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RESEARCH ARTICLE

CLASSROOM INSTRUCTIONAL PRACTICES AND STUDENTS' ENGAGEMENT IN MATHEMATICS SUBJECT IN PUBLIC DAY SECONDARY SCHOOLS IN RWANDA, A CASE OF NYARUGENGE DISTRICT, RWANDA

Uwihanganye Jean Claude[1] and Mugiraneza Faustin[2]

1. MED Student, Mount Kenya University.
2. Senior Lecturer, Mount Kenya University.

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Abstract

The purpose of this research was to examine the connection between classroom instructional practices and students' involvement in Mathematics subjects in public day secondary schools in Nyarugenge District, Rwanda. The specific objectives wereto assess the effect of using classroom mathematics toolkits on students' engagement in Mathematics subject in public day secondary schools in Nyarugenge District, Rwanda, to assess the effect, teacher feedback and cooperative learning strategies on students' engagement in Mathematics subject in public day secondary schools in Nyarugenge District, Rwanda. The sample size comprised 57 teachers, 19 deputy head teachers in charge of studies, 19 head teachers, 10 sector education inspectors, one district education officer in charge of Secondary and TVET schools, and one District Director of the Education Unit totaling 107 respondents. Pearson correlation coefficients were used to determine correlation between dependent and independent. Results indicated teachers use a computer with a projector, 34.0% were strongly agreed, and 30.9% were agreed. Result felt that teachers use provided scripted lesson in class-room instruction. There statistically association between theuse a computer with a projector and active participation (r=.320, p-value=0.001), with asking questions (r=.317, p-value=0.001). Contrary to insignificant correlation between provided scripted lesson and answering teachers' questions (r=0.006, p-value=0.950). Results showed the recognizable student effort, 55.9% show a strong agreement. A strong relationship was established between recognizable student effort and active participation (r=0.425**, p-value =0.000), The study felt association between positive interdependence and active participation, asking questions, and answering teachers' questions since the p-value was less than 0.05.The study recommends that school make supervision to teachers so as to find out the way that they perform their tasks and to give them some professional advice. Policy makers should elaborate updated professional guidelines which can be used while teaching sciences specifically in mathematics subject so as to improve the student's engagement in mathematics. The ministry of education in Rwanda should give training to teachers about strategies which should

Corresponding Author:- Uwihanganye Jean Claude
Address:- MED Student, Mount Kenya University.

be used while teaching mathematics and other science subjects so as increase students' academic performance.

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Introduction:-

Mathematics education is critical in providing students with the required skills and information to succeed in a variety of academic and professional fields. However, studies have shown that student engagement in Mathematics remains a challenge in many educational settings. Classroom instructional practices significantly influence students' engagement, understanding, and achievement in Mathematics. Studies by Chen and Wu (2019) in China and Johnson and Smith (2018) in the United States have explored the relationship between instructional practices, such as problem-solving approaches, technology integration, and student engagement in Mathematics. These studies highlight the significance of teacher-student interactions, the use of authentic tasks, and the integration of technology in fostering student engagement. Findings from these international studies provide valuable insights that can inform instructional practices and interventions to promote student engagement in Mathematics.

In the African context, research on classroom instructional practices and student engagement in Mathematics has gained momentum. Kyetumeet al. (2017) conducted a study in Uganda to explore the benefits of teacher professional development programs on student engagement in Mathematics classrooms. The findings emphasized the importance of teacher training, pedagogical content knowledge, and the use of student-centered approaches in enhancing student engagement. Similarly, in East Africa, studies by Muthaa et al. (2020) in Kenya and Habineza et al. (2019) in Tanzania have examined instructional practices and student engagement in Mathematics. These studies highlight the role of culturally responsive teaching, collaborative learning, and problem-solving approaches in promoting student engagement and achievement in Mathematics.

Studies by Niyibizi (2018) and Mukamurera (2016) have examined the challenges and opportunities of Mathematics education in Rwandan secondary schools. These studies emphasized the need for effective instructional practices, professional development for mathematics teachers, as well as the incorporation of technology to improve student engagement and accomplishment. Given the unique setting of Rwanda's Nyarugenge district, further study is required to comprehend the present level of classroom instructional approaches and students' engagement in Mathematics, as well as to identify potential strategies for improvement.

Problem Statement

Student engagement in Mathematics classrooms is a critical aspect of effective teaching and learning. However, there is evidence to suggest a lack of active participation, low motivation, and limited understanding of mathematical concepts among students in Rwanda, including Nyarugenge district. Students' classroom engagement in options encompassing mathematics subject has been widely investigated by previous researchers (Ukobizaba et al., 2021). Passive engagement in mathematics has been observed in most of the secondary schools in sub-Saharan countries, and this drawback could be ascribed to classroom instructional practices adopted by teachers while delivering instructional content. Therefore, students' engagement is hindered by teachers' ineffective teaching approaches, which leads to inadequate classroom instructional practices.

In his study (Nizeyimana et al., 2020) inadequate educational resources constitute a barrier to effective and efficient classroom instructional practices as confirmed by 88.9% of teachers in an exclusive interview was conducted.

The findings of the study conducted by Ndihokubwayo &Ndayambaje (2022) found that teachers spend the majority of their time teaching and students listening in the classroom, as claimed by 86.5% of the participated teachers. It was in 2015 that Rwanda changed from KBC to CBC to ensure that classroom practices are more student centered rather than being dominated by the teacher (Dusabimana&Mugabo, 2022), in this perspective, students are expected to be actively engaged. The shift necessitates teachers to learn innovative teaching and learning approaches that revolutionize classroom instructional practices with improved students' classroom engagement.

