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### RESEARCH ARTICLE

## ENHANCING MATHEMATICS EDUCATION IN RURAL GAMBIA: INVESTIGATING THE INFLUENCE OF TEACHER QUALIFICATIONS AND EXPERIENCE ON STUDENT ACADEMIC PERFORMANCE

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#### Abstract

This study investigates the influence of teachers' qualifications and experience on the academic performance of senior secondary school mathematics students in rural Gambia. To achieve this objective, I conducted a rigorous analysis of quantitative data sourced from surveys administered by the Ministry of Basic and Secondary Education through the Education Management Information System (EMIS) and data from the West Africa Examination Council (WAEC)-The Gambia. To ensure a representative sample, I employed a simple random sampling technique. I selected 35 schools out of the total 57 public secondary schools in rural Gambia that presented candidates in the 2022 West African Senior School Certificate Examination in mathematics. Subsequently, the collected data undergoes statistical analysis using IBM SPSS-25. A series of independent t-test analyses were conducted to compare the mean academic performance scores across various student groups while testing the formulated hypotheses at a significance level of 0.05. The study's findings revealed a substantial impact of teachers' qualifications and experience on student performance in mathematics. Considering these findings, one recommended action is to encourage and support secondary school teachers to pursue higher education degrees, particularly a Bachelor of Education (B.Ed.) specializing in mathematics.

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#### Introduction: -

Education is a continuous process in life. It is the process of training and developing people's knowledge, skill, mind, and character (Ewetan et al., 2015). It is a fundamental human right, and quality education entails explicit issues such as appropriate skills development, provision of relevant school infrastructure, educational materials and resources, or teaching force (UNESCO, 2018). The Gambia's education sector is challenged with inadequate and poor infrastructure, insufficiently trained teachers in the STEM areas, and Students' negative attitudes towards mathematics and science and learning materials, among others (Gambia Education Sector Policy 2016-2030). Teachers serve as the building blocks of any education sector, playing a pivotal role in the implementation of its programs (Kingsley, 2020). They serve as the driving force behind intellectual growth and the cultivation of essential skills in their students. However, teaching is seen as a dumping ground for any unemployed school leavers, irrespective of their area of specialization (Owolabi & Julius, 2012), and Gambia is not an exception.

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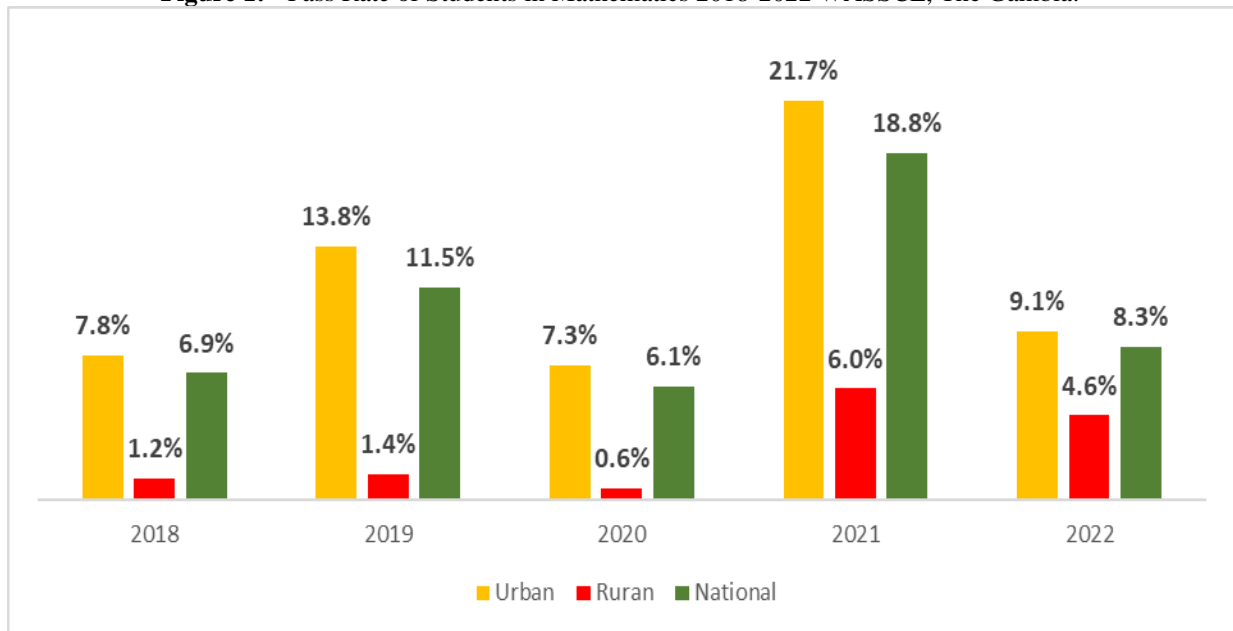
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According to Akiba et al. (2007), Teacher quality is widely recognized by policymakers, practitioners, and researchers as the most potent school-related influence on a child's academic performance. On that ground, The Gambia government promotes STEM education policy to ensure the development of a strong science, technology, engineering, and mathematics education (Gambia Education Sector Policy 2016-2030). This admirable goal can only be achieved if qualified teachers instruct students. The qualifications of teachers are widely acknowledged as a crucial driving force for enhancing overall student performance (Casian et al., 2021; Chand et al., 2021). Teachers are seen as the primary agents responsible for both school development and students' educational progress, making them instrumental in fostering knowledge acquisition and transformative change within educational institutions (Casian et al., 2021). The assessment of a teacher's subject mastery often relies on their students' performance in subject-specific exams. Effective interactions between teachers and students are expected to facilitate the students' acquisition of new knowledge and skills. When such interactions fail, it indicates the presence of an issue that needs attention (Owolabi & Julius, 2012).

