



Mathematics Proficiency and Academic Performance among Students in Selected Nigerian Tertiary Institutions

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Abstract

This study examined the relationship between mathematics proficiency and academic performance among students of Economics, Business Administration and Social Studies in three selected Nigerian tertiary institutions. A quantitative cross-sectional correlational design was adopted, with 225 students selected through multi-stage sampling. Mathematics proficiency was measured from students' reported mathematics performance and classified as low, moderate, or high, while academic performance was measured using official CGPA obtained from departmental examination officers. Data were analysed using Kruskal–Wallis, Dunn's Bonferroni-adjusted post-hoc test, Spearman's rank-order correlation and binary logistic regression. Academic performance differed significantly across programmes, $\chi^2(2) = 12.47$, $p = 0.002$, $\epsilon^2 = 0.047$, with a significant difference between Business Administration and Social Studies (adjusted $p = 0.001$). Mathematics proficiency was strongly associated with academic performance ($r_s = 0.810$, $p < 0.001$). Institutions may consider diagnostic assessment and targeted support, while future intervention studies should test their effectiveness.

Keywords: Academic performance; Mathematics proficiency; Tertiary education; CGPA; Nigerian students

Introduction

Mathematical competence is an important foundation for students' academic development, providing quantitative reasoning, problem-solving and analytical skills applicable across disciplines and professional settings. Although mathematics is commonly associated with science, technology, engineering and mathematics (STEM), quantitative competence is equally relevant to Economics, Business Administration and the social sciences, where students interpret numerical information, analyse relationships and make evidence-based decisions (Vedrenne-Gutiérrez, 2021). Mathematics proficiency may therefore extend beyond performance in mathematics courses to broader academic achievement. Evidence indicates that mathematics achievement reflects cognitive and non-cognitive factors, including prior knowledge, general cognitive ability, mathematics-specific skills, self-concept, self-regulation and metacognitive abilities (Breit *et al.*, 2025). Academic achievement is similarly shaped by cognitive, motivational and personality-related

characteristics (Schneider & Preckel, 2017). Supporting this, Delaney and Devereux (2020) found that mathematical and verbal skills were associated with university outcomes, with mathematical skills more strongly related to degree performance and first-class honours attainment.

The transition from secondary to higher education highlights the importance of mathematical preparation. Students enter tertiary institutions with prior knowledge and experiences, which may shape their ability to meet the quantitative demands of higher education (Di Martino *et al.*, 2023). These differences may be particularly important in Economics and Business Administration, where mathematics, statistics and quantitative analysis are integral to academic training. Nevertheless, mathematics proficiency is not the sole determinant of academic achievement; study habits, self-efficacy, motivation and the learning environment also influence students' outcomes (Schneider & Preckel, 2017; Breit *et al.*, 2025). In Nigeria, Falebita *et al.* (2025) found that mathematics study

habits, self-efficacy and motivation significantly predicted academic achievement among mathematics undergraduates.

Nigeria's tertiary education system comprises universities, polytechnics, monotechnics and colleges of education, each with distinct mandates, curricula and training approaches. These differences may create varied learning environments and academic demands. Quantitative reasoning is important in Business and Economics, where it supports domain expertise (Schmidt *et al.*, 2023). Mathematical understanding may help students engage with statistics, econometrics, financial analysis and other courses requiring numerical and analytical problem-solving.

Previous Nigerian studies have examined mathematics achievement and factors associated with students' performance, but much of this literature has focused on mathematics-specific outcomes rather than overall academic achievement. Awofala (2017), for instance, examined mathematical proficiency through conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition among Nigerian senior secondary students. Owan *et al.* (2020) investigated e-learning, test anxiety and undergraduates' mathematics performance, while Falebita *et al.* (2025) examined mathematics self-efficacy, motivation and study habits as predictors of achievement among mathematics undergraduates. More recently, Ituma *et al.* (2025) examined the relationship between prior mathematics qualifications and achievement in undergraduate mathematics. Although these studies provide valuable evidence, their outcomes remain largely mathematics-specific or confined to particular student groups and educational settings.

