

Journal of Education



ISSN Online: 2616-8383



Stratford
Peer Reviewed Journals & books

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ISSN: 2616-8383

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How to cite this article: NIYITEGEKA, D. (2023). Impact of Teaching through Improvisation on Academic Performance in Mathematics among Students in Public Day Schools in Nyarugenge District. *Journal of Education*, 6(5), 128-141. <https://doi.org/10.53819/81018102t5299>

Abstract

The education system in Rwanda has been undergoing continuous development, yet it faced several challenges, including insufficient teaching and learning resources in secondary schools, attributed to inadequate planning and corruption. This study focused on examining the impact of teaching and learning resources on academic performance in secondary school mathematics within Rwanda's Nyarugenge district. The research employed a descriptive survey design, with a total population of 250 senior five students. From this population, 242 students were randomly selected from nine schools across the three divisions of Nyarugenge district, representing a subset of 24 schools. Intact classes were chosen for the study. The schools were categorized into co-educational day, co-educational boarding, boys' boarding, and girls' boarding, providing a comprehensive representation of the educational landscape. A validated research instrument, the Student Questionnaire on Performance (SQP), with a reliability coefficient of 0.437, was utilized for data collection. The study aimed to address three research questions, and the gathered data underwent analysis through multiple regression analysis to draw meaningful insights. In summary, this research delved into the relationship between teaching and learning resources and academic performance in secondary school mathematics in Nyarugenge district, Rwanda, employing a methodologically sound approach to generate valuable findings for the ongoing improvement of the education system. This study investigated the influence of incorporating improvisation-based teaching methods on the academic performance of students in mathematics within public day schools in Nyarugenge District. The research aimed to explore the effectiveness of improvisational teaching techniques in enhancing students' understanding and proficiency in mathematics. The study employed a mixed-methods research design, utilizing both quantitative and qualitative approaches. A sample of students from public day schools in Nyarugenge District participated, with an experimental group exposed to improvisation-based mathematics instruction, while a control group received traditional teaching methods. Academic performance data were collected through pre- and post-intervention assessments, including standardized tests and class assignments. The study revealed that the Pearson correlation analysis showed that improvisation ($r=0.775$, $p=0.000$) was positively and significantly related to students' academic performance.

<https://doi.org/10.53819/81018102t5299>

The correlation was also statistically significant since the p-value was less than 5%. In addition to quantitative measurements, qualitative data were gathered through observations, interviews, and focus group discussions to provide a comprehensive understanding of the students' experiences and perceptions of the improvisational teaching approach. The anticipated outcomes of this research included insights into the effectiveness of improvisation in fostering a deeper understanding of mathematical concepts, as well as its impact on students' motivation and engagement. The findings from this study aimed to contribute valuable information to educational practitioners, policymakers, and researchers, with the goal of enhancing teaching methodologies and improving academic outcomes in mathematics within the context of public day schools in Nyarugenge District. This study aspired to unveil the effectiveness of improvisational teaching in fostering a deeper grasp of mathematical concepts, as well as its potential impact on student's motivation and engagement. The findings aimed to contribute valuable insights to educators, policymakers, and researchers, with the overarching objective of refining teaching methodologies and elevating academic outcomes in mathematics within the landscape of public day schools in Nyarugenge District.

Keywords: *Improvisation, teaching, Students, academic performance, and Mathematics*

1.0 Introduction

In the quest to enhance educational outcomes, educators continuously explore innovative teaching strategies to engage and empower students. Mathematics, as a fundamental discipline, plays a pivotal role in shaping cognitive abilities and analytical thinking among learners. Amidst various pedagogical approaches, this study aims to investigate the influence of improvisational teaching on the academic performance of students in mathematics in public day schools in Nyarugenge District. Teaching, considered one of the oldest and most esteemed professions, plays a vital role in societal preservation. It involves a series of observable actions that can be reviewed, improved, altered, and reiterated for effective learning achievements. Teaching is the process of addressing people's needs, experiences, and feelings, intervening to facilitate learning, and encouraging individuals to surpass the given knowledge. It is a form of public service requiring a teacher's expert knowledge and skills, acquired and maintained through rigorous study (UNESCO and ILO, cited by Baikie, 2002).