Mathematics is one of the most essential school subjects worldwide (Sa'ad et al., 2014). In the Gambia, mathematics also cuts across primary and secondary school as a compulsory subject. The discipline of mathematics holds a crucial position in the educational landscape, exerting a significant influence on the cognitive growth and scholastic achievements of students (Ewetan et al., 2015; Chand et al., 2021). Educationists commonly believe that no one can progress in any field until they have a basic knowledge of mathematics (Ali & Jameel, 2016). Society sees mathematics as the foundation of scientific-technological knowledge that is vital in the socioeconomic development of a nation (Ayebale et al., 2020). The underperformance in mathematics at the primary and secondary school levels is a significant obstacle to achieving better economic and social results, impacting both individuals and the nation (Bethell, 2016).

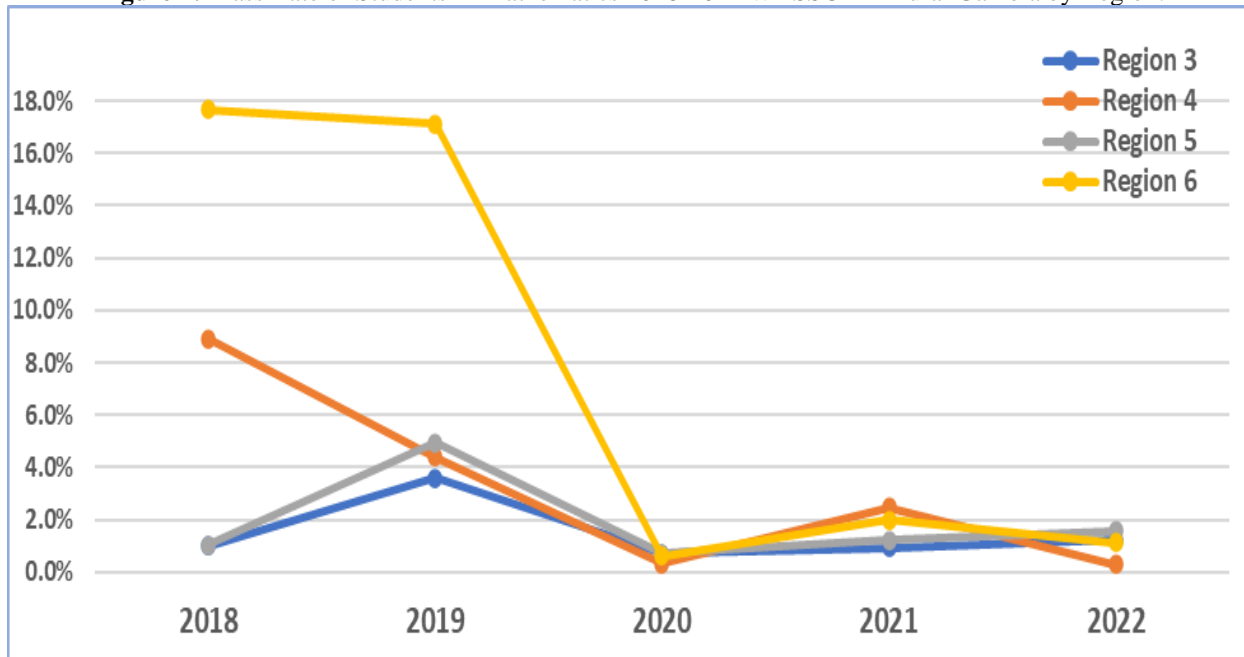
Despite mathematics's significant role, The Gambia has been underperforming in mathematics in the West African Senior School Certificate Examination (WASSCE) more servilely in rural areas. This has raised public concerns as most students fail to achieve the necessary proficiency in mathematics to qualify for tertiary education.

