

# Primary Education Outcomes and Efficiency: Evidence From the Sierra

# Leone Integrated Household Survey

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Abstract: In this study, we investigate factors affecting student reading and numeracy performance in Sierra Leonean Primary Schools. The data utilized for the study is drawn from the Sierra Leone Integrated Household Survey (SLIHS) collected in 2018. The SLIHS is the third income and expenditure survey of Sierra Leone that gathers data on household members' characteristics, agriculture, and consumption. The study uses a binary logit model that links reading and numeracy skills to pupils-specific and socioeconomic factors. The study finds that age, parent education, lack of books, time to reach school, and costs significantly affect primary education outcomes in Sierra Leone. The study suggests room for improvement in learning outcomes in Sierra Leone. Specifically, areas identified for improvement include providing adequately trained teachers and ensuring equitable distribution of schools and education resources across regions.

Key words: primary education, learning outcomes, numeracy rates, reading skills, performance

JEL codes: I210, I220, I260

# **1. Introduction**

The educational system in Sierra Leone system is divided into four levels: primary education lasting six years, junior secondary education of three years, senior secondary Education or technical vocational Education, and four years of university or tertiary education. All six years of primary education are free, and students are not required to pay fees or tuition. Primary education provides children with essential reading, writing, and numeracy skills and an elementary understanding of history, geography, basic science, art, and music. Children enter junior secondary education lasts three years, and students can either continue their education at university or shift to vocational education, where they can learn more practical skills.

However, access to quality education, retention, and school completion has been challenging for most children due to many social and economic factors, such as poverty, long distances to schools, teenage pregnancy, and gender discrimination (Government of Sierra Leone, 2022). These factors have made it impossible for many kids to complete primary school and transition to Junior Secondary school and eventually to Senior Secondary School.

To improve access, equity, and completion rates in the education system, the Ministry of Education, Science, and Technology (MEST) developed an Education Sector Plan (ESP) which aims to:

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Increase the entry and completion rates in primary school from 75.4% in 2016 to 85% in 2020 by reducing the cost of schooling to parents by streamlining the disbursement process of grants to schools to ensure that funds reach the beneficiaries on time and providing additional support to the most vulnerable communities through a targeted school grants program(Government of Sierra Leone, 2019).

Against this background, the present study will evaluate learning outcomes and the efficiency of the educational system in Sierra Leone, especially at the primary level, by estimating a simple logit model that links educational outcome measures to student level and socioeconomic characteristics. The remainder of the rest of the paper is organized as follows. Section 2 presents the educational system in Sierra Leone; Section 3 provides an overview of education expenditures in the primary schools in Sierra Leone; Section 4 reviews the literature; section 5 discusses the methodology and the data; section 6 discusses the results and section 7 provides a conclusion with policy suggestion.

### 2. The Educational System in Sierra Leone

Educational attainment levels in Sierra Leone before and immediately after independence were among the best in the world. The University of Sierra Leone was established in 1827, and Sierra Leone was dubbed the "Athens of West Africa". However, that educational system almost collapsed. Over a long period of neglect, the country witnessed an erosion of standards in its educational system. As a result, teaching and learning outcomes, the status and conditions of the education sector workforce, and education leadership and management at schools are all in dire states at the national level (Matsumoto, 2014).

The government is cognizant that education leads to learning and has a more significant societal impact by improving social equality, health, participation in the economic sector, and democracy (Hannum & Buchmann, 2005). Thus, in its education policy priorities, the government was committed to expanding access to education and improving education outcomes. The government launched an ambitious policy for national transformation through education by instituting the Free Quality School Education (FQSE) program in August 2018 to improve the quality of education. It aims to improve learning outcomes and expand access to children from struggling families by creating relevant curricula and providing teaching and learning resources to enhance the learning experience.

The FQSE program increased enrollment rates by about 29.2%, with a 2.2% increase in primary schools. The program is timely and acceptable, yet many pupils are still out of school and at risk of dropping out or not benefiting from the program because they live in remote rural areas where there are no schools or areas where the program has not yet been approved. In addition, some parents could not meet the additional costs of education not covered under the program (Government of Sierra Leone, 2022).

