
EFFECTS OF GEOBOARD AND GEOGRAPHICAL GLOBE ON SENIOR SECONDARY SCHOOL STUDENTS' PERFORMANCE IN MATHEMATICS IN KADUNA STATE

BY

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ABSTRACT

The study examined the effects of the use of instructional materials (Geoboard and Geographical Globe) on students' performance in mathematics in Sabon Gari Local Government Area of Kaduna State. Three hundred and fifty students were randomly selected from four secondary schools and used as sample for the study. The sample was divided into two groups- experimental and control. The study was quasi experimental design. A pretest was first given to both groups to ensure that they were homogeneous. Then the experimental group was taught mathematics using instructional materials like Geoboard, and Geographical Globe for six weeks while the control group was taught same topic with experimental group for same period but without the use of instructional materials. Both groups were post tested. A Mathematics Achievement Test (MAT) with a reliability coefficient of 0.78 calculated using split half methods served as the instrument of the study. Two research questions were asked and two hypotheses were formulated to guide the study. Some of the findings of the study include: Significant difference existed between the experimental and the control group with $p=0.02$; it was also discovered that there was no significance difference between the performance of male and female when taught mathematics with the use of Geoboard and Geographical Globe. Finally, it was recommended that mathematics teachers should use such as Geoboard, and Geographical Globe in their teaching

INTRODUCTION

Mathematics has held a leading position among other school subjects because it's considered to be an indispensable tool in the formation of an educated man (Osefehinti, 1990). The language of instruction may vary but the subject (mathematics) remains constant and compulsory at basic educational level in all formal schools all over the world. According to Robinson (2009) more recognition is given to mathematics because of its application in the area of defense, industrial process, finance, management, medicine and technology. Furthermore, because the world reliance on technology has grown so much the demand for people who can think in abstract terms of mathematics and science is on the

increase. Consequently technical jobs that make up nearly one-third of all employments opportunities in the developed countries are meant for candidates with mathematics background (Burghes, 2011).

Mathematics is a core skill for all adults in life. Generally, a mathematically well-educated population will contribute to Nigeria's economic prosperity. Apart from the fact that people of different vocations such as carpenters' bricklayers, farmers etc apply the knowledge of mathematics daily in their professions. More so, other science subjects such Chemistry, Physics Computer Science, solve problems in their field through Mathematics. Kreyzing (2006) buttressing this fact stated that " Problems in Engineering, Physics, and

Computer Science are mostly formulated in mathematical form, then a mathematical solution is

obtained, finally the result is interpreted back to physical form” This can be illustrated with a flow chart in Figure 1

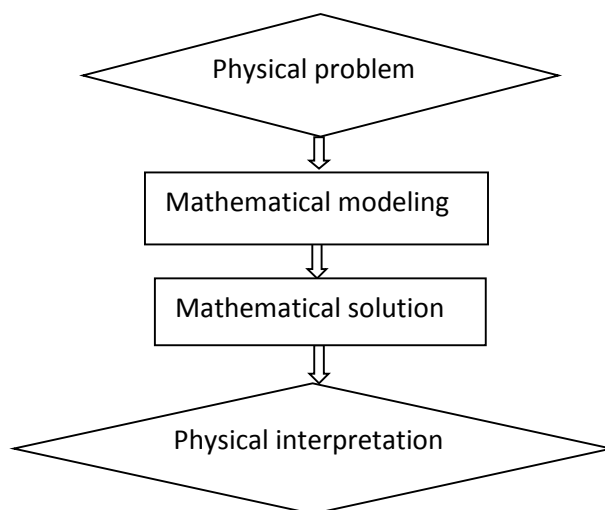


Figure 1: Flow chart

Despite the importance of mathematics to individual and indeed country’s general development, a case at hand is that the performances of secondary

school students in WAECSSCE have continued to be poor. WAEC performance statistics from 2004-2015 clearly points a fluctuating picture