Other Nigerian studies have linked mathematics competence with performance in related quantitative subjects. Otuya and Egbare (2017) found that mathematics proficiency positively predicted introductory accounting performance among university students in Delta State. Similarly, Ibrahim and Usman (2015) reported that mathematics entry grades significantly influenced financial accounting performance among NCE Business Education students. However, these studies focused on specific courses or programmes rather than overall academic performance measured by CGPA. They also did not examine students across different types of tertiary institutions. Consequently, evidence remains limited on whether higher mathematics proficiency is consistently associated with better overall academic performance, particularly among students in non-mathematics

programmes across diverse Nigerian tertiary settings. This gap warrants evidence across programmes and institutional settings nationally.

Strong mathematics performance does not necessarily translate into high achievement across all academic courses, just as students with weaker mathematical competence may perform well in disciplines with limited quantitative demands. Thus, the relationship between mathematics proficiency and overall academic performance remains an empirical question rather than an assumption. Although evidence suggests that mathematical skills and prior academic competencies are associated with higher education achievement, the strength of these relationships may vary across educational contexts, disciplines and student populations (Breit *et al.*, 2025; Schneider & Preckel, 2017). Evidence from Nigeria therefore warrants further investigation. Against this background, the present study examines whether mathematics proficiency is associated with overall academic performance among students of Economics, Business Administration and Social Studies across three selected Nigerian tertiary institutions.

Objectives of the Study

The broad objective of the study is to examine the relationship between mathematics proficiency and the academic performance of students in selected Nigerian tertiary institutions.

Specifically, the study seeks to:

1. assess the academic performance of students in Economics, Business Administration and Social Studies in the selected institutions;
2. determine the relationship between mathematics proficiency and students' academic performance and
3. examine whether students' academic performance differs across the selected programmes.

Research Hypothesis

The study tests the following null hypotheses:

- H₀₁:** There is no statistically significant relationship between mathematics proficiency and the academic performance of students in the selected Nigerian tertiary institutions.
- H₀₂:** There is no statistically significant difference in the academic performance of students across the selected programmes.

Literature Review and Theoretical Framework

Conceptual and theoretical link between mathematics proficiency and academic performance

Mathematics proficiency and academic performance are conceptually connected through the cognitive and analytical demands of tertiary learning. Mathematics proficiency refers to the ability to understand and apply mathematical concepts, perform quantitative operations and solve problems accurately, whereas academic performance reflects how well students meet academic requirements, commonly measured by GPA or CGPA. Although distinct, mathematics proficiency may support broader academic achievement by strengthening reasoning, problem-solving and engagement with quantitative material.

This relationship is grounded in the Cattell–Horn–Carroll (CHC) theory of cognitive abilities, which recognises general and broad cognitive abilities as foundations for learning and achievement. Mathematical performance draws on fluid reasoning, acquired knowledge and quantitative reasoning, which also support analysis and problem-solving in other academic contexts (Zaboski *et al.*, 2018). Meta-analytic evidence also indicates meaningful associations between broad cognitive abilities and academic achievement, although their strength varies across abilities and disciplines and diverse higher education settings. Similarly, Taub *et al.* (2014) linked mathematics achievement with cognitive abilities, particularly fluid and crystallized intelligence.

Prior academic preparation provides another explanation. Students enter tertiary education with different levels of accumulated knowledge and stronger mathematical foundations may facilitate adaptation to quantitatively demanding coursework (Peng & Kievit, 2020). Delaney and Devereux (2020) further found that mathematical skills predicted university performance more strongly than verbal skills, particularly for high degree classifications.

However, mathematics proficiency is only one contributor to academic performance. Achievement is also shaped by prior attainment, motivation, self-regulation, study habits, personality and institutional factors (Schneider & Preckel, 2017), alongside individual and contextual influences (Wang *et al.*, 2023). The present study therefore conceptualises mathematics proficiency as a contributing, rather than deterministic, factor and examines whether differences in proficiency are associated with differences in overall academic

performance among students in the selected Nigerian tertiary institutions.

