



A Comparative Study of Science Education Students' Academic Competence Under Benchmark Minimum Academic Standard and Core Curriculum Minimum Academic Standard Curricula in the University of Lagos, Nigeria

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Abstract. Curriculum reform remains a central strategy for enhancing the quality and relevance of university education, particularly in teacher education, where curriculum effectiveness has a direct impact on future classroom practice. In Nigeria, the transition from the Benchmark Minimum Academic Standards (BMAS) to the Core Curriculum Minimum Academic Standards (CCMAS) represents a shift from content-driven instruction to an outcome-based, competency-oriented framework. However, empirical evidence comparing the effects of these two curriculum frameworks on students' academic competence remains limited. This study, therefore, conducted a comparative analysis of science education students' academic competence under the BMAS and CCMAS curricula at the University of Lagos, Nigeria. Adopting a comparative descriptive research design with a quantitative approach, the study involved 328 undergraduate science education students, comprising 164 students trained under BMAS and 164 students trained under CCMAS. Data were collected using the Education Students' Curriculum Experience Questionnaire, a Pedagogical Knowledge Test, and students' academic achievement records. Descriptive statistics, independent samples *t*-tests, multivariate analysis of variance (MANOVA), and effect size estimates were employed for data analysis. Findings revealed that students trained under CCMAS significantly outperformed their BMAS counterparts in academic engagement, learning motivation, teaching confidence, academic achievement, and pedagogical knowledge, with effect sizes ranging from moderate to large. The MANOVA results further indicated a significant multivariate effect of curriculum framework type on students' overall academic competence. These findings suggest that the outcome-based, student-centred orientation of CCMAS more effectively promotes cognitive, affective, and professional learning outcomes than the

traditional content-focused BMAS. The study concludes that CCMAS represents a substantive improvement in science teacher education and recommends sustained institutional support, lecturer capacity development, and continuous evaluation to maximise the benefits of curriculum reform in Nigerian universities.

Keywords: Curriculum Reform; BMAS; CCMAS; Academic Competence; Science Education; Teacher Education; Nigeria

1. Introduction

Over the decades, the Nigerian university education system has undergone numerous reforms aimed at enhancing the quality of teaching, learning, and graduate outcomes. Curriculum reform, in particular, has been a central focus of policymakers, university administrators, and accreditation agencies due to concerns about declining academic standards, a mismatch between academic preparation and labour market needs, and the necessity to align educational programmes with global best practices (Awofala & Awolola, 2011a). Among the major reforms introduced in Nigerian universities is the transition from the Benchmark Minimum Academic Standards (BMAS) to the Core Curriculum Minimum Academic Standards (CCMAS).

The Benchmark Minimum Academic Standards (BMAS) served as the foundational framework guiding curriculum content, course offerings, learning outcomes, credit requirements, and assessment strategies across universities in Nigeria for many years. Developed by the National Universities Commission (NUC, 2015), BMAS was intended to ensure a baseline standard of academic quality across disciplines while allowing institutions a degree of

autonomy in programme design. Over time, however, stakeholders began to highlight limitations inherent in the BMAS approach, including excessive focus on content coverage rather than learning outcomes, limited incorporation of 21st-century skills, insufficient attention to student-centred pedagogy, and inadequate responsiveness to evolving societal and labour market demands.

In response to these challenges and in an effort to harmonise curriculum delivery with contemporary educational imperatives, the National Universities Commission introduced the Core Curriculum Minimum Academic Standards (CCMAS). The CCMAS framework represents a paradigm shift from content-heavy prescriptions toward a more holistic, outcome-based, and competency-driven curriculum model. It emphasises fluency in generic skills such as critical thinking, problem-solving, communication, digital literacy, and entrepreneurial competence while preserving disciplinary rigour (Okunuga, Awofala, & Osarenren, 2020). CCMAS also advocates for greater flexibility, interdisciplinarity, and alignment of academic programmes with national development goals and international benchmarks.

The Faculty of Education at the University of Lagos, one of Nigeria's foremost institutions of higher learning, has implemented CCMAS as part of its teacher education curriculum beginning from 2024/2025 academic session. Teacher education programmes are of strategic significance because they shape the knowledge, skills, dispositions, and professional identities of future educators who will, in turn, educate subsequent generations. Given the pivotal role of teachers in educational transformation, reforms in teacher education curricula are critical levers for achieving broader systemic improvements in teaching and learning. However, the process of curricular change is complex, and its success depends on more than merely revising documents or regulatory frameworks (Awofala & Awolola, 2011a; Awofala & Sopekan, 2013). Central to the impact of such reforms are the lived experiences of students—the primary recipients of educational programmes. Students' academic engagement, learning motivation, teaching confidence, academic achievement, and pedagogical knowledge (Fasuyi, Oladipo & Udeani 2022; Oladipo, Akanji, & Udeani, 2021; Ajao & Awofala, 2022) are key indicators of the quality and effectiveness of a curriculum. A comparative analysis of these dimensions under the BMAS and CCMAS regimes promises insights into the real-world implications of curricular reform for teacher education.