Table 1: Summary of WAEC SSCE Results in Mathematics

Year	Percentage pass (credit pass & above)
2004	34.51
2005	38.23
2006	39.22
2007	15.56
2008	23.00
2010	24.9
2011	38.9
2012	37.8
2013	38.3
2014	31.30
2015	39

Sources: WAEC Performance statistics records (2004-2015)

Today is no longer news that many students see mathematics as a difficult subject and therefore have little or no interest in the subject. A major cause of lack of interest and poor performance in mathematics according to Odili (2006) is excessive use of theoretical expression of formulae by mathematics teachers while the learner's remain passive listeners.

Poor performance in mathematics affect both genders. Korau (1990) Holden (1998) Guo & Leahey (2001) and Begley (2009) reported that there is very little gap in mathematics performance between girls and boys at the basic level. They further revealed that boys tend to progress much more quickly as they become older than their female counter part. Similarly Clark and Gorki (2002) reported that at higher level of mathematics girls confidence decreased drastically. In the same vein the results of Third Intentional Mathematics and Science Study (TIMSS 2003) supported the view that there is very little gap between the performance of boys and girls in primary school. The result further stated that the gap becomes wider as boys and girls grow to become men and women. The researcher of this work is interested in finding out the extent to which the use of instructional would affects these findings.

Poor performance in mathematics have been the concern of many researchers for a long time, in which Drisebiyi(1999), Meremikwu (2008); Tapia & Marsh (2004) suggested the use of instructional materials as one the solutions to poor performance in mathematics. Instructional materials are educational resources used to improve students' knowledge and skills; to facilitate the assimilation of knowledge and to contribute to overall development of the students. These materials can be visual or audio visual materials, such as flash card, poster, and tape recorder.

Some of the importance of the use of instructional materials according to Azuka (2011) includes: instructional materials serve as a channel

between the teacher and the students. They are also used to arouse the attention of the learner He further said that instructional materials help in making mathematics more meaningful and realistic as well as increase motivation and memory

An important instructional materials that is easy to make and use in mathematics classroom is called Geoboard. Geoboard is a short form for geometrical board. Russel (2013) described a Geoboard as a manipulative that is used to support learning of geometry, measurement and numeracy A Geoboard is made up of piece of wood and some nails. It can be used to demonstrate the properties of plane shapes, it also useful in the study of area and perimeter of plane shapes. Geographical Globe is another vital instructional materials that is used in teaching and learning of Longitudes and Latitude which is a common concept to both mathematics and Geography.

In a similar development Akanmu (2015) in his study on the application on Geogebra software into the teaching and learning of mathematics in Nigeria, found that when students are taught with Geogebra software performed significantly better than those that are taught using traditional method. The researchers are interested in contributing their quota, similarly, in the field of mathematics in finding out if the use Geographical Globe and Geoboard will improve students' performances in Senior Secondary School mathematics Sabon Gari Local Government in Kaduna State.

Statement of the Problem

The poor performance of students in mathematics has been a source of concern to mathematics educators, parents and government at all level. The Chief Examiner's annual reports in mathematics in the Senior Secondary School Examination (SSCE) are good testimonies to that. Mathematics educators have traced this problem to many factors such as the nature of mathematics and

teaching without the use of instructional materials .In fact, many teachers teach mathematics in absolute abstract terms which make students see no connection between mathematics and real life problems. Based on these facts, the researcher wishes to investigate if the use of instructional materials such as Geoboard, and Geographical Globe will help to improve the students' performance in mathematics

Objectives of the Study

The objectives of the study are to:

- i. find out the effects of the use Geoboard and Geographical Globe on Senior Secondary School Students performance in mathematics in Sabon Gari Local Government in Kaduna State
- ii. asses how the use of Geoboard and Geographical Globe affect the performance both gender in mathematics at Senior Secondary School Students in Sabon Gari Local Government in Kaduna State