Retention rates are about 32.4% at the primary level compared to 74.7% and 81.4% at the junior and senior levels (Table 1). Repetition rates are also high, with the highest number of repeaters in class 1. As shown in Table 1, many children are enrolled in class 1 compared to the other grades in primary school. Still, there is a significant drop in learners between class 1 and class 2, attributable to the fact that learners skip preschool and enroll directly in primary school.

Table 1         Selected Education Indicators for Sierra Leone, 2018				
	Enrolment Rates	Percentage decrease	Repeaters (% of total)	
Class 1	507,196	-	23,705 ( 4.67%)	
Class 2	329,836	34.96	3,512 (1.06%)	
Class 3	296,472	10.11	2,772 (0.93%)	
Class 4	257,303	13.21	2,025 (0.79%)	
Class 5	216,136	15.99	1,419 (0.66%)	
Class 6	163,425	24.39	248 (0.15%)	
	Gross Enrollment Rates (%)	Completion rates (%)	Retention rates (%)	
Primary	108	79.6	32.4	
JSS	55	68.6	74.7	
SSS	30	43.5	81.4	

Table 1 Selected Education Indicators for Sierra Leone, 2018

Compiled from the 2019 Annual School Census 2019

The data also shows a gradual dropout of learners throughout the system after class 1 (first year of primary school). The Table shows a high transition from one level to another. Retention rates are low, as are the completion rates. The Primary Completion Rates (CR) is 79.6%, 68.6% for Junior Secondary Schools (JSS), and 43.5% for Senior Secondary Schools. The results indicate that the CR decreases as we proceed to a higher level of schooling. The Government of Sierra Leone considers education the most critical factor in shaping the assembly of skills and knowledge for the nation's overall economic development program, hence the rationale for supporting the schools by pouring resources. The question then is how efficiently the resources allocated to education are used in the school system.

### 3. Overview of Education Expenditures in the Primary Schools in Sierra Leone

Although the education sector is relatively well funded in Sierra Leone, there is still a need for a more equitable sharing of resources within the different levels of education. Total education sector spending passed the one trillion leones mark in 2019, about 2.8% of GDP but remained lower than the globally recommended threshold of 4% for effective implementation of quality and equitable education for all (Annual School Census, 2019)

Spending levels in 2019 show an increased commitment to financing education, a welcome change from the previous trend, where the burden dropped from more than 3.1% of GDP in 2011 to a low of 2.5% in 2017. Relative to the government's discretionary expenditure, spending on education has remained above the 20% mark but dropped three percentage points in the last six years (from 23% in 2013 to 20% in 2019). (World Bank: Education Statistics, 2011-2019). Ninety-nine percent of public expenditure on education is for recurrent items such as salaries and operating costs. The lack of capital or investment spending in areas such as the construction of new schools and adding classrooms or desks raises concerns about the effective implementation of the FQSE program.

The primary sources of education funding in developing countries are the government budget, the private sector, and international donors (Saavedra, 2002). However, in most African countries, the bulk of education finances is from the government (Amin et al., 2021). Apart from the resources flowing to schools from the Government in Sierra Leone, households still contribute about 24% of the total flow, indicating that even with the

FQSE program, some schools still charge fees. While religious groups claim ownership of many schools, the share of resources in schools coming from religious organizations was reported to be only 3.8%. As a result, most households cannot afford the costs of educating their children and must rely on government support. The number of schools approved for government support is 78.7%, 76.7% of Junior Secondary, and 80.4% of Secondary. This government support has helped lower the direct and indirect costs of schooling, a significant obstacle to education for many families (Government of Sierra Leone, 2022).

# 4. Literature Review

Recognizing that the role of improved schooling has been a central part of most countries' development strategies and international organizations (Hanushek, 2013), the Government of Sierra Leone has prioritized education as one of the critical drivers of economic growth and development. It developed an Education Sector Capacity Development Strategy and an Education Sector Plan (ESP) (2014-2018) to ensure every child can access primary education (Government of Sierra Leone, 2019).

