

Investigating the Effects of Teachers' Quality on Students' performance in Mathematics in Kamonyi District, Rwanda.

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Abstract

Teacher quality has been identified as the basic factor for student performance during the learning process. For this research, a case study was conducted in three selected 12YBE schools of the Kamonyi District to investigate the effects of the teacher quality on learners' performance in Mathematics. This study involved a mixed research design where both qualitative and quantitative data were collected within a sample of 196 students, 5 teachers, and 3 head teachers from three different schools with Mathematics combinations. The quantitative data were collected using questionnaires while qualitative data were collected using semi-structured interviews. Quantitative data were analyzed using SPSS while interviews were analyzed thematically. The findings revealed that some aspects of teacher quality in Mathematics, such as monitoring, communication skills, teacher knowledge, teamwork, and providing constructive feedback, affected students' success in Mathematics. In this regard, the Rwanda Basic Education Board should organize training related to improving these aspects of teacher quality for increasing students' performance in Mathematics.

Keywords: Mathematics, monitoring and Feedback, Students performance, Teachers' quality.

Introduction

A range of literature attests to the importance of quality education during the educational process. Quality education has been found to be associated with teacher quality and the learning environment (Benegusenga, Ntawiha, & Nzabairwa, 2017). The quality of education is reflected through academic achievement which is a function of teacher quality. According to Zagyvane (2017), it has been identified that the attribution of teacher qualities such as teacher qualifications, teacher certification, teacher education, teacher experience, and teacher evaluation scores play a great role in improving the quality of education. While the objectives of the Rwanda Basic Education system are to fight against illiteracy, and to promote development of the Rwandan population through the education system as well as through empowering students in technology (MINEDUC, 2012), research conducted by Barber (2007) has suggested that the teacher is the most critical factor enabling the student to learn effectively at school. In this regard, a teachers' quality must be valued.

Based on a survey related to the factors that influence pupils' learning results, Hattie (2009) suggested that teacher quality had a greater impact on students' learning than teaching methods, curriculum quality, the school environment as well as the parents' role. The European Council and the European Commission have put out guiding principle documents concerning recommendations for quality improvement of teachers and teacher education by stimulating governments to finance the enhancement of teacher quality (European Commission, 2005). For instance,

the method of teaching used by teachers like transmission of knowledge and a focus on textbooks which prevent learner participation in classroom activities and express their ideas can influence the negative attitude of learners towards Mathematics. Additionally, it has been found that Feedback plays a primary role in student motivation and behavior in classrooms by providing students with opportunities to learn and encouraging them to achieve their goals (Bangert-Drowns, R. L., Kulik, C. C., Kulik, J. A., & Morgan, 1991). With this motivational aspect, students may succeed based on the feedbacks obtained.

According to Justice and Daniel (2015), the performance of secondary school learners in Mathematics depends on many factors such as quality and experience of the teacher, availability of teaching resources, adequate financial support, and attitudes of students towards mathematics and the teaching method. Based on the nature of Mathematics, this subject is often applied in everyday human life (Darling-Hammond, 2000). Some of the qualities of teachers include the way through which they provide feedbacks to their students, how best teachers encourage students to learn and perform, how best are energetic to teach and help students, the process of class monitoring, caring respectful and the mode of communication between teachers with students while teachers explaining the subject matter content. In the eyes of society, Mathematics is viewed as the basis of scientific-technological knowledge that is essential in the socio-economic development of Rwanda. That is why Eraikhuemen (2003) suggested that a controlled and systematic arrangement of life can only be accomplished via the principles of Mathematics. However, without a well-educated, strongly motivated, skilled and well-supported teacher, great performance in Mathematics cannot be attained in secondary school.

Within this context, this study was planned to investigate the effects of teacher quality on student's performance in Mathematics subjects in Rwandan secondary schools. Among these qualities of teachers to be investigated include, the provision of feedback, monitoring of students learning, and teachers' communication strategies. It was planned based on limited research related to the relationship between the quality of teachers and students' performance within Rwandan context.