Rwanda Education Sector Annual Report (MINEDUC, 2020), has indicated concerns regarding student performance and engagement in Mathematics. The report highlights the need for improvement in mathematical competencies and underscores the challenges faced in teaching and learning Mathematics. A study carried out by Rwanda Basic Education Board (REB) on student learning outcomes in Mathematics (REB, 2019) provides empirical evidence of

the limited understanding of mathematical concepts among students. The study revealed that a significant proportion of students in Rwanda struggle with fundamental mathematical concepts, indicating a need for effective instructional practices to promote better engagement and comprehension. Additionally, the World Bank report on education in Rwanda, titled "Rwanda Education Sector Review" (World Bank, 2020), also points to the existing challenges in Mathematics education. The report emphasizes the necessity of improving the quality of mathematics teaching and learning, as well as the need to address challenges connected to instructional practices and student engagement. Because of this, the researcher decided to investigate classroom instructional practices and their effect on student engagement in Mathematics in Rwanda: A Case of Nyarugenge District.

Research Objectives:-

General Objective

The present study was undertaken to determine the association between Classroom instructional practices and students' classroom engagement in Mathematics Subject in public day secondary schools in Rwanda using a case of Nyarugenge District.

Specific Objectives

This study was guided by the following specific objectives:

1. To assess the effect of using classroom mathematics toolkits on students' engagement in Mathematics subject in public day secondary schools in Nyarugenge District, Rwanda.
2. To assess the effect of teacher feedback on students' engagement in Mathematics in in public day secondary schools in Nyarugenge District, Rwanda.
3. To establish the effect of cooperative learning strategies on students' engagement in Mathematics subject in public day secondary schools in Nyarugenge District, Rwanda.

Literature:-

Theoretical literature

This section reviews what other researchers have written about this study. Among the documents reviewed are books, journals, and theses or dissertations.

Constructivism in Mathematics Education

Boaler (2016) advocates constructivism, which stresses the active production of knowledge by learners via social interactions and personal experiences. Constructivism emphasizes the necessity of students actively engaged in mathematical problems and collectively creating their understanding of mathematical concepts in the context of mathematics education. Vygotsky's sociocultural theory emphasizes the importance of social relationships and scaffolding in increasing student engagement and competence in Mathematics.

Socio-Cultural Theory and Mathematics Learning

According to Watson &Reigeluth (2016), socio-cultural theory, learning is a socially situated process impacted by cultural instruments and social interaction. Socio-cultural theory stresses the value of collaborative learning, cultural mediation, and real mathematical practices in the setting of mathematics education. The utilization of collaborative learning methodologies, such as group work and discourse, encourages student involvement by allowing students to exchange and negotiate mathematical concepts in a social setting. Students may access and integrate mathematical concepts within their sociocultural backgrounds through cooperation and discourse.

Cognitive Engagement, Motivation, and Mathematics Learning

Cognitive engagement is defined as students' mental effort, attentiveness, and deep processing of mathematical concepts (Hidi & Renninger, 2015). It entails pupils actively thinking, problem-solving, and creating connections in Mathematics. According to research, increasing cognitive engagement in Mathematics is vital for improving students' problem-solving ability, critical thinking abilities, and conceptual comprehension. According to Schnotz and Kürschner (2016), cognitive engagement may be increased by assigning tasks that are difficult but feasible, offering appropriate direction and feedback, and fostering metacognitive methods. Teachers may enable meaningful mathematics learning experiences for their students by encouraging cognitive involvement.

According to success goal theory, students' objectives, such as mastery or performance goals, impact their engagement and accomplishment in mathematics. Intrinsic motivation refers to pupils' natural interest in and love of

mathematical assignments. According to research, creating a supportive and mastery-oriented learning environment, giving chances for autonomy and competence, and emphasizing the relevance and real-life applications of Mathematics can boost students' motivation and engagement.

Empirical Literature

This section aims to study the effects of classroom instructional practices on the students' engagement in mathematics subject. It does this by reviewing several pertinent resources, including dissertations, books, journals, websites, and publications. This section reviews the existing literature on classroom instructional practices and students' engagement in mathematics subjects in public da**y** secondary schools and compares Rwanda with other countries.

Effect of Using Mathematics Toolkits on Students' Engagement in Mathematics

The incorporation of technology in mathematics teaching has shown promise in terms of increasing student engagement. Gadanidis and Hughes (2018) studied the use of digital math storytelling to assess student engagement. According to their findings, digital storytelling boosted students' enthusiasm, curiosity, and active involvement in mathematics. The interactive and multimodal aspects of technology increased students' engagement and strengthened their grasp of mathematical ideas. Furthermore, the usage of virtual manipulatives has been shown to increase student engagement in Mathematics (Moyer-Packenham et al., 2016). Virtual manipulatives provide students with dynamic and interactive tools for investigating mathematical ideas, resulting in enhanced engagement and conceptual comprehension.

Effect of Teacher Feedback on Student Engagement in Mathematics

According to research, teacher feedback has a major influence on student engagement in mathematics. A study by Smith and Roth (2019) in the United States investigated how timely and constructive feedback positively influenced student engagement in high school mathematics courses. The findings underscored the importance of feedback in fostering motivation, effort, and self-regulation among students. Students felt more supported and interested in their mathematics learning when they received feedback that gave specific instruction and praised their progress. Furthermore, peer evaluation was critical in increasing student involvement. Peer feedback, according to Johnson and Johnson (2014), encourages active participation, collaborative learning, and the development of students' mathematical reasoning skills.