**Figure 1:** - Pass Rate of Students in Mathematics 2018-2022 WASSCE, The Gambia.



Source: (West African Examination Council-The Gambia).

From Figure 1, it is evident that urban schools consistently outperformed rural schools in terms of mathematics pass rates over the five years. Rural schools consistently experienced pass rates below 5% from 2018 to 2020, reaching their lowest point at 0.6% in 2020. In 2021, there was a slight improvement with a pass rate of 6%, which dropped to 4.6% in the following year. Unfortunately, the national pass rate has consistently remained below 20% throughout the past five years.

**Figure 2:-** Pass Rate of Students in Mathematics 2018-2022 WASSCE in Rural Gambia by Region.

Source: (West African Examinations Council-The Gambia).

Figure 2 reveals notable declining trends and disparities in the performance of rural students in mathematics, where Region 3 and Region 5 consistently exhibit lower pass rates, dropping to as low as 0.3% and 0.6% in 2020 respectively. These may be influenced by a multitude of factors, including educational policies, teaching methods, teachers' qualifications, teachers' experience, and socioeconomic circumstances. With the growing demand for evidence-based policymaking, student achievement is considered an accurate measure of effectiveness (Ambussaidi & Yang, 2019). In rural Gambia, where educational disparities persist and pose significant challenges, understanding the nexus between teachers' qualifications, experience, and student academic performance becomes paramount. Therefore, it is against this background that this study investigates the influence of teachers' qualifications and experience on students' performance in mathematics in rural Gambia.

The influence of teachers' qualifications and experience on students' performance in mathematics holds immense educational significance. Akpomudjere (2020) defines a qualified teacher as a teacher who teaches at the level for which he/she completed a teacher training program. He further stated that teacher qualifications encompass a broad spectrum, including credentials, subject knowledge, coursework, degrees, test scores, experience, certifications, and evidence of continuous learning. Inadequate subject knowledge and pedagogical skills can hinder effective teaching (Mulkeen, 2010).

Several studies have delved into this subject, striving to comprehend how teacher qualifications and experience impact students' mathematics achievement. Casian et al. (2021) explored the effect of teacher qualifications on students' academic performance and found that teacher qualifications accounted for 36.5% of the variance in students' academic outcomes. Similarly, (Dial, 2000; Akiba et al., 2007; Morton et al., 2008; Akpo, 2012; Sa'ad et al., 2014; Ali & Jameel, 2016; Ambussaidi & Yang, 2019; Kingsley, 2020; Chand et al., 2021; Mabena et al., 2021; Claire, 2021), concurred that highly qualified teachers significantly improved students' academic performance. However, Lydia and Joash's (2015) study findings suggest that teacher qualification and experience do not have a significant influence on students' academic performance.

Furthermore, research has consistently emphasized the role of teaching experience in influencing student achievement. Empirical evidence from studies by (Dial, 2000; Rivkin et al., 2005; Akiba et al., 2007; Akpo, 2012; Ewetan et al., 2015; Gichuru, 2016; Bwenvu et al., 2020) has demonstrated a significant relationship between the number of years of teaching experience and student achievement.

These studies underscored that qualified and experienced educators have emerged as crucial in determining student success. Emphasizing the need to have well-prepared and credentialed educators in the classroom and retain such educators within the education system.

### **Statement of the Problem**

Success in mathematics is a fundamental requirement for admission to higher education institutions in The Gambia. However, there is growing concern about the underwhelming performance of students in mathematics in public senior secondary schools in the Gambia more severely in the rural areas. This raises the question of why such disparities exist. An observable trend in the West African Senior School Certificate Examination (WASSCE) data suggests that urban secondary school students tend to outperform their rural school counterparts.