Literature review

According to Njeru & Orodho (2003) it is argued that, the experiences of teachers and qualification in education had a significant influence on students' academic performances. By definition, feedback in the context of education is advice prepared by a teacher to students for reducing the gap between the accomplishment and needed objectives to achieve (Benegusenga et al., 2017). Students need feedback from the evaluations performed as a component of their claim for quality education. Currently, it has been explained that feedback from teachers is the process where learners can improve or fail. Moreover, teachers are mostly more powerful in discovering the weakness of learners during their teaching and learning activities (Mamoon-Al-Bashir, 2016). In classroom activities, the teacher can

provide different kinds of feedback like general feedback to the whole classroom for time management and personal feedback for individual students. Feedback systems aid in realizing goals of learning. It is a part of their lives that gives freedom concerning to centred official programs to be taught. Feedback coming from the teachers have the essential role of helping students to reflect on own capability and encouraging them to practice on known deficiencies (Mamoon-Al-Bashir, 2016). This kind of feedback is a necessary element during evaluation given throughout teaching. It plays the role in informing teachers if what they are working on is concerning to classroom learning objectives. The feedback is vitally important when it is used effectively. It gives students information about previous work and what to do in the next activity.

In addition to feedback, communication and collaboration has been found to be an important quality of teachers. According to Khan, Zia-ul-islam, Khan, & Education (2017) communication skills are defined as the transmission of message that involves the shared understanding between the contexts in which the communication takes place. Communication skills involve listening and speaking as well as reading and writing. A study conducted by Ehindero-&-Ajibade (2000) indicated that for effective teaching to take place, the teacher needs to have good communication skills, good classroom management, updated knowledge and personality. A teacher with good communication skills always makes things easier and understandable. Effective communication skills are really important for a teacher in transmission of education, classroom management and interaction with students in the class. To teach in accordance with the ability and capability of students, a teacher needs to adopt such skills of communication which motivate the students toward their learning process (Semir, 2018). Therefore, good communication skills of teachers are a basic requirement for bringing about academics' success of students, and professional success of life.

Teachers with poor communication skills may cause failure of students to learn and prevent the promotion of their schooling. Students need to understand what is right, and what is wrong and this totally depends upon the communication skills of teachers within in classroom (Sherwyn, Michael, Osborn & Pearson, 2000). Good communication minimizes the potential of unkind feeling during the process of teaching. For learning, the student must be attentive toward their teacher during the lecture. Communication is an active process which needs concentration and courage to face the other and convey his/her message in an effective way.

Recently, it was claimed that the students show low performance due to the reduced quality of education. This situation may be associated with different factors associated with teacher quality. It is against this background that this study was planned to investigate the effects of teacher quality on students' performance from three secondary schools of Kamonyi District. To achieve this objective, the following research questions guided the study:

1) What are the qualities of Mathematics teachers in selected schools of Kamonyi District?

- 2) What is the performance level of students in mathematics from the selected schools of Kamonyi District?
- 3). What is the relationship between teachers' qualities and student performance in Mathematics from selected schools of Kamonyi District?

Research Methodology

This study adopted a mixed research method where by both qualitative and quantitative data were collected. The researcher used Likert scale questionnaires for collecting quantitative data related to students' and teachers' perceptions about qualities of their teachers. On the other side, it used interviews for collecting qualitative data related to the perception of mathematics teachers and head teachers on the impact of teachers' qualities on the students' performance. Finally, the evaluation of students' performance was carried out to assess if the teachers' qualities increased their performance.

Population

The concerned research participants were 384 students from three 12 years' basic education schools from KAMONYI District with Mathematics combination and all mathematics teachers and head teachers from the selected schools. These three schools were purposively selected based on their accessibility and the limited time for the researcher. These 384 students were selected from 3 public schools from rural area of Kamonyi District.

Sample and sampling methods

From the above population, a sample of 196 students from upper secondary (in combination with mathematics) was randomly selected based on Yamane formula $n = \frac{N}{1+N(e)^2}$ to participate in the research. (**n=the sample size,**

N=the total population size, e=Level of precision (confidence level)). Therefore, the sample size is calculated as

$n = \frac{384}{1 + 384(0.05)^2} = 196$ students. In addition, 5 mathematics teachers and 3 head teachers were purposively

selected from the three schools under which the research were conducted. The method of students sampling was probability sampling where every student from the population being studied has an equal chance of being selected as a sample. Among the selected students (196), 113 were females while 83 were males.

To collect data, a number of tools were used. These included Likert square questionnaires for students in mathematics combinations, interview guides for mathematics teachers and head teachers as well as documentary analysis. These data collection tools were developed by the researcher in relation to the two research questions set. These research questions include; the qualities of Mathematics teachers, the performance of students in mathematics subject and the relationship between teachers' qualities and student performance. The analyzed documents were the list of students' records in national examinations for three years from 2017 to 2019.