Many African countries have made significant advances in making education more accessible at the primary, secondary, and tertiary levels, with some countries more than others making substantial improvements in education expenditure and outcomes. Poor budget management has frequently been cited as one of the main reasons governments in developing countries find it challenging to translate public spending into effective services (Dongier et al., 2003). Some have concluded that public spending on primary education becomes more effective in increasing primary education attainment in countries with good governance. (Rajkumar and Swaroop (2008) concluded that pouring more public funds into the education system is likely to bring about improvement if it is accompanied by efforts to improve governance in the sector.

Additionally, their results show that the impact of public spending on outcomes is higher when there is good governance but that the effects could still be well below their full potential. Suryadarma (2012) used school enrolment rates and performance to conclude that Public spending has a negligible impact on highly corrupt regions but a statistically significant, positive, and relatively large effect in less corrupt areas. He further concluded that public spending has no significant impact on school performance but suggested that the educational system could be improved through the efficient use of public resources via good governance, accountability, and transparency.

Obi and Obi (2014) concluded that spending might increase enrollment but not test scores. They further concluded that though the rise of financial resources has improved access to education, challenges to the quality of education persist. Jasmina (2016) employed a cross-district analysis in Indonesia during 2010-2015 to analyze the impact of government spending on the adjusted-national examination scores in junior secondary education. The study concluded that not only does the size of government spending matter, but also how the government effectively uses the money. The results show that central and local government spending does not significantly affect test scores. This result upholds earlier findings (Mingat & Tan, 1998) that higher education budget allocation has relatively tiny contributions to education outcomes.

Boateng (2014) finds that delays on the part of the government in disbursing funds to schools are correlated with dropout rates. That misappropriation of education funds (leakages) is not strongly associated with poor education outcomes. He also finds that repetition rates are driven strongly by poverty indicators.

Glawe et al. (2019) show a positive and significant relationship between expenditure per school-age individual and the learning-adjusted years of schooling (LAYS). The study concludes that approximately 16% of public resources (including education aid) dedicated to education in developing countries are wasted because of some inefficiencies. The efficiency level seems particularly low in low-income countries (about 74%). Colclough & Lewin (1993) noted that the link between outcomes and financing, albeit indirect, exists and predicted that slower progress towards (or nonachievement) of universal primary Education (UPE) is more likely among poorer countries.

Some other studies have overwhelmingly examined the impact of public spending on the net enrolment ratio, which reflects the number of educational services offered. This measure is equally relevant in assessing the impact of public expenditure in developing countries. Allocating more of the spending in education to construct new schools, building more classrooms, training and recruiting more teachers, and providing school inputs such as school textbooks and desks and other desired inputs can help improve access and education outcomes (Al-Samarrai, 2006). Notably, Sierra Leone has made substantial strides in improving primary enrollment and learning outcomes.

While many studies have focused on the relationship between government spending and learning outcomes, this study also looks at how learning outcomes could be improved and suggests policy guidelines and directions to achieve them.

# 5. Methodology and Data

Based on data from the 2018 Sierra Leone Household Survey, we apply a binary logit model to investigate the connections between learning outcomes and a set of covariates that affect educational performance. More specifically, we investigated the relationship between literacy skills and the covariates on the one hand and between numeracy skills and the covariates on the other. The dependent variable (read) is a latent variable that takes the value one if a child can correctly read and 0 otherwise. Also, the dependent (latent) variable, numeracy, take one if a child can complete simple mathematical calculations and 0 otherwise. The continuous latent variables for both equations can be written as follows:

 $OUTCOME_{i} = \beta_{0} + \beta_{1}GEND + \beta_{2}AGE + \beta_{3}FEDUC + \beta_{4}HIFEES + \beta_{5}LOBOOKS + \beta_{6}LOTEACH + \beta_{7}OVERCROWD + \beta_{8}POFACILIT + \beta_{9}TIME + \beta_{10}ATTEND + \beta_{11}URBAN + \beta_{12}COST + \epsilon$ (1)

Where: GEND is a categorical variable that denotes 1 if the pupil is female and 0 otherwise;

Age is the age of the pupil, FAEDUC is a categorical variable that denotes 1 if the father of the pupil had at least primary education and 0 otherwise, HIFEES denotes high fees;

LOBOOKS denotes lack of books; LOTEACH denotes lack of teachers; OVERDROWD denotes overcrowding; POFACILIT denotes poor facilities; TIME denotes time to reach school; ATTEND denotes attendance; URBAN is a categorical variable that denotes 1 for urban area and 0, otherwise; COST denotes cost (or educational expenses).

