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Examining the Qualifications and Professional Development of Mathematics Teachers in Kailahun District, Sierra Leone

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Abstract: This study examines the academic qualifications and professional development (PD) access of mathematics teachers in Kailahun District, Sierra Leone, a region grappling with significant educational challenges exacerbated by post-conflict recovery and rural disparities. A mixed-methods approach was employed, utilizing surveys with 100 mathematics teachers, semi-structured interviews with 10 educational administrators, and a review of national policy documents. Findings indicate a critical shortage of qualified personnel, with only 45% of teachers holding a bachelor's degree and 25% lacking any formal mathematics training. PD access is severely limited, with 60% of teachers attending fewer than two workshops in three years. Key systemic barriers identified include inadequate funding, logistical constraints, geographic isolation, and weak policy enforcement. The study concludes that the current state significantly hinders instructional quality and student achievement in mathematics. It recommends mandatory certification standards, government-funded and decentralized PD programs, strategic partnerships with NGOs, and the integration of technology to enhance teacher capacity and improve learning outcomes in this underserved context.

Keywords: *Teacher Qualifications, Professional Development, Mathematics Education, Rural Education, Sierra Leone, Educational Policy, Sub-Saharan Africa.*

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I. INTRODUCTION

A. Background and Context

Sierra Leone's education system, decimated by a decade-long civil war and further disrupted by the Ebola epidemic, continues to face profound challenges. Despite policy initiatives like the Free Quality School Education (FQSE) launched in 2018, student performance, particularly in mathematics, remains critically low. The West African Examinations Council (WAEC, 2022) reports consistently poor pass rates in mathematics nationally, with rural districts like Kailahun disproportionately affected. This underperformance is intrinsically linked to a crisis in teacher supply and quality. The post-war teacher shortage led to the recruitment of underqualified personnel, a problem most acute in specialized subjects like mathematics and in remote regions where training infrastructure is weakest (Ministry of Education, Science and Technology, 2023).

B. Problem Statement

While the FQSE initiative has increased school enrollment, it has simultaneously strained an already fragile teaching workforce. In Kailahun District, many mathematics teachers lack both subject-specific academic qualifications and access to ongoing, relevant professional development. This deficit in human capital directly contributes to poor pedagogical content knowledge, ineffective instructional practices, and consequently, low student achievement and high dropout rates. There is a pressing need to empirically investigate the specific gaps in teacher preparedness and the systemic factors that perpetuate these gaps to inform effective intervention strategies.

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C. Research Objectives

This study aims to:

- Assess the academic and professional qualifications of mathematics teachers in Kailahun District.
- Evaluate the availability, accessibility, and perceived effectiveness of PD programs for these teachers.
- Identify the systemic and institutional barriers that hinder teacher qualification and continuous development.
- Propose evidence-based policy and practical interventions to enhance teacher capacity.

D. Research Questions

- What proportion of mathematics teachers in Kailahun meet national qualification standards?
- How frequent, accessible, and relevant are PD opportunities for mathematics teachers?
- What structural, financial, and socio-geographic factors hinder teacher professional development?
- What strategic interventions can improve the preparedness and effectiveness of mathematics teachers in this context?

II. LITERATURE REVIEW

A. Theoretical Framework

This study is grounded in two complementary theories. Human Capital Theory (Becker, 1964) posits that investment in education and training enhances an individual's productivity and economic value. Applied here, it frames teacher PD as a critical investment that yields returns in the form of improved instructional quality and student outcomes. Secondly, Situated Learning Theory (Lave & Wenger, 1991) argues that learning is inherently social and contextual, occurring through participation in a "community of practice." This theory underscores the importance of collaborative, job-embedded, and contextually relevant PD, as opposed to one-off, decontextualized workshops.

B. Global and Regional Perspectives

Globally, high-performing education systems like Finland and Singapore attribute their success to rigorous teacher preparation, a high bar for entry into the profession, and sustained, high-quality PD (Darling-Hammond, 2017). In Sub-Saharan Africa, the challenges are magnified. UNESCO (2021) reports that rural teachers often face professional isolation, multi-grade teaching challenges, and severe resource gaps, making traditional PD models less effective. The need for localized, sustainable, and continuous support mechanisms is emphasized across the literature (Westbrook et al., 2013).