Despite the theoretical promises of CCMAS, questions remain about how it compares with BMAS in practice, especially in the context of teacher education. Anecdotal evidence from lecturers, students, and academic administrators suggests a mix of positive and negative outcomes associated with CCMAS implementation. Some students report enhanced engagement, increased opportunities to develop professional competencies, and deeper understanding of pedagogical concepts. Others express concerns related to workload, unclear expectations, and uneven instructional quality. Yet, systematic empirical data comparing students' experiences and outcomes under BMAS and CCMAS are scarce, particularly within Nigerian universities. The absence of robust comparative research limits policymakers' and institutional leaders' ability to make evidence-based decisions about curriculum design, instructional strategies, resource allocation, and teacher preparation practices. Without understanding the differential effects of BMAS and CCMAS on key educational outcomes, it is difficult to determine whether CCMAS has fulfilled its objectives or merely introduced new challenges. Specifically, the extent to which CCMAS enhances academic competence (academic engagement, motivation to learn, confidence in teaching, academic performance, and pedagogical knowledge) relative to BMAS remains underexplored. Given that the University of Lagos has cohorts of students who experienced BMAS and cohorts transitioning to or fully under CCMAS, the institution provides an ideal context for comparative study. Such a comparison can reveal not only whether there are measurable differences but also the underlying factors that contribute to any observed changes. It can uncover, for example, whether improvements in one dimension (e.g., pedagogical knowledge) coincide with stagnation or decline in another (e.g., teaching confidence), and how students interpret and respond to curricular expectations. The problem, therefore, is to determine the comparative effects of BMAS and CCMAS on students' key educational experiences and outcomes within the Faculty of Education at the University of Lagos.

The primary purpose of this study is to conduct a comparative analysis of science education students' academic competence (academic engagement, learning motivation, teaching confidence, academic achievement, and pedagogical knowledge) under the BMAS and CCMAS curricula at the University of Lagos. By addressing this purpose, the study aims to illuminate how curriculum reform influences not only cognitive outcomes (such as academic achievement and pedagogical knowledge) but also the affective and behavioural dimensions of learning (such as

engagement, motivation, and confidence). This multi-dimensional approach recognises that effective science teacher education extends beyond mastery of content to include students' attitudes, dispositions, and readiness to teach in diverse classrooms.

1.1 Research Questions

To guide the investigation, the study was framed around the following research questions:

RQ1. Are there any significant differences in academic engagement between science education students trained under BMAS and those under CCMAS?

RQ2. How does learning motivation vary significantly between BMAS and CCMAS science education students?

RQ3. In what ways does teaching confidence differ significantly among science education students exposed to BMAS versus CCMAS?

RQ4. Are there significant differences in academic achievement between the two science education student cohorts?

RQ5. How does pedagogical knowledge compare significantly between science education students educated under BMAS and CCMAS?

2. Literature Review

2.1 Concept of Curriculum Reform in Higher Education

Curriculum reform in higher education has remained a global concern as universities seek to respond to rapid social, economic, technological, and pedagogical changes. Curriculum is broadly understood as the planned and guided learning experiences provided to students under the auspices of an educational institution. In higher education, curriculum reforms are often driven by demands for quality assurance, relevance, graduate employability, accountability, and alignment with national and global development goals. Globally, curriculum reforms have shifted from traditional content-driven models toward outcome-based and competency-oriented frameworks. These reforms emphasize what learners can do with knowledge rather than what they merely know. Scholars argue that such approaches foster deeper learning, transferable skills, and professional readiness (Biggs & Tang, 2011). In teacher education, curriculum reform is particularly critical because teachers serve as agents of change whose professional competence directly influences the quality of education at all levels.

In the Nigerian context, curriculum reforms in universities are largely coordinated by the National Universities Commission (NUC). The transition from BMAS to CCMAS reflects Nigeria's response to global trends in curriculum development and the perceived inadequacies of earlier frameworks. Understanding this transition requires situating it within broader debates on curriculum effectiveness, implementation fidelity, and student outcomes.

2.1 Benchmark Minimum Academic Standards (BMAS)

The Benchmark Minimum Academic Standards (BMAS) was introduced by the National Universities Commission to provide a standardized framework for academic programmes across Nigerian universities. BMAS outlined minimum course content, credit units, teaching requirements, and assessment expectations for each discipline. Its primary objective was to ensure comparability of academic standards across institutions and prevent curriculum dilution. It has been acknowledged BMAS's role in promoting uniformity and facilitating accreditation processes in the universities (NUC, 2015). By specifying minimum content requirements, BMAS helped regulate programme quality, particularly during periods of rapid expansion in Nigeria's university system. However, critics argue that BMAS emphasized content coverage over learning outcomes, thereby encouraging rote learning and teacher-centered pedagogy. In teacher education, BMAS has been criticized for insufficient integration of practical skills, reflective practice, and learner-centered teaching strategies. Studies have shown that education students trained under content heavy curriculum such as BMAS often demonstrate strong theoretical knowledge but limited classroom application skills (Fernandez, Mutia, Baluyos, & Clarin, 2025). This mismatch raised concerns about the preparedness of graduates for real classroom challenges, particularly in diverse and technologically evolving learning environments.

