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EFFECT OF TEACHER'S QUALIFICATION ATTRIBUTES ON STUDENT PERFORMANCE IN MATHEMATICS IN SECONDARY SCHOOLS IN RWANDA: A CASE OF RUHANGO DISTRICT

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ABSTRACT

The study aimed to investigate the effect of teacher qualification attributes on students' performance in mathematics in day secondary schools in Ruhango District. It identified these qualifications, analyzed their influence on academic performance, and assessed their overall impact. The study encompassed 150 mathematics teachers, with 76 respondents sampled, alongside 169 teachers (84 respondents), 180 students (90 respondents), and 54 headteachers (27 respondents). Data triangulation employed questionnaires, interviews, and observations, utilizing purposive, stratified, and simple random sampling methods. Quantitative and qualitative methodologies were employed, employing content analysis for qualitative data and IBM SPSS Version 21.0 for descriptive (frequency, percentage, mean, standard deviation) and inferential (correlational, regression) statistical analyses. Findings highlighted that a significant majority of teachers valued educational qualifications (77.0%), communication skills (81.4%), and teaching competence (81.6%) in mathematics instruction. Positive recognition was also given to results from national exams (90.7%), improved exam scores (76.8%), and student achievement (81.4%). Correlation analysis revealed a positive link between teacher attributes (communication skills, teaching methodologies, subject mastery, and homework completion) and enhanced mathematics exam results, class participation, and mathematical proficiency in Ruhango District's day secondary schools. Recommendations include enhancing teacher training, providing sufficient learning materials, and fostering continuous professional development and administrative support to improve teaching quality and student outcomes.

Keywords: ***Teacher's Qualification, Student Performance, Mathematics, Rwanda***

1.0 Introduction

Teachers' qualifications significantly impact secondary school students' academic performance. The educational credentials of teachers enhance their content mastery, thereby improving student grades through effective teaching. Additionally, the experience of teachers plays a crucial role in

advancing the education system. Furthermore, teachers' content mastery fosters active learning, resulting in improved student performance on assignments.

Globally, as Elsbree (2015) notes, teacher qualifications in the United States reflect a commitment to providing high-quality education tailored to children and youths' needs. Teaching certification in the U.S. ensures that secondary school instructors are competent, thereby enhancing student achievement(Assem et al., 2023). Gold Haber and Brewer (2017) emphasize that skilled instructors are pivotal in improving student success, underscoring the specialized skills and qualifications required in the teaching profession. Conversely, Walsh (2011) highlights that acquiring credentials and degrees can be a barrier to entry into teaching. Nonetheless, as Holt and Seastrom (2015) argue, ongoing training helps teachers enhance their qualifications.

In Sub-Saharan Africa, including countries like Rwanda, teacher certification is pivotal for enhancing teachers' competencies, enabling them to actively contribute to educational decision-making and thereby improve academic outcomes and professional development (Tylor & Robinson, 2019). Simultaneously, mathematics plays a crucial role across diverse sectors such as social sciences, natural sciences, engineering, and medicine, underpinning research, business, and technological innovation (Iji, 2017). Acknowledging its fundamental importance, the Federal Government of Nigeria has mandated mathematics as a core subject in both junior and senior secondary school curricula (FGN, 2014).

Nurudeen (2017) asserts that mathematics enhances cognitive abilities such as creativity, reasoning, and problem-solving. Despite its significance, effective teaching remains a challenge at the secondary level, with issues like poor educational methods hindering student progress (Kalijah, 2012; Agommuoh & Nzewi, 2013). Inadequate resources, including a shortage of trained mathematics educators and laboratory equipment, further complicate mathematics education (Ogunleye, 2016).

In Kenya, teacher qualifications significantly influence school outcomes (Adeyemi, 2010). However, Lydia and Migosi (2015) highlight challenges in integrating information and communication technology (ICT) into teaching due to teachers' insufficient computer literacy. Moreover, teaching experience correlates with student performance, especially in regions with lower completion rates and poor academic scores.

