Journal of Education

Effect of Class Size on the Academic Performance of Students in Mathematics in Public Day Schools in Musanze District

Emmanuel Byiringiro & Dr. Opiyo Hesbon Andala

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*1Emmanuel Byiringiro & 2Dr. Opiyo Hesbon Andala

1Masters of education, Mount Kenya University

2Project Supervisor, Mount Kenya University

*Email of corresponding author: byiremmy@gmail.com

Abstract

This paper explored the effect of class size effects and students' academic performance in Mathematics subject in public day Schools in Rwanda" A case of Musanze district''. Specifically, the study attempted to determine the effect of class attendance on academic performance of mathematics subject in public day schools in Rwanda, to analyze the effect of classroom seating arrangement on academic performance of mathematics subject in public day schools in Rwanda and to establish the effect of classroom learning environment on academic performance of mathematics subject in public day schools in Rwanda. 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 who includes Students, teachers, head teachers and Sector Education officer in the district. Thus the total population was 1600 participants. Sample random technique was used to sample 320 respondents taken as a sample size. Quantitative data was analyzed through descriptive statistics. Qualitative data was analyzed through content analysis. Analysis of data was aided by statistical packages for social science (SPSS) version 21 and output exported to micro soft word in form of pie charts and tables for the purpose of reporting. From the findings, the study revealed the Pearson correlation analysis showed that class attendance ($r=0.814$, $p=0.000$) 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%. Similarly, the Pearson correlation for classroom seating arrangement ($r=0.715$, $p=0.000$) is also positively and significantly related to the supply chain performance. The correlation was also statistically significant since the p-value was less than 5%. Lastly, the Pearson correlation for classroom learning environment ($r=0.794$, $p=0.000$) is positively and significantly related to the students' academic performance. The correlation was also statistically significant since the p-value was less than 5%. Finally, the study recommended that to ensure a more meaningful academic performance among the students, small

class sizes are needed to improve the interaction between teachers and students. It is therefore pertinent that the management of the schools studied pay attention to the class sizes as pertained in their schools to ensure good academic performance.

Keywords: *Class size, community, class attendance, classroom seating, academic performance*

1.0 Introduction

Worldwide, teaching and learning in an overcrowded class room can be frustrating, overwhelming and stressful. An overcrowded classroom presents challenges that can feel impossible to overcome, even to the most effective teachers, the challenges restrain teacher's effectiveness and make teachers less productive in dishing out what they have for the student. In order to put sound education on ground and improve the academic performance of the student in School and more especially towards the point of their leaving secondary school which is the senior secondary school, there is a need for effective teaching and learning within a control populated class. For instance, in Europe, the average number of students enrolled in elementary schools in France is 22 per class.[1] This is a significant decrease from the last edition of the report in 2020, when the doubling of the number of 6 and 7-year-old pupils in priority education (extra funding for students in disadvantaged areas) was not taken into account in the study and the French average was 24 pupils. However, the average remains higher than the rest of the EU, with an average of 19.3 students per class. From ages 11 to 15, the average number of pupils is close to 26 (a situation similar to Spain), well above the average for all countries, which is below 21.[2]

In the U.S.A, over 30 states have enacted legislation for class size reduction (CSR) programs. Current Government policy in England and Wales is for a maximum class size of 30 for pupils aged 47 years, and larger cuts are planned in Scotland. There have been initiatives involving class size or pupil to adult ratio reductions in the Netherlands and New Zealand. In US, studies of class size in Texas and Israel also found benefits of smaller classes, although the gains associated with smaller classes were smaller in magnitude than those in the Tennessee STAR study. Other rigorous studies have found mixed effects in California and in other countries, and no effects in Florida and Connecticut.[3]

According to Rhodes (2017), the number of high schools' children in Britain being taught in class with 36 or more students had increased to three times what used to be there before in the past five years. The census done in UK in the year 2016 showed that there exist 17,780 government secondary schools where classes have 36 or more students being taught in one. A study done by BBC Yorkshire has showed that Brighouse High school which is located in west Yorkshire has 9

[1] Glass, G., & Smith, M. (2019). Meta-analysis of research on class size and achievement. Educational Evaluation and Policy Analysis, 1(1), 2-16. 29

[2] Topping, K. (2015) 'Trends in Peer Learning'. Educational Psychology 25 (6),   631645

Uloko, E. S. & Imoko, B. I. (2011). Effect of peer-tutoring strategy and location on learning-challenged student's achievement in Junior Secondary School statistics.   Journal of Educational Innovators. A publication of National Association for   Promoting Educational Innovations, 4 (1):422-427.