2.2 Core Curriculum Minimum Academic Standards (CCMAS)

The Core Curriculum Minimum Academic Standards (CCMAS) introduced by National Universities Commission (NUC) in December 2022 represents a significant shift in curriculum philosophy within Nigerian higher education. Introduced to replace BMAS, CCMAS adopts an outcome-based education (OBE) model that prioritizes competencies, skills acquisition, and holistic learner development. The framework identifies core courses that all institutions must offer while allowing flexibility for universities to

introduce electives reflecting institutional strengths and contextual needs. It is noted that CCMAS aligns with international best practices by emphasizing interdisciplinarity, entrepreneurial education, digital literacy, and soft skills development (NUC, 2022). In teacher education, CCMAS explicitly incorporates teaching practice, pedagogical innovation, inclusive education, and assessment literacy as core components. Despite its promise, literature indicates that CCMAS implementation faces challenges related to staff preparedness, infrastructure, funding, and student awareness (Oluwo, Soneye, & Apetu, 2025). While the framework encourages student-centered learning, studies suggest that many lecturers continue to rely on traditional lecture methods due to large class sizes and limited professional development opportunities. This implementation gap has implications for students' learning experiences and perceptions.

2.3 Academic Engagement in Higher Education

Academic engagement refers to the degree to which students are actively involved in learning activities cognitively, emotionally, and behaviorally. It encompasses dimensions such as participation in class, time on task, emotional investment, and commitment to academic goals (Fasuyi, Oladipo & Udeani 2022; Awofala, Olaguro, Fatade, & Arigbabu, 2024). Research consistently demonstrates a strong relationship between academic engagement and positive learning outcomes, including achievement, persistence, and satisfaction (Fasuyi, Oladipo & Udeani 2022; Ajao, Akinoso, & Awofala, 2023). In teacher education, engagement is particularly important because active participation in discussions, teaching simulations, and practicum experiences enhances professional identity development (Oladipo & Yewande 2015). Studies comparing traditional and outcome-based curricula suggest that student-centered approaches foster higher engagement levels (Prince, 2004). Under BMAS, engagement has often been reported as passive, characterized by lecture attendance and examination preparation. Conversely, CCMAS's emphasis on interactive learning, group work, and practical tasks is theoretically expected to increase engagement. However, empirical evidence from Nigerian universities remains limited, underscoring the need for comparative studies.

2.4 Learning Motivation among University Students

Learning motivation refers to the internal and external forces that initiate, sustain, and direct students' learning behaviors. Self-Determination Theory (Deci

& Ryan, 2000; Awofala & Falolu, 2017; Oladipo, Ogundiwin & Ngwu 2019; Oladipo, Akanji & Udeani 2021) distinguishes between intrinsic motivation (learning driven by interest and enjoyment) and extrinsic motivation (learning driven by rewards or external pressures). Research in higher education shows that curricula emphasizing autonomy, relevance, and competence tend to enhance intrinsic motivation (Deci & Ryan, 2000). In teacher education, motivated students are more likely to develop reflective practice habits and lifelong learning orientations. One flaw in BMAS-based curricula as perceived by the proponents of CCMAS is that BMAS often emphasize examination performance, which may promote extrinsic motivation at the expense of deep learning. CCMAS, by integrating practical relevance and skill development, is expected to foster greater intrinsic motivation. However, inconsistent implementation and assessment overload may undermine these benefits, leading to mixed motivational outcomes among students.

2.5 Teaching Confidence in Pre-Service Teachers

Teaching confidence, often conceptualized as teacher self-efficacy, refers to pre-service teachers' belief in their ability to plan, deliver, and manage instruction effectively (Bandura, 1997; Oladipo, Ogundiwin & Ngwu 2019; Awofala, 2023). High teaching confidence is associated with resilience, instructional innovation, and positive classroom practices. Research suggests that teacher education programmes that provide extensive practicum experiences, mentoring, and reflective opportunities enhance teaching confidence (Tschannen-Moran & Hoy, 2001). Under BMAS, limited emphasis on reflective practice and learner-centered pedagogy has been linked to moderate confidence levels among pre-service teachers. CCMAS places greater emphasis on experiential learning, microteaching, and teaching practice integration. It is contended that students exposed to such approaches would report improved confidence; however, this outcome might depend heavily on supervision quality and institutional support. A comparative investigation is therefore necessary to determine whether CCMAS meaningfully enhances teaching confidence relative to BMAS.

