

# Investigating the Alignment of Teaching Methods with Sierra Leone's Mathematics Curriculum Standards: A Mixed-Methods Study

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**Abstract:** This mixed-methods study examines the alignment between teaching methods and national mathematics curriculum standards in Sierra Leone, where persistent low student performance suggests potential implementation gaps. Data collection included systematic surveys of 150 mathematics teachers, structured observations of 30 classroom lessons, and detailed analysis of curriculum documents. Results revealed significant misalignment: while the curriculum mandates learner-centered approaches, traditional teacher-centered methods predominated, with only 38.7% of observed lessons demonstrating substantial alignment with curriculum standards. Key barriers identified include inadequate teacher preparation (65.3% of teachers reported insufficient training in curriculum implementation), severe resource constraints (71.2% of schools lacked basic manipulatives), and large class sizes (average 47:1 student-teacher ratio). The study proposes a comprehensive framework for bridging this implementation gap through targeted professional development, strategic resource allocation, and enhanced monitoring systems to ensure curriculum intentions translate effectively into classroom practice.

**Keywords:** Curriculum Implementation, Mathematics Education, Teaching Methods, Sierra Leone, Educational Alignment, Teacher Professional Development.

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## I. INTRODUCTION

### ➤ Background

Sierra Leone's education system has undergone substantial transformation through post-conflict reconstruction and post-Ebola recovery initiatives. The 2018 National Curriculum Framework represents a significant shift toward competency-based education, emphasizing critical thinking, problem-solving, and practical application in mathematics (MoE, 2018). This reform aligns with global trends in mathematics education that prioritize conceptual understanding over procedural knowledge (Boaler, 2016). However, national assessment data reveals persistent underachievement in mathematics, with only 34% of primary students and 28% of junior secondary students achieving proficiency in foundational mathematics concepts (MBSSE, 2022).

### ➤ Research Problem

The disconnect between curriculum aspirations and classroom reality represents a critical challenge in Sierra Leone's education reform efforts. While curriculum documents articulate clear standards for interactive, student-centered mathematics instruction, evidence suggests traditional transmission-based methods continue to dominate classroom practice (Jalloh, 2019). This study investigates the nature and extent of this misalignment, examining how systemic constraints and teacher capacity factors mediate curriculum implementation.

### ➤ Research Objectives

- To analyze the pedagogical requirements embedded in Sierra Leone's national mathematics curriculum standards
- To document the predominant teaching methods employed in mathematics classrooms across diverse school contexts
- To quantify the alignment between observed instructional practices and curriculum expectations

- To identify contextual factors that facilitate or impede curriculum implementation
- To propose evidence-based strategies for enhancing curriculum-teaching method coherence

II. LITERATURE REVIEW

- *Theoretical Framework: Curriculum Implementation*
- Fullan's (2007) theory of educational change provides the conceptual framework, emphasizing that successful implementation requires coherence among curriculum, pedagogy, and assessment. In mathematics education, this alignment is particularly crucial for developing the conceptual understanding emphasized in reform curricula (Stein et al., 2007).
- *Global Perspectives on Mathematics Pedagogy*
- Internationally, successful mathematics education systems share common characteristics: teacher capacity for facilitating inquiry, availability of appropriate resources, and assessment systems that reward conceptual understanding (Mullis et al., 2020). Singapore's mathematics framework, for instance, systematically integrates concrete-pictorial-abstract approaches that build conceptual understanding (Ministry of Education Singapore, 2020).
- *Sierra Leone's Educational Context*
- Previous research in Sierra Leone has identified several implementation challenges:

- *Teacher Capacity:* Only 28% of primary mathematics teachers possess specialized mathematics training (World Bank, 2020)
- *Resource Gaps:* Student-textbook ratios exceed 3:1 in 65% of schools (UNICEF, 2021)
- *Assessment Pressures:* High-stakes examinations continue to emphasize procedural knowledge (Kamara, 2020)

III. METHODOLOGY

- *Research Design*
- A convergent parallel mixed-methods design was employed, collecting quantitative and qualitative data simultaneously but analyzing them separately before integration. This approach enabled triangulation and comprehensive understanding of the research problem.
- *Sampling Strategy*
- A stratified random sample of 45 schools was selected from three districts (Western Area, Bo, Kenema), representing urban, peri-urban, and rural contexts. The final sample included:
- 150 mathematics teachers for surveys
  - 30 classrooms for observation
  - 12 curriculum developers and district supervisors for interviews
- *Data Collection Instruments*

Table 1: Data Collection Matrix

Teacher Survey (Likert-scale)	Teaching Methods Frequency, Resource Availability, Training Experiences	Cronbach's $\alpha = 0.84$
Classroom Observation Protocol	Lesson structure, student engagement, resource use	Inter-rater reliability = 0.89
Curriculum Analysis Framework	Pedagogical expectations, content emphasis, assessment approaches	Expert validation
Semi-structured Interviews	Implementation challenges, support systems, perceived barriers	Member checking

- *Data Analysis*
- Quantitative data were analyzed using descriptive statistics and chi-square tests to examine associations between teacher characteristics and alignment levels. Qualitative data underwent thematic analysis using NVivo software, with codes developed both deductively from the theoretical framework and inductively from emergent themes.