Empirical Review

Empirical evidence generally supports an association between mathematics-related competence and academic achievement, although its strength varies across educational levels, disciplines and contexts. Schneider and Preckel (2017), in a systematic review of meta-analyses, identified prior achievement and cognitive ability as important correlates of tertiary academic performance. Similarly, Richardson *et al.* (2012) found that prior academic performance and cognitive capacity were among the significant psychological correlates of university GPA. These findings suggest that students' prior and domain-specific competencies, including mathematical skills, may contribute to later academic outcomes.

Evidence also indicates that mathematics competence extends beyond mathematics courses. Delaney and Devereux (2020) reported that mathematical skills were more strongly associated with university performance and degree classification than verbal skills, particularly for first-class honours and STEM outcomes. In Nigeria, Salami *et al.* (2026), studying 897 Economics students, found that performance in Mathematics for Economists and Economics Statistics significantly predicted Econometrics success. Although course-specific, this finding reinforces the relevance of quantitative competence to analytically demanding academic work.

Broader evidence shows that mathematics achievement is intertwined with diverse learner characteristics. Breit *et al.* (2025), synthesising 30 meta-analyses involving millions of learners, identified strong associations with prior knowledge, intelligence, verbal and subject-specific skills, self-concept, self-regulation and metacognition. This suggests that any relationship between mathematics proficiency and overall academic performance may partly reflect shared underlying abilities rather than a direct causal effect.

Contextual factors also matter. Ayebale *et al.* (2020) identified prior achievement, teaching methods, attitudes, parental influence and classroom conditions as relevant to mathematics achievement, while Wang *et al.* (2023), reviewing 156 PISA-based studies, highlighted individual, household, school and system-level influences.

In Nigeria, research has largely focused on mathematics achievement itself or related subjects. Awofala (2017), Owan *et al.* (2020), Falebita *et al.*

(2025) and Esenowo (2025) examined mathematics performance and its determinants among specific student populations. However, these studies provide limited evidence on mathematics proficiency and overall tertiary academic performance measured by CGPA.

Research Gap

While theory (Zaboski *et al.*, 2018) and evidence (Richardson *et al.*, 2012; Schneider & Preckel, 2017) support a link between mathematics proficiency and academic achievement, Nigerian literature mostly addresses mathematics achievement alone or related subjects (Awofala, 2017; Owan *et al.*, 2020), neglecting institutional variation. This study fills that gap by examining mathematics proficiency and CGPA among Economics, Business Administration and Social Studies students across a university, polytechnic and college of education.

Methodology

Research Design

The study adopted a quantitative, cross-sectional correlational design to examine the association between mathematics proficiency and students' overall academic performance in selected Nigerian tertiary institutions. Data were collected at one point in time. Mathematics proficiency served as the explanatory variable, while academic performance was measured using cumulative grade point average (CGPA). Descriptive statistics summarised respondents' characteristics and academic performance. The Kruskal–Wallis H test examined differences in CGPA across Economics, Business Administration and Social Studies, followed by Dunn's Bonferroni-adjusted pairwise comparisons where appropriate. Spearman's rank-order correlation assessed the direction and strength of the association. Non-parametric procedures were selected based on the observed distributional characteristics. All findings were interpreted as associations, not causal effects.

Study Area and Population

The study was conducted in three selected tertiary institutions across three northern geopolitical zones: Usmanu Danfodiyo University, Sokoto (North-West), Federal Polytechnic, Bauchi (North-East) and Kwara State College of Education, Ilorin (North-Central). The institutions represented three major tertiary institution types: university, polytechnic and college of education. The study population comprised 467 students from Economics, Business Administration and Social Studies, including 218 from Usmanu Danfodiyo University,

141 from Federal Polytechnic, Bauchi and 108 from Kwara State College of Education, Ilorin. The selection provided geographical and institutional variation but was not nationally representative.

Sample Size and Sampling Procedure

A multi-stage sampling procedure was used to select students from the three selected tertiary institutions. Eligible students from Economics, Business Administration and Social Studies were considered for participation irrespective of their level of mathematics proficiency, thereby avoiding the restriction of the principal explanatory variable through participant selection.