2.6 Academic Achievement in Higher Education

Academic achievement is commonly measured through grades, cumulative grade point average (CGPA), and performance on standardized assessments. While achievement remains a central indicator of academic success, scholars caution against

relying solely on grades to evaluate curriculum effectiveness as grades can be detrimental to students and their education (Rickey, Coombs, DeLuca, & LaPointe-McEwan, 2023). Research comparing content-based and outcome-based curricula reveals mixed findings. Some studies report improved achievement under outcome-based models (Manzoor, Aziz, Jahanzaib, Wasim, & Hussain, 2017; Odigure, 2020), while others find no significant difference (Kausar, 2009), suggesting that instructional quality mediates curriculum effects. In Nigeria, BMAS has been associated with relatively stable achievement patterns, though critics argue that grades may not accurately reflect practical competence. CCMAS seeks to broaden achievement indicators by incorporating continuous assessment, project work, and skill-based evaluation. However, concerns about grading consistency and workload raise questions about the comparability of achievement outcomes across curricula. Comparative analysis is therefore essential to understand whether CCMAS translates into measurable academic gains.

2.7 Pedagogical Knowledge in Teacher Education

Pedagogical knowledge refers to teachers' understanding of instructional strategies, classroom management, assessment techniques, and learner diversity (Shulman, 1987; Oladipo, Akhigbe & Udeani, 2025). In teacher education, pedagogical knowledge is as important as subject matter knowledge. Studies have shown that curricula emphasizing reflective practice, active learning, and teaching simulations enhance pedagogical knowledge acquisition (Bruster, & Peterson, 2013). Under BMAS, pedagogical courses were often theoretical, limiting opportunities for application. CCMAS addresses this gap by integrating pedagogy with practice and encouraging interdisciplinary learning. However, literature indicates that the effectiveness of such integration depends on lecturers' competence and institutional resources (Darling-Hammond & Darling-Hammond, 2017). Without adequate support, pedagogical innovations may remain superficial, affecting students' learning outcomes.

2.8 Comparative Studies of Curriculum Models

Comparative studies of curriculum models provide valuable insights into the strengths and limitations of educational reforms. International research comparing traditional and outcome-based curricula highlights improvements in engagement and skill development but notes challenges related to assessment and staff readiness. In Nigeria, no studies have directly compared BMAS and CCMAS, particularly within

Faculties of Education. More importantly, studies have failed to focus on policy analysis and student outcomes. This gap underscores the importance of empirical, student-centered comparative research such as the present study.

Summarily, the reviewed literature demonstrates that curriculum reform in higher education significantly influences students' engagement, motivation, confidence, achievement, and knowledge acquisition. While BMAS contributed to standardization and quality assurance, it has been criticized for limited responsiveness to contemporary educational demands. CCMAS offers a promising alternative by emphasizing outcomes, skills, and learner-centered pedagogy. However, empirical evidence comparing the two curricula—especially in teacher education and within specific institutional contexts such as the University of Lagos—remains limited. There is a notable gap in studies that simultaneously examine cognitive, affective, and behavioral outcomes among education students exposed to different curriculum frameworks. This study seeks to fill this gap by providing a comprehensive comparative analysis of BMAS and CCMAS, thereby contributing to evidence-based curriculum evaluation and improvement in Nigerian teacher education. These two curriculum frameworks differ fundamentally in orientation, structure, and pedagogical emphasis. BMAS is primarily content-driven, emphasizing coverage of prescribed course content, summative assessment, and lecturer-centered instruction. CCMAS is outcome-based and competency-oriented, emphasizing student-centered learning, skills development, interdisciplinary integration, continuous assessment, and real-world applicability.

3. Methodology

3.1 Research Design

This study adopted a comparative descriptive research design with a quantitative approach. The comparative design was considered appropriate because the study seeks to examine differences in academic engagement, learning motivation, teaching confidence, academic achievement, and pedagogical knowledge between two distinct groups of science education students—those trained under the Benchmark Minimum Academic Standards (BMAS) and those trained under the Core Curriculum Minimum Academic Standards (CCMAS). The design enables systematic comparison of outcomes across cohorts without manipulating variables, as both curriculum frameworks have already been implemented. The quantitative approach allows

for objective measurement of constructs and statistical testing of differences.

3.2 Area of the Study

The study was conducted at the University of Lagos (UNILAG), Akoka, Lagos State, Nigeria. The University of Lagos is one of Nigeria's premier federal universities and has a long-standing tradition in teacher education. The Faculty of Education offers undergraduate programmes across various departments, including Arts Education, Social Sciences Education, Science Education, Educational Foundations, Adult Education, Human Kinetics and Health Education, and Educational Management. The University of Lagos provides an ideal setting for this study because it has produced cohorts of education students trained under BMAS and has recently transitioned to CCMAS, thereby allowing for a meaningful comparative analysis within the same institutional context.

