

Influence of Class Size and School Environment on Students' Academic Achievement in Mathematics

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Abstract

Influence of class size and school environment on student academic achievement in mathematics have been the interest for researchers over the years. This study sought to ascertain some components of class size and school environment and their influence on students' academic achievement in mathematics in senior secondary school. Five research questions were posed to guide the study. Simple random sampling technique was used to select five secondary schools in Ibadan South West Local Government Oyo State, Nigeria. The same sampling technique was adopted to select 45 students from each school. A total sample size of 225 respondents participated in the study. Two instruments were developed for the study namely: Mathematics Achievement Test (MAT) and Student Inventory Scale (SIS) with the reliability coefficient value of 0.75 and 0.76 respectively. The data obtained were analyzed using descriptive statistics of frequency count, percentages, mean and standard deviation and inferential statistics such as Pearson moment-correlation coefficient and Multiple Regression. The result revealed that about 158 (70.2%) of the sampled students indicated that there are enough chairs in the school and reasonable number of them 150 (66.70%) showed that they did not lack tables as one of educational resources in their various schools. Meanwhile, very few of them 105 (46.70%) observed that library with relevant mathematics text books in many schools are scarce. Also, result shows that there was no significant linear relationship between the classroom atmosphere and students' achievement score. The Pearson moment-correlation coefficient was very low though positive and insignificant ($r = 0.076$, $p = 0.254$). Recommendations were made on the organizing regular capacity building workshops for mathematics teachers on techniques of teaching mathematics, class control and class management.

Keywords: Class Size, School Environment, Students' Achievement and Mathematics

INTRODUCTION

Education is a formidable instrument for national development. According to Ukaoha (2012), any country that wants development in all ramifications should depend basically on sound educational development because the human development leads to national development.

There is universally held assumption of the importance of mathematics to the growth and development of mankind. Mathematics has been rated among other subjects as the queen of all sciences and servant to many disciplines.

Mathematics plays an important role in forming the basic of all other sciences which deal with the materials substance space and time.

Ukeje (2010) described the importance and the attention given to Mathematics as stemming from the fact that without Mathematics, there is no science, without science, there is no modern technology and without modern technology, there is no modern society.

Likewise, Umameh, (2011) in Tshabalala and Ncube, (2013) was of the view that mathematics is bedrock and an indispensable tool for scientific, technological and economic advancement of any nation. No wonder Federal Government of Nigeria under the auspices of the curriculum body decided to make mathematics a core subject. Mathematics is not only made as a compulsory subject in the curriculum of the primary and secondary school levels of her educational system, but also as a pre-requisite to the study of science courses and admission to tertiary institutions.

Even though, mathematics has its own language and is abstract in nature, the performance of students in the subject has been so worrisome to all education stakeholders including the parents, teachers, students, government and the general public despite the importance attached to mathematics in Nigeria education system.

The evidence of this statement reflected on the May/June chief examiners' report of West African Examination Council (2008-2017) the pass rate at credit level recorded for 2008-2017.

Table 1 shows West Africa Senior School Certificate Examination (WASSCE) result of students in mathematics in Nigeria

SUBJECT	YEAR	TOTAL ENTRY	TOTAL SAT	TOTAL CREDIT 1-6	TOTAL PASS 7-8	FAIL
	2008	1292890	1268213 (98.09)	726398 (57.28)	302266 (23.83)	218618 (17.24)
	2009	1373009	1348528 (98.22)	634382 (47.04)	344635 (25.56)	315738 (23.41)
	2010	1331374	1306535 (98.13)	548065 (41.95)	363920 (27.85)	355382 (27.20)
	2011	1540141	1508965 (97.98)	608866 (40.35)	474664 (31.46)	421412 (27.93)
	2012	1695878	1658357 (97.79)	838879 (50.58)	478519 (28.86)	298742 (18.01)
	2013	1686990	1656527 (98.19)	1897655 (54.18)	462176 (27.90)	245263 (14.80)
	2014	1655794	1632377 98.59	1011608 61.97	357555 21.90	211941 12.98
	2015	1602362	1581420 98.69	901845 57.02	425628 26.91	219759 13.89
	2016	1484034	1469585 99.02	1032175 70.23	284676 19.37	112328 7.64
	2017	1565106	1550348 99.05	1276782 82.35	160623 10.36	44874 2.89