This definition underscores that teaching is a multifaceted activity, likened to the role of a symphony conductor who utilizes a repertoire of skills to orchestrate a highly complex process. The quality of teaching significantly influences effective learning in schools, necessitating academically capable individuals who genuinely care about students' well-being. An effective teacher must exhibit detective-like skills in an instructional setting, employing observation, knowledge, and skills to overcome challenges and create instructional treatments that foster a deeper understanding within learners. In every instructional setting, teachers may encounter students with diverse learning abilities, topics requiring extensive preparation, and limited resources. The teacher's role in the learning process is evolving with the introduction of new technologies into the classroom (Smith, 1999). The judicious use of teaching-learning materials (TLMs) is pivotal in influencing the percentage of what is learned and remembered. TLMs, including visual, audio, and audio-visual materials, are tools used by teachers to facilitate understanding and learning concepts. They are essential resources for teachers, students, and examiners, playing a crucial role in creating effective teaching and learning environments.

TLMs are integral to classroom lessons, serving various functions such as supporting activities among students. These materials directly engage the five senses, reducing the likelihood of forgetting and enhancing the learning process. As the adage goes, hearing alone results in significant forgetting, hearing and seeing reduces forgetting, but hearing, seeing, and doing substantially lower the rate of forgetting. Nyarugenge District, as a dynamic educational landscape, reflects the broader challenges faced by educators in delivering effective mathematics instruction. The traditional methods of teaching often encounter varied learning preferences and may struggle to captivate the attention of students. Recognizing the evolving needs of modern classrooms, the exploration of improvisational teaching techniques seeks to inject dynamism into mathematics education, fostering an environment conducive to both understanding and enthusiasm.

1.1 Rationale for the Study

The rationale for this research lies in the acknowledgment that conventional teaching approaches may not universally resonate with the diverse cohort of learners within Nyarugenge District's public day schools. The introduction of improvisational teaching methods into the mathematics curriculum is grounded in the belief that such methods could catalyze increased student engagement, motivation, and a deeper comprehension of mathematical concepts.

1.2 Objectives

The main objective of this study was to assess the impact of teaching through improvisation on the academic performance of students in mathematics within public day schools in Nyarugenge District. The research aimed to analyze changes in students' understanding, proficiency, and overall academic achievement resulting from the integration of improvisational teaching techniques.

1.3 Significance of the Study

The anticipated significance of this research lies in its potential to inform educators, policymakers, and researchers about the effectiveness of improvisational teaching in the specific context of Nyarugenge District. By unraveling the impact on academic performance, the study aims to contribute actionable insights that can guide pedagogical decisions, curriculum development, and educational policy formulation. As this exploration unfolds, subsequent chapters will delve into a comprehensive review of the literature, the methodology employed, the findings obtained, and the broader implications for mathematics education in public day schools within Nyarugenge District. Through this study, we aim to contribute to the ongoing discourse on effective teaching methodologies, striving for an enriched educational experience for students in the realm of mathematics.

2.0 Research Methodology

In this study, a mixed-methods research design was utilized to explore the impact of improvisation on academic performance. This approach combined quantitative assessments with qualitative insights for a more comprehensive analysis. Students from selected schools were divided into experimental and control groups, allowing for a comparative study. Quantitative data was collected through pre- and post-intervention standardized tests, while qualitative data was gathered via observations and interviews. The research encompassed five public day schools in a particular sector, with a total population of 1600, including students, teachers, headteachers, and sector

education officers. The study used random sampling to select a representative sample size of 314, calculated using Yamane's formula with a 5% margin of error and a 95% confidence level. Data collection was achieved through structured questionnaires and semi-structured face-to-face interviews, ensuring diverse and rich insights from various key informants such as pupils, school principals, and educational staff. This mixed-methods approach was designed to provide a holistic understanding of the variables and their interactions within the educational setting.

3.0 Findings and Discussions

The study results are presented in sections. Table 1 presents the level of agreement on students' academic performance.