The study population comprised 467 students. The minimum sample size was determined using Slovin's formula:

The sample size (n) was determined as follows:

$$n = \frac{N}{1+N(e)^2}$$

Where n is the required sample size, N is the population size (467) and e is the level of precision (0.05). Thus:

$$\begin{aligned} &= \frac{467}{1+467(0.05)^2} = \\ \frac{467}{1+1.1675} &= \frac{467}{2.1675} \\ n &= 215.45 \approx 215. \end{aligned}$$

Although the minimum sample size was 215; 230 questionnaires were administered to enhance coverage across the three institutions: 80 at Usmanu Danfodiyo University, Sokoto, 75 at Federal Polytechnic, Bauchi and 75 at Kwara State College of Education, Ilorin. Two questionnaires were not returned, while three were excluded for improper completion. Thus, 225 valid questionnaires were retained for analysis, comprising 79 from the university, 73 from the polytechnic and 73 from the college, representing a usable response rate of 97.8%.

Data Collection Instrument and Procedure

Primary data were gathered through a structured questionnaire covering mathematics proficiency and academic performance, supplemented by face-to-face interaction to aid completion and clarify items. Of 230 questionnaires administered, 225 were correctly completed and retained for analysis.

Measurement of Variables

The study measured mathematics proficiency and academic performance. Mathematics proficiency was based on respondents' official reported performance in mathematics and

classified as low, moderate, or high. Academic performance was measured using students' cumulative grade point average (CGPA), obtained directly from the respective departments. For correlation and programme-comparison analyses, CGPA was retained as a continuous measure. For logistic regression, CGPA was coded as poor (0.00–2.39) and good (above 2.39). Mathematics Proficiency Category (MPCAT) was coded 1 = Low, 2 = Moderate and 3 = High, with low proficiency as the reference category.

Data Analysis

Data were analysed using descriptive and inferential statistics. Frequencies, percentages, means and standard deviations summarised respondents' characteristics and study variables. The Kruskal–Wallis H test examined whether CGPA differed significantly across Economics, Business Administration and Social Studies. Where the overall test was significant, Dunn's post-hoc pairwise comparisons with Bonferroni adjustment identified the specific programme pairs responsible for the difference.

Spearman's rank-order correlation assessed the direction and strength of the association between mathematics proficiency and academic performance. Spearman's rho was selected primarily because mathematics proficiency was represented by ordered categories (low, moderate and high), rather than as a continuous normally distributed measure. Preliminary screening also indicated departure from normality. The correlation was therefore interpreted as an association, not causation. Statistical significance was assessed at the 5% level.

Binary logistic regression was additionally used to estimate the likelihood of good academic performance by mathematics proficiency category. CGPA was coded 0 for poor performance (0.00–2.39) and 1 for good performance (above 2.39). MPCAT was coded 1 = Low, 2 = Moderate and 3 = High and entered into the model using two dummy variables, with Low as the reference category. Moderate proficiency was represented by MPM_i , while High proficiency was represented by MPH_i . Odds ratios and 95% confidence intervals were reported.

The binary logistic regression model was specified as:

$$\left(\frac{P_i}{1-P_i} \right) = \beta_0 + \beta_1 MPM_i + \beta_2 MPH_i + e_i$$

Where:

P_i = predicted probability that student i has good academic performance;

$1-P_i$ = predicted probability that student i has poor academic performance;

$\frac{P_i}{1-P_i}$ = odds that student i has good academic performance;

$\ln$ = the natural logarithm;

β_0 = the intercept;

β_1 = coefficient for moderate mathematics proficiency relative to low proficiency;

β_2 = coefficient for high mathematics proficiency relative to low proficiency;

MPM_i = dummy variable for moderate mathematics proficiency, where 1 = Moderate and 0 = otherwise;

MPH_i = dummy variable for high mathematics proficiency, where 1 = High and 0 = otherwise;

e_i = error term.

The predicted probability of good academic performance was expressed as:

$$P_i = \frac{1}{1 + \exp[-(\beta_0 + \beta_1 MPM_i + \beta_2 MPH_i)]}$$

The logistic regression coefficients were interpreted using odds ratios, represented by $(\exp(B))$. An odds ratio greater than one indicates higher odds of good academic performance relative to the low-proficiency reference category, whereas an odds ratio below one indicates lower odds. The statistical significance of the estimated coefficients was assessed at the 5% level.

