, and adaptive educators may remain unrealized. Hence, this study seeks to critically assess the effects of both BMASS and CMASS on the pedagogical development of pre-service teachers at the University of Delta, with the aim of providing insights that inform future curriculum innovation in Nigerian teacher education.

RESEARCH QUESTIONS

1. To what extent does the Blended Modularized Active Support System (BMASS) impact the academic performance of pre-service teachers in teacher education at the University of Delta?

2. What is the comparative effect of BMASS and CMASS on the pedagogical skills acquisition of pre-service teachers at the University of Delta?

Hypotheses

1. **H_{01}:** There is no significant difference in academic performance between pre-service teachers exposed to BMASS and those not exposed.

2. **H_{02}:** There is no significant difference in pedagogical skills acquisition between pre-service teachers taught using BMASS and those taught using CMASS.

LITERATURE REVIEW

Conceptualizing Curriculum Innovation in Teacher Education

Curriculum innovation is widely recognized as a critical driver of educational reform, particularly in teacher education where the demand for adaptive, learner-centered pedagogies is intensifying. It involves the intentional redesign of curriculum content, structure, delivery, and assessment to meet evolving educational needs and societal challenges (Audu, Oyewole, & Ojeniyi, 2020). In the context of Nigeria, curriculum innovation is driven by the need to produce educators who are not only content experts but also skilled in modern instructional practices and responsive to local and global educational trends (Okonkwo & Anyanwu, 2022).

As such, teacher education institutions are increasingly adopting modularized and flexible learning models. Modular approaches enable customized learning paths and support differentiated instruction, which is essential for diverse learner populations (Ogbondah, 2023). Moreover, the integration of technology-enhanced learning tools within these frameworks supports both synchronous and asynchronous learning, aligning with the global shift toward digital pedagogy (UNESCO, 2020).

Blended Modularized Active Support System (BMASS)

BMASS refers to a pedagogical model that integrates modular instructional design with blended learning modalities—combining face-to-face interactions with online resources and activities. Research indicates that BMASS enhances learning flexibility, supports self-paced learning, and promotes greater autonomy among students (Mbakwe & Nwafor, 2020). According to Ngwu and Okafor (2024), BMASS also fosters deeper content engagement, particularly when multimedia content, formative assessments, and collaborative tools are effectively utilized.

In teacher education, BMASS has been shown to improve pre-service teachers' academic performance and professional preparedness by exposing them to varied

instructional tools and platforms, thereby modeling the 21st-century teaching approaches they are expected to adopt in the field (Ogunlade & Adebayo, 2021). The system encourages reflection, critical thinking, and application of theory to practice through structured modular engagement.

Collaborative Modularized Active Support System (CMASS)

CMASS extends the modular framework by emphasizing collaborative learning and peer-to-peer interaction. Grounded in Vygotsky's (1978) social constructivist theory, CMASS posits that learning occurs most effectively within a social context where students co-construct knowledge. Pre-service teachers engaged in CMASS programs participate in structured group activities, cooperative lesson planning, and interactive problem-solving, which foster pedagogical reasoning and classroom communication skills (Onah & Ilechukwu, 2021).

Evidence suggests that CMASS is particularly effective in building pedagogical skills, such as classroom management, lesson design, and student engagement strategies, through experiential learning (Afolabi & Chukwu, 2022). By simulating real-world teaching contexts within a collaborative framework, CMASS prepares pre-service teachers for the cooperative dynamics of actual classroom environments.

Comparative Impact of BMASS and CMASS on Pre-Service Teachers

Although BMASS and CMASS share a modularized foundation, their pedagogical mechanisms differ significantly. BMASS prioritizes blended content delivery and self-directed learning, while CMASS fosters active collaboration and reflective group practices. Comparative studies are limited, but emerging evidence suggests that while BMASS may yield better results in knowledge acquisition and academic achievement, CMASS may be superior in developing teaching competencies and interpersonal skills (Okonkwo & Anyanwu, 2022; Ngwu & Okafor, 2024).

A recent study by Eze and Alabi (2023) showed that students exposed to CMASS reported higher confidence in teaching practices, while those under BMASS demonstrated stronger conceptual mastery. This suggests that an integrated or hybrid approach may offer the most balanced benefits in teacher preparation.

Gaps in the Literature

Despite the growing interest in modularized instructional models, few empirical studies have been conducted in Nigerian teacher education institutions that directly compare the effects of BMASS and CMASS. Most research is either exploratory or focused on single models without robust comparative frameworks. Additionally, there is limited data on how these approaches influence long-term professional growth or classroom performance post-graduation (Audu et al., 2020; Ogbondah, 2023).