Validity and Reliability of data collection tools

For ensuring validity and reliability of data collection tools, each were shared with educational experts including the supervisor of the research so that they provide comments related on how these instruments could be improved. Their comments and advice were used to adjust the questions for making the final data collection tools. In this context, the content validity index was calculated based on the rating from educational experts where it was found to be 0.8 which was good to confirm that data collection tool was reliable.

Data analysis techniques

After entering and coding data in SPSS software (Statistical Package of Social Science), descriptive statistics were computed. The tables of frequencies and percentages were the used to present the findings. In addition, data from interviews were thematically analyzed and the themes were used to support the quantitative research findings. In terms of understanding the relationship between teachers' qualities and students' performance, Spearman coefficient correlation (r) was used. In this context, the value of r ranging from ± 0.01 to ± 0.35 indicates a weak relationship, if it ranges from ± 0.36 to ± 0.65 it shows a moderate relationship while the r ranging from ± 0.66 to ± 0.99 means a strong relationship.

Presentation of research findings

Students' perception on the qualities of mathematics' teachers

The qualities of teachers may be evaluated by students through how teachers behave and help them in the process of learning. In this regard, the findings related with how students perceive mathematics teachers in selected schools are presented in the table below.

Perception of students on the qualities of mathematics teacher

Statement	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
	no	%	No	%	No	%	no	%	no	%
Communication with mathematics teacher is effective	6	3.1	5	2.6	8	4.1	86	43.9	91	46.4
Our teacher master mathematics content	5	2.6	2	1.0	8	4.1	73	37.2	108	55.1
Our mathematics teacher is good in classroom management	5	2.5	3	1.5	14	7.1	49	25.0	125	63.8
Mathematics teacher is good in students activities monitoring	5	2.6	8	4.1	2	1.0	73	37.2	108	55.1

The feedback from our mathematics teacher is effective and constructive	3	1.5	2	1.0	3	1.5	66	33.7	122	62.2
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Source: Primary data, 2021

Based on the findings in the table above, it is shown that majority of respondents agreed that communication with mathematics teacher was effective, their teacher mastered mathematics content and they were also good in classroom management. This has been indicated by the high percentage of agreement that were 90.3% (43.9% agree +46.4 strongly agree), 92.3 % (37.2% agree, 55.1% strongly agree) and 88.8% (25.0 agree,63.8 strongly agree) respectively. Similarly, a high agreement was observed on how mathematics teachers monitor students' activities (92.3 %) and they provide constructive feedback to students for further improvement (95.9%). Generally, the findings showed that students appreciated the qualities of their teachers. This is in line with the narrative from mathematics teachers who stated that, they used different techniques for classroom management, and provide various feedbacks to support students with learning difficulties. In addition, the head teachers during interviews declared that they motivate their teachers to monitors students' activities and progress so that they can detect the weakness of students thus providing the adequate feedback. They are also promoted good communication with their students so that these students could feel free to ask all questions related to the subject content for better improvement.

Level of learners' performance in Mathematics subjects in national examination from 2017-2019

In terms of evaluating the level of performance for students of selected schools, the national examination results from 2017 to 2019 were analyzed, and the findings are presented in the table below:

The performance of learners in national examination from 2017 to 2019

Academic year	Learners who sat for examination (in three selected schools)			Learners who passed		Learners who failed	
	Male	Female	Total	n	%	n	%
2017	265	204	469	204	43.4	265	56.6
2018	233	293	526	234	44.5	292	55.5
2019	258	292	550	260	47.2	290	52.7

Based on the national examination results presented in the table above, it has been shown that the level of performance in Mathematics in selected schools was low in three selected schools. In 2017 national examination, only 43.4% passed Mathematics, in 2018, 44.5% passed while 47.2% passed in 2019. However, a slight increase was observed in performance from 2017 to 2019. The difference in terms of performance may be linked with the

quality of teachers towards helping students for better performance. The relationship between qualities of teachers and students' performance are discussed below.

Relationship between teachers' qualities and students' performance

Teachers, qualities may be one of the factors that influence the students' performance. In this regard, the tables below show the relationship between teachers' qualities examined in the present with students' performance.