[3] Topping, K.J., Campbell, J., Douglas, W., Smith, A. (2018). Cross-age peer tutoring in

 mathematics with seven and 11-year-olds: influence on mathematical vocabulary, strategic dialogue and self-concept. Educational Research, 45 (3), 287-308.

Math classes where one teacher has 46 pupils. This number is big and can hinder application of different teaching methods.

In East Asia, many countries and cities including Shanghai in the Chinese Mainland, Hong Kong, Macau, Taiwan, Korea and Japan have implemented 'small class teaching' initiatives. Also in Nigeria, there is agitation for small class size.[4] Most attention has been paid to whether or not smaller classes lead to better academic outcomes for pupils. However, it is now recognized by many and not just critics of class size reductions - that in order to better understand the effects of class size, and help facilitate better classroom environments and effectiveness, we need to know more about effects on what goes on in classrooms, that is, classroom 'processes' such as interactions between teachers and pupils and pupil behavior.[5]

In Africa, the average class size in public primary schools' ranges from 26 pupils in Cape Verde to 67 in Chad (Easton, 2018)[6]. In four out of ten countries reporting data there are on average 50 or more pupils per class. This is much higher than average class sizes in the European Union or OECD member countries which are below 20 in the majority of countries and below 30 in all countries. In Guinea, Mali, Niger and Togo, multi-grade classes are on average larger than single-grade classes. There are over 70 pupils per class in Mali where nearly 20% of pupils are taught in multi-grade classes.[7] Four countries (Burundi, Malawi, Mauritius and Rwanda)[8] report having no multi-grade classes. The vast majority of multi-grade classes cover two grades. However, Cape Verde, Chad, the Congo, Guinea, Madagascar, Mali and Niger report classes which cover three or more grades. In Madagascar and Mali, up to one-quarter of multi-grade classes have at least three grades.

In Rwanda, the Basic Education (BE) sub-sector is composed of Pre-primary, Primary, and Secondary education levels. In addition, there is non-formal education, or Adult Basic Education (ABE). The Education sector includes also Higher Education and a significant TVET stream at both secondary and higher education levels. Rwanda's Education Sector Strategic Plan (ESSP), 2018/2019 – 2023/2024, recognizes pre-primary education and school readiness programmes as a vital foundation for future learning, particularly for children from disadvantaged backgrounds. It commits to expanding access to three years of early learning for children aged 3 to 6, with the national goal to increase access to 45 per cent of children by 2023/2024 (MINEDUC, 2020).[9]

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[4] Sutherland, K.S & Snyder A (2017). Effects of reciprocal peer tutoring and self-graphing on

reading fluency and classroom behavior of middle school students with emotional or behavioral disorders. Journal of Emotional and Behavioral Disorders, 15(2), 103-118.

[5] Summers, J. J. (2016). Effects of collaborative learning in math on sixth graders' individual goal orientations from a socio constructivist perspective. The Elementary School Journal, 106 (3), 273-290.

[6] Easton, L. B. (2018). *Engaging the disengaged*. Thousand Oaks, CA: Corwin Press.

[7] Dalton, S. S. (2018). *Five standards for effective teaching: How to succeed with all learners, grades K-8*. San Francisco: Jossey-Bass.

[8] Baker, J.A., Grant, S., & Morlock, L. (2018). The teacher-student relationship as a developmental context for children with internalizing or externalizing behavior problems. *School Psychology Quarterly, 23(1)*, 3-15.