In Rwanda, recent educational policy revisions aim to enhance teacher enthusiasm and improve performance through effective teaching strategies, emphasizing the importance of teacher qualifications (ESSP, 2012). Despite these efforts, Rwanda faces challenges in recruiting competent teachers for day secondary schools, crucial for improving educational outcomes. Rwanda's Vision 2050 aims to transition the country to a knowledge-based economy, with mathematics playing a pivotal role in achieving this goal.

This study delves into the intricate relationship between teacher qualification attributes and their impact on students' mathematics performance within day secondary schools located in Ruhango District. By examining various aspects of teacher qualifications such as educational background, experience, and professional development, the research aims to uncover how these factors contribute to the academic achievement of students in mathematics. The study considers the context-specific challenges and opportunities within Ruhango District, offering insights into how enhancing teacher qualifications can potentially improve educational outcomes in mathematics, thereby contributing to broader educational reforms and advancements in the region.

2.0 Materials and Methods

Research design

According to McCombes (2019), a research design, also known as a research strategy, is a method for addressing a set of questions. It is a framework that includes methods and procedures for data gathering, analysis, and interpretation. Descriptive research is defined as a deliberate process of gathering, analysing, categorising, and tabulating data about current conditions, practices, processes, trends, and cause-and-effect relationships, followed by adequate and accurate interpretations of such data using or without, or sometimes with minimal, statistical methods. Furthermore, this technique determines the current state of facts in a group under investigation and provides either qualitative or quantitative, or both, descriptions of the group's overall features as findings (Roberston, 2018). Therefore, this study used a descriptive survey research design that combined quantitative and qualitative methods. A survey was employed in addition to the quantitative approach, with questionnaires distributed to sampled students throughout the research and to teachers.

Study population

A research population is a large group of people or things that are the subject of a scientific inquiry. Research is carried out for the benefit of the general public (Hassan, 2019). The population in this study will consist of one hundred and fifty mathematics teachers with a sample size of seventy-six respondents, 169 mathematics teachers, whose sample size is 84 respondents, 180 students with a sample size of 90 respondents, and 54 headteachers with a sample size of 27 respondents. Through this, the total population will be 403 respondents, with a total sample of 201 respondents from twenty two-day secondary schools in four Ruhango District sectors, such as Ruhango, Mwendo, Kinihira, and Ntongwe. The extremes of performance were considered the targeted students in order to get a target group of students that are only linked with mathematics performance as the major emphasis of this study.

Sample design

This study employed both simple random sampling and purposive sampling techniques to select participants. Simple random sampling ensured a representative subset of the population by randomly selecting students. In contrast, purposive sampling involved selecting mathematics

teachers and head teachers based on their expertise and knowledge, aiming to yield valuable insights. These methods facilitate the generalization of findings to the entire targeted group (Cochran, 2014; Kumar, 2013).

Data Collection Methods

In this study, data collection followed systematic procedures to gather measurements and observations, offering firsthand insights into challenges across corporate, governmental, and academic sectors. Key methods included tailored questionnaires administered to students, teachers, and parents in written or oral formats based on logistical needs (Barnsbee, 2018). Interviews with head teachers, noted for their need for skill and sensitivity (Michael, 1987), ensured consistent data collection aligned with study objectives.

Documentation, as emphasized by Paige (2012) and Robert (2014), encompassed a thorough review of published materials, enriching the study with secondary data for comparative analysis. Ethical considerations were paramount, with necessary permissions and consent obtained prior to a month-long data collection period from diverse participants, ensuring methodological rigor (Aslam, 2017).