Effect of Cooperative Learning Strategies on Student Engagement in Mathematics

Cooperative learning strategies incorporate students working in small groups to achieve common learning goals. This teaching method emphasizes student participation, active engagement, and interpersonal connection. In the context of mathematics education, cooperative learning has been recognized as a beneficial pedagogical method for enhancing student participation. Cooperative learning promotes student participation in mathematics by allowing students to interact, discuss, and explain mathematical concepts and problem-solving techniques. According to Johnson and Johnson (2013), cooperative learning fosters positive interdependence among group members, which motivates students to actively participate in the learning process. Peer interaction helps students to explain their knowledge, exchange ideas, and boost one another's learning, resulting in deeper engagement and increased conceptual comprehension. Cooperative learning approaches have a positive influence on student engagement in Mathematics. Aydogdu and Cepni (2016) conducted a study to assess the effect of cooperative learning on student engagement in Mathematics classes and found that cooperative learning significantly increased student engagement levels compared to standard teaching. A meta-analysis done by Neuman and Kosko (2014) indicated that cooperative learning increased student engagement in Mathematics.Furthermore, the advantages of cooperative learning practices extend beyond academic achievements. Cooperative learning has been shown to promote good social connections, increase communication skills, and generate a sense of belonging and collaboration among students (Slavin, 2015). This pleasant social atmosphere established by cooperative learning adds to a supportive and inclusive classroom climate, which increases student engagement in Mathematics.

Theoretical Framework

Theoretical considerations for this study arefounded on Social Cognitive and Self-Determination Theory. Both Social Cognitive Theory and Self-Determination Theory are particularly important and useful frameworks for understanding the link between classroom instructional practices and students' classroom engagement in mathematics.

Social Cognitive Theory

Social Cognitive Theory states that people learn by observing, modeling, and acquiring information and skills from their social environment. Classroom Instructional Practices are critical in the context of the study since they are the major source of observational learning for students. Students are more likely to notice and absorb these behaviors when teachers employ engaging teaching tactics, display passion, and successfully model problem-solving skills. As a result, students in Mathematics may adopt comparable engaged, and active learning practices, producing a pleasant classroom atmosphere. Bandura (1986) highlights that students' perceptions of their teachers' talents and efficacy influence their engagement. When instructors correctly explain topics and provide constructive feedback, students may gain confidence in their abilities and become more involved in mathematics. This theory is pertinent to the study because it investigates how students' classroom involvement in Mathematics might be affected by their observations of teacher behaviors and instructional techniques.

Self-Determination Theory

Self-determination theory (SDT) Koestern, R., & Hope, N. (2014) focuses on individuals' intrinsic drive and asserts that humans have underlying psychological desires for autonomy, competence, and relatedness. In the context of the research, this theory can throw light on the elements that motivate students to participate in Mathematics. According to SDT, students are more likely to be intrinsically motivated and interested in the topic if they have a sense of autonomy and control over their learning, a sense of competency in grasping mathematical concepts, and positive interactions with their peers and teachers. Offering students options, chances for self-directed learning, and a sense of control over their learning process are all benefits of effective instructional approaches that foster autonomy. The likelihood that pupils will participate in educational activities increases when they feel confident in their mathematics skills. There is a desire for relatedness, which can increase students' involvement, and making a classroom climate that promotes healthy interactions between students and teachers can help with this.

Conceptual Framework

A conceptual Framework serves as an integrated system that helps researchers systematically organize and articulate the relationships, connections, overlaps, tensions, and contextual factors that shape the research environment and phenomena of interest (Ravitch & Riggan, 2016). It represents the expected relationships between the variables or qualities being investigated. The relationship is presented in Figure 2.1

