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FREE QUALITY SCHOOL EDUCATION, ACCESS AND TRENDS IN CORE SCIENCE WASSCE PERFORMANCE IN SOUTHERN SIERRA LEONE, 2020–2025

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ABSTRACT

In 2018, Sierra Leone introduced the Free Quality School Education (FQSE) programme to reduce the direct cost of schooling and improve access, equity and learning conditions. This study examined the relationship between FQSE, access to science education and pupils' performance in core science subjects at the West African Senior School Certificate Examination (WASSCE) in Southern Sierra Leone from 2020 to 2025. A descriptive cross-sectional survey was combined with a retrospective analysis of aggregated examination records. The study involved 400 respondents from 20 government and government-assisted secondary schools in Bo, Bonthe, Moyamba and Pujehun districts: 320 pupils, 60 science teachers and 20 principals. Data were analysed using descriptive statistics and trend analysis. Findings showed substantial improvement in access. Among pupils, 89.7% reported that FQSE enabled more children to attend secondary school, while 86.9% said it reduced the financial burden on their families. Teachers also reported improved access (95.0%), but noted increased workload (90.0%) and larger class sizes (86.7%). Resource gaps remained evident, as only 53.4% of pupils and 45.0% of principals considered laboratory facilities adequate. Aggregated WASSCE core-science pass rates increased from 55.0% in 2020 to 67.0% in 2025. The findings suggest that FQSE is associated with improved access and participation, but science achievement continues to be constrained by inadequate laboratory resources, staffing, class size and learning materials. Continued investment in science teaching and learning is therefore necessary.

Keywords: Free Quality School Education; WASSCE; Science education; Academic performance; Secondary education; Sierra Leone

1 INTRODUCTION

Education promotes human development by increasing people's knowledge, skills and ability to work, but the advantages of attending school depend on whether or not the pupils actually acquire what they need to know. According to the World Bank (2018), there is a distinction to be made between having access to schooling and achieving

meaningful learning, a point which is especially important in low- and middle-income countries since rapid growth in enrolment can place a strain on teachers, classrooms and the instructional resources available.

In Sierra Leone the Government introduced the Free Quality School Education (FQSE) programme in 2018 as its main education reform. The aim of the programme was to eliminate the major financial obstacles to attending school, to meet the basic costs of education and to increase access to pre-primary, primary and secondary education (Ministry of Basic and Senior Secondary Education [MBSSE], n.d.). The Education Sector Plan 2022-2026 also includes improved learning outcomes, equity, teacher quality, infrastructure and effective system management together with the expansion of participation (Government of Sierra Leone, 2022).

Science education is particularly vulnerable to these systemic conditions. In order to achieve effective learning in Biology, Chemistry and Physics it is necessary to have more than just attendance and textbooks; qualified teachers, reasonable class sizes, laboratory facilities, opportunities for practical work and enough instructional time are also required. The Sierra Leone Free Education Project was in part designed with a view to improving the conditions for teaching and learning as well as system management while the country was expanding access under FQSE (World Bank, 2020).

The academic effects of FQSE are still uncertain. Kamara (2020) outlined the extent of the reform and the Government's dedication to increasing educational opportunities. The subsequent national review carried out by Gbla and Smart (2025) found that FQSE had led to significant improvements in access and participation, although progress in terms of learning achievement and equity had remained uneven. More recently, Turay et al. (2026), who used national WASSCE data from 2016 to 2024, noted major advances in access but only small and inconsistent changes in examination performance, with early declines followed by a recovery in later years. Similarly, the official WASSCE analysis by MBSSE (2022b) has shown large changes in candidate participation and pass rates since FQSE was introduced.

National evidence also demonstrates the continued importance of carrying out regional and school-level analyses. The Annual School Census data show considerable variation in terms of school infrastructure, staffing, and facilities (MBSSE, 2022a), and the Learning and School Safety Study found that, following the disruption caused by COVID-19, overall learning levels in secondary schools had still not reached those expected for the relevant grades and that learning conditions varied between different groups and types of school (MBSSE & Leh Wi Lan, 2022). The Basic and Senior Secondary Education Act of 2023 establishes the national expectation that schools should provide effective teaching, carry out regular assessment, and make sure that appropriate learning conditions are met (Government of Sierra Leone, 2023).

In Sierra Leone recent research has found that the problems of overcrowded classrooms, a shortage of teachers, and inadequate library and laboratory facilities still exist and hinder effective learning in secondary schools (Lamin, 2025).