Ethical Considerations

Participation was voluntary, with respondents informed of the study's purpose beforehand. Responses were kept confidential and used solely for academic purposes, with no identifiable information disclosed. Respondents could decline or withdraw at any stage.

Results and Discussions

Results

Data Screening and Preliminary Analysis

Of the 230 questionnaires administered, two were not returned and three were excluded for incomplete responses, leaving 225 valid questionnaires and a 97.8% usable response rate. Preliminary screening indicated departure from normality based on the Shapiro–Wilk test. However, the choice of non-parametric methods was guided not only by normality but also by the measurement characteristics and distributional properties of the



variables. Accordingly, Kruskal–Wallis and Spearman’s rank-order correlation were employed.

Academic Performance across Programmes

Table 1 presents students’ CGPA by programme and the corresponding mean ranks. Economics students ($n = 105$) recorded a mean CGPA of 3.26 ($SD = 0.61$), while Business Administration students ($n = 68$) had the highest mean CGPA of 3.36 ($SD = 0.71$). Social Studies students ($n = 52$) recorded the lowest mean CGPA of 3.11 ($SD = 0.68$). The corresponding mean ranks

were 108.42 for Economics, 131.76 for Business Administration and 88.15 for Social Studies.

The Kruskal–Wallis test indicated a statistically significant difference in CGPA across the three programmes, $\chi^2(2) = 12.47$, $p = 0.002$. The magnitude of the difference was modest, with epsilon-squared estimated as $\epsilon^2 = (H - k + 1)/(N - k)$, where $H = 12.47$, $k = 3$ and $N = 225$. This produced an effect size of $\epsilon^2 = 0.047$, indicating that approximately 4.7% of the variation in the ranked CGPA outcome was associated with programme membership.

Table 1: Academic performance of students across selected programmes

Programme	n	Mean CGPA	SD	Mean Rank
Economics	105	3.26	0.61	108.42
Business Administration	68	3.36	0.71	131.76
Social Studies	52	3.11	0.68	88.15
Kruskal–Wallis $\chi^2(2)$				12.47
p-value				0.002
Epsilon-squared (ϵ^2)				0.047

Note: CGPA = Cumulative Grade Point Average. Epsilon-squared was calculated as $\epsilon^2 = (H - k + 1)/(N - k)$.

Dunn’s Post-hoc Pairwise Comparisons

Following the significant Kruskal–Wallis result, Dunn’s post-hoc test with Bonferroni adjustment was conducted to identify the programme pairs responsible for the observed difference. As shown in Table 2, Business Administration differed significantly from Social

Studies ($Z = 3.48$, adjusted $p = 0.001$). However, differences between Business Administration and Economics ($Z = 2.01$, adjusted $p = 0.133$) and Economics and Social Studies ($Z = 1.81$, adjusted $p = 0.210$) were not significant.

Table 2: Dunn’s post-hoc pairwise comparisons of students’ CGPA

Pairwise Comparison	Z	Adjusted p-value	Decision
Business Administration vs. Social Studies	3.48	0.001*	Significant
Business Administration vs. Economics	2.01	0.133	Not significant
Economics vs. Social Studies	1.81	0.210	Not significant

Note: Dunn’s pairwise comparisons were adjusted using the Bonferroni correction. The adjusted significance threshold was $\alpha = 0.0167$ ($0.05/3$). The adjusted p-values reported above are already adjusted by the statistical software; no further adjustment was applied. $p < 0.0167$.

Relationship between Mathematics Proficiency and Academic Performance

Spearman’s rank-order correlation between mathematics proficiency and academic performance

The relationship between mathematics proficiency and academic performance was examined using Spearman’s rank-order correlation. The analysis revealed a strong, positive and statistically significant association between the two variables ($r_s = 0.810$, $p < 0.001$, $N = 225$), as

presented in Table 3. This indicates that students with higher mathematics proficiency tended to record higher levels of academic performance. The magnitude of the coefficient suggests a strong association between mathematics proficiency and academic performance in the study sample.