Source: The West African Examinations Council (WAEC), Test Development Division, Ogba Lagos

The above table has shown the performance of senior secondary school students in mathematics between 2008-2017 in Nigeria. In 2008 the total credit pass was 57.28%. But there was decline in 2009, 2010, and 2011 with the total credit pass of 47.04%, 41.95% and 40.35%. In 2012, 2013, 2014 and 2015 there was a bit improvement in the performance of students in mathematics with the total credit pass of 50.58%, 54.18%, 61.97% and 57.02%. Between 2016 and 2017, there was a great improvement with the total credit pass of 70.23% and 82.35%. Even though, there has been some improvement in the performance of students particularly in 2016 and 2017 but there is still room for improvement so as to avoid decline in the credit pass in the future years.

In the recent times, so many factors have been responsible for low performance of students in mathematics. The decline in mathematics learning outcomes has been characterized by students' negative attitude, lack of educational resources, class size, difficulty paying attention, lack of practice, inadequate instructional materials, poor learning environment and a host of others. Class size and school environment are areas of interest for researchers over years as some of those factors that influence students' achievement in mathematics. Over enrolment has become a common feature in the Nigeria educational system and excess enrolment usually leads to overcrowded classrooms, ineffective teaching and examination malpractices. Class size is an important factor in relation to academic achievement of students in mathematics which can also be seen as an educational tool that can be used to describe the average number of students in the class in schools. The impact of class size on the achievement of students decreases as the class size

increases. As school population increases, class sizes also increase, so the performances of students become a challenge to both teachers and students. Most developing nations are still battling with the problem of large class size in their education sector both at the primary and secondary school level.

Large classes present more challenges for classroom management, pupil control, and marking, planning, and assessment (Ayeni and Olowe, 2016). They further stressed that teachers are put under more strain when faced with large classes but experience better relationships with, and have more knowledge of individual pupils when pupils are in smaller form. Class size often has direct impact on the quality of teaching and instruction delivery which invariably lead to loss of attention to teaching, poor interest in schooling and low performance of students in mathematics. One of the major reasons behind large class size is due to poor funding of educational system.

School environment plays a significant role in the life of a child. Students need safety, good health and conducive environment for learning. Byoung-Suk and Christopher (2012) asserted that the school environment is of paramount importance in shaping and reshaping intellectual ability. School environment has a wide and great influence on students' cognitive social and emotional development now and later in life. Mudassir, Norsuhaily, Abubakar and Ado (2015) opined that school environment has a vital role to play in the academic performance of students. When school is located in a noisy area, students' attention can be disrupted during the teaching-learning process. A good classroom is characterized by a relaxed atmosphere and is a composite of several factors. Also students'

emotional experiences can impact on their ability to learn.

Meanwhile, teachers have a central role to play in advancing social interaction and positive atmosphere in their classes (Anu, Maija and Liisa, 2019). Systems around the world have been affected by global changes and new understanding that challenge what it means to improve schools and build capacity for improvement. Since no two schools are the same, capacity building particularly for teachers has to take this into account. In a rapidly changing world, capacity building needs to address what is happening in the class and how teachers can cope with both emotional and classroom atmosphere of the mathematics class so that students can learn effectively. Capacity building is an effort being made to improve the abilities, skills and learning capacity of students in the school and school improvement is a used effort to make school better places for students to learn.

