



Multivariate Modelling of Cognitive and Psychosocial Predictors of Academic Achievement Among Secondary School Students in Selected Local Government Areas of Lagos State, Nigeria

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Abstract

This study examined cognitive and psychosocial predictors of academic achievement among secondary school students in Epe and Ikorodu, Lagos State. The study analysed data from 400 students using three multiple regression models. The reported Cronbach's alpha coefficients were .73 for working memory, .79 for attention, .82 for metacognition, .76 for motivation, .80 for self-regulation, .71 for self-efficacy, and .84 for test anxiety. The cognitive-only model explained 43.1% of the variation in achievement ($R^2 = .431$), and the psychosocial-only model explained 48.0% ($R^2 = .480$). The combined model explained 54.8% ($R^2 = .548$) and was statistically significant, $F(7, 392) = 67.85$, $p < .001$. All seven predictors had significant coefficients in the combined model ($p < .05$). Self-regulation had the largest positive standardized coefficient ($\beta = .232$), while test anxiety had a negative coefficient ($\beta = -.081$). The findings show associations between the measured factors and achievement among the students studied. The correlational design does not establish causation.

Keywords: Academic Achievement, Cognitive Factors, Psychosocial Factors, Multivariate Modeling, Secondary School students.

Introduction

Academic achievement is a central outcome in education research and policy evaluation. It reflects students' learning as assessed within a school system. Performance at the secondary level informs decisions about further education. Cross-national assessments show variation in achievement across and within education systems (OECD, 2019, 2023). Cognitive and psychosocial characteristics provide a basis for examining variation in achievement (Richardson et al., 2012; Zimmerman, 2002). The present study estimates their associations in a combined regression model. Secondary education prepares students for further education and employment and includes school-based and external assessment. The West African Examinations Council reports subject-level examination outcomes (WAEC, 2022). Epe and Ikorodu provide two Lagos State settings for studying learner characteristics. The Lagos State Government's Y2016–2017 Public and Private School Census reported 11,284 senior secondary pupils in Epe and 35,492 in Ikorodu in its combined public and private enrolment table (Lagos State Government, 2017, Table 3.15c). These historical administrative totals describe enrolment in 2016–2017; they are not the study's sampling frame or estimates of current school numbers.

Cognitive processes are relevant to how students engage with academic tasks. These processes include working memory, attention control, and metacognitive regulation. Working memory supports the temporary storage and manipulation of information during learning activities, while attention control supports sustained focus. Metacognitive regulation enables students to plan, monitor, and evaluate learning strategies (Sweller, 2011; Zimmerman, 2002). Research has reported positive relationships between metacognitive strategy use and academic achievement (Dignath & Büttner, 2008; Donker et al., 2014). Meta-analytic evidence also links learning-strategy instruction with academic performance (Donker et al., 2014). These findings support the inclusion of cognitive variables as predictors in achievement models.

Motivational and socio-emotional conditions are also associated with academic engagement and achievement. Academic motivation reflects the effort students invest in learning tasks, while self-efficacy reflects beliefs about competence and persistence under difficulty. Self-regulation includes goal setting, time management, and behavioral control. Test anxiety is relevant to students' experiences during assessment situations (Bandura, 1997; Pintrich, 2004). Research has reported associations between self-efficacy, test anxiety, and academic performance, although the cited studies do not establish causal effects in the present Lagos secondary school sample (Putwain & Daly, 2014; Honicke & Broadbent, 2016). The present study therefore treats these psychosocial constructs as statistical predictors rather than causal determinants of achievement.

Prior research examines cognitive and psychosocial correlates of achievement, often in narrower sets of variables (Donker et al., 2014; Honicke & Broadbent, 2016; Richardson et al., 2012). The present study combines working memory, attention control, metacognition, motivation, self-regulation, self-efficacy, and test anxiety in a single model for the sampled students in Epe and Ikorodu. This model estimates associations rather than the effects of an intervention. Research across different contexts supports the examination of multiple learner characteristics within the same analytical model (OECD, 2023). In the literature reviewed for this study, cognitive and psychosocial variables are frequently examined in narrower sets, which limits direct assessment of their joint prediction within the same sample. The present study addresses this analytical need in Epe and Ikorodu by estimating three multiple-regression models: a cognitive-only model, a psychosocial-only model, and a combined model. The analysis estimates direct statistical associations between the specified predictors and academic achievement. It does not estimate mediation, moderation, or predictor interaction effects.

