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EFFECT OF CLASSROOM ENGAGEMENT ON ACADEMIC PERFORMANCE OF STUDENTS IN MATHEMATICS IN PUBLIC DAY SCHOOLS IN MUSANZE DISTRICT, RWANDA

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Abstract:
This paper aimed to determine the effect of classroom engagement on students' academic performance in Mathematics subject in public day schools in Rwanda, the case of Musanze District. This study adopted a descriptive research design using a mixed methods research design; a combination of both quantitative and qualitative forms of research. The target population for this study was the educational practitioners in the district including students, teachers, head teachers, and sector education officers in the district. Thus, the total population was 1600 participants. A sample random technique was used to sample 320 respondents taken as a sample size. Analysis of data was aided by Statistical Package for Social Science (SPSS) version 21 and output was exported to Microsoft Word in the form of tables for the purpose of reporting. From the findings, the study revealed that the overall mean of students' engagement was found to be 3.63 (SD = .24). Respondents were found to be more engaged in social engagement ($\bar{x}$= 3.98, SD = .63), followed by emotional engagement ($\bar{x}$= 3.96, SD = .52), behavioural engagement ($\bar{x}$= 3.46, SD = .44) and cognitive engagement ($\bar{x}$= 2.80, SD = .28). Results showed a significant positive relationship between classroom engagement with academic performance of students in Mathematics ($r = 0.668$; $p < 0.001$). Multiple linear regression analysis showed that classroom engagement contributed to 67.9% of the variation in students' performance, hence playing a vital role in students' academic performance in Mathematics subject.

Keywords: classroom engagement, students' academic performance, social engagement, cognitive engagement, behavioural engagement

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1. Introduction

Formal education is a means of imparting and acquiring knowledge. This is done through teaching and learning within the school. The school system empowers the students with the necessary knowledge and skills for an effective living in society. It is expected that classroom learning be translated into solving problems in real-life situations. UNESCO (2006) stated that the worldwide drive for "Education for all" emphasizes literacy in science and mathematics. Mathematics comes out clearly as a core subject to be learned. Lee (2019) observed that Mathematics knowledge plays a crucial role in understanding the contents of other subjects such as Chemistry, Physics, Biology, and Geography, and related the importance of Mathematics to the scientific, industrial, technological, and social progress of society (Bear *et al.*, 2018).

Learning engagement refers to the intensity of students' behavior involvement and the quality of emotional experience when they start and perform learning activities (Adolfsson, 2018). Three important indicators are used to measure the degree of students' learning engagement which are the students' cognitive, emotional, and behavioral engagement. Over the years, students' learning engagement has attracted the attention of scholars both at home and abroad, not only because it can affect academic performance (Lam, 2010), but also because it is a value-added process, that can help students to have a more positive learning experience, such as higher self-efficacy (Klassen, 2019), positive academic emotions and correct learning values (Ansonga, 2017), to further promote the improvement of students' academic performance and individual development, and provide a new perspective for improving the quality of education (Hutajulu, 2019).

Various studies show that there is an inseparable relationship between mathematics learning engagement and academic performance (Gunderson, et al., 2014). Most studies only focus on the relationship between the antecedent variables and the consequence variables (including external and internal factors) and are limited to the analysis of the prediction effect of mathematics learning engagement on academic performance under the influence of other factors (Blazar, 2016). It is believed that the research on the relationship between mathematics learning engagement and academic performance needs to be more in-depth which is why this research explores more deeply the topic of the relationship between mathematics learning engagement and academic performance (Castro, 2017). Not only that, but this research will also explore the impact on the students' academic performance after improving and refining the learning engagement so that it would be more favourable for the students (Caranfil, 2017).

Students' engagement, in the classroom, can be classified as affective, behavior, and cognitive engagement (Terry, 2020). In the mathematics class context, affective engagement refers to positive emotions during mathematics class, such as interest, happiness, enjoyment, and enthusiasm. Behavioural engagement refers to observable behavior that indicates that students are actively involved in mathematics class, such as time-on-task, overt attention, classroom participation, completing class exercises, question-asking, expressing ideas, and choice of challenging tasks (Daher, 2020).