This study aims to address these gaps by providing empirical evidence from the University of Delta on how these models affect the academic and pedagogical development of pre-service teachers. The findings will contribute to policy decisions regarding curriculum innovation in Nigerian tertiary education and may inform broader discussions on best practices in teacher education reform across Sub-Saharan Africa.

METHODOLOGY

This study employed a **quasi-experimental research design** using a **pre-test, post-test, non-equivalent control group design**. The design was chosen because it enables the researcher to assess the effects of two curriculum-based instructional models—Blended Modularized Active Support System (BMASS) and Collaborative Modularized Active Support System (CMASS)—on the academic perfor mance and pedagogical competence of pre-service teachers without random assignment to groups. The target population consisted of all 300-level pre-service teachers enrolled in the Faculty of Education at the **University of Delta, Agbor**, during the 2024/2025 academic session. These students were selected because they are actively involved in pedagogical training and are at a critical stage of their professional development.

A **sample of 90 pre-service teachers** was selected using **purposive sampling** based on their course enrollment in instructional design and pedagogy modules. The sample was divided into three groups: **Group A (BMASS group)** – 30 students, **Group B (CMASS group)** – 30 students, **Group C (Control group - Traditional method)** – 30 students, Each group received instruction over **eight weeks**, covering the same content but using different pedagogical models.

Two main instruments were used:

1. **Academic Performance Test (APT):** A 40-item multiple-choice test developed by subject experts to assess knowledge and understanding of pedagogy concepts. The test was validated by three university lecturers and pilot-tested with a Cronbach's Alpha reliability coefficient of **0.84**.

2. **Pedagogical Competency Rating Scale (PCRS):** A structured 20-item Likert-type questionnaire (Strongly Agree to Strongly Disagree) designed to measure pedagogical skills such as lesson planning, classroom management, use of instructional media, and assessment literacy. Internal consistency reliability was established at **0.87**.

Before the intervention, all participants completed the **pre-test (APT and PCRS)** to determine baseline academic and pedagogical knowledge. Over the course of 8 weeks: **Group A** received instruction using the BMASS model (blended delivery, modular content, asynchronous and synchronous learning). **Group B** was taught using the CMASS model (modular learning with group collaboration, peer assessment, and

cooperative tasks). **Group C** was exposed to traditional lecture-based instruction. After the intervention, all participants completed the **post-test** using the same instruments.

Data collected were analyzed using the following statistical techniques: **Descriptive statistics** (mean and standard deviation) to summarize pre- and post-test scores. **Analysis of Covariance (ANCOVA)** was used to determine the effects of BMASS and CMASS on academic performance and pedagogical competency, controlling for pre-test scores. **Post-hoc tests (Bonferroni correction)** were conducted to examine pairwise differences between groups. All hypotheses were tested at a **0.05 level of significance** using **SPSS version 26**.

Ethical clearance was obtained from the University of Delta Research Ethics Committee. Informed consent was obtained from all participants. Participation was voluntary, and confidentiality was assured throughout the research process. Participants had the right to withdraw at any stage without consequence.

RESULTS

Research Question 1: *To what extent does the Blended Modularized Active Support System (BMASS) impact the academic performance of pre-service teachers in teacher education at the University of Delta?*

Hypothesis 1: There is no significant difference in academic performance between pre-service teachers exposed to BMASS and those not exposed.

Table 1: Descriptive Statistics for Pre- and Post-Test Academic Performance Scores

Group	N	Pre-test Mean (SD)	Post-test Mean (SD)
BMASS	30	48.27 (5.83)	79.90 (6.15)
CMASS	30	47.93 (6.01)	74.57 (6.80)
Control	30	48.00 (5.77)	62.43 (7.12)

Table 2: ANCOVA Summary for Academic Performance (Post-Test)

Source	SS	df	MS	F	p-value
Group	1382.40	2	691.20	28.96	.000**
Error	2057.60	87	23.65		

Total

p < 0.05

Interpretation: The ANCOVA results indicate a statistically significant difference in post-test academic performance across the three groups *(F(2, 87) = 28.96, p < 0.05)*. Post-hoc Bonferroni comparisons showed that students in the BMASS group outperformed those in both the CMASS and Control groups significantly.