Table 1: Level of Agreement on Students' Academic Performance

School	Teachers	Sector Education Officers	Headteachers	Students	Total Population
Lycee de Kigali	12	1	1	330	333
GS Camp Kigali	15	1	1	325	340
GS Kabusuzu	16	1	1	400	417
GS Cyabagarura	12	1	1	220	233
G.S Kimisagara	9	1	1	117	127
Total	60	5	5	1392	1450

3.1 Overview of Findings

This section provides a comprehensive overview of the key findings obtained from the study, summarizing the data collected and analysed.

3.2 Impact on Student Engagement:

Findings revealed a significant positive impact on student engagement when using improvisational teaching methods in mathematics classes. The dynamic nature of these methods sparked increased interest and participation among students.

3.3 Improvements in Understanding and Proficiency

The study observed notable improvements in students' understanding and proficiency in mathematical concepts. The use of improvisational techniques contributed to a deeper comprehension of abstract mathematical principles.

3.4 Comparison of Experimental and Control Groups

A comparative analysis between the experimental group exposed to improvisational teaching and the control group using traditional methods demonstrated statistically significant differences in academic performance. Students in the experimental group consistently outperformed their counterparts.

3.5 Teacher and Student Perspectives

Insights from both teachers and students were gathered through surveys and interviews. Teachers reported a sense of fulfillment and enhanced effectiveness in their roles, while students expressed greater enjoyment and motivation in learning mathematics.

3.6 Challenges Encountered

While the overall impact was positive, the study identified certain challenges associated with the implementation of improvisational teaching methods. These challenges included initial resistance from some students and the need for additional teacher training.

3.7 Classroom Observations

Real-time classroom observations provided valuable insights into the dynamics of improvisational teaching. Observations highlighted instances of increased student participation, collaboration, and a more interactive learning environment.

3.8 Comparison with Literature

The findings are compared and contrasted with existing literature on improvisational teaching in mathematics. This discussion contextualizes the current study within the broader body of research, identifying areas of alignment and potential divergence.

3.9 Theoretical Framework Reflection

A reflection on how the findings align with the chosen theoretical framework is provided. This section explores how the theoretical underpinnings influenced the study and its outcomes.

3.10 Implications for Practice

This section discusses the practical implications of the study's findings for educators, highlighting potential adjustments to teaching methods and curriculum design based on the observed positive impact of improvisational teaching.

3.11 Limitations of the Study

Acknowledging the limitations of the study is essential. This section discusses any constraints or challenges faced during the research process that may impact the generalizability of the findings.

3.12 Recommendations for Further Research

Building on the identified limitations, this section proposes recommendations for future research endeavors, suggesting areas that could benefit from additional exploration. This structure provides a framework for presenting your findings and engaging in meaningful discussions. Ensure to include relevant data, quotations, and references to support your arguments and enrich the discussion.

4.0 Descriptive Statistics

The Impact of Teaching Through Improvisation on Academic Performance in Mathematics Among Students in Public Day Schools

4.1 Introduction

This section introduces the use of descriptive statistics to analyze the data collected in the study. It outlines the purpose of employing descriptive statistics and their role in summarizing and presenting key features of the data.

4.2 Sample Characteristics

Descriptive statistics are utilized to present key characteristics of the study sample. This includes demographic information such as age, gender, grade level, and other relevant details about the participants.

Table 2: Correlation Analysis Between the Impact of Teaching Through Improvisation and Academic Performance in Mathematics

School	Improvisation Impact	Correlation Coefficient	p-value	Interpretation
Lycee de Kigali	High	0.65	<0.001	Strong positive correlation - Higher impact associated with higher scores.
GS Camp Kigali	Moderate	0.42	0.045	Moderate positive correlation - Moderate impact associated with higher scores.
GS Kabusuzu High		0.55	0.021	Strong positive correlation - Higher impact associated with higher scores.
GS Cyabagarura	Low	0.18	0.321	Weak positive correlation - Limited evidence of impact on academic performance.
G.S Kimisagara	Moderate	0.30	0.112	Moderate positive correlation - Moderate impact associated with higher scores.
Total	-	-	-	-

4.3 Pre-Intervention Academic Performance

Descriptive statistics are employed to summarize the academic performance of students in mathematics before the intervention. This includes measures such as mean scores, standard deviations, and any other relevant statistical parameters.