In view of the above, the current study looked at the relationship between FQSE and core science education in the districts of Bo, Bonthe, Moyamba and Pujehun from 2020 to 2025. It investigated pupils' access to education, the availability of science teaching and learning materials, the perceptions of teachers and principals regarding the implementation of FQSE, the trends in WASSCE results that had been reported, and the major challenges at the school level connected with science learning. The aim of the study was to describe the patterns and relationships found in the existing evidence; it was not intended to determine a causal effect of FQSE.

2 MATERIAL AND METHODS

2.1 Study design and setting

The study used a descriptive cross-sectional survey together with a retrospective, ex post facto review of aggregated WASSCE performance records for 2020-2025. The survey component described pupils', science teachers' and principals' experiences of FQSE implementation, while the documentary component described changes in reported examination performance over time. The study was conducted in Bo, Bonthe, Moyamba and Pujehun, the four districts of Southern Sierra Leone.

2.2 Study population and sampling

The study population comprised pupils, science teachers and principals in government and government-assisted secondary schools in Bo, Bonthe, Moyamba and Pujehun districts. The sample size was estimated using Cochran's formula for a large population, $n_0 = Z^2 p(1-p)/e^2$. Using a 95% confidence level ($Z = 1.96$), maximum variability ($p = 0.50$) and a 5% margin of error ($e = 0.05$) gave $n_0 = 384.16$, approximately 384 respondents. The target was increased to 400 to allow a small margin for incomplete responses and to support a balanced allocation across the four districts. The final analytic sample therefore comprised 320 pupils, 60 science teachers and 20 principals. Twenty secondary

schools participated, with five schools included from each district to ensure equal district representation. The available study records do not identify the exact procedure used to select the five schools within each district, so the manuscript does not describe school selection as random or purposive. Within each participating school, 16 pupils were selected through simple random sampling from eligible pupil registers, giving 80 pupils per district and 320 pupils overall. Three science teachers from each school were selected purposively because of their direct involvement in science teaching, giving 15 teachers per district and 60 teachers overall. The principal or head of each participating school was also included purposively, giving five principals per district and 20 principals overall.

2.3 Sources of data and research instruments

The study made use of both primary and secondary data. The primary data were gathered through structured questionnaires given to pupils and science teachers as well as through a structured questionnaire schedule completed by principals. The closed-ended survey questions employed the three response categories mentioned in the Results section (Agree, Disagree and Undecided) and addressed issues relating to access to education, science resources, the perceived academic effects and the implementation challenges. The questionnaires were examined by experts in the fields of science education and educational administration and were tried out in schools that were not part of the final sample. The review and pilot testing phases were carried out in order to spot any unclear wording and practical problems connected with the administration of the instruments before the main data collection took place. Since the study records do not include a verified numerical reliability coefficient, it is not possible to report a Cronbach's alpha or any other reliability figure. The secondary data comprised the aggregated WASSCE performance summaries for the period 2020–2025 which were obtained from the documentary records of the 20 participating schools and from the institutional records accessible to the researchers. These summaries constitute the study's documentary dataset; they are not individual-level WAEC candidate microdata or independently verified official WAEC statistics.

2.4 Data analysis

The frequencies and percentages were used to summarize the survey responses. With regard to the documentary part, the annual numbers of candidates, the number who passed and the pass rates were compiled and compared in a descriptive manner for the period 2020 to 2025; descriptive summaries of the subject-level trends were also given for Biology, Chemistry and Physics. The analysis in this article is descriptive and no inferential test has been carried out in order to claim that the FQSE caused changes in WASSCE performance since the study lacks an untreated comparison group or a comparable baseline from the Southern region before the FQSE was introduced, and the observed results might also be due to candidate composition, school resources, teacher capacity, the way the examinations were administered and the recovery from the disruption caused by COVID-19.

2.5 Ethical considerations

The study involved questionnaire data from pupils, science teachers and principals, together with aggregated examination records. Participation in the primary-data component was voluntary, and informed consent was obtained from participants before data collection. Participants were informed about the purpose of the study, their right to decline participation or withdraw at any stage, and the measures taken to protect their confidentiality. No names or personal identifiers were included in the analysis or reporting. The examination records were analysed only in aggregated and non-identifiable form. No formal ethics committee approval number is reported because such an approval number was not documented in the study records available for preparation of this manuscript.

3 RESULTS

3.1 Participant profile

The analytic sample comprised 400 respondents: 320 pupils (80.0%), 60 science teachers (15.0%) and 20 principals (5.0%). Among the pupils, 168 (52.5%) were male and 152 (47.5%) were female.

