

**EVALUATING THE EFFECTS OF TEACHER-MADE INSTRUCTIONAL MATERIALS ON STUDENTS' ACHIEVEMENT IN MATHEMATICS IN SELECTED SECONDARY SCHOOLS IN IJEBU-ODE LOCAL GOVT. AREA, OGUN STATE, NIGERIA.**

**Tobih, Deborah Oluwafunmilola (PhD)**

Mathematics Department,

College of Science and Information Technology

Tai Solarin University of Education, Ijebu-Ode, Nigeria

drtobih002@gmail.com

**Afolabi, Adedeji**

Department of Educational Technology,

Emmanuel Alayande College of Education, Oyo

cagemafo@yahoo.com

**Akorede, Olufunbi Jimoh (Ph.D)**

Educational Technology Unit,

Department of Educational Foundations & Instructional Technology,

Tai Solarin University of Education,

Ijebu-Ode, Nigeria

akoredejimmy55@gmail.com

## **Abstract**

The study examined the effect of teacher-made instructional materials on students' achievement in mathematics.

A pre-test –posttest control group quasi- experimental research design was used for the study. The population comprises secondary school students in Ijebu-Ode Local Government Area, Ogun State, Nigeria. Five schools were randomly selected and SS2 students of the selected schools were used for the study. The sample size in each school was divided into two groups: the experimental and control groups. The experimental group was taught mathematics using instructional materials while the control groups were taught without materials. A total sample size of 310 was used.

One (1) stimulus and one response instrument were used to collect data in this study. The stimulus instrument consisted of Instructional Guide on teacher-made instructional materials-based instruction and conventional lecture-based instruction. The teacher-made test constructed by the researchers whose reliability coefficient (0.77) was obtained using KR-20 formula while the total item difficulty level for the test is 0.57 which shows that the test was not too simple or too difficult. The scores obtained from the tests (pre-test and post-test) were used for the analysis. Three hypotheses were raised and analysis of covariance (ANCOVA) was used to analyze the data. The results revealed a significant main effect of treatment on the students' achievement in mathematics.

**Keywords:** effects, achievements, teacher- made instructional materials, pre-test, post-test, experimental group, control group.

## **Introduction**

Mathematics is the way to understand all sort of things in the world around us and only those who know the language in which the book of nature is written can read it. That language is mathematics. In other word, mathematics is fundamental to understanding of the world, it is the best way to describe the world. Mathematics is everywhere and everything seen is a combination of different concepts, an understanding of mathematics is a prerequisite to understand and appreciate nature.

Mathematics, as published by the British government in 2003, is the most versatile of all the sciences and uniquely placed to respond to the demands of a rapidly changing world. It is very much significant in our daily activities. Virtually everybody needs the knowledge, understanding and application of mathematics to make progress in life: A fashion designer who is not well versed in mathematics will spoil people's cloth, a bricklayer who doesn't know mathematics cannot erect a perfect building, a businessman who is deficient in this important subject will make a loss most often.

Study of mathematics is important because it is a preparation for citizenship and requires becoming a useful person in the sense of having vocational skills, many of which involve mathematics. In addition, participation in the political decision making process of modern societies requires a level of understanding of economic and statistical concepts. Students who want to take post secondary training at University will find that good scores in senior high school mathematics are essential requisite for admission. Achievement in Mathematics is a convenient filter for screening applicants. The justification for this is that anyone who has achieved good scores in mathematics in school examination have demonstrated a capacity for learning and is therefore likely to do well at other things. Steinbeck (1994).

An article on 'Why Study Mathematics' gave the followings as reasons for the study of mathematics: Mathematics is used in everyone's daily life. It's principle help to develop problem solving skills. It helps to build logic and pattern recognition in the brain. Without mathematics, simple cooking would be a horrendous task and will not be able to deal with fraction and measurements of all various foods. It plays an indirect role in how people make many day to day decisions in finances and time management.