[9]MINEDUC (2020) Basic Education sector. Retrieve from https://www.mineduc.gov.rw/index.php?eID=dumpFile&t=f&f=57563&token=6b306c5412dc6e99d82c4bf288ffccc 68a4880

In 2011, the national average of the number of pupils per classroom, for primary education was 81, and for secondary education, it was 42 (UNESCO, 2016). As the enrollment rises to fully implement 9YBE and 12YBE, the construction of new classrooms is not catching up with the pace to achieve the number of pupils per classroom coming down to 55 by 2015, a goal set by MINEDUC (MINEDUC, 2012). The regional statistics of 2011 show that for primary education, the Eastern Province has the highest number of pupils per classroom (84), followed by the Northern Province (83), the Southern Province (81), the Western Province (81) and the Kigali City (71) (Thomson, 2017).[10] Besides Kigali City, in all the Provinces there are around 80 pupils per classroom and the gap between Kigali City and other Provinces are around 10 pupils per classroom. It is against this kind of environment that the study will be carried out to determine how class size impacts teaching methods in public secondary schools in Rwanda taking Musanze District as the case study.

1.1 Problem Statement

In fulfilling EFA, the government of Rwanda has struggled much to increase the number of secondary schools. At least each ward is having a secondary school which is a good deal indeed. This aimed to provide opportunity to students who completed standard seven to join university. The number of students enrolled in those schools was big compared to available classrooms as well as the number of teachers employed to teach them. This has resulted into many students being put in one class so that they can all be taught by few teachers available in schools. [11]

The learning environment especially the classes seem to be forgotten as one of the important factor in accelerating students' academic performance (Muligande, 2010)[12]. It should be noted that students need a free and conducive environment to easy their learning. A teacher is likely to attend students' problems timely when there are few students in the class. However, in the case of a big class, it is very difficult for a teacher to deal with students' concerns, and managing assignments of Mathematics subject. Beside the effectiveness of any teacher is measured by the students' high academic performance. Likewise, effective teaching lies on smooth management routines of discipline problems, careful planning, give supportive and positive feedback to students, help them figure out the right answer if they are wrong but on the right track. In short, effective classroom management maximizes children's learning opportunities whereby a teacher is more of a guide, coordinator and facilitator (Nzabarirwa, 2012).[13]

It is very unfortunate that the class size in most cases has been not connected with the students' academic performance though there has been very close relationship between the class size and the students' academic performance; It should also be noted that when the process of learning is

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[10] Thompson, B. (2017). Effect sizes, confidence intervals, and confidence   intervals for effect   sizes. Psychology in the Schools, 44, 423–432.

[11] World Bank (2011). Rwanda Education country status report toward quality enhancement and achievement of universal nine years basic education. An education system in transition, a nation in transition. Retrieved on 16th /1/2014 from www.worldbank.org

[12] Muligande, C. (2010). Highlights of Rwanda's educational achievements, challenges and future direction.

The Independent.

[13] Nzabalirwa, W. & Nkiliye, I. (2012). A Study on the socioeconomic conditions of teachers in Primary and Secondary schools in Rwanda: Case of Bugesera, Nyarugenge and Ruhango Districts. Rwanda Journal of Education, 2(1), 71-82.

not well facilitated students' academic performance will automatically be affected. Therefore, this study pointed out the effect of class size on students' performance in mathematics subject in public day schools in Rwanda with reference of Muhoza sector in Musanze District.

This study sought to achieve the following specific objectives:

i.   To determine the effect of class attendance on academic performance of students in Mathematics in public day schools in Musanze District.
ii. To analyze the effect of classroom seating arrangement on academic performance of students in Mathematics subject in public day schools in Rwanda.
iii. To establish the effect of classroom learning environment on academic performance of students in Mathematics subject in public day schools in Rwanda.

3.0 Method

For the purpose of this study descriptive design was used to find out the current class size in secondary schools in Musanze District. The descriptive design was used as it aimed to accurately and systematically describe a population, situation or phenomenon really enabled the researcher to study the effect of class size on students' academic performance in Mathematics in public day schools in Rwanda; a case of Musanze District.