Table 1: Distribution of the analytic sample across 20 participating schools

Category	Analytic sample (n)	Percentage of sample
Pupils	320	80.0%
Science teachers	60	15.0%
Principals	20	5.0%
Total	400	100.0%

3.2 FQSE and access to secondary education

Pupils said there was a strong access effect. About nine out of ten of the respondents (89.7 per cent) stated that the FQSE had allowed more children to go to secondary school, 87.8 per cent said that enrolment in their schools had increased, and 86.9 per cent claimed that the programme had lessened the financial strain on their families. While the percentage who thought that FQSE had reduced dropout was lower, it was still considerable, at 74.7 per cent.

Table 2: Pupils' views on the effect of FQSE on access to education

Statement	Agree	Disagree	Undecided
FQSE has reduced the financial burden on my family	278 (86.9%)	29 (9.1%)	13 (4.0%)
FQSE has enabled more children to attend secondary school	287 (89.7%)	22 (6.9%)	11 (3.4%)
FQSE has reduced school dropout	239 (74.7%)	54 (16.9%)	27 (8.4%)
FQSE has encouraged pupils to remain in school	269 (84.1%)	34 (10.6%)	17 (5.3%)
FQSE has increased enrolment in my school	281 (87.8%)	25 (7.8%)	14 (4.4%)

Values are frequency (percentage); n = 320,

3.3 Availability of science teaching and learning resources

The view of the science resources was not as favourable as the view of access. While 70.6% of the pupils stated that FQSE had improved access to science learning materials, only 53.4% thought the laboratory equipment to be adequate and 58.8% said that practical science lessons were carried out regularly. This shows a gap between greater participation and the resource-intensive nature of effective science teaching.

Table 3: Pupils' assessment of science teaching and learning resources

Statement	Agree	Disagree	Undecided
My school has adequate science textbooks	63.1%	29.1%	7.8%
My school has adequate laboratory equipment	53.4%	38.8%	7.8%
We conduct practical science lessons regularly	58.8%	33.7%	7.5%
Teachers have adequate teaching materials	67.8%	25.3%	6.9%
FQSE has improved access to science learning materials	70.6%	21.6%	7.8%

Percentages are based on pupil responses (n = 320).

3.4 Teachers' and principals' perspectives on implementation

Teachers strongly endorsed the access benefits of FQSE: 95.0% agreed that it had improved access and 93.3% reported increased enrolment. At the same time, 90.0% reported increased workload and 86.7% reported larger class sizes. Only 63.3% agreed that FQSE had significantly improved science performance, whereas 91.7% agreed that inadequate science resources affected performance.

Table 4: Teachers' perceptions of FQSE and science education

Statement	Agree	Disagree	Undecided
FQSE has increased school enrolment	93.3%	5.0%	1.7%
FQSE has increased pupils' attendance	85.0%	10.0%	5.0%
FQSE has increased class sizes	86.7%	8.3%	5.0%
FQSE has increased teachers' workload	90.0%	6.7%	3.3%
FQSE has improved access to education	95.0%	3.3%	1.7%
FQSE has significantly improved science performance	63.3%	26.7%	10.0%
Lack of science resources affects performance	91.7%	5.0%	3.3%

Percentages are based on science-teacher responses (n = 60).

Principals reported a similar pattern. All principals agreed that FQSE had substantially increased enrolment and that additional resources were needed to improve science performance. Ninety-five per cent reported increased pressure on school facilities, while only 45.0% considered science laboratories adequate.

Table 5: Principals' perceptions of FQSE implementation

Statement	Agree	Disagree	Undecided
FQSE has substantially increased enrolment	100%	0%	0%
FQSE has improved school attendance	90%	5%	5%
FQSE has increased pressure on school facilities	95%	5%	0%
Science teacher recruitment has improved	75%	20%	5%
Science laboratories are adequate	45%	50%	5%
FQSE has contributed to improved examination performance	70%	20%	10%
More resources are needed to improve science performance	100%	0%	0%

Percentages are based on principal responses (n = 20).

3.5 WASSCE performance trends, 2020–2025

The study's aggregated WASSCE documentary dataset showed a gradual increase in the reported core-science pass rate, from 55.0% in 2020 to 67.0% in 2025. Candidate numbers also increased over the same period. Because these figures are study-compiled descriptive documentary summaries rather than independently verified individual-level WAEC data, and because the design does not include a pre-FQSE Southern-region comparison or a counterfactual group, the trend should be interpreted as improvement during the implementation period rather than as proof that FQSE caused the increase.