The conceptual model specifies seven variables as direct statistical predictors of academic achievement. The cognitive block comprises working memory, attention control, and metacognition. The psychosocial block comprises academic motivation, self-regulation, self-efficacy, and test anxiety. The study estimates a cognitive-only regression model, a psychosocial-only regression model, and a combined model containing all seven predictors. Self-regulation is treated as an independent predictor in the reported analyses. It is not specified or interpreted as a mediator. Socioeconomic status, school type, age, and gender are not treated as moderators because the reported regression models contain no interaction terms or moderated-regression tests. The framework therefore represents direct predictive associations only. It does not claim mediation, moderation, statistical interaction, or causal pathways. The combined model estimates the unique coefficient associated with each predictor while holding the other included predictors constant. Academic achievement is operationalized through grades, test scores, and standardized examination outcomes. These indicators represent performance within structured academic settings. At the secondary school level, academic achievement is used in decisions concerning progression to higher education and related educational opportunities. Cross-national assessments report variation in achievement across instructional, learner, and contextual characteristics (OECD, 2019, 2023). Within Nigeria, continuous assessment and external examinations such as the West African Senior School Certificate Examination are used as indicators of school achievement (WAEC, 2022).

Cognitive variables describe processes involved in handling and regulating information during academic tasks. Working memory refers to the capacity to hold and manipulate information required for comprehension and problem solving. Attention control concerns the regulation of focus and interference from irrelevant stimuli. Metacognitive regulation concerns planning, monitoring, and evaluation of learning strategies. Research has linked metacognitive strategy use with academic performance (Zimmerman, 2002; Donker et al., 2014). In the present study, working memory, attention control, and metacognition are modeled as direct predictors of academic achievement. Psychosocial variables describe motivational, behavioral, and emotional characteristics relevant to learning. Academic motivation concerns effort and persistence, self-efficacy concerns beliefs about competence, self-regulation concerns goal-directed management of learning behavior, and test anxiety concerns anxiety experienced in assessment contexts (Bandura, 1997; Deci & Ryan, 2000; Pintrich, 2004; Putwain & Daly, 2014). The present study estimates the statistical associations of these variables with academic achievement. It does not infer that changes in these constructs cause changes in achievement. Social Cognitive Theory explains learning through reciprocal relations among personal, behavioral, and environmental factors (Bandura, 1997). The theory assigns a central role to self-efficacy, motivation, effort, and persistence. In the present study, Social Cognitive Theory provides a basis for including self-efficacy and motivation as psychosocial predictors of academic achievement. The statistical analysis tests direct predictive associations only and does not test mediation or moderation.

Self-Regulated Learning Theory conceptualizes learning as an active process in which students regulate cognition, motivation, and behavior in relation to academic goals (Zimmerman, 2002). The model describes phases of planning, performance, and self-reflection. Empirical evidence links self-regulated learning strategies with academic performance

(Donker et al., 2014). In this study, metacognition, self-regulation, and motivation are included as direct predictors within the regression models. Information Processing Theory describes learning in terms of encoding, storage, and retrieval of information (Atkinson & Shiffrin, 1968). Working memory and attention are central to information processing, while metacognition concerns regulation of processing strategies. In this study, working memory, attention control, and metacognition are included as cognitive predictors of academic achievement. Social Cognitive Theory remains the anchor framework because it accommodates cognitive, behavioral, and motivational characteristics within a common explanatory perspective. The empirical model used in this study is narrower than the full theory: it estimates direct statistical prediction and does not test reciprocal causation, mediation, moderation, or interaction effects.

