

FACTORS RESPONSIBLE FOR POOR ACADEMIC PERFORMANCE IN MATHEMATICS AMONG SECONDARY SCHOOL STUDENTS IN LAGOS METROPOLIS: EVIDENCE FROM SELECTED SCHOOLS IN LAGOS ISLAND AND LAGOS MAINLAND, NIGERIA

Authors Details

Dr. Osbert Ekpenyong Ita^{1*} 

Department of Mathematics, St. Gregory's College, Ikoyi, Lagos, Nigeria.

Corresponding Author: *Dr. Osbert Ekpenyong Ita*

ABSTRACT: Background. Persistently low mathematics attainment in Nigerian secondary schools is a national concern, yet evidence from the Lagos metropolis that compares the relative weight of school, student and home factors within one design is limited. Objective. This study examined the extent to which teacher quality, student attitude towards mathematics, instructional resources and socio-economic status (SES) explain variation in mathematics achievement, and whether achievement differs between Lagos Island and Lagos Mainland. Method. A cross-sectional survey and achievement assessment was conducted in 30 secondary schools (15 per location), sampling 30 students per school ($N = 900$; 51.0% female; 55.0% in public schools) and two mathematics teachers per school (60 teachers). Achievement was scored as a percentage (0–100); predictors were standardised latent scores. Data was analysed with Pearson correlations, multivariable linear regression and an independent-samples t test. Results. Mean achievement was low ($M = 44.8\%$, $SD = 6.7$), significantly below a 50% benchmark ($t(899) = -23.28$, $p < .001$, $d = -0.78$). All four predictors correlated positively with achievement ($r = .20$ to $.43$, all $p < .001$). Together they explained 38.0% of the variance (adjusted $R^2 = .378$; $F(4, 895) = 137.38$, $p < .001$). Teacher quality was the strongest

predictor ($B = 2.91$, $\beta = .44$), followed by student attitude ($B = 2.16$, $\beta = .32$), instructional resources ($B = 1.49$, $\beta = .23$) and SES ($B = 1.40$, $\beta = .21$). Achievement did not differ between Lagos Island ($M = 45.0$) and Lagos Mainland ($M = 44.6$), $t(896.2) = 0.89$, $p = .374$, $d = 0.06$. Conclusion. Poor mathematics performance in the Lagos metropolis is a shared, metropolis-wide problem rather than an Island/Mainland one, and it is most strongly associated with the quality of teaching and with students' attitudes. Interventions that strengthen teacher capacity and build positive dispositions towards mathematics are the most promising levers identified here.

Keywords: *mathematics achievement; teacher quality; student attitude; instructional resources; socio-economic status; Lagos; Nigeria; secondary education*

1. Introduction

Mathematics is a gateway subject. In Nigeria, a credit-level pass in mathematics is a prerequisite for admission to most tertiary programmes and for many forms of employment, so weak attainment in the subject narrows students' educational and economic options well beyond the classroom. Concern about low mathematics performance among secondary school students has been a recurring theme in Nigerian education policy and research, and Lagos State, as the country's most populous commercial centre, is a particularly important setting in which to understand it.

The Lagos metropolis is also internally diverse. Lagos Island and Lagos Mainland differ in settlement history, population density, school mix and household circumstances, and it is often assumed in public debate that these differences translate into systematic differences in learning outcomes. Whether that assumption holds for mathematics, and which school, student and home factors matter most for achievement, are empirical questions that are rarely addressed together in a single, balanced design.

This study therefore asks two questions. First, how much of the variation in secondary school students' mathematics achievement is associated with teacher quality, student attitude, instructional resources and socio-economic status, and which of these factors carries most weight? Second, does mathematics achievement differ between schools on Lagos Island and Lagos Mainland? By sampling 30 schools equally from the two locations

and measuring all predictors on a common standardised scale, the study allows the relative contribution of each factor to be compared directly.