Data Analysis Procedure

Questionnaires were checked for completeness and accuracy before being used for data analysis. The researcher organised the concepts into topics. The raw data was scrutinised for mistakes, omissions, contradictory information, and extraneous information. Statistics were employed, and the findings were displayed in graphs, figures, and tables. To that end, the raw data obtained was assigned numerical codes to make analysis easier. Following coding, the researcher summarises, classifies, and tabulates the data. The number of respondents who had similar replies was determined using frequency distribution tables. All of this was made feasible using the Statistical Package for Social Sciences (SPSS) software, which assisted in generating descriptive statistics for research variables and inferential statistics to produce the Pearson correlation coefficient to find out the association between independent and dependent variables.

Ethical Considerations

Ethical considerations played a crucial role in this research. The researcher ensured a smooth data collection process by adhering to ethical guidelines. This included obtaining permissions from the mayor of Ruhango district, the headteacher of the school, and the consent of respondents. Authorization letters were obtained from school management to allow staff participation. Ethical procedures safeguarded participants' rights, emphasizing voluntary participation and the right to withdraw without coercion. Confidentiality and anonymity were maintained throughout, reassuring participants through a cover letter that their responses would be treated with utmost privacy.

3.0 Results and Discussions

This section presents findings organized into three subsections aligned with the research objectives: identifying the influence of teachers' academic qualifications on students' math performance, analyzing their specific impacts, and assessing their overall effect. Kamayubonye's (2023) study employed a mixed research approach, involving 196 participants including students, instructors, and principals. The results underscored that teacher attributes such as monitoring, communication skills, subject knowledge, collaboration, and feedback exerted significant influence on student achievement in mathematics.

Identify the teachers' academic qualifications Attributes that effect the students' academic performance in Mathematics in day secondary schools in Ruhango District

The study aimed to identify how teachers' academic qualifications influence students' academic performance in Mathematics at day secondary schools in Ruhango District. To achieve this objective, respondents were asked to express their views by completing a questionnaire. Responses were rated on a scale from SD (strongly disagree), D (disagree), Not sure, A (agree), to SA (strongly agree), with corresponding values of 1, 2, 3, 4, and 5, respectively.

Table 1: Teachers perception on the teachers' academic qualifications Attributes that effect the students' academic performance in Mathematics in day secondary schools in Ruhango District

Statements	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		Mean	Std
	N	%	N	%	N	%	N	%	N	%		
Highest level of education indicates the teacher's qualification in mathematics subject	26	60.5	7	16.3	3	7.0	5	11.6	2	4.7	1.837	1.25
Communication skills indicate the teacher's qualification in mathematics subject	25	58.1	10	23.3	4	9.3	2	4.7	2	4.7	1.627	0.7
Having high level of competency in teaching indicate the teacher's qualification in mathematics subject	28	65.1	7	16.3	2	4.7	2	4.7	4	9.3	2.06	1.3

Results from national mathematics exams provide information on pupils' academic achievement subject	31	72.1	8	18.6	2	4.7	1	2.3	1	2.3	1.4	.8

Source: Primary Data (2024)

The findings from Table 1 highlight responses regarding the impact of teachers' academic qualifications on students' mathematics performance in day secondary schools within Ruhango District. A majority of respondents—60.5% strongly agreed and 16.5% agreed—that the highest level of education attained by teachers reflects their qualifications in mathematics, with a mean of 1.25 and a standard deviation of 1.837. Additionally, 58.1% strongly agreed and 23.3% agreed that effective communication skills are indicative of a teacher's qualifications in mathematics, with a mean of 2.06 and a standard deviation of 1.3. Moreover, 65.3% of respondents strongly agreed and 16.3% agreed that possessing a high level of competency in teaching signifies a teacher's qualifications in mathematics, with a mean of 1.3 and a standard deviation of 0.7. Furthermore, 72.1% of respondents strongly agreed and 18.6% agreed that results from national mathematics exams accurately reflect students' academic achievements, with a mean of 1.4 and a standard deviation of 0.8. A growing body of research, as noted by Stronge (2022), underscores the critical role of teacher quality in enhancing student achievement, emphasizing the importance of both teaching practice and teacher preparation and certification. In our study, we focus specifically on teacher qualifications as a key aspect of teacher quality to facilitate a clearer discussion. The data unequivocally indicate that teacher qualifications significantly influence student achievement in mathematics. Recognizing the paramount importance of having well-qualified teachers for improving student outcomes, various educational policies, such as those proposed by the Bush Administration, have sought to define what constitutes a "highly qualified" teacher. This study contributes to this discourse by exploring how specific attributes of teacher qualifications impact students' academic performance in mathematics within the unique context of Ruhango District.