Statement of the Problem

The decline in mathematics learning outcomes has been characterized by students' negatives attitude, lack of educational resources, poor learning environment, large class size and a host of others. In recent time, some secondary schools in Oyo state in Nigeria are characterized by an increase in enrolment. Therefore, many schools overstretched their facilities and this contributed to overcrowd of students in the classroom which leads to poor performance of students in mathematics. Besides this, school learning environment has also been identified as one of the factors which influence students' low performance in mathematics. Some efforts have been made to improve the level of learning of mathematics in our society.

Curriculum organizations such as Mathematical Association of Nigeria (MAN), Science Teachers Association of Nigerian (STAN) and a host of others have also continued to make efforts to popularize mathematics by organizing annual conferences in form of capacity building workshop for mathematics teachers, where issues of contents, methodology and problems associated with mathematics are discussed. This study sought to ascertain the relative and composite contribution of class size and school environment on students' achievement in mathematics. The study also investigated relationship between emotional atmosphere and classroom atmosphere of the class and students' academic achievement in mathematics

Purpose of the Study

The major purpose of this study is to investigate the influence of class size and school environment on students' academic achievement in mathematics

senior secondary school. The research is aimed at accomplishing the following:

- i. To determine the pattern of Educational Resources for Teaching Mathematics in Secondary School
- ii. To determine relationship between emotional atmosphere of the class and students' academic achievement in mathematics
- iii. Also to know thif there is any relationship between classroom atmosphere and students' academic achievement in mathematics.
- iv. To determine the relative and composite effect of class size and school environment on students' academic achievement in mathematics.

Research Questions

1. What is the pattern of Educational Resources for Teaching Mathematics in Secondary School?
2. Is there any relationship between emotional atmosphere of the class and students' academic achievement in mathematics?
3. Is there any relationship between classroom atmosphere and students' academic achievement in mathematics? Consequently, they are related.
4. What is the composite contribution of class size and school environment on students' achievement in mathematics?
5. What is the relative contribution of class size and school environment on students' achievement in mathematics?

Significance of the Study

This study provided vital information for secondary schools, researchers and other stakeholders of education in Nigeria.

METHOD

The researcher adopted descriptive research of the survey type. . The target population of the study consists of all 'senior Secondary school students in Ibadan South West Local Government, Oyo State, Nigeria. A simple random sampling technique by balloting was used to select 5 schools from the Local government and 45 mathematics students in Senior Secondary school II (SS II) were randomly selected from each school. The total sample size of 225 students participated in the study. Two instruments were developed and used for data collections which are: Mathematics Achievement Test (MAT) and Student Inventory Scale (SIS) with the reliability coefficient value of 0.75 and 0.76 respectively. In Mathematics Achievement Test (MAT) the Blooms Taxonomy of educational objective was used to guide the structure of the items in the instrument. These items were drawn in line with Nigeria mathematics

curriculum for Senior Secondary school (SS 11). This was done to test student’s cognitive ability in mathematics. Therefore, 25-item multiple choice Mathematics Achievement Test with four options per item was constructed and the duration set for students to answer these questions was 45mins. While, Student Inventory Scale (SIS) has 3 sections. Section A was designed to elicit information about the background of the respondents, such as: name of the school, class, gender, age etc. Section B1 has 10 items which elicited some information on the availability of educational resources. Section B2 also contained 11 items which elicited information on the classroom atmosphere of mathematics class. Lastly, section C contained 15 items of the emotional

atmosphere of mathematics class respondents were asked to respond to the questions on a four point Likert Scale of strongly agree, agree, disagree and strongly disagree. The data obtained were analyzed using descriptive statistics such as frequency, percentage count, mean, standard deviation and inferential statistics of Pearson moment-correlation coefficient and multiple regression.

RESULTS

Research Question 1: What is the pattern of Educational Resources for Teaching Mathematics in Secondary School?