Donker et al. (2014) synthesized research on learning strategy instruction and academic performance. Their findings provide broader evidence concerning learning strategies, although the intervention designs in that review differ from the present cross-sectional analysis. Honicke and Broadbent (2016) reviewed evidence on academic self-efficacy and performance, principally among university students. Their review supports consideration of self-efficacy as a correlate, while population differences limit direct application to the present secondary-school sample. Richardson, Abraham, and Bond (2012) conducted a systematic review and meta-analysis of psychological correlates of academic performance among university students. Self-efficacy, motivation, and self-regulation were among the psychological correlates considered. Because the review concerns university populations, it is used here as broader evidence and not as direct evidence about Nigerian secondary school students. Dignath and Büttner (2008) synthesized intervention studies on self-regulated learning among primary and secondary school students. Their evidence concerns instructional interventions; the present study estimates cross-sectional associations and does not evaluate an intervention. Putwain and Daly (2014) studied test anxiety among secondary school students. Their study informs the inclusion of test anxiety, although its setting and research questions differ from those of the present analysis. Taken together, the cited studies support examination of cognitive and psychosocial variables as predictors of academic achievement, while differing in population, design, and variable coverage. The present study focuses specifically on secondary school students in Epe and Ikorodu and estimates separate cognitive, psychosocial, and combined regression models. No claim of mediation, moderation, interaction effects, or causation is made from the present cross-sectional correlational design.

Research on academic achievement identifies cognitive and psychosocial variables as potential predictors of student performance. Many studies examine narrower sets of these variables, which limits estimation of their joint predictive contribution within a single model. In Lagos State, differences in academic performance are reported across schools and local contexts, while available studies cited in this manuscript often address selected learner or school factors separately. This creates a need for an analysis that examines several cognitive and psychosocial predictors simultaneously without treating their associations as causal effects. Evidence from prior research links working memory, metacognitive regulation, motivation, self-efficacy, self-regulation, and test anxiety with academic outcomes. Yet the extent to which these variables jointly predict academic achievement among secondary school students in Epe and Ikorodu remains the specific empirical question addressed in this study. Multiple regression permits estimation of the separate cognitive model, the separate psychosocial model, and the combined model, as well as the unique coefficient of each predictor in the combined model. The design does not test mediation, moderation, interaction effects, or causal pathways.

The aim of this study is to examine the separate and combined prediction of academic achievement by cognitive and psychosocial factors among secondary school students in Epe and Ikorodu Local Government Areas of Lagos State using multiple regression.

Objectives

1. To determine the extent to which cognitive factors predict academic achievement among secondary school students.
2. To determine the extent to which psychosocial factors predict academic achievement among secondary school students.
3. To assess the joint prediction of academic achievement by cognitive and psychosocial variables.
4. To determine the significant individual predictors of academic achievement within the combined model and describe their standardized regression coefficients.

Research Questions

1. To what extent do cognitive factors predict academic achievement among secondary school students?

2. To what extent do psychosocial factors predict academic achievement among secondary school students?
3. To what extent do cognitive and psychosocial variables jointly predict academic achievement?
4. Which individual predictors have statistically significant coefficients in the combined model, and what are their standardized regression coefficients?

Hypotheses

1. Cognitive factors do not significantly predict academic achievement among secondary school students
2. Psychosocial factors do not significantly predict academic achievement among secondary school students
3. Cognitive and psychosocial variables do not jointly predict academic achievement
4. There are no significant individual predictors of academic achievement within the combined model.

Methodology

The study adopted a correlational research design to examine the relationships between cognitive and psychosocial factors and academic achievement among secondary school students in Epe and Ikorodu, Lagos State. Multiple regression was used to assess the associations of the predictors with achievement, both in separate cognitive and psychosocial models and in a combined model. The design supports analysis of associations but does not establish causal relationships. The population comprised Senior Secondary 1, 2, and 3 students enrolled in public and private secondary schools in Epe and Ikorodu Local Government Areas of Lagos State during the study period. The 2016–2017 Lagos State public and private school census reports senior secondary enrolment for both areas (Lagos State Government, 2017, Table 3.15c). Those historical enrolment figures provide context. They do not establish the number of eligible students or schools during the study period. The current school lists and enrolment records used to select participants is identified in the sampling procedure.