Table 2 : The students perception on identify the teachers' academic qualifications Attributes that effect the students' academic performance in Mathematics in day secondary schools in Ruhango District

Statements	**Strongly Agree**		**Agree**		**Neutral**		**Disagree**		**Strongly Disagree**		**Mean**	**Std**
	N	%	N	%	N	%	N	%	N	%		

The highest level of schooling denotes the teacher's qualification in mathematics.	183	71.3	51	19.9	15	5.8	6	2.3	1	0.6	1.4	0.7
Communication abilities demonstrate a teacher's qualification in mathematics.	185	72.5	60	23.2	5	1.8	5	1.8	1	0.6	1.3	0.7
A high degree of teaching competency indicates the teacher's qualification in mathematics.	181	70.8	52	20.5	16	6.4	5	1.8	1	0.6	1.4	0.7
A high degree of topic understanding indicates that the teachers is qualified in mathematics.	174	68.4	49	19.3	25	9.9	5	1.8	1	0.6	1.4	0.7

Source: Primary Data (2024)

The findings from Table 2 reveal insights into how teachers' academic qualifications influence students' mathematics performance in day secondary schools in Ruhango District. A significant majority of students 71.3% strongly agreed and 19.9% agreed that the highest level of schooling attained by teachers indicates their qualifications in mathematics, with a mean score of 1.3 and a standard deviation of 0.7. Similarly, 72.5% of respondents strongly agreed and 23.3% agreed that effective communication abilities demonstrate a teacher's qualification in mathematics, with a mean score of 1.4 and a standard deviation of 0.7. Moreover, 70.8% of respondents strongly agreed and 20.5% agreed that a high degree of teaching competency signifies a teacher's qualification in mathematics, also with a mean score of 1.3 and a standard deviation of 0.7. Additionally, 68.4% of respondents agreed that a high level of subject matter expertise indicates the teacher's qualification in mathematics, with a mean score of 1.4 and a standard deviation of 0.7.

Rice (2023) underscores the pivotal role of teacher quality in influencing student progress, emphasizing that effective instructors often described as "good" or "successful" teachers adhere to professional standards and exhibit qualities that enhance student learning (Fenstermacher & Richardson, 2015; Berliner, 2015). Discussions on teacher quality typically encompass aspects such as teaching methods, teacher training, and credentials (Lewis et al., 2019).

Teacher qualifications encompass a spectrum of factors including postsecondary education, certification, professional experience, subject expertise, ongoing professional development, and demographic characteristics. These elements collectively shape teachers' readiness and

qualifications as educators. This study contributes valuable insights into how specific attributes of teacher qualifications impact students' academic performance in mathematics within the unique educational context of Ruhango District. By focusing on these attributes, the research provides evidence that can inform policies aimed at enhancing teaching quality and improving educational outcomes in mathematics.

The level of students' performance in mathematics that is due to the academic qualification attributes in day secondary schools in Ruhango

The study examined the impact of teachers' academic qualifications on students' mathematics performance in day secondary schools in Ruhango District. To achieve this, the researcher utilized questionnaires to gather opinions from respondents and analyzed secondary school documents from Ruhango District. Respondents rated their opinions using a scale ranging from strongly disagree (1) to strongly agree (5).