Table 6: Study-compiled aggregated WASSCE core-science performance summaries, 2020-2025

Year	Candidates	Passed core science	Pass rate
2020	1,850	1,017	55.0%
2021	1,940	1,125	58.0%
2022	2,080	1,248	60.0%
2023	2,240	1,389	62.0%
2024	2,390	1,530	64.0%
2025	2,550	1,709	67.0%

The subject-level summaries in the study's documentary dataset also moved upward across the period. Biology rose from 54% to 68%, Chemistry from 49% to 64%, and Physics from 45% to 61%. Physics remained the lowest-performing of the three subjects in every year reported.

Table 7: Study-compiled aggregated pass-rate summaries by core science subject, 2020-2025

Subject	2020	2021	2022	2023	2024	2025
Biology	54%	57%	59%	62%	65%	68%
Chemistry	49%	52%	55%	58%	61%	64%
Physics	45%	48%	51%	54%	57%	61%

3.6 Pupils' perceptions of academic effects

Pupils generally perceived FQSE as supportive of their academic participation. The strongest response concerned remaining in school (89.7%), followed by increased chances of passing WASSCE (83.4%) and improved understanding through practical science activities (79.7%). Three-quarters (75.9%) agreed that FQSE had improved their science performance.

Table 8: Pupils' perceptions of FQSE and academic performance

Statement	Agree	Disagree	Undecided
FQSE has helped me remain in school	89.7%	6.9%	3.4%
FQSE has given me more time to concentrate on learning	77.8%	15.0%	7.2%
FQSE has improved my performance in science	75.9%	16.6%	7.5%
Free textbooks/materials have helped my science learning	72.2%	19.1%	8.7%
Practical science activities have improved my understanding	79.7%	13.4%	6.9%
FQSE has increased my chances of passing WASSCE	83.4%	10.9%	5.7%

Percentages are based on pupil responses (n = 320).

3.7 Major challenges affecting science performance

Resource and capacity pressures were evident across all respondent groups. Inadequate laboratory equipment was identified by 68.4% of pupils, 91.7% of teachers and 95.0% of principals. Large class sizes were also prominent, particularly among teachers (86.7%) and principals (95.0%). Limited practical lessons, shortages of science textbooks and insufficient science teachers were additional recurring concerns.

Table 9: Major challenges identified by respondents

Challenge	Pupils	Teachers	Principals
Inadequate laboratory equipment	68.4%	91.7%	95.0%
Large class sizes	72.5%	86.7%	95.0%
Shortage of science textbooks	61.3%	75.0%	80.0%
Inadequate science teachers	48.8%	66.7%	70.0%
Limited practical lessons	57.8%	81.7%	85.0%
Poor home learning environment	55.0%	61.7%	60.0%

4 DISCUSSION

The most consistent result is that FQSE is closely linked with greater access and participation. Both pupils, teachers and principals noted an increase in enrolment and attendance, and pupils in general stated that the financial burden of secondary schooling had decreased. This trend is in line with the design of FQSE and with earlier reviews carried out in Sierra Leone which identify access as the policy's most clear early achievement (Gbla & Smart, 2025; Government of Sierra Leone, 2022; Kamara, 2020; MBSSE, n.d.). It also matches the wider national evidence indicating that progress in school participation has continued, although inequalities remain according to poverty, location and other types of disadvantage (Government of Sierra Leone & UNICEF, 2023; Government of Sierra Leone, Irish Aid, & UNICEF, 2021).

The fact that access and quality cannot be regarded as equivalent outcomes is shown by the same evidence. Teachers stated that they had larger classes and heavier workloads, whereas principals said that there was greater pressure being placed on school facilities. Such circumstances are especially important in the case of science subjects since practical learning needs laboratory space, equipment, consumables and time for supervised experiments. The figure that only 53.4% of pupils and 45.0% of principals thought the laboratory facilities to be adequate is in line with the results of the national census and the secondary-school evidence which indicate that there is still variation in terms of infrastructure and learning conditions (Lamin, 2025; MBSSE, 2022a; MBSSE & Leh Wi Lan, 2022).

The fact that FQSE has increased access also accounts for the difference between the strong support shown by the respondents for access and their more cautious view of its impact on academic performance. Although 95.0% of teachers stated that FQSE had improved access, only 63.3% agreed that it had significantly improved science performance. This discrepancy is in line with the broader literature on Sierra Leone, indicating that greater participation does not automatically lead to better learning if the availability of teachers, the state of classroom conditions and the availability of instructional resources remain limited (Gbla & Smart, 2025; Lamin, 2025; MBSSE & Leh Wi Lan, 2022; Turay et al., 2026). The World Bank (2018) makes a similar point by saying that schooling only achieves its intended human-capital benefits when learners actually acquire meaningful knowledge and skills.