IV. RESULTS AND FINDINGS

- *Curriculum Analysis Findings*

Table 1: Pedagogical Emphasis in Mathematics Curriculum Standards

Pedagogical Approach	Frequency in Curriculum Documents	Example Indicators
Problem-based Learning	78% of units	"Students investigate real-world problems"
Collaborative Work	65% of lessons	"Work in small groups to solve"
Use of Manipulatives	45% of topics	"Use geometric solids to explore"
Technology Integration	15% of standards	"Use spreadsheets to model"
Direct Instruction	22% of objectives	"Teacher demonstrates procedure"

➤ *Classroom Observation Results*

Table 2: Observed Teaching Methods vs. Curriculum Expectations (n=30 lessons)

Teaching Method	Curriculum Expectation	Observed Frequency	Alignment Gap
Lecture/Demonstration	Limited use	73.3%	+51.3%
Whole-class Discussion	Regular use	36.7%	-28.3%
Small Group Work	Frequent use	23.3%	-41.7%
Hands-on Activities	Integrated throughout	16.7%	-48.3%
Problem-solving Tasks	Central approach	26.7%	-38.3%

➤ *Teacher Capacity and Preparedness*

Table 3: Teacher Training and Implementation Confidence (n=150)

Training Aspect	Received Adequate Training	Confident in Implementation
Curriculum Content	58.7%	72.3%
Learner-centered Methods	34.7%	41.2%
Assessment Strategies	45.3%	52.8%
Resource Adaptation	28.0%	32.1%
Technology Integration	15.3%	18.6%

$$\chi^2(4) = 23.45, p < .001, \text{Cramer's } V = .28$$

➤ *Resource Availability Analysis*

Table 4: Mathematics Teaching Resources Availability by School Location

Resource Type	Urban (n=15)	Peri-urban (n=15)	Rural (n=15)	Total
Student Textbooks (1:1 ratio)	60.0%	33.3%	13.3%	35.6%
Basic Manipulatives	46.7%	26.7%	6.7%	26.7%
Calculators (class set)	53.3%	20.0%	0.0%	24.4%
Geometry Instruments	40.0%	26.7%	13.3%	26.7%
Digital Resources	33.3%	6.7%	0.0%	13.3%

## V. DISCUSSION

The findings reveal a substantial implementation gap between curriculum rhetoric and classroom reality. Three key themes emerged from the integrated analysis:

➤ *The Professional Practice Gap*

Despite curriculum emphasis on interactive methods, traditional teacher-centered approaches persist. This gap reflects what Timperley (2008) identifies as the "knowing-doing" gap in teacher practice. Observations revealed that even when teachers understood curriculum expectations, they lacked the pedagogical content knowledge to implement them effectively, particularly in facilitating productive mathematical discourse.

➤ *Resource-Mediated Implementation*

Resource constraints significantly mediated implementation quality. The urban-rural disparity in resource availability (Table 4.4) created an "implementation gradient," where well-resourced urban schools demonstrated higher alignment levels. This supports Jalloh's (2019) findings that resource limitations force teachers toward less resource-intensive, traditional methods.

➤ *Systemic Constraints*

Large class sizes (average 47 students), limited instructional time, and examination pressures created a classroom ecology that discouraged experimentation with more complex pedagogical approaches. Teachers reported "reverting to what works" under these constraints, echoing international findings about how accountability pressures can narrow pedagogical repertoires (Au, 2007).

## VI. RECOMMENDATIONS

Based on the findings, we propose a multi-level intervention framework:

➤ *Teacher Development Strategy*

- Differentiated Training: Develop tiered professional development based on current practice levels
- Instructional Coaching: Implement school-based coaching with demonstration lessons
- Professional Learning Communities: Establish subject-based teacher networks for collaborative planning

➤ *Resource Enhancement Plan*

- Minimum Resource Package: Ensure all schools have essential mathematics manipulatives
- Digital Resource Banks: Develop open educational resources accessible via mobile platforms
- Local Resource Development: Train teachers in creating low-cost teaching aids from local materials

➤ *Policy and System Alignment*

- Revised Assessment Framework: Align examinations with curriculum competencies
- Class Size Targets: Progressive reduction to 35:1 student-teacher ratio
- Monitoring and Support: District-based curriculum implementation teams

## VII. CONCLUSION

This study demonstrates that curriculum reform success depends not only on well-designed documents but on the alignment of multiple system components. The significant gaps identified between Sierra Leone's mathematics curriculum standards and classroom practice highlight the need for comprehensive implementation strategies that address teacher capacity, resource availability, and systemic constraints simultaneously. By adopting the proposed framework, Sierra Leone can move closer to realizing its vision of quality mathematics education for all students.

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## APPENDICES

- **Appendix A:** Teacher Survey Instrument
- **Appendix B:** Classroom Observation Protocol
- **Appendix C:** Interview Guide
- **Appendix D:** Curriculum Analysis Framework