In view of the above reasons, it is essential to ensure that students' achievement in the subject is enhanced through proper teaching. Learning, according to Uyangor and Ece(2010) means an individual is developing a new knowledge, skill or attitude as a result of his/her interaction with his/her environments. The concern of educators is the purposive learning realised through instructional efforts. According to them, the way instruction are planned has an effect both on what has been learnt and on how an individual will use the thing he/she has learnt. For this reason, teaching learning process includes selection, arrangement, transferring knowledge in a poorer environment and interaction between this information and the individual learning environment means not only the place that instruction will occur but also the methods, instrument, equipment and materials which will be used in transferring the knowledge and guiding the works of individuals in learning process. (Demirel, Yagci, and Seferoglu 2003).

Consequently, it is evident that the use of instructional materials in the teaching and learning of mathematics are important. It is an integral component in the classroom which can assist students to learn and understand the material faster and better.

The many benefits of instructional materials according to Onasanya and Omosewo (2011) include helping learners improve reading comprehension skills, illustrating or reinforcing a skill or concept, differentiating instruction and relieving anxiety or boredom by presenting information in a new exciting way. Instructional materials also engage students' other senses since there are no limits in what resources can be utilized when supplementing a lesson.

Instructional materials according to Toscani Academy (2012), are those materials that help the teachers explain better instructional content and help students understand better. They include audio, visuals and audio-visual resources.

- Visuals - These are materials that use the actual vision like maps, charts, pictures.
- Audio - These materials use students' sense of hearing e.g. radio, audio player.
- Audio-Visual -Combine both the vision and hearing senses e.g. television, computer, media projector synchronized with sound.

Instructional materials, when introduced, helps to capture students' interest, motivate them to learn in a better way and retain more concepts permanently. When students see, hear, taste, and smell, it helps develop the proper image and effort is made to create real environment. It

facilitates the proper understanding and discourages the act of cramming. It also helps to effectively increase the vocabulary of students. In addition, it reduces the workloads of explanation on the part of teachers. To support these, Akkoyunlu (2002) submitted that instructional materials motivate students and encourage them to study lessons providing them with opportunity to have access to information and to evaluate it. Also, Demirel (2005) states that utilization of instructional technology in teaching-learning processes provides a more effective presentation of instructional technology in teaching-learning processes and provide a more effective presentation of instructional content and moreover makes instruction more meaningful and enjoyable. It is expected that teachers should therefore complement teaching and learning with the use of adequate instructional resources.

Omosewo (2008) and Akinsola (2000), considered human factors as the teachers' professional commitment, creativity, mechanical skills, initiative and resourcefulness. They found that many Nigerian teachers were aware of possibility of improvisation of instructional materials but many exhibited poor attitudes towards its improvisation. They also noted that majority of teachers depend on imported equipments and claim that improvisation is time consuming and fund depleting. However, Onasanya, Adegbija, Olumorin and Daramola, (2008) noted that improvisation demands adventure, creativity, curiosity and perseverance on the part of the teachers. Bassey (2002) described instructional media a system components that may be used as part of instructional processes which are used to disseminate information message and ideas or which make possible communicable in the teaching-learning process.

The findings of Sekerci, Kurban, Cimon, Kiziltas, Turan, Demirci, Basci and Goktas (2008) establish that students have a positive attitude towards the use of technology in class and that they welcome the use of technology in class through which they Can become more active during the lessons and have easy access to resources. In fact, the study of Dundar (1977) revealed that education with supplementary materials at primary schools has significantly enhanced the comprehension of mathematics.

The National Council of Teachers of Mathematics (NCTM) recommends instructional tactics that promotes conceptual understanding of mathematical concepts and useful skill development. Joann Flick (2013) submitted that in order to promote conceptual understanding, students need to assess a situation independently and apply the correct mathematical formula to solve problem beyond the classroom. Promoting higher level thinking is the key to the NCTM's release of curriculum focal points (Obioha, 2006). Media

resources such as video, computer games, animations or simulations can provide useful context for learning abstract concepts (National Research Council 2000). These technologies also accomplish an important task instruction to present the concept in a new way so that learners retain more information and grasp new concepts more readily. (NITTI, 2007).