C. Sierra Leone's Education Landscape

Sierra Leone faces a acute teacher gap, with a national pupil-teacher ratio of 1:45, a figure that is significantly worse in rural districts (World Bank, 2023). The Teaching Service Commission (TSC) has established qualification standards, but enforcement is weak, especially in hard-to-reach areas. PD initiatives, while present, are often irregular, underfunded, and concentrated in urban centers, making them largely inaccessible to teachers in districts like Kailahun (TSC Sierra Leone, 2022). This study seeks to fill a gap in the literature by providing a granular analysis of these issues within a specific, underserved Sierra Leonean context.

III. METHODOLOGY

A. Research Design

A convergent parallel mixed-methods design was employed to provide a comprehensive understanding of the research problem. Quantitative (survey) and qualitative (interview, document analysis) data were collected concurrently, analyzed separately, and then integrated during the interpretation phase to triangulate findings and provide robust conclusions.

B. Sampling Strategy

- Quantitative Sample: Stratified random sampling was used to select 100 mathematics teachers (50 from primary schools, 50 from secondary schools) across Kailahun District.
- Qualitative Sample: Purposive sampling was used to select 10 key informants, including school principals, headteachers, and district education officers, chosen for their direct involvement in teacher management and PD planning.

Table 1 Data Collection

Data Collection Tool	Purpose	Sample Size
Teacher Survey	To collect data on demographics, qualifications, PD attendance, and challenges.	100 teachers
Semi-structured Interviews	To gain in-depth insights on systemic barriers, policy implementation, and solutions.	10 administrators
Policy Document Analysis	To review national teacher qualification standards and PD policy frameworks.	TSC, MoEST documents

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C. Data Analysis

- Quantitative Data: Analyzed using SPSS (v.28). Descriptive statistics (frequencies, percentages, means) were computed. Chi-square tests were used to examine associations between variables (e.g., school level and qualification status).
- Qualitative Data: Interview transcripts were analyzed using thematic analysis in NVivo. Initial coding was followed by the identification of broader themes related to barriers, impacts, and potential solutions.
- Integration: Quantitative results provided a broad overview of the trends, while qualitative data enriched these findings with detailed explanations and contextual depth.

D. Ethical Considerations

Informed consent was obtained from all participants. Anonymity and confidentiality were ensured by using codes instead of names. Participants were informed of their right to withdraw at any stage without penalty.

IV. FINDINGS

A. Demographic and Qualification Profile of Teachers

Table 1: Demographic Characteristics of Participants (N=100)

Characteristic	Category	Frequency	Percentage
Gender	Male	62	62%
	Female	38	38%
School Level	Primary	50	50%
	Junior Secondary (JSS)	30	30%
	Senior Secondary (SSS)	20	20%
Years of Experience	< 5 years	35	35%
	5 - 10 years	40	40%
	> 10 years	25	25%

Table 2: Highest Academic and Professional Qualifications Held

Qualification	Frequency	Percentage
Bachelor's Degree (B.Ed. Maths or B.Sc. + PGDE)	45	45%
Higher Teacher Certificate (HTC) / Diploma	45	25%
Teacher Certificate (TC)	30	30%
Formal Mathematics-Specific Training		
Yes (Degree or Diploma major/minor in Maths)	40	40%
No (Only general pedagogy or other subjects)	60	60%

B. Professional Development Access and Participation

Table 3: PD Workshop Attendance in the Last 3 Years

Number of Workshops Attended	Frequency	Percentage	Cumulative Percentage
None	25	25%	25%
1 - 2 workshops	35	35%	60%
3 - 5 workshops	30	30%	90%
More than 5 workshops	10	| 10%	100%
More than 5 workshops	10	| 10%	100%

Table 4: Perceived Relevance and Effectiveness of PD Attended (n=75 who attended PD)

Aspect	Highly Relevant/Effective	Moderately	Not Relevant/Effective
Content (e.g., new curriculum, methods)	20%	45%	35%
Pedagogical Skills Acquired	25%	40%	35%
Overall Effectiveness in Improving Teaching	15%	50%	35%