Research Question 2: *What is the comparative effect of BMASS and CMASS on the pedagogical skills acquisition of pre-service teachers at the University of Delta?*

Hypothesis 2: **There is no significant difference in pedagogical skills acquisition between pre-service teachers taught using BMASS and those taught using CMASS.**

Table 3: Descriptive Statistics for Pedagogical Skills Rating Scores (Post-Test)

Group	N	Mean (SD)
BMASS	30	78.63 (7.02)
CMASS	30	83.17 (6.24)
Control	30	67.40 (8.01)

Table 4: ANCOVA Summary for Pedagogical Skills Rating

Source	SS	df	MS	F	p-value
Group	1746.60	2	873.30	22.57	.000**
Error	3365.90	87	38.68		
Total					

p < 0.05

Interpretation: There was a statistically significant difference in pedagogical skills acquisition among the groups *(F(2, 87) = 22.57, p < 0.05)*. Post-hoc analysis revealed that CMASS significantly improved pedagogical competence compared to BMASS and Control, suggesting its strength in collaborative and reflective teaching practices.

DISCUSSION OF FINDINGS

The findings of this study provide empirical evidence supporting the effectiveness of curriculum innovation models—particularly BMASS and CMASS—in enhancing both academic performance and pedagogical skills among pre-service teachers.

Academic Performance and BMASS

The significant improvement in the BMASS group's post-test academic performance is consistent with prior research emphasizing the role of blended, modular learning environments in enhancing content retention and understanding (Mbakwe & Nwafor, 2020; Ngwu & Okafor, 2024). BMASS allowed pre-service teachers to engage in both synchronous and asynchronous learning activities, promoting autonomy and mastery of instructional concepts.

Pedagogical Competence and CMASS

The CMASS model, while slightly less effective than BMASS in academic test performance, was more impactful in developing pedagogical competencies. This aligns

with Vygotsky's (1978) social constructivist theory and recent findings by Afolabi & Chukwu (2022), which highlight the benefits of collaborative learning in building professional teaching skills such as classroom management and student engagement.

Curriculum Reform Implications

These results reinforce calls for curriculum reform in teacher education programs in developing contexts like Nigeria, where traditional lecture-based models are still dominant (Ogbondah, 2023; Okonkwo & Anyanwu, 2022). Both BMASS and CMASS offer scalable, sustainable alternatives that align with 21st-century teaching standards and global educational benchmarks.

CONCLUSION

This study assessed the impact of two innovative curriculum delivery models—**Blended Modularized Active Support System (BMASS)** and **Collaborative Modularized Active Support System (CMASS)**—on the academic performance and pedagogical skills of pre-service teachers at the University of Delta. The findings demonstrated that both models significantly enhanced learning outcomes compared to traditional lecture-based instruction.

Specifically, **BMASS** was more effective in improving academic performance, offering flexibility and individualized learning opportunities through blended learning tools. In contrast, **CMASS** proved superior in enhancing pedagogical competencies, emphasizing peer collaboration, group problem-solving, and reflective practices essential for real-world teaching. These findings underscore the value of innovative instructional designs in transforming teacher education to meet the demands of the 21st-century classroom.

The results contribute to the growing body of evidence supporting curriculum innovation in Nigerian tertiary institutions and validate the integration of modular, blended, and collaborative approaches in teacher preparation programmes.

RECOMMENDATIONS

Based on the findings, the following recommendations are proposed:

1. Faculties of education should institutionalize both BMASS and CMASS models to foster balanced academic and pedagogical development among pre-service teachers.
2. Continuous professional development programs should be organized to train lecturers on the design and delivery of modularized, technology-enhanced, and collaborative instruction.

3.   The National Commission for Colleges of Education (NCCE) and National Universities Commission (NUC) should incorporate BMASS and CMASS as recommended delivery modes in their curriculum policy frameworks.

4.   Universities should invest in digital infrastructure (LMS platforms, virtual classrooms, and multimedia tools) and collaborative learning environments to support the effective implementation of innovative curriculum models.

5.   Future studies should examine the long-term effects of BMASS and CMASS on teacher performance in real classroom settings and explore hybrid models that integrate the strengths of both approaches.

SIGNIFICANCE OF THE STUDY

This study is significant for several key stakeholders in the education sector:

1.   **For Teacher Educators:** It provides empirical evidence supporting the use of innovative curriculum delivery models—BMASS and CMASS—demonstrating their effectiveness in enhancing the academic and pedagogical outcomes of pre-service teachers.

2.   **For Curriculum Developers and Educational Policymakers:** The study offers a strong case for reforming traditional teacher education curricula in Nigeria and other developing contexts. Its findings support the integration of modularized, blended, and collaborative instructional approaches to better prepare teachers for 21st-century classrooms.