Each dependent variable takes the value of 1 if the pupil can read a sentence correctly or perform a simple numerical exercise correctly and 0 if not with probabilities of  $P_i$  and  $1 - P_i$ .

Where  $P_i$  is the conditional probability of a positive response for a pupil with characteristics specified in equation (1). By letting  $P_i$  depend on a vector of observed covariates  $X_i$ , then  $P_i$  would be a linear function of the covariates such that.

$$P_i = X_i' \beta \tag{2}$$

Where  $\beta$  is a regression coefficient vector and  $X'_i$  Vector of covariates. Applying ordinary least squares to the above specification might result in results that might not restrict the predicted values to lie within the specified range. Thus, equation (1) can be rewritten as

$$\Pr(OUTCOME_i) = \log\left(\frac{P_i}{1-P_i}\right) = X_i'\beta$$
(3)

The logit is the natural log of the odds of the dependent variable, and the odds are the ratios of probabilities  $(P_i)$  that a pupil can read or do basic math skills correctly, While  $(1-P_i)$  is the probability that a currently enrolled pupil needs to be able to read or do basic math skills correctly. Taking the antilog of equation (3) on both sides, the equation for predicting the probability that a pupil enrolled in a Sierra Leonean elementary school will read correctly or do math skills accurately can be obtained from the logit model by solving for  $P_i$  to give the following:

$$P_i = \frac{exp\{X_i'\}}{1 + exp\{X_i'\}} \tag{4}$$

The coefficient  $\beta$  determines the directional relationship between the predictor variables and the logit of the categorical outcome variable. The coefficients  $\beta$ 's are estimated using the maximum likelihood (ML) method. The ML is designed to maximize the likelihood of reproducing the data given the parameter estimates. The estimation process involves finding the values  $\beta$ 's that maximize the likelihood function in equation (4). However, estimating it is cumbersome and can be simplified by taking the likelihood's natural logarithm. Thus, the loglikelihood equation (4) yields the loglikelihood function as follows:

$$LogL(\beta_0) = \sum_{i=1}^{N} Y_i(\beta' x) - \sum_{i=1}^{N} \log[1 + e^{\beta x}]$$
(5)

The conjecture or null hypothesis underlying the overall model states that all  $\beta$ 's equal 0 or that the predictor variables (*X<sub>i</sub>*), which include Gender  $\beta$ 1, Age  $\beta$ 2, Father Education  $\beta$ 3, High Fees  $\beta$ 4, Lack of books  $\beta$ 5, Lack of teachers  $\beta$ 6, Overcrowding  $\beta$ 7, Poor facilities  $\beta$ 8, time to reach school  $\beta$ 9, Attendance  $\beta$ 10, Urban  $\beta$ 11, Costs  $\beta$ 12 do not influence the likelihood that a student would have a significant influence on learning outcomes, that is, literacy and numeracy skills.

The data for the study was drawn from the Sierra Leone Integrated Household Survey (SLIHS) for 2018, consisting of over 40,000 households and 421 variables. The estimated sample of 9,908 with 12 variables was drawn from the dataset, and missing data were eliminated. The dependent variable used for the logit regression is OUTCOME which is a dichotomous variable that takes the value one if the student can read or perform basic arithmetic operations correctly and 0 otherwise.

## 6. Results and Discussion

The regression results, as shown in Tables 2 and 3, provide some insightful findings on the state and quality of education, especially at the primary level in Sierra Leone. The country faces a critical human development deficit besides demographic pressure. Only one in three children born in Sierra Leone will survive infancy, go through education, then grow into adulthood and realize their full economic and professional potential. This low probability is linked to the weak learning environment in many schools, which means that children do not benefit as much as they should from being in class. The essential reading and numeracy skills needed to become and

remain literate in their adult lives are fraught with difficulties, as revealed in the study. Age is crucial because as the pupil ages, the odds of advancing and completing primary school with good reading and numeracy skills increase by about 24% and 16%, respectively. However, most students still need to complete primary school: dropout and retention rates are low, as shown in Table 1.