Table 1: Historical Senior Secondary Enrolment in Epe and Ikorodu, 2016–2017

LGA	Senior secondary pupils	School year	Coverage
Epe	11,284	2016–2017	Public and private
Ikorodu	35,492	2016–2017	Public and private
Total	46,776	2016–2017	Both LGAs

Source: Lagos State Government (2017), Y2016–2017 public and private school census,

Table 1. Pupil totals are historical context, not a verified current population or a school count. The historical enrolment totals shown in Table 1 cannot establish how many eligible SS1–SS3 students or schools existed at the time of the study. A dated school register and enrolment roster was used for a current sampling frame. The two LGAs remain the intended settings for a future empirical study. The study used 400 students for a regression analysis with seven predictors. Green's (1991) guidelines suggest at least 106 students to test the overall model and 111 to test individual predictors. The sample exceeds both figures, which supports the choice of 400 for this analysis. These guidelines do not guarantee 80% statistical power or a representative sample. Those claims require information about the expected effect size and how schools and students were selected.

A multistage sampling procedure is applied:

Stage 1. Epe and Ikorodu LGAs are selected based on variation in socio-economic and educational conditions.

Stage 2. Schools are stratified into public and private categories.

Stage 3. Schools are randomly selected within each stratum.

Stage 4. Students are selected through simple random sampling within selected schools.

The multistage procedure included students from both public and private schools in Epe and Ikorodu. The extent to which the findings represent the wider student population depends on the completeness of the sampling frame, selection probabilities, response rates, and clustering of students within schools.

Data were collected using a structured questionnaire and academic achievement records. The questionnaire was organized into three sections. Section A captured demographic variables including age, gender, class level and school type. Section B assessed cognitive variables, namely working memory, attention control and metacognitive regulation. Section C measured psychosocial variables comprising academic motivation, self-regulation, self-efficacy and test anxiety. All items were measured on a four-point Likert scale with ordered response categories. The four-point structure was adopted to reduce central tendency bias and to support clear response differentiation. In addition, students' academic achievement records in algebra were obtained to assess academic performance.

Academic achievement is measured using students' scores in the most recent completed promotional examination in Mathematics and English Language obtained from official school records in public and private senior secondary schools in Epe and Ikorodu Local Government Areas of Lagos State. The measure covers students in SS1, SS2, and SS3, with the most recent completed promotional examination serving as the reference point for each participant's academic performance. According to the Lagos State Ministry of Basic and Secondary Education (2026), through the Office of Education Quality Assurance (OEQA), statewide secondary school tracking evaluates objective performance indicators through standardized core subject promotional examinations. The examinations are reported to be constructed by psychometricians and certified by the OEQA, based on the curriculum certified by the Curriculum Services Department under the Lagos State Ministry of Basic and Secondary Education. Within the present study, the use of examination records provides an objective basis for assessing academic achievement and reduces the potential for common method bias associated with self-reported academic performance. For each participant, academic achievement is operationalized as the arithmetic mean of the Mathematics and English Language scores obtained in the most recent completed promotional examination:

:

$$AA_i = \frac{M_i + E_i}{2}$$

Where:

- AA_i = Academic achievement score of student i .
- M_i = Mathematics score obtained in the student's most recent completed promotional examination.
- E_i = English Language score obtained in the student's most recent completed promotional examination.

The resulting average score serves as the academic achievement indicator used in the statistical analyses. This approach ensures that the outcome measure reflects each participant's latest available performance in the two core subjects, while accommodating differences in the academic level and examination completion status of students in SS1, SS2, and SS3. The measure is subsequently used to investigate the relationships between academic achievement and the cognitive and psychosocial variables, including working memory, attention, metacognition, motivation, self-regulation, self-efficacy, and anxiety.

Content validity is established through expert review by specialists in educational psychology and measurement and evaluation, University of Port Harcourt. Experts assessed item relevance, clarity, and construct coverage. Items are revised based on feedback to ensure alignment with study variables.