Cognitive engagement refers to students' mental effort to master mathematics learning material, such as strategy use, meaningful processing, concentration, self-monitoring, and metacognition. Moreover, disengagement refers to irrelevant behavior and cognitive activities in the mathematics learning process (Downer, 2015).

In spite of the significant impact of engagement, research on teacher variables affecting engagement is sparse. The lack of research is surprising when it is considered that teachers are the most significant people in schools for boosting student engagement and achievement (Wolfe, 2018). To help address these shortcomings, this study includes classroom variables as well as student variables. Verifying teacher variables in a classroom helps policymakers and administrators make research-based decisions for better teacher recruitment. The main research question addressed is this: How much math performance can be predicted by student engagement in the classroom (Gichuru, 2016). How does classroom engagement affect students' academic performance? This research will add to this line of literature by examining the link between student engagement and fall-to-spring achievement gains in math.

The main objective of this study is analyze the effect of class attendance on the academic performance of students in Mathematics in public day schools in Musanze District.

This study sought to achieve the following research hypothesis:

H_{o1}: There is no significant relationship between classroom engagement and academic performance of students in Mathematics in public day schools in Musanze District.

2. Methodology

Research design serves as a systematic framework for study procedures. This research employed both qualitative and quantitative methods to investigate the causes, effects, and relationships between variables. Using a survey research design, data from students, teachers, head teachers, and Sector Education officers from five public day schools from Musanze sector which are GS Muhoza I, GS Muhoza II, GS Kabaya, GS Cyabagarura, and GS Busogo I. Thus, the total population was 1600 participants. The table below gives details of the target population.

Table 1: Table showing the size of the population of selected schools

Schools	Number of teachers	Sector education officers	Number of head teachers	Number of students	Total population
GS Muhoza I	10	-	1	338	354
GS Muhoza II	11	-	1	321	332
GS Kabaya	11	-	1	398	415
GS Cyabagarura	11	-	1	390	408
GS Busogo I	7	-	1	347	411
Total	50	5	5	1540	**1600**

Source: Musanze District report (2023).

Random sampling was used to select a representative sample of each of the parties used in the study. This study consists of 1,600 persons as the research population and the sample size was determined using Yamane's (1973) formula:

$$n = \frac{N}{1+N(e)^2}$$

Where:
n is the sample size,
N is the population size, and
e is the marginal error of 5% through the level of confidence of 95%.

Thus, this formula is applied to the above sample. Therefore:

$$n = \frac{1600}{1+1600(0.05)^2} = 320$$

N: Total population under the study was 1600, and
n: sample is 320.

A carefully constructed questionnaire and written interview guide were used to compare the written and oral responses of key informants, including students, school principals, sector education staff, and teachers. Scheduled interviews are semi-structured face-to-face interviews that allow the researcher to elicit additional information from participants.

4. Findings and Discussion

4.1. Findings

In this study, the research sampled Mathematics teachers, headteachers, and science/mathematics students of seniors 4, 5, and 6 because they have better knowledge and experience about their schools' teaching and learning practices compared to other students in their respective schools.

Table 2: Response rate

Respondents	Targeted	Obtained	Response rate (%)
Head teachers	5	5	100
Teachers	8	8	100
Sector education officer	1	1	100
Students	306	250	81.6
Total	320	264	82.5

Source: Field Research (2023).

As shown in Table 2, from the targeted respondents, four questionnaires from teachers and 56 questionnaires from students were not returned, so the participation rate was reduced to 12 (75%) of the teachers and 250 (81.6%) of the students. Regarding headteachers, the study sampled 5 school headteachers from 5 secondary schools and

they were interviewed; therefore, the response rate was 100%. Overall, the response rate of respondents was 82.5%.

4.1.1. Descriptive statistics

4.1.1.2. Effect of classroom engagement on academic performance of mathematics subject

In this research, the study attempted to determine the effect of classroom engagement on the academic performance of mathematics subjects in public day schools in Rwanda.