This study targeted five public day schools from Musanze sector which are GS Muhoza I, GS Muhoza II, GS Kabaya, GS Cyabagarura and GS Busogo I. The target population for this study was the educational practitioners in the district who includes Students, teachers, head teachers and Sector Education officers in the district who teach which sums to a total of 1600 participants. The table below gives details of the target population.

Table 1: Table showing size of population of selected schools

Schools	Number of teachers	Sector Education officers	Number of head teacher	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

The researcher used simple random sampling to select the schools and head teachers, teachers, students and Sector Education officers. Random sampling technique was used to select a representative sample from each of the parties that were used in the study. This research is composed of 1600 people as the study population whereby sample size is found by using the Yamane formula (1973)

where n stands for the sample size,

 N stands for the population size

e stands for the margin of error (0.05) as follows:

$$n = \frac{N}{1+N(e)^2} \quad \text{Therefore, } n = \frac{1600}{1+1600(0.05)^2} = 320$$

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

A questionnaire which was carefully be designed together with a written interview guide was used to provide comparison between written and oral responses from key informants who included the Students, head teachers, Sector Education officers and the teachers. Interview schedules was made semi-structured personal interview to enable the researcher to examine the respondents to get more information from them. Interviews were used because they help in generating detailed qualitative data also guarantee immediate feedback from the respondents when obtaining in depth-information pertaining to the themes of the study.

4.0 Findings and Discussion

4.1 Descriptive Statistics

Effect of class attendance on academic performance of mathematics subject

In this research the study attempted to determine the effect of class attendance on academic performance of mathematics subject in public day schools in Rwanda.

Table 2: Class attendance and academic performance of Mathematics subject

Statements	Mean	Std Dev
Students attend class more frequently in Mathematics subjects when learning includes students' input about what and how topics will be discussed in class	4.42	.69
Students attend class in Mathematics subject more frequently when teachers make learning more relevant to their daily life	4.10	.81
Students attend class more frequently in Mathematics subject when teachers provide ways for students to express their opinions	4.11	.90
Students attend class more frequently in Mathematics subject when teachers provide opportunities for students to debate	4.28	.84
Students attend class more frequently in Mathematics subject when students are challenged in their learning	4.18	.81

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

As shown by Table 2 shows the results about 5 items that were assessed about class attendance on academic performance of mathematics subject. From the results, the first item indicated that the majority of the respondents strongly agreed that students attend class more frequently in Mathematics subjects when learning includes students' input about what and how topics will be discussed in class with a high mean of 4.42 and strong positive correlation standard deviation of 0.69. The second item respondents were asked whether Students attend class in Mathematics subject more frequently when teachers make learning more relevant to their daily life. As per the findings, majority of the respondents agreed (M=4.10, Std=0.81) that statement. On third item, students attend class more frequently in Mathematics subject when teachers provide ways for

students to express their opinions showed by the majority of respondents who strongly agreed with the mean of 4.11 and very positive and strong correlation standard deviation of 0.90. On the fourth item, the respondents were required whether students attend class more frequently in Mathematics subject when students are challenged in their learning. To this, the respondents strongly agreed that statement with a mean of 4.28 and very strong positive correlation standard deviation of 0.84 this indicates that statement. The other considered item in the class attendance was whether students attend class more frequently in Mathematics subject when students are challenged in their learning. To this, the majority of the respondents agreed with a mean obtained was 4.18and standard deviation of 0.81. Therefore, this means that the majority of respondents strongly agreed and in harmony that all above mentioned items are key components of class attendance applied in those sampled schools and affects students' academic performance.