The results also show that Father's Education determines a child's future success in school. They are about 1.4 times more likely to develop their reading and numeracy skills if the father is educated. One reason for this phenomenon is that educated parents highly value educational attainment. Sierra Leone also means that the father, the head of the household, has a relatively high and stable income to meet the costs associated with educating the child. The statistical significance of the father's income indicates that educational outcomes correlate with the household's income and other aspects, such as the parent's education.

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	В	S.E.	Sig.	Exp(B)
Gender	066	.082	.416	.936
Age	.237	.018	.000*	1.267
Father education	.364	.124	.003**	1.439
High fees	146	.192	.446	.864
Lack of books	392	.102	.000*	.676
Lack of teachers	.105	.156	.500	1.111
Overcrowding	.156	.186	.403	1.168
Poor facilities	010	.159	.951	.990
Time to reach school	.004	.002	.018**	1.004
Attendance	.014	.010	.153	1.014
Urban	.643	.094	.000*	1.903
Costs	1.888	.128	.000*	6.605
Constant	-6.935	.329	.000*	.001

Table 2 Logit Regression for the Probability That a Pupil Can Read Correctly

\*, \*\* Significant at 1 and 5 percent, respectively

Table 3 Logit Regression for the Probability That a Pupil Can Do Basic Math Skills Correctly

	В	SE.	Sig.	Exp(B)
Gender	023	.172	.896	.978
Age	.158	.035	.000*	1.172
Father Education	.308	.194	.113	1.361
High fees	.021	.436	.962	1.021
Lack of books	591	.211	.005*	.554
Lack of Teachers	.381	.414	.358	1.463
Overcrowding	116	.305	.704	.891
Poor facilities	055	.369	.882	.947
Travel time	.011	.005	.026**	1.011
Attendance	.007	.021	.735	1.007
Urban	.260	.195	.183	1.297
LOCOST	1.318	.256	.000*	3.737
Constant	-3.260	.653	.000*	.038

The study reveals that other aspects of socioeconomic development, such as child labor and early marriages, must be improved while mitigating the wide disparities and inequalities between urban and rural areas. More than four million people in Sierra Leone live below the poverty line, with rural households bearing the brunt of the unequal distribution of resources. Moreover, the incidence of poverty varies. Nine out of ten people in the rural areas live in poverty compared to two out of ten in the capital, Freetown, indicating a vast social divide across the country.

As the results show, the pupils living in urban areas have a 1.9 and 1.3 chance of participating and succeeding in reading and performing basic mathematical operations. Although primary education is much more available and attended in the country, there still exists much inequality in primary education. Urban and more affluent children are much more likely to participate in this level of education.

Overall, across all levels of education, those in the poorest quintile are less likely to experience more significant numbers in each level of education. The disparities increase with the level of education, and attendance ratios are much lower in rural areas, outside the Western Area, and for poorer households. Furthermore, disparities can be found in educational performance, access to academic inputs (such as quality teachers), and public expenditure on education.

With a significant number of children attending non-approved schools not covered by the Free Quality School Education (FQSE) program, the pressure from poverty on these households becomes unbearable. Even for approved schools, household consumption surveys indicate that FQSE is unlikely to entirely remove the burden that was paying for education placed on families. The study reveals that costs are an essential determinant of learning outcomes 6.61 for reading and 3.72 for numeracy. Fees are, however, insignificant because most learners are enrolled in approved schools or receive financial assistance from the government. Still, parents must bear other costs, which are usually unaffordable.

The results also link school travel time and students' learning outcomes. Most students must travel to school on foot, which negatively affects their ability to read and perform basic math operations. This phenomenon is common in other sub-Saharan countries, as Afoakwah & Koomson (2021) confirmed using household data from the Ghana Living Standards Survey.

Next to a committed and prepared teacher, textbooks in sufficient quantities are needed to improve instruction and learning. The study shows that the lack of books is significant. Students at all levels either lack books or must share them with others. Without textbooks, children can also spend many of their school hours copying content from the blackboard, severely reducing the time for engaged learning. Being older, father's Education, Lack of books, time to reach school (distance), living in an urban environment, and costs positively affect the likelihood of being able to read and perform basic mathematical operations as per the significance tests.