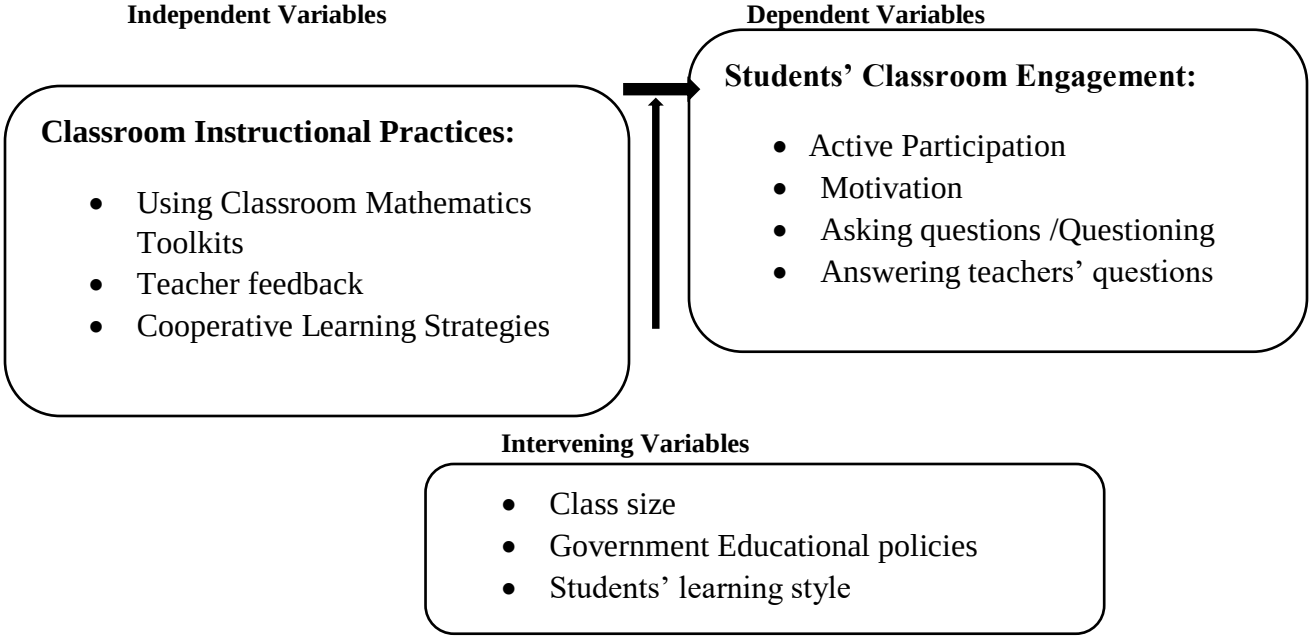

Figure 2.1:- Conceptual Framework.
Source: Researcher, 2024

The total learning process may be enhanced by using teacher-directed and student-centered techniques that influence students' motivation, engagement, and comprehension in mathematics. Student-centered instructional strategies encourage involvement, boost motivation, and strengthen pupils' grasp of mathematics. Like that, adding cooperative learning strategies to the curriculum has been linked to higher student engagement and better problem-solving abilities. The effectiveness of teaching methods and students' involvement in mathematics in the classroom may be significantly influenced by factors including class size, government educational laws, and students' learning preferences. Large class sizes, for instance, may make it difficult for teachers and students to engage and provide individualized attention, which would limit participation levels. Government educational policies that support and provide funding for programs based on students might boost the likelihood that students got involved.

Methodology:-

Design of the Study

Jackson (2014) defines a research design as a conceptual framework for doing research that contains aspects for data collecting, measurement, and analysis. The descriptive survey approach will be used for this study. According to Jackson (2016), a descriptive research design is a type of study that combines qualitative and quantitative research methodologies to get comprehensive knowledge.

Target Population

The target population usually has varying characteristics. This study's population consisted of 107 people composed of 1 DDE, 1 DEO, 10 SEIs, 19 HTs, 19 DOS, and 57 teachers. The choice of this population within the secondary schools was necessitated by the following factors: Firstly, mathematics teachers were picked as they are likely to know the linkage between classroom instructional practices and students' classroom engagement in Mathematics Subject. Head teachers, SEIs, DEO in charge of secondary and TVET, and DDE were chosen because they are likely to understand the challenges of the educational process as educational leaders.

Sample Design

A sample is a subset of a population chosen for research and observation, according to Alvi (2016). A sample size of 107 respondents was chosen in this study. The current study included both purposive sampling strategies.

Sample Size

Table 3.1:- Distribution of Sample Size.

Categories	Population Targeted	Population Sampled

Teachers	57	57
DOS	19	19
Head Teachers	19	19
SEIs	10	10
DEO	1	1
DDE	1	1
Total	**107**	**107**

Source: Researcher (2024)

Table 3.1 reveals that there are 107 responders in the sample. Among them, there are 107 responders in the sample. Among them, there are 1 DDE, 1 DEO, 10 SEIs, 19 HTs, 19 DOS, and 57 teachers. Because our population is small (107), the whole targeted population was involved in the study and was selected purposively by census.

Sampling Technique

According to Creswell (2013), sampling technique refers to the precise plan or approach for taking a sample from a certain population. To complete this study, 1 DDE, 1 DEO, 10 SEIs, 19 HTs, 19 DOS, and 57 mathematics teachers were selected because our population was small (107), the whole targeted population was involved in the study and was selected purposively by census.

Data Collection TechniquesandInstruments for collecting data

The questionnaires were administered to teachers, head teachers, and Sector Education Inspectors, while the interview guides were used to conduct interviews with the District Director of Education and District Education Officer. Methods for gathering information were classified into three subtopics: tools for collecting information, administration of research tools, and validity and reliability of research instruments. To grade respondents' opinions, the following scales were used:SD (Strongly Disagree), D (Disagree), N (Neutral), A (Agree), and SA (Strongly Agree). The numbers 1,2,3,4 and 5 were allocated to these ratings. Appendices offer copies of the instruments.

Findings and Discussion:-

Demographic Characteristics

Demographic data such as gender profile, age group, experience, education profile, and position hold by respondents on the project. Demographic data are very pertinent owing to fact that it is helpful in producing confidence in the reliability of information.

Gender Profile

The researcher collected information on 105 respondents in order to know if and how the gender profile of respondents may affect the level of Classroom Instructional Practices adopted in within public day secondary schools in Nyarugenge District, Rwanda.

Table 4.1:- Gender Profile.

Items	Frequency	Percentage
Men	23	21.7
Women	82	78.3

Source: Field Data (2024)

Results presented in Table 4.1 explained the proportion of women in comparison with respondents. In this regard, the male participants were 78.3% of respondents and 21.7% of respondents were female respondents. It means that classroom mathematics toolkits, teacher feedback, and cooperative learning strategies within public day secondary schools in Nyarugenge District, Rwanda. The data on gender helped the researcher to assess the teachers and students options, conditions, and experiences. Economic as well as cultural and kinship systems profoundly gendered. Deep understanding of gender patterns enhanced the accuracy and scope of work in this field of study.

Age of Respondents

The researcher collected information on 105 respondents in order to know if and how the age groups of respondents may affect the level of classroom mathematics toolkits, teacher feedback, and cooperative learning strategies within public day secondary schools in Nyarugenge District, Rwanda.

Table 4.2:- Age of Respondents.

Age Groups	Frequency	Percentage

21 to 30 to Years	16	15.7
31 to 40 Years	46	44.1
41 to 50 Years	33	30.3
Above 51 Years	10	9.9

Source: Field Data (2024)

Results presented in Table 4.2 demonstrated the age of various group of respondents to the research. Therefore, 21 to 30 years are 15.7% of respondents; 31 to 40 years are 44.1% of respondents, between 41 and 50 years. By using appropriate questions to identify the age demographic of the people who took in this study, using age brackets for convenience and consistency, potentially gained a lot of valuable detail during the analysis, to reveal any correlation between age and subsequent opinions and behavioral traits.