In The Gambia, it is common for qualified teachers to decline postings to rural or isolated schools in favor of more attractive urban locations. Consequently, many remote schools find themselves with unqualified teachers (Mulkeen, 2010). This has led to a perception among the public and some educators that urban senior secondary schools possess superior human and material resources, particularly for effectively implementing the mathematics curriculum, in contrast to their rural counterparts. It is widely acknowledged that the most critical factor in ensuring that learners attain high standards in mathematics is the presence of an effective teacher in the classroom, as Bethell (2016) emphasized. This underscores the necessity of conducting a comprehensive study to investigate the influence of teachers' qualifications and experience on students' performance in mathematics in public senior secondary schools in rural Gambia. Such research is vital to address the existing disparities and develop strategies for improving mathematics education in these underserved regions.

### **Purpose of the study**

The purpose of the study is to investigate the influence of teachers' qualifications and experience on students' mathematics performance in senior secondary schools in rural Gambia. To examine the academic achievements of students in mathematics, specifically focusing on the disparities between those instructed by highly qualified teachers (B.Ed/BA) versus those instructed by low-qualified teachers (HTC/AD), and also to explore the disparities in mathematics performance among students taught by highly experienced teachers compared to those taught by low experienced teachers.

### **Research Question**

Based on the problem statement and the study's purpose, the following research questions were formulated to help drive the focus of the study.

1. Is there any significant difference in the academic performance of senior secondary school mathematics students based on their teachers' qualifications?
2. Is there any significant difference in the academic performance of senior secondary school mathematics students when comparing highly experienced teachers to low experienced teachers?

### **Research Hypotheses**

The aforementioned hypotheses were established and subsequently evaluated at a significant level of 0.05.

Ho1: There is no significant difference in the academic performance of senior secondary school mathematics students based on their teachers' qualifications level.

Ho2: There is no significant difference in the academic performance of senior secondary school mathematics students when comparing highly experienced teachers to that of low experienced teachers.

### **Significance of the Study**

This study will be important to the Ministry of Basics and Secondary Education, school principals, mathematics teachers, and future researchers. To the Ministry of Basics and Secondary Education, the findings from the study will reveal the influence of teachers' qualifications and experience on students' performance in mathematics in rural Gambia. Also, the findings from the study will help school principals and mathematics teachers to know the performance level of their students in mathematics based on teachers' qualifications and experience. Furthermore, the study's findings will help future researchers to draw inferences when conducting related research.

### Research Methodology:-

The present study utilized stringent methods to examine the various elements that impact the academic achievement of students in mathematics in public senior secondary schools situated in rural Gambia. The subsequent sections provide an outline of the research design, sample selection, data collecting, and data analysis.

### Research Design

The study employed a cross-sectional research design to examine the variables that influence the academic performance of students in mathematics within the public senior secondary schools located in rural areas of the Gambia.

### Sample Selection

The researcher employed a simple random sampling technique to choose 35 (61%) out of the 57 public senior secondary schools that present candidates in rural Gambia for the 2022 West African Senior School Certificate Examination in mathematics. This method ensured that each school had an equal opportunity to be included in the study. Each sampled school was anticipated to have at least one mathematics teacher who taught the candidates. Therefore, 35 teachers, consisting of 32 males and 3 females, were purposively included in the study. From the sampled schools, a random sample of 1,910 (72%) students was drawn from the pool of 2,659 candidates who had taken the West African Senior School Certificate Examination in mathematics during the year 2022 of the study. The students' scores were used to measure their mathematics performance.

### Data Collection

The teachers' biographical information, gender, educational qualification, and teaching experience were obtained from surveys administered by the Ministry of Basic and Secondary Education (MoBSE) through the Education Management Information System (EMIS). Teachers' educational qualifications were grouped into two categories: "low qualifications," comprising the Higher Teachers' Certificate (HTC) and Advanced Diploma (AD), and "high qualifications," including individuals with University Degrees such as Bachelor of Education (B.Ed.) and Bachelor of Arts (BA). The teaching experience was grouped into "highly experienced teachers," who had five years or more of teaching experience, and "low-experienced teachers," who had less than five years of teaching experience. Student exam scores from the 2022 West African Senior School Certificate Examination (WASSCE) were collected from WAEC and used as an indicator of students' performance/achievement.