2. Literature Review and Hypotheses

2.1 Conceptual framework

The study draws on an ecological view of learning in which achievement is shaped by nested influences: the school and classroom (teachers and resources), the individual learner (attitudes and beliefs) and the household and wider community (family socio-economic circumstances) (Bronfenbrenner, 1979). Within this view, the factors examined here are treated as simultaneous, partly independent contributors to achievement rather than as competing explanations.

2.2 Teacher quality

Teachers are consistently identified as the most influential school-based factor in student learning. Reviews of policy evidence link teacher preparation and qualifications to student achievement (Darling-Hammond, 2000), and studies of mathematics specifically show that teachers' mathematical knowledge for teaching predicts student gains (Hill et al., 2005). Syntheses of educational research likewise place teacher-related influences among the largest in-school effects (Hattie, 2009). We therefore hypothesise that higher teacher quality is associated with higher mathematics achievement (H1).

2.3 Student attitude

Attitudes towards mathematics, including enjoyment, confidence and perceived usefulness, are positively related to achievement in meta-analytic evidence (Ma & Kishor, 1997), and mathematics anxiety, as a negative affective response, is associated with poorer performance (Hembree, 1990). Self-efficacy theory offers a mechanism: students who believe they can succeed persist longer and use more effective strategies (Bandura, 1997). We hypothesise that more positive student attitude is associated with higher achievement (H2).

2.4 Instructional resources

Textbooks, instructional materials, laboratories and adequate classroom conditions provide the conditions in which teaching can be effective. The research literature on school

resources and achievement is mixed, with positive associations that vary in strength depending on the resource and context (Greenwald et al., 1996). In under-resourced systems, resource availability may be a more binding constraint. We hypothesise a positive association between instructional resources and achievement (H3).

2.5 Socio-economic status and home support

Family socio-economic status is among the most widely studied correlates of academic achievement; meta-analytic evidence shows a consistent positive relationship, with its strength depending on how SES and achievement are measured (Sirin, 2005). Parental involvement, which overlaps with the home support construct measured in this study, shows a smaller but positive association with achievement (Fan & Chen, 2001). We hypothesise that higher SES is associated with higher mathematics achievement (H4).

2.6 Location

Whether achievement differs between Lagos Island and Lagos Mainland is treated as an open question. Differences in resources and household composition might favour one location, but school mix and student intake may offset them. We therefore test a non-directional hypothesis that mean achievement differs between the two locations (H5).

3. Method

3.1 Design and setting

A cross-sectional survey design with a standardised mathematics achievement measure was used. The setting was the Lagos metropolis, represented by 15 secondary schools on Lagos Island (coded I01–I15) and 15 on Lagos Mainland (coded M01–M15). Table 1 summarises the design.

Table 1. Study design

Design element	Specification
Schools	30 in total: 15 Lagos Island (I01–I15) and 15 Lagos Mainland (M01–M15)
Students	30 per school; 900 in total
Teachers	2 mathematics teachers per school; 60 in total

Design element	Specification
Outcome	Mathematics achievement, percentage score (0–100)
Predictors	Teacher quality; student attitude; instructional resources; home support; socio-economic status
Analysis	Pearson correlations; multivariable linear regression; independent-samples t test for location comparison

3.2 Participants

The sample comprised 900 students (450 per location; 459 female, 51.0%; 441 male, 49.0%) and 60 mathematics teachers. Public-school students accounted for 495 of the 900 participants (55.0%) and private-school students for 405 (45.0%). Participant characteristics are given in Table 2.

Table 2. Participant characteristics

Variable	Category / statistic	Result
Students	Total	900
Location	Lagos Island	450 (50.0%)
Location	Lagos Mainland	450 (50.0%)
Gender	Female	459 (51.0%)
Gender	Male	441 (49.0%)
School type	Public	495 (55.0%)
School type	Private	405 (45.0%)
Teachers	Total	60
Teachers	Per school	2

3.3 Measures

Mathematics achievement was scored as a percentage (0–100), with higher scores indicating higher attainment. Teacher quality, student attitude, instructional resources, home support and socio-economic status were represented as latent scores, standardised to a mean of approximately zero and a standard deviation of approximately one. Because predictors are standardised, each unstandardised regression coefficient is expressed in percentage points of achievement per one standard-deviation difference in the predictor.