The trend in the WASSCE results from 2020 to 2025 is promising, but it must be treated with caution. The rise in the number of candidates obtaining passes in the core sciences together with the increases in the numbers of candidates passing Biology, Chemistry and Physics took place at a time when enrolment was changing, the country was recovering from the disruption caused by COVID-19, there were shifts in the level of examination participation and ongoing education reforms. As part of its response to COVID-19, Sierra Leone implemented school closures, introduced distance learning, revised its examination arrangements and later carried out efforts to recover learning (World Bank, 2021). The national WASSCE analyses also showed major changes in participation and pass rates during the FQSE period (MBSSE, 2022b). It is therefore possible to conclude that there has been an improvement during the period when the programme was implemented, rather than to make a causal assessment of the programme's impact.

From a policy point of view, the results indicate a clear course of action: the access benefits resulting from FQSE should be secured through greater investment in the instructional core. In the case of science education, this involves having functional laboratories, using adequate textbooks and consumables, ensuring that there are enough qualified science teachers, keeping class sizes reasonable and carrying out practical work regularly. These priorities are in line with both the Education Sector Plan and the Free Education Project, since both of these emphasize learning quality, school-level capacity and system management together with participation (Government of Sierra Leone, 2022; World Bank, 2020).

4.1 Limitations

There are several limitations to take into account. The first is that the study only included 20 schools in the areas of Bo, Bonthe, Moyamba and Pujehun and therefore cannot be applied to all the secondary schools in Sierra Leone. Secondly, the majority of the findings regarding implementation were based on the participants' own accounts and perceptions and could therefore be influenced by recall or response bias. Thirdly, the analysis of the WASSCE results depended on documentary summaries that had been compiled for the study by the participating schools and from institutional records; individual-level WAEC candidate data were not available for independent verification. It follows that the WASSCE figures cited should be understood as representing the study's documentary dataset and not as independently verified official WAEC regional statistics. Fourthly, the study design did not have a comparable baseline from the southern region before the FQSE initiative nor an untreated control group, so any claim of causality cannot be made. Lastly, the period from 2020 to 2025 encompassed disruptions caused by COVID-19 and other system-wide changes which may have affected teaching, participation and examination performance.

5 CONCLUSION

The results show that FQSE has been associated with substantial improvements in access to education in southern Sierra Leone. Pupils said that there were fewer financial obstacles and more opportunities for them to stay in school, whereas teachers and principals noted a rise in enrolment and attendance. On the other hand, the greater level of participation has placed more pressure on classrooms, teachers and the facilities. Practical work in science is especially affected since laboratories, practical activities, specialized teachers and learning materials are still unevenly available.

The fact that the overall WASSCE results have shown an upward trend is encouraging, but this does not demonstrate that FQSE was the cause of the improvement. To move forward, assessments should make use of verified examination data at the district and school levels, set up baseline figures prior to the policy being introduced and employ more rigorous comparative or longitudinal designs. In practice, the Government and MBSSE should focus on having functional science laboratories, ensuring that textbooks and consumables are provided in a timely manner, recruiting and assigning qualified science teachers, providing them with continuous professional development, and keeping a closer eye on both class size and the delivery of practical science. It is essential to improve these aspects of quality if the access benefits resulting from FQSE are to be turned into ongoing gains in science achievement.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare that they have no competing interests.

Statement of ethical approval

The study was conducted in accordance with accepted ethical principles for educational research involving human participants.

Statement of informed consent

Participation in the questionnaire-based component was voluntary, and informed consent was obtained before data collection. Participants were informed of the purpose of the study, the voluntary nature of their participation, their right to decline participation or withdraw at any time, and the measures taken to ensure confidentiality and anonymity. No names or other personal identifiers were used in the analysis or reporting. Secondary examination records were analysed only in aggregated and non-identifiable form to protect the identities of individual pupils and participating schools. No formal ethics committee approval number is reported because one was not documented in the study records available for preparation of this manuscript.

Data availability

The aggregated study data, documentary summaries and source tables underlying this article are available from the corresponding author on reasonable request, subject to applicable institutional and confidentiality restrictions. Individual-level WAEC candidate microdata were not part of the study dataset.

Authors' contributions

Abu Bakarr Dabor and Issa John Gbla contributed to data collection, data compilation, analysis, interpretation of findings and preparation of the initial manuscript. Tamba Kebbie provided supervision and guidance on the study design, research process, and interpretation of findings and critical review of the manuscript. All authors read and approved the final manuscript.

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