The effect of classroom seating arrangement on academic performance of students in Mathematics subject

The second objective of the study was to determine the effect of classroom seating arrangement on academic performance of students in Mathematics subject in public day schools in Rwanda. The following table gives us details:

Table 3: Seating arrangement and academic performance of students in Mathematics subject

Statements	Mean	Std Dev
The seating arrangement when teaching Mathematics as subject facilitates the teacher's assistance during class.	3.82	1.04
The seating arrangement when teaching Mathematics facilitates class related interaction among the students during class.	4.26	.63
The seating arrangement when teaching Mathematics allows for ease of movement.	3.90	.75
Classroom seating arrangements when teaching Mathematics affect student engagement in class activities through the level of convenience of communication and interaction.	4.35	.72
In my class I can see every student in the class when teaching Mathematics	4.50	.75

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

As indicated in Table 3, the seating arrangement when teaching Mathematics as subject facilitates the teacher's assistance during class to a high extent with Mean score of 3.82 and very high positive standard deviation of 1.04. This gave a high standard deviation in the respondents' perceptions. The second item investigated in relation to the classroom seating arrangement in sampled public day schools if the seating arrangement when teaching Mathematics subject allows for ease of movement. To this, the respondents disagreed with a mean of 4.26 and a positive correlation standard deviation of 0.63. This showed that most of the respondents were in agreement about that statement. On the next item, on whether the seating arrangement when teaching Mathematics allows for ease of movement, the majority of respondents strongly disagreed with a mean of 3.90 and positive high correlation standard deviation of 0.75. On the fourth item on whether classroom seating arrangements when teaching Mathematics affect student engagement in class activities through the level of convenience of communication and interaction. To this, the respondents were

strongly agreed with a mean of 4.35 and a positive high correlation standard deviation of 0.72. Lastly, the respondents were also asked if in the class they can see every student in the class when teaching Mathematics subject. To that statement, the respondents also strongly disagreed that statement with a mean of 4.00 and a very high correlation standard deviation of 1.16 which showing high divergence in the respondents' perceptions. Therefore, this means that the majority of respondents disagreed and in harmony that all above mentioned items are not key components of classroom seating arrangement and affects students' academic performance in those sampled schools.

The effect of Classroom learning environment on academic performance of students in Mathematics subject

In this research, the study attempted to establish how classroom learning environment affects academic performance of students in Mathematics subject in public day schools in Rwanda.

Table 4: Classroom learning environment on academic performance of students in Mathematics subject

Statements	Mean	Std Dev
Classroom interaction is a fundamental component in the mathematics teaching and learning process	4.33	.84
Classroom learning environment is very important factor to encourage the students' motivation in learning Mathematics	4.40	.78
Effective learning of mathematics is directly associated to the teacher's ability to establish constructive and critical classroom interaction in learning environment.	4.42	.76
A conducive Mathematics learning environment provide the attractiveness to the learning procedure or process.	4.46	.75
Classroom interaction is regarded as one of the indispensables and influencing variables in mathematics learning environments	4.28	.72

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

The Table 4 shows the respondents' perceptions on the effect of classroom learning environment affects academic performance of mathematics subject in public day schools in Rwanda. For the first item seeking whether classroom interaction is a fundamental component in the mathematics teaching and learning process, the respondents agreed with a mean of 4.33 and a very high positive correlation standard deviation of 0.84. This implied that the respondents acknowledged the importance of small class size while learning Mathematics. On the second item whether classroom learning environment is very important factor to encourage the students 'motivation in learning Mathematics subject. The respondents strongly agreed with a mean of 4.40 and a very high positive correlation standard deviation of 0.78. On the third item, the respondents were asked whether effective learning of Mathematics subject is directly associated to the teacher's ability to establish constructive and critical classroom interaction in learning environment., the respondents agreed with a mean of 4.42 and standard deviation of 0.76. This means that in learning Mathematics subject teacher's ability play a big role in interaction in bid class size.

On whether a conducive Mathematics subject learning environment provides the attractiveness to the learning procedure or process, the respondents agreed with a mean of 4.46 and 0.75 of standard correlation. Finally, on the item, on whether classroom interaction is regarded as one of the indispensables and influencing variables in mathematics learning environments, the majority of respondents strongly agreed with a mean of 4.28 and a very high positive correlation standard correlation of 0.72. The mean scores for all the items related to classroom learning environment ranged from 4.28 to 4.46. Therefore, this means that the majority of respondents strongly agreed and in harmony that all above mentioned items are key components of classroom learning environment in sampled public day schools in Rwanda. The analysis also showed that a high standard deviation spread from 0.72 to 1.01 which implies that respondents were more varied in their opinion to the responses given under classroom learning environment.