Research Questions

The following research questions were formulated to guide the direction of this study

- i. What is the effect of the use Geoboard, and Geographical Globe on the students' performance in mathematics among Senior Secondary School Students in Sabon Gari Local Government in Kaduna State?
- ii. What is the difference between the performance of male and females in Senior Secondary School Mathematics when taught with or without the use Geoboard and Geographical Globe

Hypotheses

The following null hypotheses were formulated to guide the study

H₀₁: There is no significant difference between the performance of students taught mathematics with the use of Geoboard, and Geographical Globe and those taught without Geoboard and Geographical Globe.

H₀₂: There is no significant difference between the performance of male and female Senior Secondary School Students' in mathematics when taught with the use of Geoboard and Geographical Globe and the students taught without it

METHODOLOGY

The population of the study consisted of all the public secondary schools in Sabon Local Government Area of Kaduna state. The total population of SS II students in public secondary school in Sabon Gari Local Government Area is 5800. A stratified random sampling technique was used to select a total of 350 student from four secondary schools (168 male and 182 females) as suggested by Morgan and Krejcie (1970).

Two of the schools were designated as experimental and control group respectively. The experimental schools were: Government Secondary School, Basawa and Government Day Secondary School, Kwangila. While the control schools were: Government Day Secondary School, Bomo and Government Commercial College Zaria. The schools were selected by balloting. The research design was quasi experimental- pretest and posttest control group. The subjects were first pretested to ensure that they were homogeneous Then the experimental group was taught mathematics using instructional materials (Geoboard, , Geographical globe) while the control group was taught without the use of these materials. The topics taught include: Plane Geometry, Circle Theory Longitude and latitude. These topics are considered to be difficult areas in ordinary level mathematics.

Instrumentation

The research instrument used for the data collection was constructed by the researcher; it was tagged 'Mathematics Achievement Test' (MAT). The instrument was validated by two experts in Mathematics Education; a Professor and a Reader from Ahmadu Bello University Zaria. Both face and content validity was done to enhance its usage. The suggestions given by the

experts were incorporated and corrections effected. The reliability coefficient was calculated to be 0.78 after the pilot test result was subjected to split half method:

Results

The mean, standard deviation and t-test analysis were calculated using statistical packages for social science (SPSS). The results are as follows:

RQ1: What is the difference between the performance of students taught with instructional materials and those taught without instructional materials?

Table 2: Mean and Standard Deviation of Student Performance

Sources	N	Mean	SD
Experimental	175	74.11	12.46
Control	175	53.95	12.70

From Table.2. It's clear that the mean of experimental group is greater than the mean of control Hypothesis

group. However, we cannot conclude whether the difference is significant or not; until we test the

H0: There is no significant difference between the performance of the experimental and control group.

Table 3: t- test Statistics on the Performance of Experimental and Control Groups

Source	N	mean	S.D.	df	t	p	Decision
Exp	175	74	12.46	348	4.2	0.02	significant
Control	175	53	12.70				

Table.3 shows that there is significant difference between the experimental and the control group since the value of $p=0.02$ is less than 0.05.

Therefore, the null hypotheses is rejected and the alternative hypotheses is retained

Research question 2

RQ2: What is the difference between the performance of male and females in secondary school mathematics taught with or without teaching material?

Table 4: Mean and Standard Deviation of Student Performance according Gender

Source	Gender	N	Mean	S.D
Experimental	Male	84	76.73	11.70
	Female	91	71.69	12.67
Control	Male	84	55.65	12.00
	Female	91	52.33	13.16

From Table 4 it is obvious that both gender (male and female) of the experimental group performed better than the control group. However, we cannot say that the difference is significant or not. Furthermore we

can see little difference between the performance of boys and girls in both experimental and control group in favors of boys

H_{02} : There is no significant difference between the performance of boys and girls in the experimental group.