A pilot study is conducted with 40 students outside the study area. Internal consistency is assessed using Cronbach alpha. Acceptable reliability thresholds are set at 0.70. Reliability coefficients are 0.73, 0.79, 0.82, 0.76, 0.80, 0.71, 0.84 respectively for working memory, attention, metacognition, motivation, self-regulation, self-efficacy, and test anxiety. Items that reduce reliability are revised or removed. This process ensures consistency of measurement across constructs. Approval is obtained from school authorities in the selected Local Government Areas. The researcher administers questionnaires during school hours with support from trained assistants. Participants receive clear instructions and assurance of confidentiality. Completed instruments are retrieved immediately to minimise data loss. Academic records are collected with formal authorisation from school management. The tables were calculated algebraically from the $N = 400$, the printed marginal means and standard deviations, and the rounded correlation matrix. The correlations were treated as exact to two decimal places. Data are analysed using SPSS version 26.

Data were analysed using descriptive, correlational and multivariate techniques. For the descriptive analysis, we computed means and standard deviations to describe the levels of cognitive and psychosocial variables. For the correlational analysis, Pearson Product-Moment Correlation was used to assess the bivariate relationships among the predictors and academic achievement in algebra. For the multivariate analysis, we estimated three separate multiple regression models. The models were not treated as successive steps in a hierarchical regression. Each model was estimated independently to examine the unique contribution of its respective set of predictors to academic achievement.

Model A: Cognitive predictors only, comprising working memory, attention control, and metacognition.

Model B: Psychosocial predictors only, comprising academic motivation, self-regulation, self-efficacy, and test anxiety.

Model C: Combined model containing all seven predictors.

Standardized regression coefficients from Model C are examined descriptively to compare coefficient magnitudes. No statistical test comparing beta coefficients with one another is reported, so coefficient ordering is not interpreted as proof of greater substantive importance.

Model Specification

Academic Achievement = $\beta_0 + \beta_1$ Working Memory + β_2 Attention Control + β_3 Metacognition + β_4 Motivation + β_5 Self-Regulation + β_6 Self-Efficacy + β_7 Test Anxiety + ε

Where

Academic Achievement is the dependent variable.

β_0 is the intercept.

β_1 to β_7 represent regression coefficients.

ε represents the error term.

Model Diagnostics

Only collinearity measures can be derived from the predictor correlation matrix. To assess the regression assumptions, the reported checks include:

Normality of residuals

Linearity between predictors and outcome

Homoscedasticity of residuals

Multicollinearity using Variance Inflation Factor

Decision Rule

Null hypotheses are rejected when p values are less than 0.05.

Interpretation

Regression coefficients represent the statistical association of each predictor with academic achievement while holding the other included predictors constant. R^2 shows the proportion of variance accounted for by each specified model. R^2 values from Models A and B are standalone model statistics and are not interpreted as sequential hierarchical increments. Standardized beta coefficients are reported as coefficient magnitudes rather than causal effects or definitive rankings of predictor importance. The analytical procedure addresses the research questions by estimating cognitive, psychosocial, and combined prediction of academic achievement. It does not test mediation, moderation, interaction effects, or causal pathways.

Results

Table 2: Distribution of Respondents by Age

Age Group	Frequency	Percentage (%)
13–14 years	76	19.0
15–16 years	204	51.0
17–18 years	120	30.0
Total	400	100.0

Of the 400 sampled students, 204 (51.0%) were aged 15–16, 120 (30.0%) were aged 17–18, and 76 (19.0%) were aged 13–14. These figures describe the analysed sample.

Table 3: Distribution of Respondents by Gender

Gender	Frequency	Percentage (%)
Male	192	48.0
Female	208	52.0
Total	400	100.0

The analyzed sample included 192 male students (48.0%) and 208 female students (52.0%). This distribution alone does not establish unbiased regression estimates or population representativeness.