Discussion

Findings on Class attendance

From the findings, the study revealed that class attendance affects students' academic performance by students who attend class more frequently in Mathematics subjects when learning includes students' input about what and how topics will be discussed in class, by students who attend class more frequently in Mathematics subject when teachers provide ways for students to express their opinions, by students who attend class more frequently in Mathematics subject when teachers provide opportunities for students to debate and by students attend class more frequently in Mathematics subject when students are challenged in their learning.

The interview data gathered the views of the participants on the effect of large class size on the academic performance of the students. Expressing his views, a headteacher had this to say:

"Yes, I think the size of the class has greatly affected the academic performance of the students. The size of the class determines the extent of interaction between the tutor and the students. When the class size is small, it promotes better communication between the tutor and the students, and the tutor is able to address the learning difficulties of each student. On the other, in large class size like we have in this college, it limits the exchanges between the tutor and the students, and the tutor is unable to attend to individual learning needs "

These findings are in agreement with Cohen and Johnson (2016) who have found a very positive dependence between the attendance and the academic performance. The study was done on the sample of 347 students of the Economic school. In some recent studies, Spaho & Godolja (2014)[14], Alija (2013)[15] is used the so called binary logistic regression. By this study they try to find the dependence of the regular attendance to the final results achieved in the exams. The study done with the students of Economic department has shown that the regular attendance during the lectures have a significant statistical influence to the final success both on the subject of mathematics and some other subjects.

[14] Spaho.,A. & Godolja, M. D. (2014). Lecture attendance and success on general mathematics. Case study of first year business students, university of Tirana, Albania IMPACT: *International Journal of Research in Business Management*, Vol. 2, Issue 5, 73-78.

[15] Alija, S. (2013). How attendance affects the general success of the student, *International Journal of Academic Research in Business and Social Sciences*, Vol. 3, No. 1, pp. 168-182.

Findings on classroom seating arrangement

From the findings, the study revealed that classroom seating arrangement affect academic performance of mathematics subject, by the seating arrangement when teaching Mathematics as subject facilitates the teacher's assistance during class, by the seating arrangement when teaching Mathematics facilitates class related interaction among the students during class, by the seating arrangement when teaching Mathematics allows for ease of movement and by classroom seating arrangements when teaching Mathematics affect student engagement in class activities through the level of convenience of communication and interaction.

The head teacher has been interviewed on how teachers in Mathematics subject try to handle the class which is large. He stated: "In my view, large class size is one of the major causes of poor performance in my college. We don't get regular feedback from the tutors on our learning because they complain about the large number of students. Marked quizzes and projects are either not returned or they are brought late. Also, class exercises are not given. Therefore, we find it difficult to track our learning progress."

These findings are relevant since Simonsen (2008)[16] pointed out that altering student seating arrangement can have several beneficial effects in a classroom including class participation, behavior, and academic performance. Altering classroom seating positions and arrangements is an easy way to effectively minimize or eliminate student misconduct and behavior without the use of consequence intervention or other differential reinforcement or punishment.

Findings on Classroom learning environment

From the findings, the study revealed that classroom learning environment affects academic performance of mathematics subject in public day schools in Rwanda by classroom interaction is a fundamental component in the mathematics teaching and learning process, by classroom learning environment is very important factor to encourage the students' motivation in learning Mathematics subject, by effective learning of mathematics is directly associated to the teacher's ability to establish constructive and critical classroom interaction in learning environment, by a conducive Mathematics learning environment provide the attractiveness to the learning procedure or process and by classroom interaction is regarded as one of the indispensables and influencing variables in mathematics learning environments

During the interview with the sector education officer on point regarding classroom learning environment and academic performance of students, he observed that:

 "The teaching-learning process cannot take place in a vacuum. In formal education settings, it occurs as a result of interaction among members of the classroom. In classroom settings, elements of teaching-learning process include: teacher, students, content, learning process and learning situation. The learning situation or learning environment means the conditions in which learning take place. Each classroom has unique teaching - learning conditions. Classes may seem similar from the distance but are different in its procedures and the processes."