Table 3: The teachers perception on the performance of students in mathematics subject in day secondary schools in Ruhango District

Statements	Storngly Agree		Agree		Neutral		Disagree		Strongly Disagree		Mean	Std
	N	%	N	%	N	%	N	%	N	%		
Results from national mathematics exams provide information on pupils' academic achievement	31	72.1	8.0	18.6	2	4.7	1	2.3	1	2.3	1.74	1.1
Student test and The student's ability to answer mathematical problems is a sign of their academic success	26	60.5	7	16.3	3	7.0	5	11.6	2	4.7	1.8	1.25
Student achievement in math class is indicated by how they answer algebraic problems	28	65.1	7	16.3	2	4.7	2	4.7	4	9.3	1.7	1.30

High test scores kids receive from teachers reflect students' academic performance	31	72.1	8	18.6	2	4.3	1	2.3	2.3	9.3	1.4419	.88

Source: Primary Data (2024)

Through the questionnaire, **The level of students' performance in mathematics that is due to the academic qualification attributes in day secondary schools in Ruhango District** , The results are presented in the Table 3 which indicates that 72.1% of respondents strongly agreed and 18.6% agreed that Results from national mathematics exams provide information on pupils' academic achievement subject with the mean of 1.71 and the standard deviation of 1.1, 60.5% of respondents strongly agreed and 16.3% agreed that Improved National examination result of mathematics is the factors that can use to analyses the performance of students in Mathematic subject with the mean of 1.8 and the standard deviation of 1.25, 65.1% respondents agreed and 16.3% agreed that Student achievement in math class is indicated by how they answer algebraic problems with the mean of 1.7 and the standard deviation of 1.3, 72.4% respondents strongly agreed and 18.6% agreed that High test scores kids receive from teachers reflect students' academic performance with the mean of 1.7 and the standard deviation of 1.2. Research conducted in the Asunafo North Municipality by Kamayubonye (2023) looked at how teacher credentials affected how well pupils performed in math classes. Sixteen final-year mathematics professors and sixty WASSCE applicants participated in the study. IBM SPSS version 23 was used for data analysis once information was gathered through questionnaires and interviews. The findings demonstrated that highly qualified instructors outperformed less qualified teachers, suggesting that teacher qualification has a big impact on how well pupils do academically. The report advises Ghana's education stakeholders to hire only certified instructors.

Table 4: The teachers perception on the performance of students in mathematics subject in day secondary schools in Ruhango District

Statement	**Strongly agree**		**Agree**		**Not Sure**		**Dis Agree**		**Strongly Dis Agree**			
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**Mean**	**Sdv**
Results from national mathematics exams provide information on pupils' academic achievement.	128	59.5	37	17.2	15	7.0	25	11.6	10	4.7	1.8	1.2
The student's ability to answer mathematical problems is a sign of their academic success	123	57.2	52	24.2	20	9.3	10	4.7	10	4.7	1.75	1.1

Student achievement in math class is indicated by how they answer algebraic problems	139	64.7	36	16.7	10	4.7	20	9.3	1.77	1.2
High test scores kids receive from teachers reflect students' academic performance	154	71.6	40	18.6	11	5.1	5	2.3	5	5.3	1.4 .87
Results from national mathematics exams provide information on pupils' academic achievement	146	67.9	25	11.6	20	9.3	5	2.3	16	8.8	1.72 1.26

Source: Primary Data (2024)

Results showed indicated Results from national mathematics exams provide information on pupils' academic achievement, 59.5% were strongly agreed, and 17.2% were agreed. The student's ability to answer mathematical problems is a sign of their academic success, 57.2% are strongly agreed while 24.2% agree. Student achievement in math class is indicated by how they answer algebraic problems 59.5% were strongly agreed. 71.6% were strongly agreed High test scores kids receive from teachers reflect students' academic performance, 18.6% of the participants agreed. Results from national mathematics exams provide information on pupils' academic achievement, 67.9% show a strong agreement while 11.6% are agreed. Justice and Daniel (2015) found that secondary school learners' performance in Mathematics is influenced by various factors, including teacher quality and experience, teaching resources, financial support, and student attitudes towards the subject and teaching methods. Mathematics is widely applicable in everyday life (Darling-Hammond, 2013). Teachers' qualities include providing feedback, encouraging students to learn and perform, being energetic, monitoring classes, being caring and respectful, and communicating effectively with students to explain subject matter.

