



## EFFECTS OF MATHEMATICAL MODELLINGS ON PERFORMANCE AS A MEANS OF MATHEMATICAL CREATIVITY AMONG SECONDARY SCHOOL STUDENTS IN BORNO STATE.

MARI LIKITA AND ENOS N. MAMMAN

*Kashim Ibrahim College of Education, Maiduguri.*

### Abstract

**T**his study investigated the effect of mathematical modeling on problem solving abilities of senior secondary school students (ss1) in Borno State, Nigeria. A sample ( $n=220$ ) of ss1 students was drawn from twelve (12) Senior Secondary Schools in four local government areas using simple random sampling method. The research instrument which consists of 20 items questionnaire on the effect of mathematical modeling was administered on the students in the schools to measure the students abilities to solving problems. The study shows there is no significant

difference between mathematical modeling and performance because almost all question items were greater

### KEYWORDS:

Mathematical Modeling, Problem Solving Abilities, Performance, Mathematics creativity

than 2.50 which was considered to be acceptance level. The study recommended that teachers should use mathematics models to enhance students abilities and performance and to encourage students have interest in mathematics.

### INTRODUCTION

**T**here is no doubt that Mathematics is taught to learners in pre-primary, primary and secondary schools on a daily basis as compulsory subject in Nigeria and many other countries in the world. The reason among others is the fact that the knowledge of

mathematics is indispensable in the training of individual learners to be able to live a useful life in the society. Buttressing this reason, Okonkwo (1996), Ebeh (2000), Kline as cited by Obodo and Onoh (2000) and Folayan and Ibrahim (2000) admitted that Mathematics is a core course of study which serves as the bed rock of technology and gate way to other Sciences and a very significant subject for the intellectual development of an individual.

Furthermore, they submitted that Mathematics serves as a tool for realizing a given Nation 's scientific aspirations, most especially through the aspiration of the knowledge in all human activities. Azuka (2000) summarized the vital role of Mathematics especially in national development by stating that science and mathematics in particular must be conceived as a process of social assimilation as well as the means for transmission of scientific and technical knowledge needed to transform rural societies of Africa into modern urban industrial states, without which it would be difficult to develop scientifically. Also, individuals in a given society would find it difficult to live a useful life without Mathematics (Bot, 2010).

(1).Mathematics models are a representation in Mathematical term of behavior of real devices and objects we want. (2).Mathematics model is a method of simulating real life situation with mathematical equations to forecast their interest (Bot 2010). Problem solving techniques comprises identifying and choosing mathematical problems which grow out of the experiences of individual students. Placing these problem before and guiding them as those of reflective thinking (Obodo, 2004).

According to Ogbazi (1989), problem solving is an approach of correlating sense, experiences and already accepted or established thoughts. Okries (1986) outlined sequence of problem solving as follows:

- Identifying the mathematical problem
- Define and delimit the mathematical problem
- Collect data and other evidence for solving the mathematical problem
- Propose hypothesis for the solution of the problem
- Try out the propose hypothesis
- Check the findings

Polya (1973) designed a frame work for solving word problem and other problems in mathematics which include:

- Understanding the problem
- Developing a plan to solve the problem
- Carrying out the plan
- Looking back

Despite the importance of mathematics and the use of models in teaching to solve mathematical problems, students' problem solving abilities and their performance over the years in mathematics most especially that of the candidate writing mathematics in external examination; the West African Examination Council (WAEC) and National Examination Council (NECO) has been declining fast, while the grades remains constantly poor for many years in Nigeria. The statistics of entries and result in May/June Secondary Schools Certificate Examination in mathematics as reported by WAEC (2012) and NECO (2012) Chief examiner shows that students' performance was poor compared to the other subjects.

Statement of the problem

The importance of mathematics in life of an individual and in national development cannot be overemphasized. However, there is dissatisfaction over the achievement of students in the subject **because** of poor performance especially in WAEC and NECO examinations. Consequently, there is need to address **this poor performance by exploring various methods of** teaching mathematics to students particularly through mathematical modeling.

#### **PURPOSE OF THE STUDY**

The main purpose of study is to see whether the use of mathematics modeling in problem solving can improve mathematics achievement of secondary school students.

#### **Research questions**

1. Does the use of mathematics modeling in problem solving lead to the development of better problem solving abilities and better understanding of mathematics among secondary school students?

2. To what extent does the use of mathematics modeling in problem solving lead to better achievement in mathematics?
3. Does the use of mathematics modeling have differential effects on boys and girls achievement in mathematics?
4. In what ways do the use of mathematical modeling develop students positive attitude in mathematics?

The research design used in the study includes population and sample, sampling procedure, method of collecting data and data analysis.

To carry out this study, the quasi-experiment research design was used in the non equivalent control group. Pre-test and post-test were administered to the control and the experimental group to ascertain the difference in performance.

The target population of the study comprised all Senior Secondary School Students (SS1) in Borno State.

The sample used for study consisted of 240 students. Twenty (20) students were randomly selected from SS1 in three (3) schools from each of the four local government areas.

Simple random sampling technique was used to select the schools and the local government areas.

The instrument for data collection were questionnaire with twenty items called the Mathematics Modeling Understanding Questionnaire (MMUQ) and Mathematics Achievement Test (MAT) constructed and validated by the researchers to answer the research questions

With the aid of the co-researchers and some teachers in the sampled schools, the twenty item questionnaire were administered to the student including the MAT.