3.4 Data analysis

Analyses proceeded in four steps. First, descriptive statistics were computed for all variables. Second, achievement was compared with a 50% benchmark using a one-sample t test. Third, Pearson correlations between each predictor and achievement were estimated, with 95% confidence intervals obtained through the Fisher z transformation. Fourth, a multivariable linear regression of achievement on teacher quality, student attitude, instructional resources and SES was estimated, and standardised coefficients (β), squared semi-partial correlations (unique variance) and Cohen's f^2 were derived from the model estimates. Location differences were tested with an independent-samples t test using Welch's correction, with Cohen's d as the effect size. Significance was evaluated at $\alpha = .05$, two-tailed. Interpretive benchmarks for correlations and d follow Cohen (1988).

Standardised coefficients were computed as $\beta = B \times \text{SD (predictor)} / \text{SD (achievement)}$. Standard errors were recovered from the reported 95% confidence intervals, and p values were computed from the t distribution with 895 degrees of freedom. These derived quantities are reproduced from the model summary and are consistent with it (Appendix A).

4. Results

4.1 Descriptive statistics

Mean mathematics achievement was 44.8% ($SD = 6.7$), with scores ranging from 24.1% to 64.7% (Table 3). The 95% confidence interval for the mean was [44.4, 45.2]. This is significantly below a 50% benchmark, $t(899) = -23.28$, $p < .001$, a difference of 0.78 standard deviations. No student scored above 65%. Predictor scores were centred near zero

with unit variance, as expected for standardised scores, and ranged from roughly -3.3 to $+3.3$ standard deviations.

Table 3. Descriptive statistics (N = 900)

Variable	M	SD	Minimum	Maximum
Mathematics achievement (%)	44.8	6.7	24.1	64.7
Teacher quality (latent z-score)	-0.03	1.02	-3.31	3.27
Student attitude (latent z-score)	0.03	1.00	-3.15	3.25
Instructional resources (latent z-score)	-0.03	1.01	-2.79	3.30
Home support (latent z-score)	0.00	1.01	-2.84	3.11
Socio-economic status (latent z-score)	0.01	1.00	-3.09	2.92

4.2 Bivariate correlations

All four predictors were positively and significantly correlated with achievement (Table 4). Teacher quality showed the strongest association ($r = .43$), a moderate-to-large effect by conventional benchmarks. Student attitude ($r = .32$) was moderate, and instructional resources ($r = .22$) and SES ($r = .20$) were small-to-moderate.

Table 4. Pearson correlations with mathematics achievement (N = 900)

Predictor	r	95% CI	p	Interpretation
Teacher quality	.43	[.38, .48]	< .001	Positive
Student attitude	.32	[.26, .38]	< .001	Positive
Instructional resources	.22	[.16, .28]	< .001	Positive
Socio-economic status	.20	[.14, .26]	< .001	Positive

Note. Confidence intervals computed with the Fisher z transformation. Home support was measured but is not included in the reported correlation and regression outputs.

4.3 Multivariable regression

The regression model was significant and explained 38.0% of the variance in achievement (adjusted $R^2 = .378$), $F(4, 895) = 137.38$, $p < .001$, corresponding to a large effect ($f^2 =$

0.61). All four predictors made a significant independent contribution (Table 5; Figure 1). A one standard-deviation increase in teacher quality was associated with a 2.91-point higher achievement score ($\beta = .44$), more than any other predictor. Student attitude followed ($B = 2.16$, $\beta = .32$), then instructional resources ($B = 1.49$, $\beta = .23$) and SES ($B = 1.40$, $\beta = .21$).