Understanding of the basic knowledge of mathematics particularly at the foundation level and even at all levels need diligent teachers who have deep understanding of the basic concepts of mathematics by themselves and are ready to give it all it will take to dispense the knowledge to all learners.

The use of instructional materials in the teaching of mathematics for better understanding of mathematical concepts cannot be over-emphasized, however, many teachers teach mathematics without using instructional materials for many reasons, probably because they lack the knowledge of the concept, some of the materials are not readily available and they don't know how to improvise. Everybody (teachers and students alike) wants to be spoon-fed and nobody wants to go extra mile to do what will make his/her class interesting, many of the teachers are waiting for the school administrators and government to provide everything before they could work and if there is nothing, they are not bothered, no wonder the standard of education is falling everyday and even the government are not helping matters: irregular payment of salaries, no incentives for teachers. All these are the problems that make even those who may like to work not to be encouraged. Obioha (2006) and Ogunleye (2002) reported that there were inadequate resources for teaching science subjects, (including mathematics) in secondary schools in Nigeria, available ones are not in good conditions and may be too expensive. This then, call for improvisation of teaching materials which according to Daramola (2008) demands adventure, creativity, curiosity and perseverance on the part of the teachers, the skill which are only realizable through well planned training programme on improvisation. This study aimed at investigating the effect of the teacher-made of instructional materials on students' achievement in mathematics at secondary schools in Ijebu-Ode local government area, Ogun State, Nigeria. Most of the few teachers that are using instructional materials rely extensively on commercially produced instructional materials which are not readily available to teach even topic hence the need for teacher/made instructional materials.

Teachers-made instructional materials are resources produced by the classroom teacher, using available local materials among other, to complement teachers' effort in teaching and

learning. However the effectiveness of most of these teacher-made instructional materials, especially in mathematics, is rarely investigated hence the need for this study.

### **Statement of the problem**

Past studies have pointed to effectiveness of instructional materials in improving students achievement in school subjects including Mathematics.

Notably, most teachers relied on commercially-produced instructional materials which are expensive, not accessible and not available to cover all the topics in the scheme of work, thereby making the use of instructional materials in the classroom difficult if not impossible.

Some researchers have suggested the use of teacher-made instructional materials as alternative approach; however, there are few studies that have investigated the effectiveness of these teacher-made instructional materials especially in school subject like mathematics, hence the need for this study. Therefore, this study determined the effects of teacher-made instructional materials on students' achievement in selected topics in Mathematics in selected secondary schools in Ijebu-Ode Local Government Area, Ogun State, Nigeria.

### **Scope of the study**

The study covered the following topics in Senior Secondary School II Mathematics; Trigonometric ratios, Sine rules, Cosine rules and Trigonometric functions of special angles in senior secondary schools in Ijebu-Ode Local Government Area, Ogun State, Nigeria were involved in the study.

### **Research Questions**

The study provides answer to the following research questions

1. Will there be any difference between the experimental and control groups on Mathematics achievement Test?
2. Will there be any difference in the students' achievement Test in mathematics by gender.

### **Hypotheses**

The following hypotheses were tested at .05 level of significance.

HO<sub>1</sub>: There is no significant main effect of treatment on students' achievement in Mathematics

HO<sub>2</sub>: There is no significant main effect of gender on students' achievement in Mathematics

HO<sub>3</sub>: There is no significant interaction effect of treatment and gender on students' achievement in Mathematics

## **Methodology**

### **Research Design**

This study adopted a pre-test, post-test control group quasi-experimental design. There were two groups classified into experimental and control group respectively.

