

# Teaching Strategies for Students' Competences in Mathematics in Public Secondary Schools of Rwanda

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**Abstract:** This research assessed the influence of teaching strategies towards student's competences in Rwandan public secondary schools. Specifically, the study has to examine the current status of teaching strategies and students' competences in mathematics from selected Rutsiro Public Secondary Schools. The study intends to assist teachers to improve their teaching strategies that directly empower students' competences. The researcher used descriptive survey design for the first and the second research question and the correlation research design was used to find the relationship between the variables, where both quantitative and qualitative approaches were used, as well as questionnaires and guided interview to collect data. The survey was involving 132 Mathematics learning students that were sampled by using simple and stratified random sampling techniques from 440 mathematics learning students aged eighteen and above. And seven mathematics' teachers, seven Head of schools in public secondary schools that teach mathematics in A 'level in the schools of Rutsiro district which was sampled purposefully. The confirmed that learning Mathematics helps them to solve problems in daily life as it was confirmed by 35% responded strongly agree and 38.6% responded agree. The same teachers confirmed that the use of ICT in teaching mathematics motivates learners in effective learning of mathematics and this is confirmed by 42.8% that responded strongly agree, 28.6% responded agree. The relationship between teaching strategies and students' competences in Mathematics showed that the regression a coefficient of the group learning of mathematics not statistically significant in explaining critical thinking and problem solving except the use of ICT in learning mathematics. The researcher recommended that the ministry of education that should work hand in hand with different stakeholders in education so that a lot of effort be put in learning science especially mathematics.

**Keywords:** Teaching strategies, mathematic competences.

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## 1. INTRODUCTION

The difficulty in understanding the subject matter, as well as the difficulty in educating key variables, was major reasons for dislike of Mathematics. According to the Assist, 20% of that polled thought math was a very difficult subject, 54% thought it was a medium difficulty, and only 10% thought it was a simple subject. The researcher moreover appeared that around 42% fall flat to recognize the ways to illuminate issues given in their course reading. A large proportion of students use daze techniques in mathematics learning and have less flexible self-efficacy and epistemological convictions (Gafoor & Kurukkan, 2015).

In Sub-Saharan Africa (SSA) competences in mathematics have been portrayed as a complex subject by most of the learners/ students especially Tanzania, Kenya, and Rwanda where standards have been extremely low. The researcher observed the SSA countries and compared the teaching mathematics as the particular methods to impart skills to students

in the purpose of solving (Fidele et al., 2019). Rwanda Basic Education Board have put an effort aimed at realizing such expectations to improve the students with required knowledge, skills and attitudes (Ndiokubwayo *et al.*, 2020). The Rwanda Education Board also believed that providing learners with the necessary skills could lead to the development of a knowledge-based economy, allowing students to compete globally (Ndiokubwayo *et al.*, 2020).

### 1.1 Problem Statement

The Rwanda Education Board also agreed that preparing students with essential hands on skills and development of knowledge based economy allowing Rwandans to compete in the global market (Group & Rwanda, 2020). Many factors, including teaching strategies, teachers' and students' cognitive and beliefs, affective and psychomotor characteristics, subject matter and the learning environment influence students' mathematical competence (Robas et al., 2018). Consequently, less competence of students in mathematics affects students' thinking capacity, developing understands skills and knowledge and solving problems capacity. Hence the study aims to identify the effective teaching strategies which may influence student's competences in mathematics in Rwandan public secondary schools, case study in Rwanda.

### 1.2 Purpose of the Study

To examine the current status of teaching strategies and students' competences in mathematics from selected Public Secondary Schools.

### 1.3 Significance of the Study

Since the study intends to determine the influence of teaching strategies towards student's competences in mathematics in Rwandan public secondary schools, the findings of the study will be important to strengthen competences of student in mathematic course not only in Rutsiro public schools but also a whole country's school both public and private. The objective of this study is to find effective teaching practices that can influence students' mathematics skills in Rwandan public secondary schools, with a focus on the Rutsiro District.

## 2. REVIEW OF RELATED LITERATURE

### 2.1 Theoretical Literature

The researcher attempts to examine ideas that elaborate the influence of teaching strategies and mathematics teaching in secondary schools of Rwanda. According to Department of Education research, focusing on assignment for 2 to 3 periods per one can significantly improve student proficiency in science, mathematics and English Language (Vasagar, 2012). However, a Stanford University study indicated that too much schoolwork might lead to increased stress, physical health problems, unbalance, and social isolation (Boddison, 2015). Despite the potential benefits of homework, there is no agreement among teachers on how often it should be assigned. According to previous TIMSS survey data, the frequency of assigning homework for mathematics and the length of time it takes to complete homework differ from nation to country and even from teacher to instructor. Because teachers have differing perspectives on the benefits of homework, homework practices vary from one teacher to the next. Distinct countries have different policies about assigning homework, which results in different applications of providing homework (Mullis et al., 2012). In addition, homework creates issues for teachers, students, and parents, since teachers complain about students' lack of effort in completing assignments, and kids grumble about spending time on homework rather of entertainment (Xu, 2013). Parents are also unhappy about doing homework since they cannot agree on when, or how the task should be completed (Güven & Akçay, 2019).