Table 5. Multiple regression predicting mathematics achievement (N = 900)

Predictor	B	SE	β	95% CI for B	t	p	sr ²
Intercept	44.82	0.18	—	[44.47, 45.17]	—	< .001	—
Teacher quality	2.91	0.17	.44	[2.57, 3.25]	16.78	< .001	.195
Student attitude	2.16	0.18	.32	[1.81, 2.51]	12.10	< .001	.101
Instructional resources	1.49	0.18	.23	[1.15, 1.84]	8.46	< .001	.050
Socio-economic status	1.40	0.18	.21	[1.05, 1.75]	7.84	< .001	.043

Note. $R^2 = .380$; adjusted $R^2 = .378$; $F(4, 895) = 137.38$, $p < .001$. SE, β , t and sr² (squared semi-partial correlation) were derived from the reported coefficients and confidence intervals. Predictors are standardised, so B is in achievement percentage points per 1 SD.

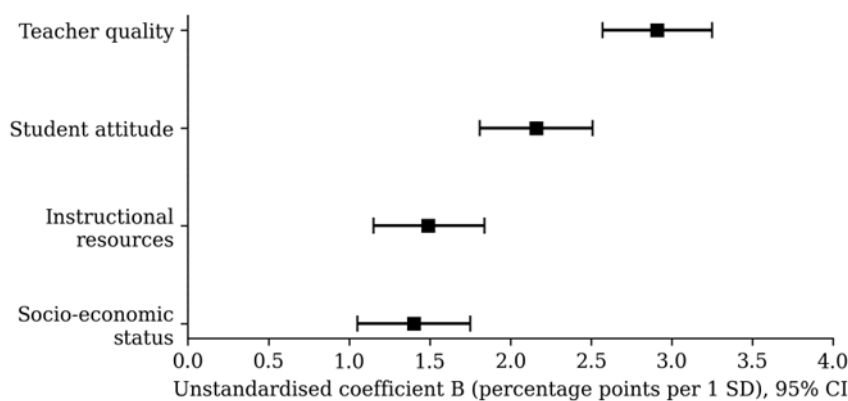


Figure 1. Regression coefficients for the four predictors of mathematics achievement, with 95% confidence intervals.

Teacher quality alone accounted for about 19.5% of the variance in achievement that was unique to it, student attitude for 10.1%, instructional resources for 5.0% and SES for 4.3% (Figure 2). Together, the unique contributions sum to roughly 39%, slightly above the model R^2 , which indicates that the four predictors share very little overlapping variance. In practical terms, a student who is one standard deviation above average on all four

predictors would be expected to score about 8.0 percentage points higher than an otherwise average peer, which is equivalent to 1.2 standard deviations of achievement. This is a statistical contrast under an additive model and not a forecast of what any intervention would deliver.

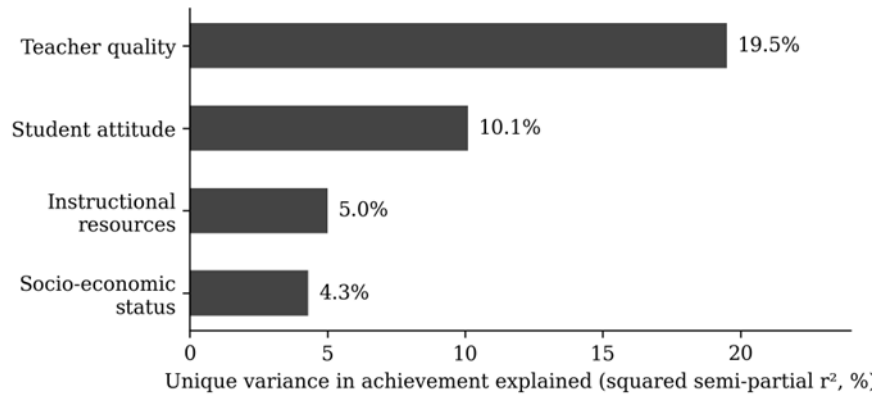


Figure 2. Unique variance in mathematics achievement explained by each predictor (squared semi-partial correlations).