### Data Analysis

The data that was gathered was subjected to statistical analysis employing the subsequent techniques. Descriptive Statistics: Frequency counts and percentage calculations were employed to provide a clear overview of the data, including the distribution of teacher qualifications and experience levels. Inferential Statistics were also utilized. A set of independent t-test analyses was conducted to compare the mean academic performance scores between different groups of students to draw conclusions regarding the relationship between teacher qualification, experience, and variations in students' performance in mathematics. A significance level of 0.05 was set to determine the statistical significance of these relationships. The Statistical package IBM SPSS-25 was employed to generate t-test statistics and perform the necessary data analysis to explore these relationships.

**Table 1:-** Presents the Demographic Data of both Teachers and Students.

| Variables                          | Labels                             | Frequency |      | Percentage |       |
|------------------------------------|------------------------------------|-----------|------|------------|-------|
|                                    |                                    | Female    | Male | Female     | Male  |
| Students Score                     | Students                           | 1038      | 872  | 54.3%      | 45.7% |
| Age of Teachers'                   | 20-30yr                            | 3         | 14   | 8.6%       | 40.0% |
|                                    | 31-40yr                            | 0         | 10   | 0.0%       | 28.6% |
|                                    | 41-50yr                            | 0         | 7    | 0.0%       | 20.0% |
|                                    | >51yr                              | 0         | 1    | 0.0%       | 2.9%  |
| Teachers Educational Qualification | Advanced Diploma (AD)              | 1         | 10   | 2.9%       | 28.6% |
|                                    | Bachelor of Education (B.Ed.)      | 1         | 9    | 2.9%       | 25.7% |
|                                    | Bachelor of Arts (BA)              | 1         | 4    | 2.9%       | 11.4% |
|                                    | Higher Teachers' Certificate (HTC) | 0         | 9    | 0.0%       | 25.7% |
| Teaching Experience                | Highly experienced Teacher(>=5yr)  | 1         | 21   | 2.9%       | 60.0% |

|                             |                                |   |    |  |      |       |
|-----------------------------|--------------------------------|---|----|--|------|-------|
|                             | low experienced Teacher (>5yr) | 2 | 11 |  | 5.7% | 31.4% |
| <b>Qualification Status</b> | Non-Trained Teachers           | 2 | 8  |  | 5.7% | 22.9% |
|                             | Trained Teachers               | 1 | 24 |  | 2.9% | 68.6% |

From Table 1: The data shows a slightly higher percentage of female students (54.3%) compared to male students (45.7%). Most teachers (48.6%) fall in the (20-30) age group, indicating a relatively young teaching workforce. The distribution of educational qualifications among teachers is notable. A higher percentage (57.2%) of teachers teaching in public senior secondary schools hold low educational qualifications; Higher Teachers' Certificate (HTC) and Advanced Diploma (AD). A higher percentage (37.1%) of teachers have low experience in teaching with less than five years of teaching experience. The presence of non-trained teachers (28.6%) may raise questions about the adequacy of teacher training programs and the need for professional development opportunities. Policymakers may need to focus on improving teacher training and certification processes to enhance the overall quality of education.

### Empirical Results

**Table 2:-** Independent t-tests of Teachers' Qualification Level on Students' Academic Performance

| Variables       | N    | Mean  | Std. D | t      | Sig   |
|-----------------|------|-------|--------|--------|-------|
| <b>B.Ed./BA</b> | 1500 | 31.84 | 5.882  | 2.3787 | 0.017 |
| <b>HTC/AD</b>   | 410  | 31.11 | 3.674  |        |       |

*Bachelor of Education (B.Ed.), Bachelor of Arts (BA), Higher Teachers' Certificate (HTC), Advanced Diploma (AD). Significant at  $p=0.05$*

H01: There is no significant difference in the academic performance of senior secondary school mathematics students based on their teachers' qualification levels.

From Table 1, Based on the mean scores, students taught by teachers with a B.Ed./BA qualification have a mean score of 31.84, which appears to perform slightly better on average than those taught by teachers with an HTC/AD qualification with a mean score of 31.11. The p-value of 0.017 indicates a statistically significant difference in academic performance between the two groups of students: those taught by B. Ed/BA and those taught by HTC/AD. This significance level of 0.017 is below the commonly used threshold of 0.05, suggesting that the observed difference is unlikely to be solely attributed to random chance. Consequently, I reject the null hypothesis.