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C. Systemic Barriers to Qualifications and PD

Thematic analysis of interviews revealed four overarching barriers:

- Financial Constraints: "The workshop itself is free, but there is no stipend for transport or accommodation. How can I travel from Pendembu to Kenema on my salary?" (Secondary Teacher, Participant T47).
- Geographic and Logistical Challenges: Poor road networks, lack of reliable transportation, and the concentration of PD in urban centers (Freetown, Kenema) effectively exclude rural teachers.
- Inadequate Policy Enforcement and Monitoring: Officials acknowledged a lack of capacity to monitor teacher qualifications or mandate PD attendance. "The policy is on paper, but we cannot refuse a teacher in a classroom if that is the only warm body available." (District Education Officer).

- Irrelevance of PD Content: Many teachers reported that PD often focuses on general pedagogy rather than subject-specific (mathematics) content knowledge and hands-on strategies for low-resource, multi-grade classrooms.

V. DISCUSSION

This study reveals a critical gap in the human capital foundation of mathematics education in Kailahun District. The low percentage of degreed and mathematics-specialized teachers (45% and 40% respectively) aligns with national reports of rural teacher deficits (World Bank, 2023) but presents a more dire picture for a foundational subject like mathematics. This directly undermines the goals of the FQSE initiative.

The limited access to PD, with 60% of teachers attending two or fewer workshops in three years, indicates a system failing to provide continuous support. This finding resonates with situated learning theory; the lack of collaborative, ongoing, and contextual learning opportunities prevents the formation of strong professional communities of practice (Lave & Wenger, 1991). The perceived irrelevance of much of the PD further diminishes its potential impact, suggesting a top-down approach that does not address teachers' real-world classroom challenges.

The identified barriers—financial, geographic, and systemic—confirm the regional challenges outlined by UNESCO (2021). The discussion with officials highlights a stark implementation gap between national policy aspirations and local realities, a common issue in post-conflict states with limited institutional capacity (Higgs, 2021).

VI. RECOMMENDATIONS

Based on the findings, the following phased interventions are proposed:

➢ *Short-Term Interventions (0-2 Years)*

Mobile Teacher Resource Centers: Utilize vans equipped with materials and master trainers to conduct rotating, cluster-based PD workshops within the district, eliminating travel costs for teachers.

Mentorship Programs: Pair less experienced teachers with master teachers in nearby schools for ongoing coaching and support, fostering situated learning.

Leverage Technology: Develop and disseminate PD content via SMS, radio broadcasts, and low-bandwidth mobile apps to reach isolated teachers (e.g., curated lesson plans, teaching tips).

➢ *Long-Term Strategies (2-5 Years)*

Policy Reform and Enforcement: The Teaching Service Commission must develop a clear, phased plan to enforce minimum qualification standards, supported by incentives for teachers to upgrade their qualifications through distance learning programs.

Dedicated PD Funding: The Ministry of Education and district councils should allocate a specific percentage (min. 5%) of their annual budgets to teacher PD, ring-fenced for stipends, materials, and logistics.

Strategic Partnerships: Forge formal partnerships with NGOs (e.g., UNICEF, Plan International) and higher education institutions (e.g., Njala University, Freetown Teachers College) to co-design and deliver accredited, context-specific training programs.

Establish District-Based Hubs: Create a permanent Teacher Development and Resource Center in Kailahun to serve as a continuous professional learning hub.

VII. CONCLUSION

This study provides empirical evidence that the poor state of mathematics education in Kailahun District is fundamentally linked to underqualified teachers and a system that fails to support their professional growth. Investing in these teachers is not merely an educational issue but a critical development imperative. By implementing the recommended targeted, context-sensitive, and multi-stakeholder interventions, Sierra Leone can begin to bridge the rural-urban educational divide and build a qualified, supported, and effective teaching workforce capable of driving improved learning outcomes for all students.

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APPENDICES

Appendix A: Teacher Survey Questionnaire
Appendix B: Semi-Structured Interview Protocol for Administrators
Appendix C: Detailed Data Tables (Cross-tabulations of qualifications by school level, etc.)