Table 3: Spearman's rank-order correlation between mathematics proficiency and academic performance

Variables	Mathematics Proficiency	Academic Performance
Mathematics Proficiency	1.000	0.810***
Academic Performance	0.810***	1.000
N	225	225

Note: r_s = Spearman's rank-order correlation coefficient. *** $p < 0.001$ (two-tailed).

The finding provides sufficient evidence to reject the null hypothesis of no significant relationship between mathematics proficiency and academic performance. Higher mathematics proficiency was associated with better academic performance. However, this association should not be interpreted causally. Given the cross-sectional design, the study cannot establish directionality. Prior academic preparation, motivation, study habits, programme requirements and general

academic ability may also explain the observed relationship.

Binary logistic regression of academic performance

To complement the correlation analysis, binary logistic regression examined whether mathematics proficiency was associated with the likelihood of good academic performance. Academic performance was coded 0 for poor (CGPA = 0.00–2.39) and 1 for good (CGPA > 2.39), with low mathematics proficiency as the reference category. The model was statistically significant, $\chi^2(2) = 62.847$, $p < 0.001$, with Nagelkerke $R^2 = 0.331$. The Hosmer–Lemeshow test was non-significant, $\chi^2(3) = 3.124$, $p = 0.373$, indicating adequate model fit, while 74.2% of cases were correctly classified. Moderate proficiency significantly increased the odds of good performance ($B = 1.826$, $SE = 0.412$, $p < 0.001$; $OR = 6.209$, 95% CI [2.770, 13.918]). High proficiency showed an even stronger association ($B = 2.805$, $SE = 0.478$, $p < 0.001$; $OR = 16.523$, 95% CI [6.473, 42.173]). Thus, both proficiency categories were associated with substantially higher odds of good academic performance.

Table 4: Binary logistic regression of academic performance on mathematics proficiency

Variable	B	SE	Wald	p-value	Odds Ratio	95% CI for OR
Moderate proficiency	1.826	0.412	19.641	<.001	6.209	2.770–13.918
High proficiency	2.805	0.478	34.427	<.001	16.523	6.473–42.173
Constant	–1.149	0.310	13.740	<.001	0.317	—

Model $\chi^2(2) = 62.847$, $p < 0.001$; $-2 \text{ Log Likelihood} = 226.318$; Nagelkerke $R^2 = 0.331$; Hosmer–Lemeshow $\chi^2(3) = 3.124$, $p = 0.373$; overall classification accuracy = 74.2%.

Discussion

Academic Performance across Programmes

The findings showed a statistically significant difference in academic performance across the three programmes. Business Administration students recorded the highest mean CGPA and mean rank, followed by Economics, while Social Studies students recorded the lowest. The Kruskal–Wallis test confirmed that these differences were statistically significant; however, the epsilon-squared estimate ($\epsilon^2 = .047$) indicates a modest effect. Thus, programme membership was associated with differences in academic performance but explained only a small proportion of the variation in students' CGPA. This finding is consistent with Nigerian evidence showing variation in academic performance across programmes and educational contexts. Ezenwoke *et al.* (2018)

reported differences across 23 undergraduate programmes, while Ogundokun *et al.* (2019) found variation across 12 programmes. These studies support the view that academic performance may differ across programmes.

However, the finding does not imply that Business Administration is inherently superior to Economics or Social Studies. The post-hoc results showed that the significant pairwise difference was between Business Administration and Social Studies, whereas comparisons involving Economics were not significant after Bonferroni adjustment. The overall Kruskal–Wallis result should therefore be interpreted alongside the pairwise findings rather than as evidence that all programmes differed. Several factors may explain the observed differences, including curriculum structure, assessment requirements, quantitative demands,

teaching practices and student characteristics. Importantly, programme and institution effects cannot be completely separated because each selected programme is linked to a particular institution. The observed differences should consequently be understood as differences across programme-institution settings, potentially reflecting institutional resources, teaching environments, academic support and student characteristics rather than pure programme effects.