Working Experience

The researcher collected information on 105 respondents in order to know if and how working experience of respondents may affect the level of classroom mathematics toolkits, teacher feedback, and cooperative learning strategies within public day secondary schools in Nyarugenge District, Rwanda. Results presented in Table 4.3 demonstrated that participants working experience. Below one year are five participants that were 10.0% of participants, one to two years are 12 participants that were 24% of participants three to four were 46% of participants, five and six years were 8% of respondents and over years old were 12% of respondents. Personal experience is important in research for a number of reasons. In qualitative research, the researcher's own interpersonal and intrapersonal experience was invaluable in, for example, getting the best data from respondents and key informants especially district director of education, and district education officers as well as head teachers as secondary schools

Table 4.3:- Working Experience.

Working Experience	**Frequency**	**Percentage**
Less than one Years	10	9.8
Between one and Two Years	25	23.7
Between three and four Years	48	46.1
Between five and six Years	8	7.8
Over 6 Years	14	11.8

Source: Field Data (2024)

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Education Level

The researcher collected information on 105 respondents in order to know if and how working education profile of respondents may affect the level of classroom mathematics toolkits, teacher feedback, and cooperative learning strategies within public day secondary schools in Nyarugenge District, Rwanda**.**

Table 4.4:-Education Level.

Education Profile	**Frequency**	**Percentage**
Diploma	61	57.9
Degree	12	11.8
Postgraduate	3	2.6
Masters	3	3.3
Others	26	24.3

Source: Field Data (2024)

Results presented in Table 4.4 demonstrated that those who hold diploma were 57.9% of respondents, those who hold bachelor's degree were12% of respondents while 2.6% of respondents hold postgraduate and 24.3% of respondents hold master degree. Therefore, there was wide change in public institutions like in few yarns contribute to persons with high qualification and may be trained in levels. The qualification of respondents was needed in a survey to understand the characteristics that define the population who choose to participate in the study. By identifying their qualification, the researcher tailored their strategies to promote participation and engagement in mathematics subjects.

Presentation of Findings

The researcher analyzed data using tables of frequencies and percentages. Information was presented based on the effect of classroom mathematics toolkits, teacher feedback, and cooperative learning strategies on students' engagement in mathematics subject in public day secondary schools in Nyarugenge District, Rwanda.

Table 4.5:- Students' Engagement in Mathematics Subject.

	Strongly Disagree		Disagree		Not Sure		Agree		Strongly Agree				
Students' Engagement in Mathematics Subject	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**Total**	**Mean**	**Sdv**
Active Participation	42	40.1	12	11.8	2	1.9	7	15.8	32	30.2	105	3.323	1.333
Motivation	13	11.8	8	7.9	0	0.0	25	23.7	59	56.6	105	3.695	1.131
Asking questions /Questioning	22	21.1	4	3.9	6	5.9	25	23.7	48	45.4	105	3.323	1.333
Answering teachers' questions	7	5.9	8	7.9	4	3.9	8	7.9	78	74.3	105	3.695	1.131

Source: Field Data (2024)

Results showed indicated the active participation, 32.2% of respondents and 15.8% of respondents were accepted. Results showed indicated the motivation, 56.6% were strongly agreed, and 23.7% were agreed. Asking questions /questioning, 45.4% were strongly agreed, and 23.7% were agreed. Result evidenced that answering teachers' questions, 74.3% were strongly agreed, and 7.9% were agreed. Result evidenced that promoting hand on skills. The present study findings concur with the engagement theory emphasizes students' active engagement, motivation, and interest in the learning process, Chhavi Malik (2021). It includes behavioral, emotional, and cognitive involvement. In mathematics education, engagement theory emphasizes the need to encourage students' interest, motivation, and sense of ownership in mathematical work.

Effect of Classroom Mathematics Toolkits on Students' Engagement

Before establishing effect of the effect of classroom mathematics toolkits on students' engagement, the researcher started with descriptive statistics in order to give information on whether the availability of the effect of classroom mathematics toolkits in public day secondary schools in Nyarugenge District, Rwanda.

Table 4.6:- Classroom Mathematics Toolkits.

Statement on classroom mathematics toolkits, teacher feedback, and cooperative learning strategies	**Strongly Disagree**		**Disagree**		**Not Sure**		**Agree**		**Strongly Agree**				
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**Total**	**Mean**	**Sdv**
Teachers use a computer with a projector in the classroom.	14	13.8	18	19.7	0	0.0	32	30.9	36	34.0	105	3.53	1.5
Teachers use the provided scripted lesson in their class-room instruction.	6	5.9	19	17.8	0	0.0	38	36.2	42	40.1	105	3.25	1.21
Teachers were able to assess lessons using one of the assessing tools, which included plickers, voting cards, traffic lights, show-me-cards, and exit tickets.	6	5.9	8	7.9	5	3.9	41	39.5	45	42.8	105	3.23	1.20
Teachers were able to engage their students in playing/manipulating e-resources themselves, predict the outcome before manipulating the resources, and pause the resources/video to clarify the content.	10	9.9	15	13.8	0	0.0	38	36.1	42	40.1	105	3.48	1.27

Source: Field Data (2024)

Results showed indicated the Teachers use a computer with a projector in the classroom, 34.0% were strongly agreed, and 30.9% were agreed. Result evidenced that Teachers use the provided scripted lesson in their class-room instruction. Data demonstrated that the Teachers use the provided scripted lesson in their class-room instruction, 40.1% are strongly agreed while 36.2% agree. The study revealed that teachers were able to assess lessons using one of the assessing tools, which included plickers, voting cards, traffic lights, show-me-cards, and exit tickets where 42.8 accepted the use of those materials, 40.1% were strongly agreed with the statement, 36.1% of the participants agreed. The results demonstrated the Teachers were able to engage their students in

playing/manipulating e-resources themselves, predict the outcome before manipulating the resources, and pause the resources/video to clarify the content. From 105 respondents, 22.4% show a strong agreement while 61.8% are agreed. This indicated that most school teachers successfully used the provided modernized tool. The obtained results are in agreement with previous research arguing that the use of the modernized tool is effective in teaching and learning mathematics and sciences (Salas-Rueda, 2021). However, most teachers did not engage students in using e-resources in their lessons.