Table 1: Pattern of Educational Resources for Teaching Mathematics

S/N	Item	Not available	Available	N	Mean	SD
		Freq. (%)	Freq. (%)			
1	Chairs	67 29.80 (%)	158 70.20 (%)	225	1.70	0.46
2	Tables	75 33.30 (%)	150 66.70 (%)	225	1.67	0.47
3	Good chalk board	58 25.80 (%)	167 74.20 (%)	225	1.74	0.44
4	White board	162 72 (%)	63 28 (%)	225	1.28	0.45
5	Graph board	165 73.30 (%)	60 26.70 (%)	225	1.27	0.44
6	Projector	190 84.40 (%)	35 15.60 (%)	225	1.16	0.36
7	Charts/diagrams	181 80.40 (%)	44 19.60 (%)	225	1.20	0.40
8	Construction/ drawing instruments	165 73.30 (%)	60 26.70 (%)	225	1.27	0.44
9	Computers	116 51.60 (%)	109 48.40 (%)	225	1.48	0.50
10	Library with relevant mathematics text books	120 53.30 (%)	105 46.70 (%)	225	1.47	0.50

Table 1 depicts that about 158 (70.2%) of the sampled students indicated that there are enough chairs in the school and reasonable number of them 150 (66.70%) showed that they did not lack tables as one of educational resources in their various schools. Also, among the sampled students 167 (74.20%) viewed that they possessed good chalk board for their lessons, few of them 63 (28%) indicated that in many of their schools’ white board was not used for lessons and some 60 (26.70%) indicated that there was nothing like graph board in their schools.

about 44 (19.60%) indicated that there are insignificant charts/diagrams, a very minute number of them 60 (26.70%) indicated that they don’t have construction/ drawing instruments, about 109 (24.9%) of the sampled students submitted that they lack computer gadgets in their schools and very few of them 105 (46.70%) observed that library with relevant mathematics text books in many schools are scarce.

Moreover, few 35 (15.60%) viewed that they don’t have, not to talk of using projector in their schools,

Research Questions 2: Is there any relationship between emotional atmosphere of the class and students’ academic achievement in mathematics?

Table 2: Presents correlation statistics between emotional atmosphere of the class and students’ academic achievement in mathematics

Correlations		Achievement score
Emotional atmosphere	Pearson Correlation	0.455**
	Sig. (2-tailed)	0.00
	N	225

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

Table 2 shows that there was significant positive linear relationship between the emotional atmosphere and students' achievement score. The Pearson moment-correlation coefficient was low and significant ($r = 0.455, p = 0.000$). This implies that the strength of relationship between them was low and emotional atmosphere of the classroom has

something to do with students' achievement in mathematics.

Research Questions 3: Is there any relationship between classroom atmosphere and students' academic achievement in mathematics? Consequently, they are related.

Table 3: Presents correlation statistics between classroom atmosphere and students' academic achievement in mathematics

Correlations	
Classroom_atmosphere	Achievement_score
	Pearson Correlation
	Sig. (2-tailed)
	N

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

Table 3 shows that there was no significant linear relationship between the classroom atmosphere and students' achievement score. The Pearson moment-correlation coefficient was very low though positive and insignificant ($r = 0.076, p = 0.254$). This implies that the strength of relationship between them was very low and classroom atmosphere has little influence on students' achievement in mathematics.

Therefore, they are statistically independent of one another.

Research Question 4

What is the composite contribution of class size and school environment on students' achievement in mathematics?

Table 4: Presents Regression Summary of Composite Contribution of Class Size and School Environment on Students' Achievement in Mathematics

R	= 0.392				
R square	= 0.154				
Adjusted R square	= 0.146				
Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1160.987	3	580.493	20.191	0.000
Residual	6382.409	222	28.75		
Total	7543.396	225			

Table 4 shows that multiple regression correlation coefficient indicating the relationship between the predictor variables (class size and school environment) and students' achievement in mathematics was 0.392. The adjusted R square was 0.154, this means that the predictor variables accounted for about 15.4% variation in the students' achievement in mathematics. Also, it was further ascertained using multiple regression ANOVA $F_{(2,441)}$

= 20.191; $p < 0.05$. This indicated there was significant linear relationship between the predictor variables and students' achievement in mathematics.