The study employed 2 x 2 factorial matrices which is made up of instructional approach at two levels, Teacher-made instructional materials-based instruction and conventional lecture method while the moderator variable, gender, was examined at two levels (male and female)

### **Population**

The population for the study comprised secondary school students in Ijebu-Ode Local Government Area, Ogun-State, Nigeria.

### **Sample and Sampling Technique**

The sample comprised ten intact classes of 310 students selected from five secondary schools which are randomly selected. In each of the schools, two intact classes assigned into experimental and control groups respectively were used.

### **Instrumentation**

One(1) stimulus and one response instrument were used to collect data in this study. The stimulus instrument consisted of:

1. Instructional Guide on:
  - (i) Teacher-made instructional materials-based instruction
  - (ii) Conventional lecture-based instruction

### **Validation of Instructional Guide.**



The instructional guide was presented for expert review to determine the face validity, Procedural effect and Its suitability for the sample used. Their suggestions were used to produce the corrected version used in this study.

The response instrument consisted of Mathematics Achievement Test (MAT)

MAT was designed by the researchers and it is made up of two sections, A and B. section A consisted of demographic information while section B comprised Mathematics test to elicit the cognitive achievement of the students in selected topics in Mathematics.

MAT is a 40 multiple choice items with four options A-D. It is designed to cover the topics taught.

### **Validation of MAT**

The face validity of the instrument was done giving a 70-item test to five lecturers in the Mathematics Department, Tai Solarin University of Education, Ijebu-Ode, two experienced Mathematics teachers at Ijebu-Ode Grammar School, Ijebu-ode and two lecturers at Tai Solarin University of Education, Ijebu-Ode who are versed in test construction and development to ascertain the validity of the test in terms of suitability, clarity and breadth. This finally resulted into 40 item achievement test.

### **Reliability of MAT**

The reliability co-efficient of 0.77 was obtained using KR-20 formula while the total item difficulty level for the test is 0.57 which shows that the test was not too simple or too difficult.

### **Scoring of MAT**

Each item on the instrument attracted a score of one mark for correct response and zero for incorrect response. This gave a total of 40 marks which was converted to 100.

### **Research Procedure**

- Pre-test (for all at first)

- Treatment (each of the group)
- Post- test (each of the groups)
- Post test (each of the groups)

### Data Analysis

The data collected were analysed using Analysis of Covariance (ANCOVA) and T-test.

The ANCOVA was used to test the hypotheses and estimate of the effects of various factors on the dependent variable while T-test was carried to determine group difference and gender effects.

### Results

The results of this study are presented according to the sequence in which research questions were answered and the hypotheses tested.

#### Research Question 1

Will there be any difference between the experimental and control groups in Mathematics achievement test?

**Table 1.0: T-test of the difference between the control and Experimental Group**

Variable	Groups	N	Mean	SD	Sig.	Remark
Achievement	Control	155	56.94	25.57	.320	NS
	Experimental	155	60.14	22.79		

Table 1.0 shows that the control group had achievement mean score of 56.94 while the experimental group had 60.14. Notably, the experimental group had higher mean score than the control group which indicated that there was a difference between the two groups.

However, when the effect size was calculated it shows that the difference was not significant.  
 $P > 0.05 = .320$

**Research Question 2: Will there be any difference in the students' achievement test in Mathematics by gender?**

**Table 2: T-test of the difference in the students' achievement test in mathematics by gender**

Variable	Groups	N	Mean	SD	Sig.	Remark
Gender	Male	152	56.65	26.05	.022	Sig.
	Female	158	61.32	22.07		

Table 2 shows that male participants had achievement mean score of 56.65 while female participants had 61.32. Notably, the female participants had higher mean score than their male counterparts which indicated that there was a difference between the genders. However when the effect size was calculated, it shows that the difference was significant  $P < 0.05 = .022$ .