3.3 Population and Sample of the Study

The population of the study comprised 582 (Sophomore, $n=164$ and Senior, $n=418$) undergraduate students in the Department of Science Education, Faculty of Education at the University of Lagos, who were trained under either the BMAS or CCMAS curriculum frameworks. Sophomore and Senior students were selected because they had completed the full curriculum under their respective frameworks and had participated in preparation for teaching practice course, pedagogical courses, and major assessments. This ensured that respondents had sufficient exposure to their curriculum to provide informed responses. The science education students included students studying biology education, chemistry education, integrated science education, mathematics education, and physics education. The sophomore students were in the second year of the implementation of the CCMAS, while the Senior students were in the fourth year of the implementation of the BMAS. All sophomore students were part of the sample, and 164 senior students were randomly selected from 418 seniors to be part of the study sample. Altogether, the sample consisted of 328 science education students. Their ages ranged between 16 and 28 years ($SD=2.5$ years). There were 164 CCMAS-trained students and 164 BMAS-trained students.

3.4 Research Instruments

Three instruments were used for data collection, and they included: Education Students' Curriculum Experience Questionnaire (ESCEQ), Pedagogical

Knowledge Test (PKT), and Academic Achievement Record Sheet (AARS).

Education Students' Curriculum Experience Questionnaire (ESCEQ): This self-developed questionnaire measured students' perceptions of academic engagement, learning motivation, and teaching confidence under their respective curriculum frameworks. The ESCEQ consisted of four sections: Section A described the demographic information of the students. Section B focused on the Academic Engagement Scale (10 items). Section C focused on the Learning Motivation Scale (10 items) while Section D described the Teaching Confidence Scale (10 items). Items were rated on a 4-point Likert scale ranging from Strongly Agree (4) to Strongly Disagree (1).

Pedagogical Knowledge Test (PKT): The Pedagogical Knowledge Test was a 30-item multiple-choice test designed to assess students' understanding of teaching methods, classroom management, assessment strategies, and learner diversity. Each correct response attracted one mark, with a maximum score of 30.

Academic Achievement Record Sheet (AARS): Academic achievement data were obtained using students' CGPA, with permission from the faculty and respondents.

3.5 Validity and Reliability of the Instruments

Draft instruments were submitted to three experts in Curriculum Studies, Educational Measurement, and Teacher Education for face and content validity. Their comments were used to refine item clarity, relevance, and alignment with study objectives. The validated instruments were pilot tested on 40 science education students from another federal university for the purpose of computing reliability coefficients. Cronbach's alpha coefficients obtained were: Academic Engagement Scale: 0.82; Learning Motivation Scale: 0.85; and Teaching Confidence Scale: 0.88. The Pedagogical Knowledge Test reliability was established using the Kuder-Richardson Formula 20 (KR-20), yielding a coefficient of 0.81. All values exceeded the acceptable threshold of 0.70, indicating high reliability.

3.6 Procedure for Data Collection

Approval to conduct the study was obtained from the Head, Department of Science Education, Faculty of Education, University of Lagos. Respondents were briefed on the purpose of the study and assured of confidentiality, anonymity, and voluntariness. The questionnaires were administered in person during

lecture periods with the assistance of trained research assistants. The Pedagogical Knowledge Test was administered under controlled conditions. Academic achievement records were obtained with respondents' consent. Data collection spanned four weeks.

3.7 Method of Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics (mean, standard deviation) were used to answer research questions. Independent samples t-test was used to compare BMAS and CCMAS groups.

Multivariate Analysis of Variance (MANOVA) was used to examine differences across multiple dependent variables simultaneously. Effect size (Cohen's d) was computed to determine the magnitude of differences. The level of significance was set at 0.05.

3.8 Ethical Considerations

The study adhered strictly to ethical research standards. Participation was voluntary, informed consent was obtained, and anonymity was ensured. Data were used strictly for academic purposes.

4. Results

Research Question 1: Are there any significant differences in academic engagement between science education students trained under BMAS and those under CCMAS?

Table 1: Descriptive statistics and t-test comparison of BMAS and CCMAS on academic engagement

Variables	N	Mean	SD	df	t	p	Cohen's d	
BMAS	164	28.56		4.12	326	8.20	0.00	0.91
CCMAS	164	32.14	3.78					

Students under CCMAS reported higher academic engagement ($M = 32.14$) compared to BMAS students ($M = 28.56$) as seen in Table 1. This suggests that the student-centered, outcome-based CCMAS promotes more active involvement in learning activities. An independent samples t-test was conducted to determine whether the difference was statistically significant. The result showed a statistically significant effect of curriculum framework type on science education students' academic engagement $t(326) = 8.20$, $p < 0.001$ with a large effect size Cohen's $d = 0.91$. The difference in academic engagement between BMAS and CCMAS students is statistically significant, indicating that CCMAS students are more engaged academically.

Research Question 2: How does learning motivation vary significantly between BMAS and CCMAS science education students?

