

# A Multilevel Regression Analysis of Socioeconomic Factors Affecting Secondary School Students' Academic Achievement

KAYODE, OLAREWAJU JOSEPH<sup>1</sup>, OMOTOSO SALIU ADEWOLE<sup>2</sup>

<sup>1, 2</sup>*Mathematics and Statistics Department, Rufus Giwa Polytechnic, Owo, Ondo State*

*Abstract—This study examined the influence of socioeconomic factors on secondary school students' academic achievement using a multilevel regression framework. Academic achievement among secondary school students has remained a major concern in many developing countries, particularly Nigeria, where disparities in parental income, educational background, and school resources continue to widen achievement gaps. Traditional regression models often ignore the hierarchical structure of educational data, where students are nested within schools. This study employed multilevel regression analysis to account for both student-level and school-level variations in academic performance. A cross-sectional survey design was adopted. Data were collected from 1,200 students drawn from 30 secondary schools through stratified random sampling. Students' academic achievement was measured using standardized examination scores, while socioeconomic variables included parental income, parental education, occupation, family size, access to learning materials, and school infrastructure indicators. Descriptive statistics, intraclass correlation coefficient (ICC), and two-level hierarchical linear models were employed for analysis. Results showed that parental education, household income, availability of textbooks, internet access, and school infrastructure significantly influenced students' academic achievement. Approximately 21% of the variation in academic performance occurred between schools, while 79% occurred within schools. The findings emphasize the importance of targeted educational policies aimed at reducing socioeconomic inequalities and improving school learning environments. The study recommends increased government intervention in educational funding, scholarship schemes for low-income families, and improved infrastructure in public secondary schools.*

**Keywords:** *Academic Achievement, Socioeconomic Status, Multilevel Regression, Hierarchical Linear Model, Secondary Education, Nigeria.*

## I. INTRODUCTION

Education remains one of the most important tools for socioeconomic development and poverty reduction. Academic achievement at the secondary

school level plays a critical role in determining students' future educational and occupational opportunities. However, academic performance is influenced by numerous factors, including socioeconomic conditions of students and institutional characteristics of schools.

In Nigeria and many developing nations, disparities in academic achievement have been linked to unequal access to educational resources. Students from wealthier households often enjoy better educational opportunities than their counterparts from low-income families.

Previous studies have identified factors such as: Parental income, Parents' educational attainment, and Family structure, Access to educational materials, School quality, and Teacher effectiveness as major determinants of academic success. Most previous studies used ordinary least squares regression, which assumes independence of observations. However, students are clustered within schools, violating this assumption. Multilevel regression models address this issue by accounting for variations at both student and school levels.

Multilevel modeling is well-suited to this inquiry, as students are nested within schools (and schools within districts or states), creating multiple sources of variation. Prior studies illustrate its utility: for instance, Akay and Karadağ (2019) used a hierarchical model on Turkish secondary entrance exam data and found that 37% of score variance was between schools (school effectiveness accounting for 85% of that). They also found that students in wealthier neighborhoods had higher average scores. Similarly, Azubuike *et al.* (2024) applied multilevel logistic regression to Nigerian Education Data Survey (NEDS) data and identified large state- and community-level SES effects on literacy and numeracy, beyond individual household wealth.

These examples indicate that context (school and region) factors matter greatly for learning outcomes.

This study seeks to fill this methodological gap by applying multilevel regression analysis to examine socioeconomic determinants of academic achievement among secondary school students.

Model Specification

$$Y_{ij} = \beta_{0j} + \beta_1 X_{10j} + \beta_2 X_{20j} + \dots + \gamma_{ij}$$

Where

$Y_{ij}$  = academic score of student I in school j

$\beta_{0j}$  = intercept for school j

$\gamma_{ij}$  = student-level error term

School-level Model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} W_j + u_j$$

Where

$W_j$  = school infrastructure quality

Combined Model

$$Y_{ij} = \gamma_{00} + \gamma_{01} X_{ij} + \gamma_{01} W_j + u_j + \gamma_{ij}$$

Data Analysis Technique

Intraclass correlation coefficient (ICC)

$$ICC = \frac{\gamma_{00}}{\gamma_{00} + \delta^2}$$

## II. RESULTS

Descriptive Statistics

Variable	Mean	S.D
Academic Score	62.4	11.8
Parental Income	₦95,000	35,000
Family Size	5.3	2.1

Null Model

Between-school variance= 28.5

Within-school variance= 107.3

$$ICC = \frac{28.5}{28.5 + 107.3} = 0.21$$

This implies that 21% of academic performance differences occurs between schools

Fixed Effects Model

Variable	Coefficient	P-Value
Parental Income	0.42	0.001
Parental education	1.85	0.000
Family size	-0.76	0.021
Internet access	2.44	0.000
Textbooks	1.91	0.004

School-level Effects

Variable	Coefficient	P-value
Infrastructure	3.12	0.000
Teacher-student ratio	-1.58	0.018

## III. DISCUSSION OF FINDINGS

The findings reveal that students from higher-income households perform better academically due to improved access to educational resources.

Parental education significantly enhances student outcomes because educated parents provide better academic guidance.

Larger family sizes negatively affect performance due to resource dilution.

School infrastructure also significantly contributes to improved academic achievement.

These findings align with studies by James Coleman and Pierre Bourdieu.

## IV. CONCLUSION

Socioeconomic inequality remains a major determinant of academic achievement among secondary school students. Multilevel regression provides a robust framework for understanding both student-level and school-level influences.

## V. RECOMMENDATIONS

1. Increase funding for public schools.
2. Provide scholarships for low-income families.
3. Improve school infrastructure.
4. Promote parental education programs.
5. Expand access to digital learning tools.

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