Table 3: Level of agreement on how classroom engagement and academic performance in Mathematics subject

Statements	Mean	StdDev
Students pay attention in class while learning Mathematics subject.	4.11	.60
Students are willing to follow directions while learning Mathematics.	4.42	.84
Students can understand and follow directions while learning Mathematics subject.	4.29	.45
Students complete homework assignments given in the classroom.	4.15	.70
Students volunteers answer/take part in class discussions and conversations.	3.93	.84
Students' feeling of cognitive, emotional, and social engagement in Mathematics is effective when adopting deep and strategic approaches.	4.71	.90

Note: D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree, M = Mean, Std = Standard deviation.

As shown in Table 3, the results relate to the six statements assessing the effect of classroom engagement on students' achievement in Mathematics subject. The results show that for the first statement, the majority of respondents strongly agreed that Students pay attention in class while learning Mathematics subject, with a mean value of 4.11, and a high positive correlation standard deviation of 0.60. The second question asked respondents whether students are willing to follow directions while learning Mathematics. The results showed that the majority of respondents strongly agreed with this statement (M = 4.42, SD = 0.84). For the third statement, students can understand and follow directions while learning mathematics subject', the majority of respondents agreed with this statement, with a mean of 4.29 and a very positive and low standard deviation correlation (0.45). The fourth statement asked whether students complete homework assignments given in the classroom. Respondents strongly agreed with this statement, with an average of 4.15 and a very strong positive standard correlation of 0.70. The next question on students' volunteers taking part in class discussions and conversations. The majority of respondents agreed with this statement, with a mean of 3.93 and a strong correlation standard deviation of 0.84. On the last statement regarding students' feeling of cognitive, emotional, and social engagement in mathematics is effective when adopting deep and strategic approaches, the majority of respondents strongly agreed with a mean of 4.71 and a positive very strong correlation standard deviation of 0.90. The results showed that it implies that the majority of respondents strongly agreed and agreed that all of the above are key elements of classroom engagement used in their five selected schools and have an effect on student learning outcomes.

Table 4: Participant's mean score and standard deviation of student engagement

Variables	Mean	StdDev
Behaviour engagement	3.63	.495
Emotional engagement	3.93	.529
Cognitive engagement	3.42	.338
Social engagement	3.96	.559
Students' engagement (Overall)	3.76	.264

Note: D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree, M = Mean, Std = Standard deviation.

Pearson correlation analysis was conducted to determine the relationships between student's engagement with performance. Table 3 indicates a positive relationship between overall engagement with performance ($r = 0.312^{**}$, $p<0.01$). In contrast, a significant negative relationship was seen between behaviour engagement and performance ($r = -0.278^{*}$, $p<0.05$). However, the correlation between social engagement and performance was absent.

4.1.2. Inferential statistics

Table 5: Correlation analysis between independent and dependent variable

		Class attendance	Students' academic performance
Classroom engagement	Pearson correlation	1	
	Sig. (2-tailed)		
	N	250	
Students' academic performance	Pearson correlation	.668**	1
	Sig. (2-tailed)	.000	
	N	250	250
**. Correlation is significant at the 0.01 level (2-tailed).			

According to the findings reported in Table 3, the Pearson correlation analysis showed that classroom engagement ($r = 0.668$, $p = 0.000$) is positively and significantly related to students' academic performance. The correlation was deemed to be statistically significant since the p-value was less than 5%.

The findings therefore the correlation analysis showed that there is a positive and statistically significant relationship between classroom engagement and students' academic performance in the five sampled public day schools in Musanze District. The classroom is a critical factor in students' academic success in Mathematics subject.

4.1.3. Multiple regression

A multiple regression analysis was performed in this section to identify the predictor and its contribution towards the criterion. It aims to determine the prediction of a single dependent variable from a group of independent variables. The multiple regression analysis was performed with all the assumptions complied with. The study would like to test the following hypothesis:

H_{01}: There is no significant effect between classroom engagement and students 'academic performance in Mathematics subjects in Musanze District.