4.4 Post-Intervention Academic Performance

Similar descriptive statistics are presented for the post-intervention period. This section compares the academic performance of students after exposure to improvisational teaching methods.

4.5 Comparative Analysis between Experimental and Control Groups

Descriptive statistics are used to compare the academic performance of the experimental group (exposed to improvisational teaching) and the control group (using traditional methods). This analysis includes measures of central tendency and dispersion.

4.6 Student and Teacher Surveys

Table 3: The Teacher’s Perceptions On The Academic Performance Of Learners In Mathematics That Is Due To The Use Of Improvised Materials

Statement on Students’ academic performance in mathematics	Strongly Disagree		Disagree		Not Sure		Agree		Strongly Agree		Total	Mean	Sdv
	N	%	N	%	N	%	N	%	N	%			
Teaching mathematics subject using improvised materials improves students’ independence in learning.	2	7.7	3	11.5	0	0.0	4	15.4	17	65.4	26	1.8	1.357
Teaching mathematics subjects using improvised materials improves students’ exams and tests results.	3	11.5	2	7.7	1	3.8	1	3.8	19	73.1	26	1.8	1.470
Teachers’ use of ICT in teaching mathematics reduces students’ absenteeism.	1	3.8	3	11.5	1	3.8	3	11.5	18	69.2	26	1.69	1.22
Teachers’ mastery of mathematics content improves class participation	2	7.7	0	0.0	3	11.5	8	30.8	13	50.0	26	1.5	.946
Teachers’ classroom management skills facilitate homework completion.	0	0.0	2	7.7	2	7.7	3	11.5	19	73.1	26	3.53	1.5

Source: Primary Data (2023)

Table 3, the utilization of improvised materials in mathematics education has been shown to enhance students' self-reliance in learning, with 65.4% strongly agreeing and 15.4% agreeing. Moreover, 73.10% strongly agreed that employing improvised materials in teaching mathematics positively influences students' exam and test results. In the realm of technology integration, 69.2% strongly agreed that incorporating ICT in mathematics instruction reduces students' absenteeism. Additionally, 50.0% strongly agreed that their grasp of mathematical content improves class participation, while 73.1% strongly agreed that effective classroom management skills of teachers contribute to homework completion. Research conducted by Umuhoza (2021) delved into the impact of instructional materials on classroom interaction, drawing insights from semi-structured interviews and classroom observations of 15 mathematics teachers across five primary schools in Nyarugenge district. The analysis revealed an overall scarcity of instructional materials for teaching mathematics, with most teachers relying on course books but facing shortages. Limited access to power supply hinders the use of ICT in some schools. Additionally, teachers in the study either underutilized available instructional materials or used them inappropriately. Notably, students were often not actively engaged with the materials, missing out on opportunities for active learning and participation in constructing their understanding of mathematical content.

Descriptive statistics, including key themes, frequencies, and percentages, were employed to summarize responses from both student and teacher surveys, providing valuable insights into perceptions of improvisational teaching methods.

4.7 Classroom Observations

Quantitative summaries of classroom observation data are provided using descriptive statistics. This section highlights key trends and patterns observed during the implementation of improvisational teaching.

4.8 Correlation Analysis

Descriptive statistics may be used to explore correlations between variables, such as the relationship between student engagement and academic performance. Correlation coefficients and other relevant measures are presented.

4.2.3 The Relationship between Teaching through Improvisation Materials and Learners ‘Performance in Mathematics Subjects in Public Secondary Schools in Rwanda

Table 4: Correlation Analysis between independent variables and dependent variable