Table 4.7:- Regression for classroom mathematics toolkits and Active Participation.

Model		Standardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.328	.527		10.112	.000
	Use A Computer With A Projector	.045	.117	.041	.387	.699
	Provided Scripted Lesson	.042	.081	.058	.520	.604
	Using one of the assessing tools	-.472	.081	-.569	-5.799	.000
a. Dependent Variable: Active Participation						

Source: Field Data (2024)

In the same line Gadanidis and Hughes (2018) studied the use of digital math storytelling to assess student engagement. The interactive and multimodal aspects of technology increased students' engagement and strengthened their grasp of mathematical ideas. Furthermore, the usage of virtual manipulatives has been shown to increase student engagement in Mathematics (Moyer-Packenham et al., 2016). Virtual manipulatives provide students with dynamic and interactive tools for investigating mathematical ideas, resulting in enhanced engagement and conceptual comprehension.

Table 4.8:-Regression for classroom mathematics toolkits and asking questions.

Model		Standardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.556	.677		8.209	.000
	Use A Computer With A Projector	.721	.150	.450	4.815	.000
	Provided Scripted Lesson	-.715	.104	-.671	-6.845	.000
	Using one of the assessing tools	-.675	.105	-.555	-6.452	.000

a. Dependent Variable: asking questions

Source: Field Data (2024)

Data presented in Table 4.10 indicates regression coefficients of mathematics toolkits. It showed that the use a computer with a projector was statistically significant to asking questions (B=.450, p-value=0.000). Results shown that provided scripted lesson was influencing asking questions /questioning (B=-.671, p-value=0.000. Therefore, results shown that using one of the assessing tools is inflicting affecting asking questions /Questioning (B=0.280, p-value=.001). The fact that statistical significance was found in school location and grade levels in favour of teachers located in urban areas and secondary school teachers may be depicted from the infrastructures, which are not the same across Rwandan schools concerning urban schools and from qualification in regards to secondary school teachers. This may be caused by the fact that teachers in rural areas are not much advantaged to get more training and interact with many peers for the exchange of information. Such variables have previously shown controversies (Sibomana et al., 2021) before embarking on this project.

Table 4.9:-Regression for classroom mathematics toolkits and teachers' questions.

Model	Standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

1	(Constant)	9.007	.306		29.387	.000
	Use A Computer With A Projector	-.744	.068	-.568	-10.973	.000
	Provided Scripted Lesson	-.475	.047	-.545	-10.047	.000
	Using one of the assessing tools	-.494	.047	-.497	-10.435	.000

a. Dependent Variable: teachers' questions

Source: Field Data (2024)

Effect of Teacher Feedback on Students' Engagement

The second objective examined the effect of teacher feedback on students' engagement in mathematics subject in public day secondary schools in Nyarugenge District, Rwanda. Most commonly physical facilities include: encourage student to view mistakes, recognizable student effort, focus on student on progress, and create most powerful effort for learning and constructing the way forward. Results demonstrated that there are encourage student to view mistakes, 40.1% strongly agree while 30.3% agree. Results showed the recognizable student effort, 55.9% show a strong agreement while 32.5 were agreed. Results argued the focus on student on progress, the results revealed that 26.3% of participants were strongly agreed, and 26.3% show an agreement with the statement. Results showed the most powerful effort for learning, 38.2% of the respondents were strongly agreed, 28.3% of the participants are agreeing. Results showed the constructing the way forward, 59.8% of the respondents.

This is an indication that the students realized that for them to perform well they only need to do practice every now and then and therefore allocated more lessons for mathematics in their timetable. Reconsidering the above information, the present study concur with previous studies done by Smith and Roth (2019) in the United States who investigated how timely and constructive feedback positively influenced student engagement in high school mathematics courses. The findings underscored the importance of feedback in fostering motivation, effort, and self-regulation among students.

Table 4.10:-Descriptive Statistics on the Teacher Feedback.

Statement on Teacher Feedback	**Strongly Disagree**		**Disagree**		**Not Sure**		**Agree**		**Strongly Agree**				
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**Total**	**Mean**	**Sdv**
Encourage student to view mistakes	21	19.7	8	7.9	2	1.9	32	30.3	42	40.1	105	3.50	1.05
Recognizable student effort	4	3.9	8	7.9	0	0.0	34	32.2	59	55.9	105	3.40	1.21
Focus on student on progress	12	11.8	35	33.6	10	9.9	28	26.3	20	26.3	105	3.52	1.19
Create Most powerful effort for learning	12	11.8	16	15.7	6	5.9	30	28.3	41	38.2	105	3.34	1.18
Constructing the way forward	42	40.2	0	0.0	0	0.0	0	0.0	63	59.8	105	3.50	1.05

Source: Field Data (2024)

Table 4.11:-Regression for Teacher feedback and Active Participation.