As stated (Skage *et al.*, 2020), the subject of Mathematics is likely to be believed as the mother to all sciences world widely, that if the schools and countries fail to implement this policy of mathematics as the engine would have failed their direction. There is also evidence to consider as stated Mullender-Wijnsma *et al.*, (2019), that students who undertake the science related courses are likely to get developing in their lives because they are said to be multipurpose in their daily activities is in performing different actions.

### 2.2 Group work for learning

As confirmed by the different studies, educators have many techniques used in imparting learners with required skills. According to Anderson (2000) argued that in the group work activities the teachers and the learners interact effectively in

mathematics sessions. The researcher continued by arguing that there is not different between the teaching and learning mathematics and assessment. The evaluation of learners also boost their awareness in the journey to improve them competences in science learning especially in mathematics learning as the engine of the of the course development in the setting of the classroom cooperation and the use of the effective materials (Anderson *et al.*, 2000).

### 2.3 Application of mathematics and information technology in social or group learning

Social learning style of applying mathematics impart students with the effective methods of practicing the subject of mathematics by allowing students interacting in the group and supporting one another. The researcher Aktepe & Coskun (2014) declared that the application of mathematics is likely to easy and allow the learners having fun during the class setting or in the neighboring comrades where both the students and the facilitator or students to students share the experiences in learning. Group work is a great methods of keeping students together and communicate various aspect related to their academic journey. Some students try to interact and build relationship in other to occupy some part of the content assigned by the teacher.

According to the Koçak *et al.*, (2009), group work assist the individual development and team development in transforming their learning into reality and more creative. In each group everyone is responsible for as supporting another so that they performance together as a team. That is why the group participants are eager to get responsibilities of succeeding together and correcting each other mistakes in purposes of group achievements (Aktepe & Coskun, 2014).

Traditionally teaching and learning mathematics methods have played major role in assisting students getting important skills for developing memories and participants were passively learning but were not able to share knowledge due to the fact that they were not motivated to work in group but the competitions were playing a big roles in schools. The researchers kept exploring the best methods which can equip students with the collaboration and communications.

The researcher Koçak *et al.*, (2009), conducted a study on the alienation and studying mathematics subjects and came up with the power of putting people who want to learning mathematics sessions together and encouraged them to leaner independently but lather encouraged them to share their outputs t the other colleagues until each one get the required skills shared by the colleagues. Through their methods, according to the same researcher, the students used social learning methods in other to help each other learning effectively by asking questions and providing the answers to the open discussions and students were free to express themselves depending on their level of understandings. The research kept arguing that the methods equipped leaners with great atmosphere and leaners were performing well in mathematics and the science related courses.

In this area of teaching and learning mathematics, the study conducted by the other theorists showed that people were competitive in learning the science courses including mathematics. The group learning assisted by the integration of ICT tools in education has become the catalyst in the modern education settings where students were advised to interact with the gadgets without the presence of the teachers. According to Vigosky (1978), hen courses bring the anxiety among the leaners the ICT tools should be involved in order to increase the social learning via conversations and discussion and collaboration ration rather than competition. The purpose of the teacher to integrate the ICT gadgets in the class is that the essential points get mastered by the beneficiaries. The study concluded that learners like other media resources in their learning rather than chalk and talk with the black or white board.

### 2.4 Abraham Maslow's Theory of Motivation Needs

Maslow (1954) proposed a hierarchy of needs divided into two categories, Deficiency and growth needs. The five levels developed are fully applicable into a school and classroom. Physiological, safety, social needs are all classified in deficiency. Esteem and self-actualization are classified in growth needs. Physiological need is satisfied by supporting student to get meals, water, clothing, shelter and rest. The students' needs to be well fed, taken care of right away from home before he/she can learn. Safety and security needs means the need for social interaction, strong relationship with others, freedom, free from anxiety, feel loved and secure. To enhance this in the classroom there should be different clubs, group works so that children can perform well.

Esteem can be satisfied by providing learners with feedback and this increase student's confidence. At Self-actualization level, student should achieve at their full potential. So, this theory is very relevant to the study at hand both teaching strategies and students' competences because once students are motivated their competences were highly developed.