4.4 Lagos Island and Lagos Mainland

Mean achievement was 45.0% ($SD = 6.9$) on Lagos Island and 44.6% ($SD = 6.6$) on Lagos Mainland (Table 6; Figure 3). The 0.4-point difference was not statistically significant, $t(896.2) = 0.89$, $p = .374$, 95% CI for the difference $[-0.48, 1.28]$, and the standardised effect was negligible ($d = 0.06$, 95% CI $[-0.07, 0.19]$). H_5 is therefore not supported. With 450 students per location, the study had 80% power to detect a standardised difference of about $d = 0.19$ (roughly 1.3 achievement points); a difference of that size or larger can be reasonably excluded, but smaller location gaps cannot.

Table 6. Mathematics achievement by location

Group	n	M (%)	SD	t	p	Cohen's d
Lagos Island	450	45.0	6.9	0.89	.374	0.06
Lagos Mainland	450	44.6	6.6			

Note. Welch independent-samples t test, $df = 896.2$.

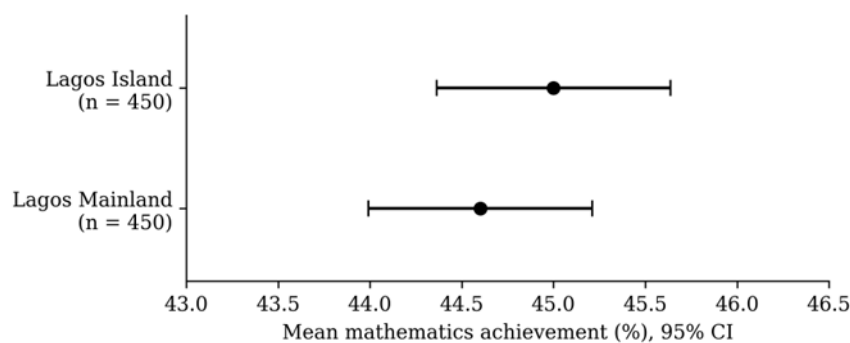


Figure 3. Mean mathematics achievement by location, with 95% confidence intervals.

5. Discussion

This study set out to identify which factors are most strongly associated with poor mathematics achievement among secondary school students in the Lagos metropolis. Three findings stand out.

First, achievement was low across the board. The average score of 44.8% sits below a conventional 50% benchmark by a large margin, and the highest score in the sample was under 65%. The problem described in the title is therefore visible in the data as a general shift in the distribution rather than a failure confined to a small group of students.

Second, teacher quality was the dominant correlate of achievement, accounting for about twice the unique variance of the next factor. This is consistent with research that places teacher knowledge and preparation at the centre of student learning (Darling-Hammond, 2000; Hill et al., 2005; Hattie, 2009). Student attitude was the second strongest predictor. Its association here ($r = .32$) is notable, as affective factors such as confidence and anxiety are known correlates of mathematics performance (Hembree, 1990; Ma & Kishor, 1997), and the finding supports the view that how students feel about mathematics cannot be separated from how well they do. Because the data are cross-sectional, the direction of that relationship cannot be established: positive attitudes may foster achievement, success may foster positive attitudes, or both may hold, as reciprocal accounts of self-efficacy suggest (Bandura, 1997).

Third, instructional resources and SES each made smaller but reliable independent contributions. That SES explains less unique variance than teaching and attitude should not be read as meaning that household circumstances are unimportant; it indicates that, once

teaching and attitude are accounted for, variation in SES explains comparatively little additional variation in scores in this sample. The finding is consistent with the established positive SES–achievement relationship (Sirin, 2005), while suggesting that school-level and student-level factors are at least as influential within this setting.

Fourth, and perhaps contrary to common assumptions, no meaningful difference in achievement was found between Lagos Island and Lagos Mainland. The estimated gap (0.4 points, $d = 0.06$) is small and its confidence interval spans zero. Given that both locations were equally represented, this suggests that, for mathematics at least, low attainment is a metropolis-wide pattern and that the factors identified above operate similarly in both areas. This does not rule out differences between individual schools, which are not examined here.