Relationship between Mathematics Proficiency and Academic Performance

The strongest finding was the positive and statistically significant association between mathematics proficiency and academic performance. Spearman's rank-order correlation yielded $r_s = 0.810$ ($p < 0.001$), indicating a strong positive relationship. Students with higher mathematics proficiency therefore tended to achieve better academic performance, providing evidence against the null hypothesis. This finding aligns with Esenowo (2025), who reported a significant positive relationship between mathematics proficiency and Physics performance among secondary-school students. Although that study focused on Physics rather than overall tertiary academic performance, it similarly highlights the relevance of mathematical competence to logical, analytical and quantitative academic tasks. The finding is also consistent with Breit *et al.* (2025), whose review identified prior knowledge, intelligence, mathematics-specific skills, self-concept and self-regulation as important correlates. Nevertheless, $r_2 = 0.810$ indicates association, not causation.

Recent Nigerian evidence further highlights the importance of these factors. Falebita, Asanre and Chibisa (2025), studying 411 mathematics undergraduates in Southwestern Nigeria, found that mathematics self-efficacy, attitude, motivation and study habits jointly explained 59.4% of the variation in academic achievement, with study habits, self-efficacy and motivation particularly important. Similarly, Zakariya (2021) reported significant relationships among prior mathematics knowledge, mathematics self-efficacy and performance in introductory mathematics among university students. These findings suggest that prior knowledge and learner characteristics may partly shape mathematics-related outcomes.

Binary Logistic Regression and Academic Performance

The logistic regression analysis provided further evidence of the association between

mathematics proficiency and academic performance. The overall model was statistically significant, with no significant evidence of poor model fit. Students with moderate mathematics proficiency had 6.21 times the odds of good academic performance compared with those with low proficiency, while students with high proficiency had 16.52 times the odds. This pattern is consistent with the Spearman correlation, which also indicated a strong positive association between mathematics proficiency and academic performance. The convergence of these findings strengthens the evidence of a close association between mathematics proficiency and academic outcomes within the study sample. This result is broadly consistent with Falebita, Asanre and Chibisa (2025), who found that mathematics self-efficacy, study habits, motivation and attitude were important predictors of achievement among Nigerian mathematics undergraduates. Together, the findings highlight the relevance of mathematical competence and related learner characteristics to academic achievement, without implying causality.

Nevertheless, the odds ratios should not be interpreted as causal effects. The finding that high-proficiency students had 16.52 times the odds of good academic performance does not mean that increasing mathematics proficiency alone would produce a sixteen-fold improvement. The association may partly reflect prior academic ability, learning strategies, motivation, self-efficacy, programme requirements and other unmeasured factors. Research on university mathematics similarly shows that prior mathematics knowledge and self-efficacy can jointly influence performance. Mathematics proficiency should therefore be regarded as an important academic resource rather than a sole determinant of achievement. Institutions could identify students with weak mathematical foundations early and provide targeted quantitative-skills support, particularly in programmes involving statistics, economics, accounting, or related coursework. Such support should complement broader measures addressing study habits, motivation and self-efficacy, consistent with Falebita *et al.* (2025).

Conclusion

This study examined the relationship between mathematics proficiency and academic performance among students of Economics, Business Administration and Social Studies in three selected Nigerian tertiary institutions. Academic performance differed significantly across programmes, with the significant pairwise difference

occurring between Business Administration and Social Studies. Mathematics proficiency was also strongly and positively associated with academic performance, with higher proficiency linked to higher CGPA and greater odds of good performance. Within the sampled students and selected programme-institution settings, these findings indicate that mathematics proficiency is closely associated with academic performance.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Tertiary institutions should assess students' mathematics proficiency early to identify support needs, using such assessment diagnostically rather than assuming remedial intervention will improve academic performance.
2. Students with lower mathematics proficiency should be considered for targeted quantitative-skills support, while longitudinal or experimental research should evaluate whether such interventions improve CGPA and academic performance.
3. Institutions should consider prior preparation, study habits, motivation, self-efficacy and programme requirements, while future studies should incorporate these factors into multivariable models to explain academic performance more comprehensively.
4. Future research should use larger, diverse samples, objective measures of mathematics proficiency and longitudinal data to assess whether the observed association persists across settings and whether improved proficiency translates into better academic performance.

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