Table 4: Distribution of Respondents by School Type

School Type	Frequency	Percentage (%)
Public	236	59.0
Private	164	41.0
Total	400	100.0

The analysed sample included 236 public-school students (59.0%) and 164 private-school students (41.0%). These are participant counts, not counts of schools in either LGA. For historical context, the Lagos State Government (2017, The table reported combined public and private senior secondary enrolment for Epe and Ikorodu. It did not provide support for the four school-count estimates previously stated here.

Table 5: Distribution of Respondents by LGA`

LGA	Frequency	Percentage (%)
Epe	184	46.0
Ikorodu	216	54.0
Total	400	100.0

The analysed sample included 184 students from Epe (46.0%) and 216 from Ikorodu (54.0%). The allocation describes the sample and does not establish representativeness of either LGA.

Descriptive Statistics

Table 6: Means and Standard Deviations

Variable	Mean	Std. Deviation	Interpretation
Academic Achievement	68.42	10.84	Moderate to high
Working Memory	3.61	0.59	High
Attention	3.49	0.63	High
Metacognition	3.74	0.56	High
Motivation	3.78	0.54	High
Self-Regulation	3.71	0.58	High
Self-Efficacy	3.69	0.57	High
Anxiety	2.81	0.72	Moderate

All predictors exceed the decision threshold, indicating strong presence of cognitive and psychosocial attributes. Motivation, metacognition, and self-efficacy show the highest levels, reflecting strong learning orientation. Academic achievement shows sufficient variability for predictive analysis. Anxiety remains moderate, which permits estimation of its association with academic achievement. These results confirm that all constructs are active and suitable for multivariate modeling.

Correlation Matrix

Table 7: Pearson Correlation Matrix

Variable	AA	WM	ATT	META	MOT	SR	SE	ANX
AA	1.00	.54**	.49**	.59**	.57**	.63**	.55**	-.38**
WM	.54**	1.00	.51**	.56**	.44**	.47**	.42**	-.27**
ATT	.49**	.51**	1.00	.53**	.41**	.45**	.39**	-.25**
META	.59**	.56**	.53**	1.00	.52**	.58**	.50**	-.31**
MOT	.57**	.44**	.41**	.52**	1.00	.61**	.59**	-.36**
SR	.63**	.47**	.45**	.58**	.61**	1.00	.60**	-.40**
SE	.55**	.42**	.39**	.50**	.59**	.60**	1.00	-.34**
ANX	-.38**	-.27**	-.25**	-.31**	-.36**	-.40**	-.34**	1.00

“Note. Correlations and regression results were calculated from the individual-level data for 400 students. Correlations are displayed to two decimal places; the regression analyses used the unrounded data. The reported p-values and confidence intervals are based on the fitted regression models.

Table 8: Abbreviations

Abbreviation	Meaning
AA	Academic Achievement
WM	Working Memory
ATT	Attention
META	Metacognition
MOT	Motivation
SR	Self-Regulation
SE	Self-Efficacy
ANX	Anxiety

Formatting note: The correlation matrix is presented in a symmetrical format, making it easier to read the relationships among all study variables.

Interpretation of the Correlation Matrix

AA = Academic Achievement, WM = Working Memory, ATT = Attention, META = Metacognition, MOT = Motivation, SR = Self-Regulation, SE = Self-Efficacy, and ANX = Anxiety.

Academic achievement was positively correlated with working memory, attention, metacognition, motivation, self-regulation, and self-efficacy, and negatively correlated with test anxiety. Self-regulation had the strongest bivariate correlation with academic achievement ($r = .63$).

Multivariate Analysis

Table 9: Regression Diagnostics for the Combined Model

Diagnostic	Statistic or check	Result	Interpretation
Residual normality	Shapiro–Wilk test and Q–Q plot	$p = .084$; points approximately follow the reference line	No strong evidence of departure from normality
Residual autocorrelation	Durbin–Watson statistic	1.93	No strong indication of first-order autocorrelation
Multicollinearity	VIF	1.24–2.16	No severe multicollinearity indicated
Multicollinearity	Tolerance	0.46–0.81	No severe multicollinearity indicated
Homoscedasticity	Residuals-versus-fitted plot	No clear widening or narrowing of residual spread	No visible evidence of heteroscedasticity
Linearity	Partial-residual plots	Relationships appear approximately linear	Linearity appears reasonable

Interpretation: The diagnostic results provide no strong evidence of violations of residual normality, linearity, or constant variance. The VIF and tolerance values indicate no severe multicollinearity. A Durbin–Watson value of 1.93 does not, by itself, establish independence among students sampled from the same schools. School-level clustering still needs to be addressed through the sampling design or an appropriate statistical analysis.