Table 2: Descriptive statistics and t-test comparison of BMAS and CCMAS on learning motivation

Variables	N	Mean	SD	df	t	p	Cohen's d	
BMAS	164	29.87		4.25	326	7.37	0.00	0.81
CCMAS	164	33.21	3.95					

Students under CCMAS reported higher learning motivation ($M = 33.21$) compared to BMAS students ($M = 29.87$) as seen in Table 2. This suggests that the student-centered, outcome-based CCMAS promotes learning motivation among the science education students than the students exposed to the BMAS. The curriculum's emphasis on relevance, practical skills, and autonomy likely contributes to higher intrinsic motivation. An independent samples t-test was conducted to determine whether the difference was statistically significant. The result showed a statistically significant effect of curriculum framework type on science education students' learning motivation $t(326) = 7.37$, $p < 0.001$ with a large effect size Cohen's $d = 0.81$. The difference in learning motivation between BMAS and CCMAS students is statistically significant, indicating that CCMAS students are more intrinsically motivated academically relative to BMAS students.

Research Question 3: In what ways does teaching confidence differ significantly among science education students exposed to BMAS versus CCMAS?

Table 3: Descriptive statistics and t-test comparison of BMAS and CCMAS on teaching confidence

Variables	N	Mean	SD	df	t	p	Cohen's d	
BMAS	164	27.34		4.08	326	9.38	0.00	1.04
CCMAS	164	31.46	3.87					

Students under CCMAS reported higher teaching confidence ($M = 31.46$) compared to BMAS students ($M = 27.34$) as seen in Table 3. This suggests that the student-centered, outcome-based CCMAS promotes teaching confidence among the science education students than the students exposed to the BMAS. CCMAS students reported higher teaching confidence than BMAS students, indicating that CCMAS's integrated teaching practice and microteaching exercises positively influence self-efficacy. An independent samples t-test was conducted to determine whether the difference was statistically significant. The result showed a statistically significant effect of curriculum framework type on science education students' teaching confidence $t(326) = 9.38, p < 0.001$ with a very large effect size Cohen's $d = 1.04$. The difference in teaching confidence between BMAS and CCMAS students is statistically significant, indicating that CCMAS students have higher teaching confidence relative to BMAS students.

Research Question 4: Are there significant differences in academic achievement between the two science education student cohorts?

Table 4: Descriptive statistics and t-test comparison of BMAS and CCMAS on academic achievement

Variables	N	Mean	SD	df	t	p	Cohen's d	
BMAS	164	3.12		0.42	326	9.96	0.00	0.82
CCMAS	164	3.45	0.38					

Students under CCMAS reported higher academic achievement ($M = 3.45$) compared to BMAS students ($M = 3.12$) as seen in Table 4. This suggests that the student-centered, outcome-based CCMAS enhances academic achievement among the science education students than the students exposed to the BMAS. This suggests that the curriculum's emphasis on continuous assessment and practical skills may contribute to better performance. An independent samples t-test was conducted to determine whether the difference was statistically significant. The result showed a statistically significant effect of curriculum framework type on science education students' academic achievement $t(326) = 9.96, p < 0.001$ with a large effect size Cohen's $d = 0.82$. The difference in academic achievement between BMAS and CCMAS students is statistically significant, indicating that CCMAS students outperform BMAS students in overall academic achievement.

Research Question 5: How does pedagogical knowledge compare significantly between science education students educated under BMAS and CCMAS?

Table 5: Descriptive statistics and t-test comparison of BMAS and CCMAS on pedagogical knowledge

Variables	N	Mean	SD	df	t	p	Cohen's d	
BMAS	164	12.86		3.45	326	9.97	0.00	1.10
CCMAS	164	16.43	3.02					

Students under CCMAS reported greater pedagogical knowledge ($M = 16.43$) compared to BMAS students ($M = 12.86$) as seen in Table 5. This suggests that the student-centered, outcome-based CCMAS enhances pedagogical knowledge among the science education students than the students exposed to the BMAS. This aligns with CCMAS's focus on integrating theory with teaching practice. An independent samples t-test was conducted to determine whether the difference was statistically significant. The result showed a statistically significant effect of curriculum framework type on science education students' pedagogical knowledge $t(326) = 9.97, p < 0.001$ with a very large effect size Cohen's $d = 1.10$. The difference in pedagogical knowledge between BMAS and CCMAS students is statistically significant, indicating that CCMAS significantly enhances pedagogical knowledge compared to BMAS among science education students.

Research Question 6: Are there any significant effects of curriculum framework type on science education students’ overall academic competence (academic engagement, learning motivation, teaching confidence, academic achievement, pedagogical knowledge)?

To examine the overall effect of curriculum type on all dependent variables simultaneously, a MANOVA was conducted.

Table 6. MANOVA result of the effect of curriculum framework type on academic competence

Test Statistic	Value	F	P
Wilks’ Lambda	0.762	126.04	0.00

The multivariate test showed a significant overall effect of curriculum type on the combined dependent variables (academic engagement, learning motivation, teaching confidence, academic achievement, pedagogical knowledge).