Relationship between teachers' feedback and students' performance

SN	Variable	N	M	SD	r	Sign
1	Students perception on teachers' feedback	196	3.6	0.8	0.701**	0.007
2	Students' academic performance	196	4.093	0.93		

** Correlation is significant at the 0.004 level (2-tailed).

Source: Primary data, 2021

The above table above shows the strong relationship between teachers' feedback quality with students' academic performance. Based on this table, the value of coefficient of correlation was found to be 0.701 at the significant level of 0.007 which was greater than 0.65. Therefore, there was a strong relationship between feedback provision with students' performance. This was in line with the findings from both mathematics teachers and head teachers interviews. For example, one mathematics' teacher said: "*we used to provide constructive feedback on students based on their level of understanding. Based on these feedback that we provide, the performance of students has increased*". One of the head teachers further stated that the regular feedback provided to students based on the areas of their weakness may improve their performance.

Relationship between teachers' communication skills and students' performance

SN	Variable	N	M	SD	r	Sign
1	Students' perception on teachers' communication skills	196	4.24	0.78	0.38**	.004
2	Students' academic performance	196	4.093	0.93		

** Correlation is significant at the 0.004 level (2-tailed).

Source: Field data, 2021

The findings of this table showed the correlation coefficient of 0.38 at the significant level of 0.004. This demonstrated a moderate relationship between communication style used by teachers during the teaching and learning process and students' performance as the correlation coefficient was greater than 0.36. This relationship was also stressed by mathematics teachers within their interviews. They stated that "*effective communication*

facilitated in improving students' performance. Through this communication clear information is shared to students for shaping their knowledge hence improved performance”.

Relationship between mathematic teachers' knowledge of mathematics content and students' performance

SN	Variable	N	M	SD	r	Sign
1	Students' perception on teacher knowledge of mathematics content	196	4.21	0.69	0.72**	.001
2	Students' academic performance	196	4.07	0.93		

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

N: Sample size, **M:** Mean, **SD:** Standard Deviation, **r:** correlation coefficient, **Sign:** significant level.

Source: Primary data, 2021

The results in the table above showed a correlation coefficient of 0.72 between mathematic teachers' knowledge of mathematics content with student's performance at significant level of 0.001. This indicated a strong relationship between mathematic teachers' knowledge of mathematics content with students' performance as the value of the correlation coefficient is greater than 0.65. This was also confirmed by the interviews with mathematics teachers who said that if teachers are well equipped with subject content they teach effectively. One of head teacher further said: “ *every one transmit what he/she has, so the strong teachers teach effectively as they have what to teach*”.

Relationship between mathematic teachers' classroom management and students' performance

SN	Variable	N	M	SD	r	Sign
1	Students' perception on teacher' classroom management	196	4.21	0.69	0.82**	.001
2	Students' academic performance	196	4.07	0.93		

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

N: Sample size, **M:** Mean, **SD:** Standard Deviation, **r:** correlation coefficient, **Sign:** significant level.

Source: Primary data, 2021

The results in the table above showed a correlation coefficient of 0.82 between mathematic teachers' classroom management with student's performance at a significant level of 0.001. This indicated a strong relationship between mathematic teachers' classroom management with students' performance as the value of correlation coefficient is greater than 0.65. This finding was also confirmed within interviews with mathematics teachers who said that if students are well managed they could perform well. They said “ *classroom management is the key for*

students performance as it provides a conducive environment that facilitate them to learn effectively hence their improved performance”.

Relationship between student’s activities monitoring and their performance

SN	Variable	N	M	SD	r	Sign
1	Students’ perception on teacher’ activities monitoring	196	4.21	0.69	0.68**	.001
2	Students’ academic performance	196	4.07	0.93		

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

N: Sample size, **M:** Mean, **SD:** Standard Deviation, **r:** correlation coefficient, **Sign:** significant level.

Source: Primary data, 2021

The results in the table above showed a correlation coefficient of 0.68 between students’ activities monitoring and their performance at the significant level of 0.001. This indicated a strong relationship between activities monitoring and students’ performance as the value of correlation coefficient is greater than 0.65. This finding was confirmed by the interview with mathematics teachers who said that if students activities are monitored, this helps to detect the weakness of students so that the corrective measures could be taken. Moreover, the head teacher added “ the process of monitoring students’ activities play a great role for students’ performance as it shows what to be addressed in the teaching and learning process in terms of helping students to perform well”.