A mean rating scale was used to answer the research questions in which a discussion was presented based on the level of mean  $\geq 2.50$  accepted and  $\leq 2,50$  rejected and the pre-test scores obtained from the administration of MAT instrument were analyzed using mean( $\bar{x}$ ), standard deviation (SD) and t-test at 5% level of significance. The mean and standard deviation were used to measure the scores of both males and females in MAT, while the t-test was used to measure the level of significance  $\bar{x}$  for each of the experimental and control groups.

$$\bar{x} = \frac{\sum x}{N}, \text{ SD} = \frac{\sqrt{\sum (x-\bar{x})^2}}{N} \quad \text{and} \quad t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where  $\bar{x}$  = mean, N= number of class (single size) =  $\sum x$  = sum of all scores (responses),  $s_1^2$  = Variance in scores for males,  $s_2^2$  = Variance in scores for females.

## RESULTS AND DISCUSSION

The research intended to find out the effect of Mathematics Modeling in problem solving abilities of senior secondary school student (SS1) in Borno state. Twenty questionnaires were collected and returned by the students sampled in each school. The research questions were analyzed by mean rating scale of  $\geq 2.50$  accepted and  $\leq 2.50$  rejected, while hypotheses were tested by mean, standard deviation and t-test for level of significance between experimental and control groups.

Table 1. Does the mathematical model in problem solving lead to the development of best problem solving and better understanding of mathematics among students?

S/n	Item	mean	Description
1.	Mathematics is very difficult subject to learn	4.14	Accepted
2.	Mathematics modeling enhances any problem solving abilities?	3.47	Accepted
3.	Mathematical symbols are difficult to identify and interpret	3.13	Accepted
4.	Mathematical models are difficult to identify and interpret	2.76	Accepted
5.	My teacher has difficulty in interpreting mathematical models	3.86	Accepted

From table 1 above, most of the item have mean above 3.00 and the greatest mean of  $3.47 > 3.00$  which means mathematical model enhance the problem solving abilities among students.

Table two 2. To what effect does the use of mathematical modeling in problem solving lead to better understanding in mathematics?

S/n	Item	mean	Description
6.	There are no adequate mathematics model in classes	3.82	Accepted
7.	Mathematical problems in mathematics are more preferred to worded problems than models	3.54	Accepted
8.	I hardly understand what my mathematics teacher is saying in the class when using models	2.40	Accepted
9.	The models used in the mathematics textbooks are difficult to understand and interpret	3.61	Accepted
10.	There are no adequate mathematics textbooks in the library	3.35	Accepted

From table 2 above, only one item has its mean less than 2.50 and the grand mean of  $3.82 > 3.00$  which shows that there are no adequate models in class thereby affecting the performance of the students in problem solving abilities.

Table 3. How does the use of mathematical modeling have differential effects on boys and girls achievement in mathematics?

S/n	Item	mean	Description
11.	I enjoy mathematics when taught with models.	3.57	Accepted
12.	I do not surrender easily when solving mathematics because I am a boy.	3.80	Accepted
13.	I am good in mathematics because I am a female.	3.06	Accepted
14.	My mathematics teacher is friendly to boys than girls.	2.22	Accepted
15.	Boys see mathematics as an easy subject.	3.42	Accepted

Table 3 above indicated that most item have mean greater than 2.50 and the grand mean of 3.80 >3.00. This shows that boys enjoy and do not surrender easily when solving mathematical problems which result in better performance than girls. This is further buttressed by the fact that teachers are more friendly to boys than girls.

Table 4. In what ways do the use of mathematical modeling in secondary schools develop students positive attitude in mathematics?

S/n	Item	mean	Description
16.	Girls see mathematics as a hard subject	2.40	Accepted
17.	I attend mathematics lesson regularly and perform good when teacher uses models.	4.10	Accepted
18.	I like mathematics because my teacher encourages me and supplies me with all mathematical models.	3.92	Accepted
19.	My mathematics teacher encourages me to develop interest in mathematics.	3.83	Accepted
20.	I am happier in mathematics lessons than the other Lessons.	3.50	Accepted

From the table above , one item shows a mean of less than 2.50 and grand mean of 4.10 , this reveals that students who regularly attend lessons perform better when teachers uses models. It also indicate that they like mathematics and they were encouraged by their teachers, which means that using mathematical modeling in teaching enhance performance and develop positive attitudes in mathematics.

#### **CONCLUSION/RECOMMENDATIONS**

Based on the following findings, the following conclusions were made. Twenty item questionnaires were distributed and a Mathematical Achievement Test (MAT) was administered to 240 students in the selected schools in the state. The responses from the students were collected and analyzed by mean rating of which decision was taken to reject and to accept. The mean rating scales of less than 2.50 were rejected and greater than 2.50 were accepted, and the study revealed

that mathematical modeling enhances, develop and motivates the students to perform better in mathematics.

The researchers would like to make the following recommendations based on the findings of the study. The recommendations if adopted will go a long way in improving students performance in mathematics.

1. It is important that necessary measures be put in place in our education system to enhance student use mathematical modeling.
2. There is need to apply any form of method to eradicate mathematics phobia in students.
3. Mathematics teachers are to be trained and retrained in using mathematical modeling in teaching mathematics.
4. Students should be encouraged to build positive attitude towards mathematics.

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