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[16] Simonsen, B., Fairbanks, S., Briesch, A., Myers, D., & Sugai, G. (2008). Evidence-based practices in classroom management: Considerations for research to practice. Education and Treatment of Children, 351-380.

These findings are relevant since Udom (2006)[17] investigated the relationship between school Physical Environment and students' academic performance in science related subjects in Kano State Senior Secondary Schools. The result obtained also showed a significant relationship between school physical environment and science students' academic performance. This therefore translates to the fact that good school facilities and a good school learning environment stimulate teachers' efforts, invigorate, empower and even encourage them to pursue their assignments to logical conclusions most, if not all the time.

4.2 Inferential Statistics

Correlation Analysis

According to the findings reported in Table 4.13, the Pearson correlation analysis showed that class attendance (r=0.814, 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%. Similarly, the Pearson correlation for classroom seating arrangement (r=0.715, p=0.000) is also positively and significantly related to the supply chain performance. The correlation was also statistically significant since the p-value was less than 5%. Lastly, the Pearson correlation for classroom learning environment (r=0.794, p=0.000) is positively and significantly related to the students' academic performance. The correlation was also statistically significant since the p-value was less than 5%.

The findings therefore revealed that all the three indicators of class size affects students' academic performance. Generally, the correlation analysis showed that there is a positive and statistically significant relationship between class size and students' academic performance in the five sampled public day schools in Musanze District. These findings are consistent with the findings of Blatchford et *al.* (2016)[18] who conclude that class size directly affects classroom instruction due to larger class sizes requiring teachers to utilize class time for management tasks rather than for instruction. Class size also directly affects classroom instruction through the interactions of the teachers with the students and at the same time affects students' academic performance.

Multiple Regression

The results of the multiple regression are presented in the tables that follow.

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.840[a]	.706	.693	.27206

a. Predictors: (Constant), class attendance , Classroom seating arrangement, Classroom learning environment

Source: Field research, 2023

[17] Udom, A. H. (2006). Relationship between School Physical environment and students' Academic achievement in Kano Sate Senior Secondary Schools. Unpublished Ph.D thesis. Kano: Bayero University

[18] Blatchford, P., & Lai, K. C. (2010). Class size: arguments and evidence. In B. McGraw, E. Baker, & P. P. Peterson (Eds.), *International encyclopedia of education* (3rd edition). Elsevier.

Table 5 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 dependent variable. In this model, the value is 0.840, which indicates that there is a great deal of variance shared by the independent variables and dependent variables. The next value, R Square=0.706, is simply the squared value of R. This is frequently used to describe the goodness of fit or the amount variance explained by a given set of predictor variables and its value is 70.6 % of the variance in t students 'academic performance is explained by class size effect in the model.

Table 6: Significance of Independent variables (ANOVA Table)

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	12.073	3	4.024	54.372	.000[b]
1	Residual	5.033	68	.074		
	Total	17.107	71			

a. Dependent Variable: Performance
b. Predictors: (Constant), class attendance , Classroom seating arrangement, Classroom learning environment

Source: Field research, 2023

Table 6 indicated standard regression which provides the significance of the prediction of individual predictor variables on the dependent variable. Those variables are class attendance, Classroom seating arrangement and Classroom learning environment. The table shows the output analysis and whether there it has a statistically significant difference group mean. As seen, the model (F=54.372, p=0.000) was found to be significant at 5% since the p-value (P=0.000) was less than the 5% threshold Therefore, class size significantly affects students 'academic performance.