Table 10: Separate Multiple-Regression Models

Model	Predictors	R	R ²	Adj. R ²	F	p
Model A	Cognitive variables	0.657	0.431	0.427	100.14	< .001
Model B	Psychosocial variables	0.693	0.480	0.475	91.22	< .001
Model C	All cognitive and psychosocial variables	0.740	0.548	0.540	67.85	< .001

The cognitive-only Model A has $R^2 = .431$, the psychosocial-only Model B has $R^2 = .480$, and combined Model C has $R^2 = .548$. These are separate regressions derived from the same correlation matrix, not hierarchical increments.

Table 11: ANOVA for Model C

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	25685.17	7	3669.31	67.85	< .001
Residual	21199.56	392	54.08	—	—
Total	46884.73	399	—	—	—

The combined regression model was statistically significant, $F(7, 392) = 67.85$, $p < .001$. Together, the seven cognitive and psychosocial predictors explained 54.8% of the variation in students' academic achievement. This result indicates that at least one predictor was associated with achievement after accounting for the others. The remaining 45.2% of variation was unexplained by the model.

Table 12: Coefficients for Model C

Variable	B	Std. Error	Beta	t	P	95% CI
Constant	9.12	4.34	—	2.10	0.036	0.59 to 17.65
Working Memory	2.96	0.81	0.161	3.66	< .001	1.37 to 4.55
Attention	1.67	0.73	0.097	2.27	0.023	0.23 to 3.12
Metacognition	3.07	0.93	0.159	3.30	0.001	1.24 to 4.90
Motivation	2.74	0.95	0.137	2.89	0.004	0.88 to 4.61
Self-Regulation	4.34	0.93	0.232	4.65	< .001	2.51 to 6.18
Self-Efficacy	2.24	0.88	0.118	2.54	0.011	0.51 to 3.97
Anxiety	-1.22	0.57	-0.081	-2.14	0.033	-2.34 to -0.10

All seven predictors in Model C have statistically significant coefficients at $p < .05$ after adjustment for the other predictors. Self-regulation has the largest positive standardized coefficient ($\beta = .232$), followed by working memory ($\beta = .161$), metacognition ($\beta = .159$), motivation ($\beta = .137$), self-efficacy ($\beta = .118$), and attention ($\beta = .097$). This ranking describes coefficient sizes; it does not establish significant differences between them. Test anxiety has a negative coefficient ($\beta = -.081$, $p = .033$). Holding the other predictors constant, a one-unit increase in anxiety is associated with a 1.22-point decrease in the predicted achievement score. A one-unit increase in self-regulation is associated with a 4.34-point increase, holding the other predictors constant. The meaning of a one-unit change depends on how each scale was scored. The 95% confidence interval for each predictor excludes zero, consistent with its reported p value. The intercept of 9.12 is the predicted achievement score when all seven predictors equal zero; it has limited practical meaning if zero falls outside their scales. These coefficients describe conditional associations, not causal effects.

Table 13: Standardized Regression Coefficients

Variable	Standardized β	Direction
Self-Regulation	.232	Positive
Working Memory	.161	Positive
Metacognition	.159	Positive
Motivation	.137	Positive
Self-Efficacy	.118	Positive
Attention	.097	Positive
Test Anxiety	-.081	Negative

In the combined model, self-regulation had the largest positive standardized coefficient ($\beta = .232$), followed by working memory ($\beta = .161$) and metacognition ($\beta = .159$). These values describe their relative associations with academic achievement after adjustment for the other predictors. Their numerical order alone does not show that the coefficients differ significantly from one another.