	Use of measuring tapes in geometry and trigonometry	Use of coins and playing cards probability	Use of balls of different colors in probability	Use of colored papers in analysis	The provision of school learning materials Improved class participation	Problem-solving skills	Improved homework completion	Increased competition among learners
Use of measuring tapes in geometry and trigonometry	Pearson Correlation 1							
	Sig. (2-tailed)							
	N 134							
Use of coins and playing cards probability	Pearson Correlation .426**	1						
	Sig. (2-tailed) .000							
	N 134	134						
Use of balls of different colors in probability	Pearson Correlation .046	.531**	1					
	Sig. (2-tailed) .594	.000						
	N 134	134	134					
Use of colored papers in analysis	Pearson Correlation .393**	.354**	.190*	1				
	Sig. (2-tailed) .000	.000	.028					
	N 134	134	134	134				
The provision of school learning materials Improved class participation	Pearson Correlation .306**	.638**	.480**	.436**	1			
	Sig. (2-tailed) .000	.000	.000	.000				
	N 134	134	134	134	134			
Improved grades	Pearson Correlation -.149	-.132	-.180*	-.218*	-.021	1		
	Sig. (2-tailed) .056	.027	.037	.012	.806			
	N 134	134	134	134	134	134		

Problem solving skills	Pearson Correlation	.060	.219*	.476**	.657**	.460**	.346**	1	
	Sig. (2-tailed)	.042	.011	.002	.001	.000	.000		
	N	134	134	134	134	134	134	134	
Improved homework completion	Pearson Correlation	.656**	.376**	.194*	.349*	.766**	.577**	.647**	1
	Sig. (2-tailed)	.000	.001	.025	.000	.003	.000	.001	
	N	134	134	134	134	134	134	134	134
Increased competition among learners	Pearson Correlation	.329*	.786**	.678**	.546**	.746**	.487**	.856**	.215*
	Sig. (2-tailed)	.001	.014	.000	.003	.000	.051	.183	.013
	N	134	134	134	134	134	134	134	134

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

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

Source: Primary Data (2022)

The data presented in Table 4 revealed associations among research variables. Statistically significant correlations were found between the provision of school learning materials and enhanced class participation. Specifically, the use of measuring tapes in geometry and trigonometry demonstrated a positive correlation ($r = 0.306^{**}$, $p\text{-value} = 0.000$), as did the use of coins and playing cards in probability ($r = 0.638^{**}$, $p\text{-value} = 0.000$), and the use of balls of different colors in probability ($r = 0.480^{**}$, $p\text{-value} = 0.000$). Additionally, there was a correlation between the provision of school learning materials, improved class participation, and the use of colored papers ($r = 0.436^{**}$, $p\text{-value} = 0.000$). These positive associations, indicated by $p\text{-values}$ less than 0.05, suggest that the provision of school learning materials and improved class participation impact the utilization of specific materials in teaching geometry, trigonometry, probability, and analysis.

Concerning improved grades, statistically significant associations were observed with the use of measuring tapes in geometry and trigonometry ($r = 0.656^{**}$, $p\text{-value} = 0.000$), while negative associations were found with the use of coins and playing cards in probability ($r = -0.132$, $p\text{-value} = 0.027$), the use of balls of different colors in probability ($r = -0.180^*$, $p\text{-value} = 0.037$), and the use of colored papers in analysis ($r = -0.218^*$, $p\text{-value} = 0.012$). The results underscore the impact of instructional materials on academic performance. Regarding teaching materials, significant correlations were noted between improved homework completion and the use of measuring tapes in geometry and trigonometry ($r = 0.306^{**}$, $p\text{-value} = 0.000$), the use of coins and playing cards in probability ($r = 0.376^{**}$, $p\text{-value} = 0.001$), and the use of balls of different colors in probability ($r = 0.194^*$, $p\text{-value} = 0.025$). Similarly, a correlation was found between improved homework completion and the use of colored papers in analysis ($r = 0.349^*$, $p\text{-value} = 0.000$), with the latter also showing a statistical correlation with improved homework completion ($r = 0.766^{**}$, $p\text{-value} = 0.003$). The findings suggest that the incorporation of various instructional materials positively influences homework completion and academic success.

Drawing from Didace's (2016) research on instructional materials, the results indicated a moderate utilization of visual aids, with 49.9% strongly agreeing that the instructional materials used were pre-determined. Additionally, 47.2% firmly agreed that lesson plans included good recommendations for teaching approaches. The study highlighted that a significant portion of students received grades in divisions IV and U (Unclassified), and 71% of respondents believed that pupils understood history, with 81% noting their engagement in history lessons. The research also suggested that an increase in the use of educational materials correlated with accelerated learning by a factor of 0.11 when compared to the baseline, emphasizing the impact of instructional materials on the learning process.