Research Question 5

What is the relative contribution of class size and school environment on students' achievement in mathematics?

Table 5: Coefficient Showing relative contributions of class size and school environment on students' achievement in mathematics

Model	Unstandardized Coefficients		Standardized Coefficients		T	Sig.
	B	Std. Error	Beta			
(Constant)	-12.534	3.709			-3.38	0.001
School environment	0.279	0.046	0.384		6.119	0.000
class size	-0.116	0.191	-0.038		-0.609	0.543

*Dependent Variable: Achievement Score

Table 5 depicts that among the predictor variables, only school environment ($\beta = 0.384, t(225) = 6.119; p < 0.05$) was found to have significant relative contribution towards students' achievement in mathematics. It was revealed that only the school environment was a potent factor that influenced students' achievement in mathematics.

DISCUSSION OF THE FINDINGS

The goal of a teacher is to create positive changes in the behavior of the learners providing the necessary learning environment for the changes to occur. Educational resources are indispensable to the effective teaching and learning of Mathematics in secondary schools. The importance of educational resources is to improve students' knowledge,

abilities, and skills. From the foregoing, it implies that government and stakeholders in the sector are not doing optimally well, in providing educational resources needed by the teachers and students for advancing teaching and learning process. More importantly, government at various level needs to provide resources that is in conformity with what is trending at this 21st century such as electronic board, projector, computers, e-library etc. These will enhance teaching- learning and students' performance in all ramifications.

The finding of the study supported the assertion of Kochhar (2012) who asserted that availability of educational resources are very important learning and teaching tools. Favorable school environment provides necessary stimulus for learning experience since students spend their most of their time in the school. Shamaki (2015) asserted that learning environment could be an essential key determinant to the students' achievement in mathematics. The findings of this study also agree with the study of Tata, Abba and Abdullahi (2014) who found out that lack of libraries and mathematical laboratories, lack of supervision and inspection of mathematics teachers are some of the main causes of poor performance in mathematics among public senior secondary school students. School environment go a long way in the teaching and learning mathematics.

Mudassir et al (2015) opined that school environment has a significant influence on academic performance of students. Class size is an important factor with respect to student academic achievement in mathematics. From the findings class size particularly large class has negative effect on the way student learn mathematics which later result to their poor performance in the subject. when class is overcrowded, teacher may lose class control and thereby unable to meet student's demand. Ayeni and Olowe(2016) study also corroborate this findings that class size can present more challenges for classroom management, pupil control, and marking, planning, and assessment.

CONCLUSION

Mathematics is an indispensable subject of study and plays an important role in forming the basic of all other sciences. Mathematics is a compulsory subject without which no student can gain admission to tertiary institution except he/she has credit pass in it. Besides this, one utilises the knowledge of mathematics in one form or the other on day basis. Therefore, as the matter of importance of this subject, teachers, students, government and all education stakeholders should continue to tackle and proffer solution to the factors responsible for students' poor performance in mathematics.

RECOMMENDATIONS

Based on the finding of the study, the following recommendations are made:

1. Large class size sometimes is as a result of poor funding. Government should increase the allocation budget on education sector so that there will be provision of more classrooms, furniture fittings, well stock library, textual materials, chairs and tables etc.
2. Regular capacity building workshops and training should be organized for mathematics teachers on techniques of teaching mathematics, class control and class management.
3. There should be effective guidance and counseling unit in all secondary schools, whereby students will be guided on the importance of mathematics and the need for paying serious attention to it. Also, student's social and emotional problems would be addressed.
4. There should be regular annual competition and quiz organized by Mathematical Association of Nigeria (MAN) and others.
5. Alumni, Parents and education stakeholders through P.T.A. should work to see that the school environment is friendly and conducive enough for learning.

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