Model		Standardized Coefficients		Standardized Coefficients		
		B	Std.Error	Beta	t	Sig.
1	Constant	1.757	.569		3.089	.003
	Encourage student to view mistakes	.147	.111	.169	1.328	.187

	Recognizable student effort	.173	.135	.185	1.283	.202
	Focus on student on progress	.324	.115	.395	2.808	.006

a. Dependent Variables:Teacher feedback and Active Participation
Source: Field Data (2024)

Results show inferential statistics of independent variables are insignificantly associated with active participation. It demonstrated that encourage student to view mistakes is insignificantly correlated active participation (b=0.169, p-value =0.187). This implies that the encourage student to view mistakes did not affect active participation. The recognizable student effort was insignificantly correlated with Focus on student on progress and active participation (b=0.185, p-value =0.202). It denotes that focus on student on progress did not affect active participation. This suggests that there is significance difference in achievement in mathematics between the students provided with goal directed feedback and those who were provided with non- goal directed feedback. The learners who were provided with non- goal directed feedback achieved more. This in effect means that the use of non-goal directed feedback had a greater positive impact in achievement in mathematics. As a result, students strive to outperform their peers to come across as smart. Teachers establish goals for their pupils in performance-oriented classrooms and publicly acknowledge those who meet those goals (Park et al., 2016).

Table 4.12:-Regression for Teacher feedback and asking questions.

Model		Standardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std.Error	Beta		
1	(Constant)	-2.339	.439		-5.333	.000
	Encourage student to view mistakes	.885	.085	.693	10.359	.000
	Recognizable student effort	-.112	.104	-.082	-1.076	.285
	Focus on student on progress	.594	.089	.495	6.683	.000

a. Dependent Variable: Improved Trainee Practical Skills
Source: Field Data (2024)

Results on encourage student to view mistakes was correlated with asking questions /questioning in the p-value of 0.000 where a change in encourage student to view mistakes affect asking questions /questioning by 0.693 units. Regression analysis with recognizable student effort is not significantly affecting asking questions /questioning with a level of significance of 0.285 where recognizable student effort did not lead automatically to asking questions /questioning by 0.082 units. Finally, there is not focus on student on progress and asking questions /questioning with significance of 0.649 where the focus on student on progress affect asking questions /questioning by -0.036 units. Regression analysis with encourage student to view mistakes was significantly affecting Answering teachers' questions by 0.002 where an increase in encourage student to view mistakes affect automatically answering teachers' questions by 0.118 units. Regression analysis with the recognizable student effort was significantly affecting answering teachers' questions with a level of significance of 0.002 where an focus on student on progress lead automatically to answering teachers' questions by 0.130 units.

Table 4.13:-Regression for Teacher Feedback and Answering Teachers' Questions.

Model		Standardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.348	.198		6.823	.000
	Encourage student to view mistakes	-.123	.038	-.118	-3.198	.002
	Recognizable student effort	-.146	.047	-.130	-3.114	.002
	Focus on student on progress	-.139	.040	-.141	-3.458	.001

a. Dependent Variable:Answering teachers' questions
Source: Field Data (2024)

Effect of Cooperative Learning Strategies on Students' Engagement

Third objective assessed Effect of Cooperative Learning Strategies on Answering teachers' questions. Most commonly cooperative learning strategies were: positive interdependence group processing, social skills and promotive interaction.

Table 4.14:- Descriptive Statistics on the Cooperative Learning Strategies.

Statement on Cooperative Learning Strategies	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree				
	N	%	N	%	N	%	N	%	N	%	Total	Mean	Sdv
Positive interdependence	42	40.1	12	11.8	2	1.9	17	15.8	32	30.2	105	3.42	1.26
Group processing	12	11.8	8	7.9	0	0.0	25	23.7	60	56.6	105	3.61	1.07
Social skills	22	21.1	4	3.9	6	5.9	25	23.7	48	45.4	105	3.59	1.21
Promotive interaction	6	5.9	8	7.9	4	3.9	8	7.9	79	74.3	105	3.32	1.32

Source: Field Data (2024)

Results demonstrated the positive interdependence 30.2% strongly agreed. 15.8% remarked a strongly agreement. Results showed group processing, 56.6% strongly agreed while 23.7% agreed. The social skills, 45.4% show a strong agreement, while 23.7% agreed with the statement. Results showed the promotive interaction, 74.3% indicate strongly agreement.

These findings are relevant with topping (2011) who pointed out that cooperative learning technique enables learners to learn from each other and gain important interpersonal skills. The goals of cooperative learning are to enhance learners' learning and to develop their social skills like decision-making, conflict management and communication skills. This teaching strategy provides opportunities for higher order thinking as opposed to passive listening, reinforces listening to others and gives opportunity for immediate feedback and adjustment of thought.

Table 4.15:-Regression for Cooperative Learning Strategies and Active Participation.

Model		Standardized Coefficients		Standardized Coefficients		
		B	Std.Error	Beta	t	Sig.
1	(Constant)	1.123	0.798		1.407	0.161
	Positive interdependence	0.652	0.147	0.330	4.446	0.000
	Group processing	0.114	0.102	0.081	1.115	0.266
	Promotive interaction	-0.050	0.080	-0.047	-0.617	0.538

a. Dependent Variable: Active Participation

Source: Field Data (2024)

Information in Table 4.19 revealed that positive interdependence was impacting active participation with a level of significance of 0.000 where an increase in group processing led automatically to active participation by 0.330 units. There is no significance between the promotive interaction with a level of significance of 0.226. This study concurs with the ccording to Johnson and Johnson (2013), cooperative learning fosters positive interdependence among group members, which motivates students to actively participate in the learning process. Peer interaction helps students to explain their knowledge, exchange ideas, and boost one another's learning, resulting in deeper engagement and increased conceptual comprehension.