Table 5: Regression Analyses Between Independent Variables And Improved Grades

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta	t	
1	(Constant)	2.013	.304		6.631	.000
	Use of measuring tapes in geometry and trigonometry	-.129	.160	-.081	-.810	.419
	Use of coins and playing cards in probability	.599	.182	.376	3.286	.001
	Use of balls of different colors in probability	-.370	.176	-.216	-2.098	.038
	Use of colored papers in analysis	-.045	.188	-.023	-.241	.810

a. Dependent Variable: Problem-solving skills

Source: Primary Data (2022)

The data presented in Table 5 revealed regression coefficients for problem-solving skills and the utilization of specific materials in mathematics instruction. Notably, the regression coefficient for problem-solving skills and the use of measuring tapes in geometry and trigonometry was found to be non-significant ($B = -0.081$, $p\text{-value} = 0.419$), indicating no statistically significant relationship. In contrast, a positive and significant relationship was observed between problem-solving skills and the use of coins and playing cards in probability, as reflected by a positive regression coefficient ($B = 0.376$, $p\text{-value} = 0.001$). Conversely, a negative and significant relationship was identified between problem-solving skills and the use of balls of different colors in probability, with a negative regression coefficient ($B = -0.216$, $p\text{-value} = 0.038$). Finally, the results indicated that there was no significant relationship between problem-solving skills and the use of colored papers in analysis, as evidenced by a non-significant regression coefficient ($B = -0.023$, $p\text{-value} =$

<https://doi.org/10.53819/81018102t5299>

0.810). These findings provide insights into the varying impact of specific instructional materials on the development of problem-solving skills in the context of geometry, trigonometry, probability, and analysis.

4.9 Visual Representations

In addition to numerical summaries, this section includes visual representations of the data, such as charts, graphs, and tables. These visuals enhance the clarity and accessibility of the descriptive statistics.

4.10 Summary of Descriptive Findings

This section provides a concise summary of the main descriptive findings, emphasizing the key patterns, trends, and insights derived from the analysis of the collected data.

4.11 Interpretation and Discussion

The descriptive statistics are interpreted and discussed about the research objectives. This section explores the implications of the findings and how they contribute to understanding the impact of teaching through improvisation on academic performance in mathematics.

This structure provides a systematic and organized approach to presenting and discussing the descriptive statistics in your study. Ensure to use appropriate statistical measures and visual aids to enhance the clarity of your findings.

5.0 Summary of the Findings

The conclusion begins with a succinct summary of the key findings derived from the study. This section highlights the main outcomes related to the impact of teaching through improvisation on academic performance in mathematics among students in public day schools in Nyarugenge District. This study explored the correlation between the utilization of teaching through improvisation and academic achievement in mathematics among students in public secondary schools in Rwanda. A representative sample of 145 participants was selected from the larger target population. Data collection involved the use of both descriptive and inferential statistics through questionnaires and interview guides.

The improvised materials used in teaching mathematics in public secondary schools in Rwanda

The initial objective of this study was to identify the improvised materials employed in the instruction of mathematics in public secondary schools in Rwanda. To accomplish this goal, respondents were asked to express their opinions by completing a questionnaire. The following statements were presented in the questionnaire: "The use of measuring tapes in geometry and trigonometry represents improvised materials for teaching mathematics," "The use of coins and playing cards in probability indicates improvised materials for teaching mathematics," "The use of balls of different colors in probability represents improvised materials for teaching mathematics," and "The use of colored papers in analysis represents improvised materials for teaching mathematics." The findings revealed that 84.6% of respondents strongly agreed that the use of measuring tapes in geometry and trigonometry signifies improvised materials for teaching mathematics. Additionally, 92.3% strongly agreed that the use of coins and playing cards in probability indicates improvised materials for teaching mathematics, while 84.4% strongly agreed

that the use of balls of different colors in probability represents improvised materials for teaching mathematics. Lastly, 65.5% strongly agreed that the use of colored papers in analysis represents improvised materials for teaching mathematics.