Effective mathematics teaching and learning strategies are critical not only for exam purposes, but also for preparing students to live in a modern age of science, mathematics, and engineering, and to empower them to contribute to the world's and developing countries' social and economic advancement.

### 3. RESEARCH METHODOLOGY

Marshall and Rossman (2006) claim that the descriptive design provides a clear answer to the following questions: what, who, why, where, and when (Wilson, 1998). It's the most effective technique to show a connection between two variables. In addition, the correlational study design was used to describe the degree to which variables are related.

#### 3.1 Sample Size

A total of 132 Mathematic learning students, all seven mathematics teaching teachers, seven Heads of Schools were chosen from a sample of 454 people in four sectors of Rutsiro district to be part of the study where the total of sample size of 146 respondents were determined. The researcher determined the sample size by using the formula of Javeau (1985) who allowed the conclusion of the sample size to be of between 20% and 30% from each school located in the sample size.

The following formula was used to determine sample size:  $n = \sum (30\%N * Ni/N)$

Where: **N**: total number of students in all in four selected schools of Rutsiro District.

**Ni**: Total number of each group

**n**: Sample size

#### 3.2 Sampling technique

The research team conveniently sampled mathematic learning beneficiaries at each school that meet with the criteria and available for the interview. To obtain a comprehensive and rich description of beneficiaries' perceptions regarding factors associated with teaching strategies and student competences, a method of sampling at random was used to choose the participants, followed by interviews that are semi-structured with queries that are both open-ended and closed-ended and a survey questionnaire. Bivariate and multivariable analyses were utilized the correlation between the variables.

#### 3.3 Data Collection Methods

For data collection, a one-on-one interview was carried out in accordance with a pre-tested semi-structured interview schedule. The questionnaire was written in English to find interpretation and help respondents with English background. Six Data collectors, including one principal were involved in data collection. The surveyed students were divided into three groups, i.e. those who study in senior four, senior five, and senior six classrooms then further interview continue with their respective classes.

#### I. Questionnaire

As a data gathering tool, a questionnaire was chosen. A questionnaire is a list of questions that has been printed out designed with the objective of gathering information from respondents' written responses and teachers. To measure the influence of teaching approaches on students' mathematical abilities, the researcher administered questionnaires to teachers and students. Closed-ended questions make up the questionnaires.

#### ii. Interviews

An interview is defined as the discussion and analysis between different people with the aim of gathering data about the factor under study. Interviews demand an interaction between two people namely the researcher and the respondent (Al-Thumali, 2011 & Ghauri, 2010).

The researcher used the open ended questions interview to gather information from head teachers and deputy head teachers. The researcher had a list of questions that were addressed in a predetermined order during the session. The interview schedules were considered appropriate to head teachers and provided additional information to those from teachers and students in the questionnaires.

### 3.4 Validity and Reliability

The instrument which was used to collect data is suitable for measurement (Polit & Hungler, 1993). It's the level at which an instrument represents all of the variables to be studied components or factors. The content validity of an instrument refers to how well it is tailored to the issues being studied (Parahoo, 1997). The research supervisor assured this by receiving the questionnaires and interviews, reading them, and making suggestions. All questions in both surveys and interviews evaluated the knowledge of head teachers, teachers, headmasters and students about the effects of mathematic teaching practices on student skills in order to attain content validity. The researcher ensured the researcher's reliability by reducing data collection errors; in this case, the researcher administered the questionnaires directly to respondents, allow enough time for respondents to respond to questions, and standardize the physical and psychological conditions of respondents, such as advising them to answer the questions when they have time during a break or on the weekend.

### 3.5 Data Analysis

The researcher did all of the data verifying, compiling, and editing by hand. The data were coded, entered into Microsoft Excel, and cleaned before being analyzed using the SPSS version 17 software suite, Basic descriptive statistical data such as frequencies, means, modes, and standard deviation was generated, and associated factors between the different variables in connection to the outcome variable was assessed using a chi-square test with a 95 percent confidence interval and an odds ratio. Bivariate analysis was done to see if factors have an individual relationship with the dependent variable, and multivariate logistic regression was used to look at teaching tactics that are linked to student competences.

## 4. RESEARCH RESULTS

During the research, the respondents were distributed depending on their categories where researcher has demonstrated the background of the respondents and their characteristics. As the study was conducted in schools and other stakeholders in education such as schools leaders, local authorities and others who contribute to daily teaching and learning activities, the respondents were 146 total number of all informants including 7 teachers, 7 school leaders and deputy school leaders, 132 students of public secondary schools of Rutsiro District, Rwanda.