**Table 3:-** Independent t-tests of Teachers' Experience on Students' Academic Performance

| Variables                         | N    | Mean  | Std. D | t      | Sig.  |
|-----------------------------------|------|-------|--------|--------|-------|
| <b>Highly Experience Teachers</b> | 1600 | 31.90 | 5.863  | -3.982 | 0.000 |
| <b>Low Experience Teachers</b>    | 310  | 30.55 | 2.611  |        |       |

*Significant at  $p=0.05$*

H02: There is no significant difference in the academic performance of senior secondary school mathematics students when comparing highly experienced teachers to low-experienced teachers.

In Table 3, Students taught by highly experienced teachers have a mean score of 31.90, outperforming those taught by low-experienced teachers, with a mean score of 30.55. The p-value of 0.000 indicates a statistically significant difference in academic performance between the two groups of students: those taught by highly experienced and low-experienced teachers. The significance level of 0.000 is less than the commonly used threshold of 0.05, suggesting that the observed difference is unlikely to be solely attributed to random chance. Consequently, I reject the null hypothesis.

### Discussion:-

The analysis indicated a statistically significant difference ( $p = 0.017$ ) in the academic performance of senior secondary school mathematics students based on their teachers' qualifications. Students taught by teachers with Bachelor of Education (B.Ed.) and Bachelor of Arts (BA) degrees performed significantly better (Mean = 31.84) compared to those taught by teachers with Advanced Diploma (AD) and Higher Teachers' Certificate (HTC)

qualifications (Mean = 31.11). This finding suggests that higher educational qualifications among teachers positively impact student achievement in mathematics. This result is in line with existing literature (Morton et al., 2008; Sa'ad et al., 2014; Ambussaidi & Yang, 2019; Kingsley, 2020; Chand et al., 2021; Mabena et al., 2021; Claire, 2021). The study's empirical results also found a highly significant relationship ( $p = 0.000$ ) between teachers' years of teaching experience and students' academic performance. Highly experienced teachers significantly produced better academic performance among students (Mean = 31.90) compared to low-experience teachers (Mean = 30.55). This finding reveals the importance of teacher experience in students' educational achievements. This result is in line with existing literature (Akiba et al., 2007; Akpo, 2012; Bwenvu et al., 2020; Dial, 2000; Ewetan et al., 2015; Gichuru, 2016; Rivkin et al., 2005).

The findings from this study provide compelling evidence that teachers' qualifications and years of teaching experience are strong predictors of student's academic performance in senior secondary school mathematics. Specifically, students taught by teachers with higher qualifications (B.Ed./BA) outperformed those taught by teachers with lower qualifications (AD/HTC). Additionally, students benefited when taught by highly experienced teachers, as indicated by the substantial difference in mean scores.

### **Conclusion:-**

Based on the research findings, this study provides empirical evidence supporting the notion that both teacher qualifications and years of teaching experience significantly influence students' academic performance in mathematics. This underscores the importance of focusing on teachers' qualifications and providing continuous professional development opportunities to ensure that teachers remain current with the best practices in mathematics education to enhance the quality of education and promote student success in mathematics.

### **Recommendations: -**

1. There should be implementation of robust teacher development initiatives and comprehensive teacher training programs that equip teachers with essential pedagogical skills and subject knowledge, particularly in mathematics.
2. The Ministry of Basic and Secondary Education should encourage and support secondary school teachers to pursue higher education degrees, such as a Bachelor of Education (B.Ed.), specializing in mathematics.
3. The Ministry of Basic and Secondary Education should consider alternative pathways for teachers lacking professional training, to acquire formal teaching qualifications, such as organizing part-time or distance education programs.

### **Limitation and Future Research Direction**

1. The study's data is based on 2022 WASSCE exam data, and educational contexts can change over time. Therefore, the findings may not necessarily reflect the current state of education in the region or country. Future research can compare the findings from the 2022 WASSCE data with data from other years to identify trends or changes in educational outcomes. This comparative analysis can shed light on how education has evolved over time and whether teacher qualifications and experience continue to be significant factors.
2. The study focuses on cross-sectional data, which may not capture changes in teacher effectiveness or student performance over time. Future research can conduct longitudinal studies that track educational outcomes over several years or decades. This would help in understanding how teacher qualifications and experience impact student performance over time, considering potential changes in educational policies and practices.
3. The study primarily focuses on teacher qualifications and experience as factors influencing academic performance. It did not consider other contextual factors such as socioeconomic status, parental involvement, school resources, or curriculum quality, which can also be crucial in student achievement. Future research can expand the research scope to include a broader range of contextual factors influencing academic performance.

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