#### 7. Diagnostic Tests

Tables 2 and 3 show that most predictors accounted for significant success and likelihood ratio variations. The diagnostics further confirm this in Tables 4 and 5. Apart from the chi-square, the Cox and Snell R Square and the Nagelkerke R Square value presented in Table 4 explain the model's usefulness in representing variation in the dependent variable defined by the model. It shows that the model can explain 23.8% percent to 35.4 percent of the variation in reading variables. The Hosmer and Limeshow tests, with their non-significant tests, indicate a good overall model fit, further confirming the validity of the results. With the large sample size, sparseness was not a problem.

As per the classification results, the model developed through the logistic regression correctly classified 80.2% percent of cases in which it predicted 42.4% of the students could not read and 92.4% percent could read.

Cox and	Snell R Square and	the Nagelkerke	R Square		
Step	-2 Lo	og likelihood	Cox & S	Snell R Square	Nagelkerke R Square
1		3745	.050ª	.238	.354
Hosmer a	and Lemeshow Test	Ś			
Step		Chi-square		df	Sig.
1		17	7.729	8	.023
Classific	ation results				
Step			Predicted		Percentage correct
1	Read C	0	462	627	42.4
		1	256	3110	92.4
	Overall Percer	ntage			80.2

Fable 4	Diagnostic	Tests	READ
	- Auguro Dere		

In Table 5, the Cox and Snell R Square and the Nagelkerke R Square value below explain 6.6% to 15.4% percent of the variation in the variables affecting numeracy. The Hosmer and Limeshow tests indicate a good overall model fit, further confirming the validity of the results. In the case of numeracy, the model has classified 92% of cases correctly and predicted that 99% of the students have numeracy skills.

		Tuble 5 Diagnostie Tests 1(01)				
Cox and Snell R Square and the Nagelkerke R Square						
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square			
1	992.734ª	.666	.154			
Hosmer and	Lemeshow Tests					
Step	Chi-square	df	Sig.			
1	9.396	8	.310			
Classification	n results					
Step	Numeracy	Predicted	Percentage			
1	0	162	0.0			
	1	1876	99.9			
	Overall Percentage		92.9			

# Table 5Diagnostic Tests NUM

#### 8. Conclusion

This research aimed to investigate the factors most likely affecting learning outcomes at the primary level in Sierra Leone. In a broader context, the study is critical because the government has enabled most of the poor to access primary schools under the FQSE program. The key motivation for school attendance and primary school completion is to help the pupils acquire basic skills, especially reading and numeracy, and to progress to secondary education, increasing their chances of getting a job in the formal sector. Primary education has long-term non-economic benefits (lower fertility, improved health, greater self-efficacy, increased political participation) for individuals/households.

The expected economic returns are the critical factor shaping household and individual decisions about primary schools in Sierra Leone. Nevertheless, the study does indicate that the learning outcomes could be better at best and will not provide the hoped-for economic returns. The results highlight the need to improve the quality of Education in Sierra Leone. The low-performance level, as observed in this study and national exams and

assessments, emphasizes the need for policy action by the government. The traditional approach to improving student outcomes by increasing input has been shown only sometimes to be an effective policy option. Increasing average spending only occasionally leads to higher test scores because of the weak effect of school (Hanushek, 1986). Only sometimes could a systematic relationship be found between inputs in the aggregate and test scores. Even when reviewing the impact of particular inputs like teacher quality, the results could be equivocal, as has been observed by other researchers.

Even so, particular input resources such as more textbooks and qualified teachers have been demonstrated to affect learning outcomes. An uneven distribution of teachers across schools further complicates the need for more government-paid teachers. Indeed, there is little relationship between the number of teachers and students in a school. In 2019, for example, the allocation of government-paid teachers at the primary school level was random and estimated at 58% (against 39% in 2011), meaning that the distribution of teachers to primary schools is mainly determined by factors other than enrolment. Thus, the government must institute policies that increase public education expenditures and allocate them efficiently against good governance and even political will.

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