### 4.2 Examining the current status of teaching strategies on students' competences in mathematics

The researcher presents the findings of the study conducted in Rutsiro District Rwanda in secondary public schools, and the general objective was to identify effective teaching strategies and other factors that may influence students' competences through mathematics in Rwandan public secondary, while during the data analyze the three specific objectives were taken into consideration, though the researcher found out the preferred teaching strategies that can affect students' competences in Mathematics, examined the current status of teaching strategies and students' competences in mathematics from Rutsiro Public Secondary Schools, and assessed the relationship between teaching strategies and students' competences in Mathematics in Rutsiro public secondary schools. The researcher has assessed the status of teaching strategies aiming at improving competences of students in secondary schools. Here are students views on the teaching strategies used in teaching and learning Mathematics in public secondary schools:

**Table 1: Students views on the status of teaching strategies and competences**

Statement	Str. Dis		Dis		Neut		Agr		St. Ag	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Teacher provides assignment to encourage in creative for complex problems	2	1.5	9	6.8	11	8.3	67	50.8	43	32.6
Teacher divides students into groups	5	3.8	5	3.8	18	13.6	46	35	58	44
My teacher uses ICT in mathematics	4	3	11	8.3	14	10.6	55	41.7	48	36.3
<b>Mean</b>	4	3	8.3	6.3	14.7	11.1	56	42.2	49.6	37.6

Source: Primary Data (2023).



In table 1, the researcher identified teachers' views on the competences developed by students during teaching and learning Mathematics in public secondary schools of Rutsiro District. The teachers were asked if they provide assignment to encourage learners creative for complex problems; 32.6% responded strongly agree, 50.8% responded agree, while the total of 8.3% % was in disagreement side. Teachers were also asked if group work activities improve the development of students competences in secondary schools; 44% responded strongly agree, 35% responded agree, while the total of 7.6% were in disagreement side. They were also asked if they use ICT in teaching mathematics to help students in improving competences; 36.3% responded strongly agree, 41.7% responded agree, while the total of 11.3% were in disagreement. Since the majority of the respondents were in agreement side this means that teaching using ICT promote learners competences in mathematics. According to Baya'a and Daher (2013), ICT inclusion in teaching and learning mathematics has changed the history of traditional learning.

The study done by Baya'a and Daher (2013) clarified that the studies were active only when the teachers were able to value the use of the devices containing some resources digitalized to attract students feeling comfortable. The study showed that the use and inclusion of the ICT materials made the students active and affordable materials were students were assisted in deep understandings of the concepts where the capacity of the learners was motivated by the interaction of the Information Technology tools in practicing the given exercises even in the absence of the educators. Qualitatively, the data were analyzed in order to get more information about the application of mathematics using different strategies where the researcher has analyzed interviews from heads and deputy heads of schools of Rutsiro District.

The results were described as follow:

*During the study the respondents were asked the strategies teachers use in order to impart skills to their students and they responded that some of the strategies were encouraging students discussions and independent learning, where the students get encouraged to share views regarding to their subject. According to them, mathematics need practices and interaction that student of public secondary schools learn well when the first learners share with the weak learners. Therefore, as they answered, the students enjoy and have fun in learning mathematics when they interact with ICT tools. These gadgets attract them in learning using different strategies live simulation, explanations, and imitation.*

*The school leaders were asked about the ways they use to encourage teachers assisting students developing their competences during mathematics lessons and they responded that students develop required competences via learning mathematics subjects such as critical thinking and problem solving, and logical mathematics skills. This helps them thinking critically before they start an idea and prevent the risks before they occur. Students who are bright in mathematics, they added, become good problem solvers.*

*They were asked the extend they think using ICT instruments helps students performing effectively in mathematics and they responded that ITC is an ingredient and gear in teaching and learning mathematics because it (ICT) attracts students learning and exploring ways that can ease learning via fun and enjoyment ways.*

## 5. CONCLUSIONS AND RECOMMENDATIONS

The results showed that teachers assist students developing their competences during mathematics lessons and they responded that students develop required competences via learning mathematics subjects such as critical thinking and problem solving, and logical mathematics skills. They emphasized on the think using ICT instruments which helped students performing effectively in mathematics and they responded that ITC inclusion is the important resources to boost students independent learning of mathematics.

### 5.1 Recommendations

The Ministry of education should work hand in hand with different stakeholders in education so that a lot of effort be put in learning science especially mathematics that is the basic skills to study other lessons, The district of Rutsiro has to enforce the daily supervision regarding to the teaching and learning using ICT to encourage learners learning mathematics with confidence, Teacher should keep exploration the new strategies that can help learners learning mathematics effectively since there are basic strategies, Students should enhance the discussion in small groups in order to share experience in learning mathematics and helping each other in their daily assignment either at their home or at school,

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