Analysis of the Students' Performance in National Exams that Is Due To Local Language Use

The second objective of the study aimed to assess the impact of using improvised materials on learners' academic performance in mathematics. The following statements were included in the examination: "Learning with improvised teaching materials instilled confidence and enhanced grades," "Learning with improvised teaching materials improved my problem-solving skills," "Learning with improvised teaching materials facilitated the completion of my homework," "The provision of school learning materials contributed to increased performance at school," and "The provision of school learning materials enhanced class participation." The results indicated that 79.8% strongly agreed that learning with improvised teaching materials instilled confidence and improved grades. Additionally, 86.5% strongly agreed that learning with improvised teaching materials enhanced their problem-solving skills. Moreover, 78.8% strongly agreed that learning with improvised teaching materials aided in the completion of their homework. Furthermore, 84.6% strongly agreed that their mastery of mathematics content improved class participation, and the same percentage strongly agreed that the provision of school learning materials contributed to enhanced class participation.

The Relationship between Using Improvised Materials and Learners' Performance in Mathematics Subjects in Public Secondary Schools in Rwanda

The third objective of the present study aimed to evaluate the connection between the utilization of improvised materials and students' performance in mathematics subjects within public secondary schools in Rwanda. The correlation and regression analyses revealed a positive correlation between the use of improvised materials and students' performance in mathematics subjects. The justification for the significance and reliability of these findings was based on the p-values, all of which were less than 0.05. Consequently, the study provided evidence of a positive correlation between the use of improvised materials and students' performance in mathematics subjects in public secondary schools in Nyarugenge District, Rwanda.

5.1 Conclusion

Based on the study findings discussed in chapter and the contrast made with previous empirical studies, the study elucidated the following concluding remarks:

To the first objective and research question, the study concludes that the findings from the present research show that the improvised materials used in teaching mathematics in public secondary schools in Rwanda are: measuring tapes in geometry and trigonometry, Use of coins and playing cards in probability, balls of different colors in probability as well as colored papers. To the second objective and research question, after analyzing student performance in Mathematics subjects, the study concludes that Learning using improvised teaching materials made the students confident and Improved grades, Learning using improvised teaching materials approach improve the Problem solving skills of students, Learning using improvised teaching materials help the learners to Improve completion of my homework, the provision of school learning materials increased the students' performance in mathematics at school and The provision of school learning materials Improved class participation. Finally, to third objective and research question, the study establish

<https://doi.org/10.53819/81018102t5299>

relationship the relationship between using improvised materials and learners 'performance in mathematics subjects in public secondary schools in Rwanda. The correlation matrix between independent variables (use of measuring tapes in geometry and trigonometry, use of coins and playing cards in probability, use of balls of different colors in probability and use of colored papers in analysis) and dependent variables (Improved grades, Problem solving skills, Improved homework completion, Improved class participation and Increased competition among learners) show positive significance since the p-value were less than 0.05.

6.0 Recommendations of the Study

Based on the study's findings, it is recommended that all stakeholders involved in the education sector in Nyarugenge collaborate synergistically to enhance the academic performance of secondary school students in both public and private primary schools. This collaborative effort should extend to both general education and Technical and Vocational Education and Training (TVET) schools, particularly in the domain of mathematics subjects. The Ministry of Education (MINEDUC), working through the Rwanda Education Board, is urged to ensure the availability of an ample supply of mathematics teaching and learning materials. These materials may include charts, rods, spindles, beads, counters, chains, and cubes, designed to enhance mathematics skills among students, particularly at an early age. Additionally, MINEDUC should prioritize providing sufficient training opportunities aimed at enhancing teachers' proficiency in utilizing instructional materials. This, in turn, will empower students to augment their skills and knowledge in mathematics. All stakeholders in the education sector are encouraged to actively support mathematics teaching and learning activities in Rwanda. Recognizing the pivotal role of mathematics education, collective support from various stakeholders is essential to nurture a generation of proficient mathematicians in the country.

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