Table 7: Regression coefficients and significance of the independent variable

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	1.000	.230		4.354	.000
	class attendance	.188	.065	.212	2.892	.006
1	Classroom seating arrangement	.237	.087	.297	2.722	.008
	Classroom learning environment	.382	.094	.499	4.088	.000

a. Dependent Variable: students 'academic performance

Source: Field research, 2023

Information presented in Table 7 evidenced that all the indicator variables used in this research to study the class size effects were all statistically significant. This implied that they individually have significant contributions to the students 'academic performance. The regression model was thus formulated as Y=1.0+ 0.188X1 + 0.237 X2 + 0.382X3 +ε Where y= Students' academic performance, X1, X2 and X3 represented class attendance, Classroom seating arrangement and classroom learning environment. The regression coefficients are useful to know which of the different independent variables is more important in contributing to the students 'academic

performance in those five sampled public day schools in Musanze District. They are used in comparison of effect of any independent variable on the dependent variable.

As indicated in regression coefficients table, classroom learning environment ($β3=0.382$) had the highest regression coefficient followed by classroom seating arrangement ($β2=0.237$) This revealed that classroom seating arrangement as among class size effect that would greatly influence the students 'academic performance. The regression output above shows that class attendance, classroom seating arrangement and classroom learning environment are predictor variables which are statistically equal to significant. This shows the regression of independent variables are associated with students 'academic performance. Multiple analysis regression result above indicates the effect of independent variables based on the regression coefficient.

5.0 Conclusion

From the findings of this study, the study concluded that class attendance affects students' academic performance by students who attend class more frequently in Mathematics subject when learning includes students' input about what and how topics will be discussed in class, by students who attend class more frequently in Mathematics subject when teachers provide ways for students to express their opinions, by students who attend class more frequently in Mathematics subject when teachers provide opportunities for students to debate and by students attend class more frequently in Mathematics subject when students are challenged in their learning. Besides, the study also concluded that classroom seating arrangement affect academic performance of mathematics subject by the seating arrangement when teaching Mathematics as subject facilitates the teacher's assistance during class, by the seating arrangement when teaching Mathematics facilitates class related interaction among the students during class, by the seating arrangement when teaching Mathematics allows for ease of movement and by classroom seating arrangements when teaching Mathematics affect student engagement in class activities through the level of convenience of communication and interaction.

Finally the study also the study concluded that classroom learning environment affects academic performance of mathematics subject in public day schools in Rwanda by classroom interaction is a fundamental component in the mathematics teaching and learning process, by classroom learning environment is very important factor to encourage the students' motivation in learning Mathematics subject, by effective learning of mathematics is directly associated to the teacher's ability to establish constructive and critical classroom interaction in learning environment, by a conducive Mathematics learning environment provide the attractiveness to the learning procedure or process and by classroom interaction is regarded as one of the indispensables and influencing variables in mathematics learning environments

6.0 Recommendations

Addressing attendance requires a holistic approach to engage students within and outside the classroom. Since attendance of the students is an alarming issue, attendance improvement initiatives need to be done to improve students' attendance in order to help students learning Mathematics subject. Thus, teachers should record daily attendance of the students to monitor regular absentees.

The management of schools should frequently visit classrooms in order to assess participation, involvement, and understanding of the students and offer support to those teachers also who lack

competencies required to improve the learning situation and environment in mathematics classrooms due to the size of the class.

The study, therefore, recommended that the teachers of the Mathematics subject should adopt teaching approaches that focus on learners, provide prompt feedback to students, and make teaching real through the use of relevant teaching aids to boost academic performance of the students. Also, the tutors could design their instructions in a manner to encourage students to support each by sharing ideas and assisting each other.

This study assesses the effect of class size and students' academic performance in Mathematics subject in public day Schools in Rwanda." A case of Musanze district'' Further research work should work on the effect of classroom environment on academic performance of all subjects in primary school should be carried out. Further research should also be carried out in regard to the extent to which the government should be involved in the running and management of primary education in Rwanda. There is need to carry out research on the importance of learning corners in classrooms. Also research could be carried out on the methods and techniques of teaching mathematics in primary school to improve on the students' performance. Finally, further research work should be carried out to establish the minimum training required for primary teachers as there are no standards currently

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