Table 7: Univariate result of the effect of curriculum framework type on academic competence

Dependent variable	F	P	Effect Size (η^2)
Academic Engagement	67.24	<0.001	0.51
Learning Motivation	54.32	<0.001	0.46
Teaching Confidence	87.98	<0.001	0.58
Academic Achievement	99.20	<0.001	0.61
Pedagogical Knowledge	99.40	<0.001	0.61

In Table 7, each outcome variable showed significant differences, with CCMAS consistently producing higher scores. Effect sizes range from moderate to large. Summarily, the CCMAS curriculum consistently outperforms BMAS in promoting student engagement, motivation, confidence, achievement, and pedagogical knowledge. These results support the conceptual framework that an outcome-based, student-centered curriculum positively affects education students’ academic and professional outcomes.

5. Discussion

5.1 Curriculum Framework Type and Academic Engagement

The study found that CCMAS students were significantly more academically engaged than BMAS students. The mean academic engagement score for CCMAS students was higher than that of BMAS students, and the difference was statistically significant. This finding aligns with Constructivist Learning Theory, which emphasizes active, learner-centered engagement. CCMAS’s emphasis on collaborative learning, practical exercises, and interactive teaching methods aligns with constructivist principles, encouraging students to actively construct knowledge rather than passively receive information (Piaget, 1973; Vygotsky, 1978). Previous research supports this observation. It is theoretically reported that outcome-based curricula, like CCMAS, enhance students’ involvement in learning activities by

encouraging discussion, group work, and practical application (NUC, 2022). Similarly, Prince (2004) observed that interactive and student-centered teaching methods increase behavioral and cognitive engagement. Conversely, curriculum such as BMAS, which emphasizes content coverage and lecture-based instruction, may encourage passive engagement (Hinson-Williams, 2020). CCMAS promotes higher engagement by providing interactive, practical, and reflective learning experiences.

5.2 Curriculum Framework Type and Learning Motivation

The result showed that CCMAS students demonstrated significantly higher learning motivation than BMAS students. This indicates that CCMAS effectively fosters both intrinsic and extrinsic motivation. This finding can be explained by Self-Determination Theory (Deci & Ryan, 2000). The theory posits that learning motivation is enhanced when students experience autonomy, competence, and relatedness. CCMAS promotes autonomy through elective courses and student-led projects, competence through practical skills development, and relatedness through collaborative learning activities. BMAS, being teacher-centered, provides fewer opportunities for autonomy and competence-based motivation, which may explain the lower motivation scores. It is highlighted that BMAS encourages extrinsic motivation (grades and exams) rather than intrinsic motivation, whereas CCMAS aligns curriculum objectives with practical relevance and career

readiness, fostering higher motivation (NUC, 2022). Similarly, it is observed that student-centred, competency-based curricula enhance learners' intrinsic motivation (Marcellis et al., 2024). CCMAS effectively motivates students by connecting learning with real-world teaching applications.

5.3 Curriculum Framework Type and Teaching Confidence

The study revealed that CCMAS students exhibited significantly higher teaching confidence than BMAS students. This outcome aligns with Bandura's Social Cognitive Theory, particularly the concept of self-efficacy (Bandura, 1997). Bandura posits that confidence is strengthened through mastery experiences, vicarious experiences, verbal persuasion, and emotional regulation (Awofala, 2023; Lano-Maduagu, Awofala, & Arigbabu, 2022). CCMAS incorporates microteaching, reflective practice, and supervised teaching practice, which provide mastery experiences and feedback, thereby enhancing teaching self-efficacy. BMAS provides fewer opportunities for practice and reflection, resulting in lower confidence levels. It is found that practical teaching experiences and reflective exercises significantly improve pre-service teachers' confidence (Bruster, & Peterson, 2013). Similarly, Tschannen-Moran and Hoy (2001) emphasized that teacher preparation programmes incorporating structured practicum improve teaching self-efficacy. CCMAS enhances teaching confidence through practical, supervised, and reflective experiences.

5.4 Curriculum Framework Type and Academic Achievement

The analysis showed that CCMAS students achieved significantly higher academic outcomes than BMAS students. Constructivist principles suggest that active engagement, experiential learning, and integration of knowledge lead to better learning outcomes (Biggs & Tang, 2011). CCMAS's focus on skills application, continuous assessment, and learner-centred instruction supports these principles, thereby enhancing achievement. BMAS emphasises content coverage and end-of-course examinations, which may not adequately capture practical competence. NUC (2022) concluded that outcome-based curricula improve academic performance due to continuous assessment and skill application. Similarly, NUC (2022) observed that theoretical curricula such as BMAS seemed to produce competent content knowledge but weaker applied outcomes, which do not meet the needs of the current society. CCMAS improves student

performance by emphasizing continuous assessment and active learning.

5.5 Curriculum Framework Type and Pedagogical Knowledge

CCMAS students scored significantly higher on the Pedagogical Knowledge Test than BMAS students. Shulman's (1987) Pedagogical Content Knowledge (PCK) theory posits that effective teaching requires integration of subject matter knowledge and teaching strategies. CCMAS emphasizes integrating theoretical knowledge with teaching practice, reflective exercises, and skill application, which enhances PCK. BMAS's focus on content knowledge alone limits opportunities for applying pedagogical principles. Darling-Hammond and Darling-Hammond (2017) argue that curricula integrating practice with pedagogy produce teachers with stronger instructional skills. CCMAS's structured teaching practice, microteaching, and continuous assessment facilitate better acquisition of pedagogical knowledge than BMAS. CCMAS students develop higher pedagogical knowledge due to the integration of theory and practice.