Table 6: Model summary

Model	R	R square	Adjusted R square	Std. error of the estimate
1	.824[a]	.679	.669	.48571
a. Predictors: (Constant), Classroom engagement				

Table 6 above shows the quantity of variance that is explained by the predictor variables. The first statistic, R is the multiple correlation coefficient between all the predictor variables and the dependent variable. In is model, the value is .824, which indicates that there is a great deal of variance shared by the independent variables and dependent variables. The next value, R Square, is simply the squared value of R. This is frequently used to describe the goodness of fit or the amount of variance explained by a given set of predictor variables and its value is 67.9 % of the variance in the dependent variable is explained by independent variables in the model. The hypothesis is well tested and verified but it is rejected.

Table 7: Significance of independent variable

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	62.518	4	15.630	66.250	.000[b]
	Residual	29.490	125	.236		
	Total	92.008	129			
a. Dependent Variable: Students 'academic performance						
b. Predictors: (Constant), Classroom engagement						

Table 7 above indicates standard regression which provides the effect of individual predictor variables. That variable is classroom engagement. The table shows the output analysis and whether there is a statistically significant difference group mean. As seen, the significance value is 0.00[b] and the mean square is 15.630 which is above 0.05. Therefore, there is a statistically significant difference in the mean length of the model.

4.2. Results and Discussions

From the findings, the study found that classroom engagement affects students' academic performance in Mathematics subject when students pay attention in class while learning Mathematics subject when students are willing to follow directions while learning Mathematics, when students can understand and follow directions while learning Mathematics subject, when students complete homework assignments given in the classroom, when students volunteers answers/take part in class discussions and conversations and when students' feeling of cognitive, emotional and social engagement in Mathematics is effective when adopting deep and strategic approaches.

The interview data gathered the views of the participants on the effect of the classroom on the academic performance of the students in Mathematics subject in Musanze District.

There were interviewed Sector Education officers and head teachers, the findings from the interview given them about students' engagement and academic performance in Mathematics subject showed that all respondents unanimously agreed that there is a strong correlation between classroom engagement and the academic performance of students in the Mathematics subject.

One of them expressing his views, a headteacher had this to say:

> *"Student engagement is an interaction between students and their environment that helps us understand the antecedents and consequences of how students think, behave, and feel in school. Student engagement has been found to be important for learning, academic performance, persistence, retention, and academic achievement. Academically engaged students have been found to have better academic achievement in Mathematics and more compared to disengaged students here in Musanze District"* (11th October, 2023)

These findings are in agreement with Christensen (2012) who stated that student engagement is a fairly new, broad, and multidimensional construct, that is alterable and refers to student's participation in and commitment to academics and school-related activities. It is an interaction between students and their environment that helps us understand the antecedents and consequences of how students think, behave, and feel in school.

5. Conclusion

From the findings of this study, it was concluded that classroom engagement affects students' academic performance in those five selected schools in Musanze District when students are willing to follow directions while learning Mathematics, when students can understand and follow directions while learning mathematics subjects when students complete homework assignments given in the classroom, when students volunteers answers part in class discussions and conversations and when students' feeling of cognitive, emotional and social engagement in mathematics is effective when adopting deep and strategic approaches

In light of the conclusions drawn, the researcher offers recommendations. Teachers should consider students' engagement during class as one of the components of evaluation judgment, and students' appropriate behaviors should be appreciated in a proportional credit because the main purpose of teaching in school is students' learning. For further study, it can be recommended that educators, policymakers, and researchers pay greater attention to student engagement and methods to improve it. One way is to have experts and target stakeholders' involvement in the development of a scale's content validity and perhaps more importantly, in producing an instrument that is relevant and

has a broader applicability. Poorly performing items can be removed to examine if a different pattern of factors may arise, which would necessitate calibration or interpretation of the theoretical framework.

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Conflict of interest statement
The author declares no conflicts of interest.

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Mr. Emmanuel Byiringiro holds a Master's degree in Education and is pursuing a PhD in the same field at Mount Kenya University. He is currently the headmaster of Brilliant School in Musanze District. His research interest is secondary school education and learning styles, especially in mathematics. He has been teaching mathematics in secondary schools for over ten years. He has worked as an analyst and PR manager at RTN and CTA. He has obtained various certificates from the University of Santiago; one in Planning and Management and the other in Administration and Management.

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