Discussion of findings

The present study was focused on examining students’, teachers’, and head teachers’ perceptions about Mathematics teacher’s quality and student’s performance in Mathematics subjects. The findings revealed that some teachers’ quality in mathematics such as monitoring, communication skills, teamwork and constructive feedback influence students’ performance in mathematics. This is in line with the study of Blömeke, S., & Delaney (2012) who identified that students’ achievements are associated with teacher quality such as teacher’s qualifications, educational background, teaching experience and personality characteristics like teachers’ self-efficacy. The teachers’ qualification increases the teachers’ knowledge while the personality characteristics of teachers determine the way they communicate with students and how they provide constructive feedbacks.

The students argued that their mathematics teachers monitored them during classroom activities so that they achieve more in the learning process thus their increased performance. They added that their teachers are collaborative which means that they have a teamwork spirit and they were flexible to be asked all questions related to the teaching and learning process. For instance, when students asked him/her where they have difficulties, the

teachers listen and help them to get the solution. This means that the teachers give opportunity to the learners to find out resolution concerning real life problem. Really, the finding showed that 90.3% of the feedbacks provided by teacher have a significance relationship with student's performances in mathematics.

The strong relationship was identified on feedback provision and student performance ($r=0.701$), mathematic teachers' knowledge of mathematics content and students' performance ($r=0.72$), classroom management and students' performance ($r=0.82$), and student's activities monitoring and their performance ($r=0.68$). The teachers' feedbacks were found to be relevant for students' achievement as they were found to play a primary role in student motivation and behavior in classrooms by providing students with opportunities to learn and encouraging them to achieve their goals (Bangert-Drowns, Kulik, Kulik & Morgan, 1991). Similarly, it has been found that feedbacks can motivate students in comparing one's own outcomes over time as well as comparing one's outcomes with those of others thus may results in their improvement (Elliot & Harackiewicz, 1994). The importance of feedbacks on students' performance was also emphasized by both mathematics teachers and head teachers during interview. One of the interviewed teachers said: "When you provide feedback to students, they realize their mistakes in work done so that they can improve for the next time". On the other side, the head teacher said: "teachers have to regularly provide feedbacks on students and investigate if the feedbacks provided have helped them to improve their learning process thus improved performance.

Additionally, the findings of earlier study of Ajibade & Ehindero (2000) reported that 98% of students totally depend on the knowledge of the contents of the subject which is possessed by their teachers. This is as a result of the competence and confidence the teacher exhibits in his teaching which is a reflection of their in-depth knowledge of the contents of the subject. Similarly, Udofot, (1995) in an earlier study found out that a classroom serves as a theatre stage for learning, the prevailing control and discipline are strong determinants of successful learning and commensurate output. The nature of the lesson atmosphere depends on how the teacher teaches. When the teacher is firm and fair, he creates a better classroom climate with minimum tension and anxiety and the students are able to perform better.

On the other side, a moderate influenced on the students' performance was observed on communication and languages used by mathematic teachers ($r=0.38$). These relationships were confirmed by mathematics teachers and head teachers during interviews where most of them confirmed that the mode of communication and flexibility of teachers towards the questions asked by students in relation to the subject matter content may influence students' performance. This is in line with the findings of (Afangideh, 2001) who reported that any educational system depends to a large extent on the effectiveness of the communication system being adopted. It has been found that no single subject can be learnt properly without communication; the use of its appropriate terms facilitates the

understanding of whatever is being learnt. How successful any classroom interaction would be determined by the competence of the teacher in initiating and promoting effective communication between and among his students.

Regardless to the importance of teachers' qualities on students' performance, head teachers claimed that students' performance was not good (less than 50%) in Advanced level based on different factors including the wrong orientation of student in mathematics options, lack of follow up of parents to their children and insufficient teaching and learning materials as well as the lack of convenient feedbacks provided by teachers as well as the lack of effective communication between students and teachers towards performance.

Conclusion and Recommendation

Based on the findings from this study some qualities of mathematics teachers in mathematics subject like monitoring motivation, communication skills, classroom management and providing constructive feedback can influence student performance. Based on interview of head teachers and teachers, they told the researcher that the low level of monitoring of teacher can influence not succeeding of mathematics subject. Based on the importance of different aspects of teacher quality on students' performance it is recommended that all educational agents should invest more in providing trainings to teachers on the effective methods of teaching and learning which enhance students' performance. In addition, adequate teaching and learning materials should be provided for enhancing the improved teaching and learning process. Schools' administration should make regular follow-ups and organize different continuous professional development among teachers on the effective methods for effective teaching and learning.

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