**Table 3.0: Summary of 2 x 2 ANCOVA of post-test Achievement scores of students in Mathematics by Treatment and Gender**

**Tests of Between-Subjects Effects**

Dependent Variable: Achievement

Source	Type III Sum of Squares	df	Mean square	F	Sig	Remarks	Partial Eta Squared
Corrected Model	69740.265 <sup>a</sup>	7	9962.895	26.934	.000		.384
Intercept	3605.918	1	3605.918	9.748	.002		.031
groups	121.828	1	121.828	.329	.566	NS	.001
archpret	12242.176	1	12242.176	33.096	.000	Sig	.099
gender	1019.039	1	1019.039	2.755	.098	NS	.099
groups* gender	181.654	1	181.654	.491	.484	NS	.002
Error	111710.770	302	369.903				
Total	1243753.000	310					
Corrected Total	181451.035	309					

a R Squared = 384 (Adjusted R Squared = 370)

### Estimated Marginal Means

#### Groups

Dependent Variable: achpost

groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
control grp	57.523 <sup>a</sup>	1.582	54.410	60.636
expgrp	60.512 <sup>a</sup>	1.590	57.382	63.641

a. Covariates appearing in the model are evaluated at the following values:

b. archpret= 38.2581, gender= 1.5097

**HO<sub>1</sub>: There is no significant main effect of treatment on students' achievement in Mathematics**

Table 3.0 shows that there is a significant main effect of treatment on students' achievement in mathematics ( $F_{(2,308)} = 33.096$ ;  $p < .05$ ). Therefore, hypothesis one is rejected.

This shows that there is significant difference in mathematics achievement mean scores of students exposed to treatment.

**HO<sub>2</sub>: There is no significant main effect of gender on student's achievement in mathematics.**

Table 3.0 shows that there is no significant main effect of gender on students' achievement in mathematics ( $F_{(2,308)} = 2.75$ ;  $p > .05$ ). Therefore, hypothesis two is therefore not rejected

**HO<sub>3</sub>: There is no significant interaction effect of treatment and gender on students' achievement in mathematics.**

Table 3.0 shows that there is no significant interaction effect of treatment and gender on students' achievement in mathematics ( $F(12,308) = 0.491$ ;  $P > 0.05$ ). Therefore, hypothesis three is therefore not rejected.

### **Discussion of Findings**

The first finding of this study indicated that the group of students taught with the use of teacher-made instructional materials had better achievement than their counterpart taught without the use of instructional materials. Another related finding revealed that there was significant effect of teacher-made instructional material on students' achievement in secondary school Mathematics.

These findings are supported by Awolaju (2015) who reports that students acquire more information which facilitates deep instructional materials understanding of the topics taught. Again, the finding also agrees with Mbah (2013) whose study revealed that use of instructional materials improved the quality of learning among the students.

The plausible reasons for this can be attributed to the fact that mathematics concepts are abstract in nature but when instructional materials are used, it enables the teacher to present the concepts in concrete forms which account for mastery learning and better understanding which might lead to better achievement in mathematics.

Further, the findings of this study also revealed that both male and female exposed to teacher-made instructional materials perform well but female students had better achievement than their male counterparts. However, the difference is not statistically significant. This findings support Okoboh et al. (2001) and Mbah (2013) who found that both male and female students perform better when they are taught with instructional materials and also similar to that of Bassey (2005) who also found that there was no significant effect of gender on students' achievement in physics. The plausible reasons for this may be due to the fact that students

acquire more information through many instructional materials which possibly brought deeper understanding of the topics under consideration. (Onasanya and Omosewo (2011))

### **Recommendations**

Based on the finding from this study, the following are recommended:

1. Teachers should develop a positive attitude towards the production and use of instructional materials
2. There should be organized workshops and seminars for teachers of mathematics in secondary schools on improvisation of instructional materials in the teaching and learning of mathematics
3. Teachers that produced teacher-made instructional materials for classroom instruction should be rewarded.

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