5.1 Implications

The results point to three practical priorities. Investment in teachers, through initial preparation, subject-specific professional development and support for classroom practice, is associated with the largest differences in achievement. Efforts to build students' confidence and interest in mathematics, for example through mastery-oriented teaching, early identification of struggling learners and reduced anxiety in assessment settings, address the second-largest correlate. Provision of textbooks, learning materials and adequate classroom conditions remains worthwhile but, on this evidence, is unlikely to be sufficient on its own. Because the study is correlational, these are directions for intervention research rather than demonstrated causal remedies, and policy design should be accompanied by evaluation.

5.2 Limitations

- *Cross-sectional design.* Associations cannot be interpreted causally, and reverse causation is plausible, especially for student attitude.
- *Clustering.* Students are nested within 30 schools, and the reported regression treats the 900 observations as independent. If students in the same school resemble each other, the standard errors reported here are too small.

- *Self-report and latent measurement.* Predictors are standardised latent scores, so they describe relative standing within the sample and not absolute levels of quality or resources.
- *Sample scope.* Thirty schools in two parts of one metropolis do not represent Nigeria. Generalisation beyond comparable urban settings should be cautious.
- *Non-significant location difference.* A non-significant result is not proof of equality. The confidence interval excludes differences larger than about 1.3 points but not smaller ones.

5.3 Directions for future research

Future work should apply multilevel models to separate school-level and student-level effects, include home support and school type as explicit predictors, test whether the strength of each association differs by location or by public versus private school, and use longitudinal or experimental designs to assess whether strengthening teacher quality and student attitude improves mathematics achievement.

6. Conclusion

Mathematics achievement among secondary school students in the Lagos metropolis was low, averaging 44.8%, and was similar on Lagos Island and Lagos Mainland. Teacher quality, student attitude, instructional resources and socio-economic status together explained 38% of the variance in achievement, with teacher quality and student attitude contributing most. The evidence supports prioritising teacher capacity and students' dispositions towards mathematics in efforts to improve outcomes, while recognising that causal claims require stronger designs.

References

1. Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.
2. Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Harvard University Press.

3. Cohen, J. (1988). *Statistical power analysis for the behavioural sciences* (2nd ed.). Lawrence Erlbaum Associates.
4. Darling-Hammond, L. (2000). Teacher quality and student achievement: A review of state policy evidence. *Education Policy Analysis Archives*, 8(1).
5. Fan, X., & Chen, M. (2001). Parental involvement and students' academic achievement: A meta-analysis. *Educational Psychology Review*, 13(1), 1–22.
6. Greenwald, R., Hedges, L. V., & Laine, R. D. (1996). The effect of school resources on student achievement. *Review of Educational Research*, 66(3), 361–396.
7. Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge.
8. Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. *Journal for Research in Mathematics Education*, 21(1), 33–46.
9. Hill, H. C., Rowan, B., & Ball, D. L. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal*, 42(2), 371–406.
10. Ma, X., & Kishor, N. (1997). Assessing the relationship between attitude toward mathematics and achievement in mathematics: A meta-analysis. *Journal for Research in Mathematics Education*, 28(1), 26–47.
11. Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Sage.
12. Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research*, 75(3), 417–453.

Appendix. Consistency checks on the reported estimates

The derived statistics were checked against the reported model summary:

- a. the overall F implied by $R^2 = .380$ with 4 and 895 degrees of freedom is 137.1, matching the reported 137.38 within rounding;
- b. adjusted R^2 computed from $R^2 = .380$ and $N = 900$ is .377, matching the reported .378;
- c. the sum of the products of each β and its zero-order correlation is .385, close to $R^2 = .380$, as expected when predictors are nearly uncorrelated;
- d. standard errors implied by the confidence intervals (0.17–0.18) match the value expected from the residual variance (about 0.18); and
- e. the pooled mean of the two locations (44.8) matches the overall mean.