Data presented in Table 4.20 indicates that positive interdependence was not significantly affecting asking questions /questioning with a level of significance of 0.571 where an increase, group processing did not automatically to asking questions /questioning by 0.045 units.

Table 4.16:-Regression for Cooperative Learning Strategies and asking questions.

Model		Standardized Coefficients		Standardized Coefficients	t	Sig.
		Beta	Std.Error	Beta		
1	(Constant)	3.697	0.931		3.971	0.000
	Positive interdependence	0.097	0.171	0.045	0.568	0.571
	Group processing	-0.034	0.119	-0.022	-0.288	0.774
	Promotive interaction	0.018	0.094	0.016	0.195	0.845

a. Dependent Variable: Asking questions

Source: Field Data (2024)

There is no significance between the promotive interaction with asking questions and questioning with a level of significance of 0.774. Cooperative learning approaches have a positive influence on student engagement in Mathematics. Aydogdu and Cepni (2016) conducted a study to assess the effect of cooperative learning on student engagement in Mathematics classes and found that cooperative learning significantly increased student engagement levels compared to standard teaching.

Table 4.17:-Regression for Cooperative Learning Strategies and Answering teachers.

Model		Standardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constnat)	3.489	0.847		4.118	0.000
	Positive interdependence	-0.132	0.156	-0.066	-0.845	0.399
	Group processing	-0.011	0.108	-0.007	-0.097	0.923
	Promotive interaction	0.171	0.085	0.162	2.005	0.046
a. Dependent Variable: Answering teachers' questions						

Source: Field Data (2024)

Therefore, positive interdependence was not significantly affecting answering teachers' questions with a level of significance of 0.399 where group processing did not automatically to answering teachers' questions and value by 0.066 units. There is no significance between the promotive interaction and value with a level of significance of 0.923. The present study concurs with the work of Johnson and Johnson (2013) who evidenced that learning fosters positive interdependence among group members, which motivates students to actively participate in the learning process. Aydogdu and Cepni (2016) conducted a study to assess the effect of cooperative learning on student engagement in Mathematics classes and found that cooperative learning significantly increased student engagement levels compared to standard teaching. A meta-analysis done by Neuman and Kosko (2014) indicated that cooperative learning increased student engagement in Mathematics.This pleasant social atmosphere established by cooperative learning adds to a supportive and inclusive classroom climate, which increases student engagement in Mathematics.

Conclusion and Recommendations:-

Conclusion:-

In answering the first research question, on the use of classroom mathematics toolkits and its influence on students' engagement in mathematics subject in public day secondary schools in Nyarugenge District, Rwanda, the researcher concludes that the most commonly mathematics toolkits used were computer with a projector in the classroom, the provided scripted lesson in their class-room instruction and use of the assessing tools, which included plickers, voting cards, traffic lights, show-me-cards, and exit tickets and e-resources themselves. In this regards, a statistically positive relationship was established between mathematics toolkits used and student's engagement in mathematics. Therefore, teachers were found to use modernized tools and innovative teaching and learning methods. The study found that the majority of teachers use modernized toolkits.

In answering the second research question, on teacher feedback and its influence on students' engagement in mathematics, the researcher concludes that teachers feedback was adequately provided to students and these feedbacks are delivered in term of encourage student to view mistakes, recognizable student effort, focus on student on progress, and create most powerful effort for learning and constructing the way forward. In this regards, a statistically relationship was established between teachers feedback and students engagement in mathematics subjects. It is apparent that feedback when provided to students during assessment of mathematics influences the performance and thus improved results. The study reveals that feedback influence performance of learners in mathematics greatly therefore it is an important technique in assessment of mathematics in that it changed the attitudes of the learners towards mathematics positively when it was negative. The feedback which is directed towards the goal does guide the students to success however, showing the students short calculation where there was misconceptions appeared to be most effective. Delayed and immediate feedback is both effective however students prefer immediate feedback since it motivate the students when the minds of the students are still thinking about the performance. The findings suggest that short calculations are more effective than explanation written on the students work. The explanations appear to cause confusion among the students hence making them to use trial and error method.

In answering the third research question, the researcher concluded that that the most commonly adopted cooperative learning strategies to ameliorate students engagement in mathematics were positive interdependence group processing, social skills and promotive interaction. Results demonstrated that cooperative learning were associated with the students engagement in mathematics subjects and of course their expected academic learning outcomes. The students in Jigsaw group had higher participation in the process of learning thanstudents in the comparison group. Cooperative learning also enhances understanding and self-confidence. These results would imply that incorporating cooperative learning in themathematics classroom would enhance the learning of mathematics in secondary schools.

Recommendations to the Study:-

Basing on the findings of the study and discussions which were made, the recommendations of the study were addressed to school head teachers, policy makers and the ministry of education in Rwanda.

From the findings concerning the first objective, the school head teachers should employ teachers who are profession in teaching mathematics. They should also make supervision to teachers so as to find out the way that they perform their tasks and to give them some professional advice. Policy makers should elaborate the updated professional guidelines which can be used while teaching sciences specifically in mathematics subject so as to improve the student's engagement in mathematics. The ministry of education in Rwanda should give training to teachers about strategies which should be used while teaching mathematics and other science subjects so as increase the students' academic performance.

Future practice should monitor how all upper primary, mathematics, and science teachers modernized tools. Even though ICT was integrated into teaching mathematics and science, it still needs more effort to improve the competence of teachers in exploring and using ICT resources. Many teachers were found not allowing students to manipulate instructional materials, giving assessments that involve higher order thinking skills, giving immediate feedback, and giving enough time to discuss and ask questions for more understanding of the learned content.

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