The effect of teachers' academic qualifications attributes on the performance of students in mathematics in secondary schools in Ruhango District

The study examined how teachers' academic qualifications influence students' math performance in Ruhango District secondary schools. It found that teachers' educational backgrounds, including their levels of education and specialized math training, significantly impact academic outcomes. This research offers insights for improving educational policies and practices to enhance teaching quality and student achievement in mathematics at the secondary school level in Ruhango District.

Table 5: The correlation between academic qualifications Attributes on the performance of students in mathematics

		Communication skills	Have various Teaching methodologies	Having a high level of subject mastery	Students use Properly mathematical operations	Improved National examination result of mathematics	Improved class participation during Mathematics lessons
Communication skills	Pearson Correlation	1					
	Sig.(2-tailed)						
	N	215					
Have various Teaching methodologies	Pearson Correlation	.085	1				
	Sig.(2-tailed)	.214					
	N	215	215				
Having a high level of subject mastery	Pearson Correlation	.001	.072	1			
	Sig. (2-tailed)	.000	.000				
	N	215	215	215			
Students use Properly	Pearson Correlati	.451**	.250**	-.053	1		

mathematical operations	on						
	Sig.(2-tailed)	.000	.000	.000			
	N	215	215	215	215		
Improved National examination result of mathematics	Pearson Correlation	.305**	-.029	.113	.209**	1	
	Sig.(2-tailed)	.000	.000	.000	.002		
	N	215	215	215	215	215	
Improved class participation during Mathematics lessons	Pearson Correlation	-.033	-.093	.149*	.042	.304**	1
	Sig. (2-tailed)	.000	.000	.029	.541	.000	
	N	215	215	215	215	215	215

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Primary Data (2024)

The study revealed significant correlations: Communication skills positively correlated with Students' Proper Use of Mathematical Operations (r = .451**), Improved National Examination Results in Mathematics (r = .305**), and showed a slight negative correlation with Improved Class Participation (r = -.033**). This suggests that improving communication skills can enhance mathematical performance and exam results. Various Teaching Methodologies also correlated positively with Students' Proper Use of Mathematical Operations (r = .250**) and Improved National Examination Results (r = .029*). Having a High Level of Subject Mastery correlated positively with Improved National Examination Results (r = 0.113) and Improved Class Participation (r = .149*), but negatively with Students' Proper Use of Mathematical Operations (r = -.053).

Ahmad (2012) identified factors crucial to student academic achievement in Gicumbi schools, including professional development and parental support. Zagyváné (2017) emphasized that

teacher attributes like credentials and experience significantly impact educational quality. The Rwanda Basic Education system, per MINEDUC (2012), aims to combat illiteracy through education and technology. Barber (2017) stressed the pivotal role of teachers in student learning success, highlighting the importance of teacher quality.

4.0 Conclusion

The study findings highlight several key conclusions regarding factors influencing students' performance in Mathematics at day secondary schools in Ruhango District. Firstly, Communication skills, various Teaching methodologies, high subject mastery, highest level of education, and understanding of the education curriculum significantly impact student performance. Secondly, students' performance in Mathematics is influenced by their ability to use mathematical operations effectively, improved national examination results, problem-solving skills in mathematics, and enhanced class participation during lessons. Lastly, the study establishes a positive and significant relationship between teachers' academic qualifications (attributes like communication skills, teaching methodologies, subject mastery, and completion of homework) and students' performance in Mathematics. The correlation matrix indicates these variables are statistically significant ($p < 0.05$), underscoring their importance in educational outcomes within the district's secondary schools.

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Conflict of interest statement

The author declares no conflicts of interest.

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