Table 5: t-test of the Performance of Experimental Group According to Gender

Gender	N	Mean	S.D	df	t	p	Decision
Male	84	76.7	11.70	173	2.4	0.16	NS
Female	91	71.70	12.67				

From Table 5.it can be seen that the p value is greater than 0.05 which is not significant. This indicates

that this use of instructional material is gender friendly since both genders benefitted from the treatment.

H_{03} : There is no significant difference between the performance of males and females in the control group

Table 6: t-test Statistics of the Performance of the Control Group according to Gender

Gender	N	mean	S.D	df	p	decision
Male	89	55.5	12.00	178	0.00	S
Female	91	52.5	13.16			

Table 6 shows that there is significant difference between the performance of male and female students in the Control Group. This shows that the lecture method is not a gender friendly method.

DISCUSSIONS

From Table.3, it can be seen that the first hypothesis which states that there is no significant difference between the performances of students taught mathematics with the use of instructional materials (Geoboard, Geo-trigonometric Sets and Geographical Globe) and those taught using conventional method was rejected with p-value is 0.02 which is less than 0.05. And alternative hypothesis is accepted. In summary students taught with instructional materials performed significantly better than those without instructional materials. This agrees with the findings of Tapia and Mash (2003) which said that the instructional materials are essential materials that enhance the teaching and learning process. It also agrees with the findings of Akanmu (2015) who found that the use of Geo-gebra software enhances students' performance in mathematics. This also in line with the findings of John (2013) which revealed that the use of instructional materials increases students' performances in Economics.

The results of the experimental group based on gender showed that there is no significance difference between the performance of boys and girls in mathematics when instructional materials is used in teaching mathematics with $p=0.16 > 0.05$. In other words we can say that the hypothesis is retained. This is in conformity with the findings of Korau (1990); Holden (1998); Begley (2009 and TIMSS (2013) which all indicated that there is no significant difference between the performance of boys and girls in Mathematics at the lower level. Furthermore one can conclude that the use of instructional materials is gender friendly.

However, the results from the control group based on gender showed significant difference existed between the performance of males and females in favor of males. This shows when students are taught without the use of instructional materials the boys perform better than girls.. This shows that the use of instructional materials helps in bridging the gap between the performances of males and female in mathematics.

SUMMARY OF THE FINDINGS

The study was conducted to find out the effects of the use of instructional materials in the teaching and learning of mathematics. The summary of the findings are as follows:

- i) There is significant difference between the performance of the experimental group (those that were taught using Geoboard and Geographical Globe) and the control group (those that were taught without instructional materials)
- ii) There is no significant difference between the performance of boys and that of girls in the experimental group. This indicates that the use of Geoboard and Geographical Globe is gender friendly.
- iii) Significant difference was found between the performance of boys and girls when taught without the use Geoboard and geographical Globe.

CONCLUSION

The findings of the study have shown that student when taught mathematics with instructional material performs better than those who are taught without instructional materials. The result is in conformity with other findings not only mathematics but in other subjects. The use of instructional materials in the teaching and learning of mathematics reduces the abstract nature of mathematics, arouses the students'

interest, and makes learning of mathematics more meaningful and more interesting.

RECOMMENDATIONS

Based on the findings above, the following recommendations are given:

- Mathematics teachers in secondary schools in Sabon Gari LGA should use instructional materials (Geoboard and Geographical globe) in teaching of mathematics
- Principals of secondary schools in Sabon Gari LGA should encourage their mathematics teachers on the use of instructional materials such as Geoboard, Geographical globe
- Principals, proprietors of schools and ministry of educations should ensure that they supply of instructional materials mentioned above to their mathematics teachers.
- Authors of mathematics text books should motivate teachers on the use of Geoboard, Geographical Globe and other instructional materials through the illustrations of the use of these materials in their text books
- State Ministries of Education should organize regular retraining workshop for their mathematics teachers on the use of instructional materials such Geoboard, and Geographical Globe

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