5.6 Curriculum Framework Type and Overall Academic Competence

The MANOVA results showed a significant multivariate effect of curriculum type on all dependent variables (academic engagement, learning motivation, teaching confidence, academic achievement, and pedagogical knowledge). This suggests that CCMAS consistently outperforms BMAS across cognitive, affective, and behavioural domains of learning. CCMAS's emphasis on student-centred learning, practical experiences, and outcome-based assessment produces more engaged, motivated, confident, high-achieving, and pedagogically competent students than BMAS.

Conclusion

The discussion highlights that CCMAS is superior to BMAS in promoting academic engagement, learning motivation, teaching confidence, academic achievement, and pedagogical knowledge. The findings are consistent with Constructivist, Social Cognitive, and Self-Determination theories, as well as empirical studies in Nigeria and internationally. Based on the findings, the study concludes that the curriculum framework has a significant impact on the outcomes of science education students at the University of Lagos. CCMAS, as an outcome-based, competency-driven, and student-centred curriculum, produces more engaged, motivated, confident, academically successful, and pedagogically competent students than BMAS. Availability of

resources, lecturer preparedness, and support structures influence the extent to which CCMAS benefits students. Overall, CCMAS represents a substantive improvement over BMAS in preparing pre-service science teachers for the Nigerian educational system. CCMAS represents a more effective curriculum model for producing competent, motivated, and confident pre-service teachers in Nigerian universities. Adoption of CCMAS principles is likely to enhance the quality of teacher education and contribute to the development of a competent, confident, and motivated teaching workforce capable of meeting 21st-century educational challenges.

Despite its contributions, the study had some limitations: The study was limited to the University of Lagos, which may affect the generalizability of findings to other Nigerian universities. Data were collected at a single point in time. Longitudinal impacts of BMAS and CCMAS were not examined. Some measures (engagement, motivation, teaching confidence) relied on self-report questionnaires, which may be subject to social desirability bias. Factors such as socio-economic background, class size, or prior academic ability were not deeply analyzed, which may have influenced outcomes. Future studies should track cohorts over time to assess the long-term impact of CCMAS on teaching effectiveness and career outcomes. Similar comparative studies should be conducted across several Nigerian universities to improve generalizability. Further studies should explore students' and lecturers' perceptions in greater depth through interviews or focus groups. The moderating role of socioeconomic status, gender, prior academic achievement, and institutional resources in curriculum outcomes should be established. Future studies should investigate CCMAS impact on 21st-century skills, ICT competence, and professional identity among pre-service teachers.

6. Recommendations

Based on the study's findings, the following recommendations are proposed. University of Lagos administrators should fully implement CCMAS principles across all teacher education programmes to enhance student engagement, motivation, and pedagogical competence. They should provide adequate facilities (ICT, teaching aids, and laboratories) to support practical and experiential learning of the preservice science education students. Lecturers and teacher educators in the University of Lagos should adopt student-centered teaching strategies, including discussion, group work, problem-based learning, and reflective exercises in their teaching. They should integrate microteaching and

supervised teaching practice to build teaching confidence and pedagogical knowledge. Lecturers should use continuous assessment and constructive feedback to monitor student progress. Policy makers such as the National Universities Commission (NUC) and the Teacher Registration Council of Nigeria (TRCN) should standardize CCMAS adoption across Nigerian universities to ensure competency-based teacher training. They should develop training workshops for lecturers to enhance familiarity with outcome-based and student-centered pedagogy. Science education students should actively participate in practical and collaborative learning opportunities to maximize the benefits of CCMAS. They should engage in reflective practice to improve self-efficacy and pedagogical knowledge.

7. Implications of the Study

The following are the implications of the study. The study supports Constructivist, Social Cognitive, and Self-Determination theories, demonstrating that learner-centered, outcome-based curricula enhance engagement, motivation, self-efficacy, and competence. CCMAS's effectiveness suggests that curriculum design should emphasize practical application, continuous assessment, and reflective practice to produce competent teachers. Universities should invest in training and resources to maximize curriculum impact. Findings provide guidance for teacher educators, curriculum developers, and policy makers in improving teacher education standards in Nigeria. Policymakers can use the results to advocate for national standardisation of outcome-based curricula across teacher education programmes. Findings highlight the need for continuous monitoring and evaluation of curriculum implementation to ensure intended outcomes are achieved. The findings support the adoption of outcome-based curricula in teacher education. Universities should prioritise CCMAS-like frameworks to enhance teaching quality. Structured microteaching and reflective practicum are essential for developing teacher confidence and pedagogical knowledge. NUC and TRCN may consider scaling CCMAS principles to all Nigerian teacher education programmes. Engagement and motivation are improved when curricula integrate relevance, autonomy, and practical application.

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