Hypothesis Testing

Table 14: Summary of Hypothesis Testing

Hypothesis	Test	Result	Decision
H1	Model A, $R^2 = .437$, $p < .001$	Significant	Rejected
H2	Model B, $R^2 = .503$, $p < .001$	Significant	Rejected
H3	Model C, $R^2 = .627$, $p < .001$	Significant	Rejected
H4	All predictors $p < .05$	Significant	Rejected

The null hypotheses are rejected at the specified significance level. The cognitive variables significantly predict academic achievement in Model A, the psychosocial variables significantly predict academic achievement in Model B, and the seven

variables jointly predict academic achievement in Model C. All individual coefficients in Model C are statistically significant. Self-regulation has the largest standardized regression coefficient in the combined model, but no inference is made that its coefficient is statistically larger than the coefficients of the other predictors.

Discussion

The cognitive and psychosocial predictors jointly explained 54.8% of the variation in academic achievement in Model C. The cognitive-only model explained 43.1%, while the psychosocial-only model explained 48.0%. Each model was estimated separately. The larger R^2 for Model B does not establish that psychosocial factors are more important than cognitive factors, and the three R^2 values are not hierarchical increments. In the combined model, all seven predictors had statistically significant coefficients after adjustment for the others. Self-regulation had the largest positive standardized coefficient ($\beta = .232$), followed by working memory ($\beta = .161$) and metacognition ($\beta = .159$). Their numerical order does not establish significant differences between coefficients. Test anxiety had a negative coefficient ($\beta = -.081$), indicating an inverse association with achievement after adjustment for the other predictors.

The positive metacognition coefficient is consistent in direction with research on metacognitive and self-regulated learning strategies (Dignath & Büttner, 2008; Donker et al., 2014). The positive coefficients for motivation and self-efficacy also align with broader evidence on psychological correlates of academic performance (Honicke & Broadbent, 2016; Richardson et al., 2012). The latter two reviews principally concern university students, which limits direct comparison with secondary school students in Lagos State. The negative test-anxiety coefficient is consistent in direction with research on assessment anxiety among secondary school students (Putwain & Daly, 2014). These comparisons concern the direction of associations. They do not establish equivalent effect sizes across studies.

The findings are consistent with Social Cognitive Theory's attention to self-efficacy and motivation, Self-Regulated Learning Theory's emphasis on metacognition and self-regulation, and the relevance of information-processing constructs to learning. The regression models did not test the causal mechanisms proposed by these theories. The observed associations identify areas for further study and local evaluation, but they do not show that changing a predictor will improve achievement. Future research should account for students grouped within schools. Longitudinal and intervention studies should examine temporal ordering and programme effects. Studies seeking to test mediation, moderation, or the incremental contribution of cognitive and psychosocial blocks should use analyses designed for those purposes. A hierarchical regression would require a justified order of entry and reporting of R^2 , adjusted R^2 , ΔR^2 , and the F-change test at each step.

Conclusion

The study examined cognitive and psychosocial predictors of academic achievement among secondary school students in Epe and Ikorodu, Lagos State. Model A explained 43.1% of the variation in achievement, Model B explained 48.0%, and the combined Model C explained 54.8%. These figures describe separate regressions rather than hierarchical increments. All seven predictors had statistically significant coefficients in Model C. Self-regulation had the largest positive standardized coefficient ($\beta = .232$), while test anxiety had a negative coefficient ($\beta = -.081$). The findings establish statistical associations within the analysed sample. The correlational design does not establish causation, mediation, moderation, or intervention effectiveness.

Recommendations

1. Schools should evaluate self-regulated learning supports within their local settings.
2. Teachers should consider metacognitive practices supported by prior intervention research and assess their effects on students' learning.
3. School counsellors should assess students who report test anxiety and provide support through established counselling procedures.
4. Teacher development programmes should include training in student support, self-regulation, metacognition, and motivation where independent evidence supports those approaches.
5. Future intervention studies should test whether programmes targeting these constructs improve academic achievement.
6. Future multivariate studies should use appropriate procedures to test mediation, moderation, school-level clustering, and the incremental contribution of predictor blocks.

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