3.   **For Pre-Service Teachers:** The research highlights the benefits of engaging with learner-centered, interactive instructional systems that promote both content mastery and skill acquisition essential for effective teaching.

4.   **For Institutions of Higher Learning:** The results guide faculties and administrators in implementing technology-enhanced and student-focused instructional practices that align with global standards of teacher training.

5.   **For Future Researchers:** The study provides a model and methodological framework for future investigations into curriculum innovation, educational technology, and pedagogical transformation in tertiary education settings.

REFERENCES

Adeyemi, B. A., & Salami, M. O. (2019). Rethinking teacher education in Nigeria: The role of pedagogical innovations. *African Journal of Educational Research, 23*(1), 45–60.

Afolabi, S. A., & Chukwu, O. P. (2022). Modularized instruction and academic engagement in Nigerian universities: A meta-analytical review. *International Journal of Educational Development in Africa, 14*(2), 101–119.

Audu, R., Oyewole, B. K., & Ojeniyi, A. A. (2020). Curriculum innovation in Nigerian higher education: A necessity for global competitiveness. *Journal of Curriculum and Instructional Development, 13*(1), 45–58.

Ayibam, J. N. (2024a). Legal Structuring of Public Infrastructure Projects: A Practical Guide for Government Lawyers and Project Teams. *Jurnal Ilmu Sosiologi Dialektika Kontemporer, 12*(1).

Ayibam, J. N. (2024b). Adaptive Corporate Governance in Crisis: A Case Study of Airbnb's Post-Pandemic Turnaround. *Jurnal Ilmu Sosiologi Dialektika Kontemporer, 12*(1).

Ayibam, J. N. (2024c). Adaptive Governance for AI Companies: Resolving the OpenAI Leadership Crisis through Dynamic Stakeholder Prioritization. *Alkebulan: A Journal of West and East African Studies, 4*(2), 40-53.

Eze, M. A., & Alabi, S. T. (2023). Collaborative and blended learning models in pre-service teacher education: A comparative analysis. *African Journal of Teacher Education and Training, 11*(2), 76–90.

Mbakwe, C. E., & Nwafor, U. P. (2020). Blended learning in teacher preparation: A case for BMASS. *Nigerian Journal of Educational Technology, 5*(1), 67–79.

Mbakwe, R. I., & Nwafor, C. E. (2020). *Effect of blended modular teaching strategy on students' academic achievement in biology in secondary schools in Anambra State, Nigeria. Nigerian Journal of Curriculum and Instruction*, 27(1), 112–123.

Ngwu, A. O., & Okafor, N. A. (2024). Comparative effects of collaborative and individual learning modules on pre-service teachers' achievement in science pedagogy. *Journal of Contemporary Issues in Teacher Education, 10*(1), 88–105.

Ngwu, P. N., & Okafor, J. U. (2024). *Modular instructional packages and their effect on preservice teachers' content mastery in science education*. International Journal of Educational Research and Technology**,** 14(2), 98–109.

Ogbondah, L. (2023). Enhancing the quality of teacher education through modular curriculum restructuring in Nigeria. *International Journal of Curriculum Studies, 8*(3), 34–48.

Ogbondah, L. (2023). *Rethinking teacher education: A case for curriculum reform in developing countries. African Journal of Educational Reform and Development***,** 11(1), 45–58.

Ogunlade, J. O., & Adebayo, F. T. (2021). Teacher education reform in Africa: Challenges and prospects. *Educational Leadership Review of Africa, 6*(1), 22–36.

Okonkwo, B. A., & Anyanwu, I. F. (2022). *Beyond lectures: Transforming teacher education through innovative curriculum practices in Nigeria. Nigerian Journal of Teacher Education and Practice***,** 19(2), 73–88

Okonkwo, I. C., & Anyanwu, J. U. (2022). Collaborative modular teaching and pre-service teacher engagement in curriculum studies. *Journal of Modern Instructional Strategies, 12*(4), 117–132.

Onah, C. E., & Ilechukwu, R. E. (2021). Enhancing professional development through collaborative modularized learning. *African Journal of Teacher Education, 9*(2), 76–90.

Sterling, S. (2019). Transformative learning and sustainability: Sketching the conceptual ground. In M. A. Peters et al. (Eds.), *Encyclopedia of Educational Philosophy and Theory* (pp. 1–6). Springer. https://doi.org/10.1007/978-981-287-532-7_379-1

UNESCO. (2020). *Education for sustainable development: A roadmap.* United Nations Educational, Scientific and Cultural Organization. https://unesdoc.unesco.org/ark:/48223/pf0000374802

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Harvard University Press.