

# EFFECTS OF IMPROVISED INSTRUCTIONAL MATERIALS ON SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT AND INTEREST IN MATHEMATICS IN ENUGU EAST LOCAL GOVERNMENT AREA ENUGU STATE, NIGERIA

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**Abstract:** The study investigated the effects of improvised instructional materials on senior secondary school students' academic achievement and interest in Mathematics in Enugu East local government area of Enugu state. A quasi-experimental pre-test, post-test control group design was adopted for the study. A population of 1650 students and a sample of 78 students from public secondary schools in Enugu east local government area of Enugu state participated in the study. The researcher used Mathematics achievement test (M AT) and Mathematics Interest Inventory (MII) to collect relevant data for the study. The instruments were validated by three experts from measurement and evaluation and Mathematics education all from Godfrey Okoye University Enugu. The instruments were trial tested and the reliability index found to be 0.75 using Kudar-Richrdson 20 (K R 20). The MII yielded a reliability of 0.65 using Cronbach's Alpha formula. The data was analyzed using means and standard deviation while t-test analysis used to test the hypotheses. The findings of the study include those students who were taught Mathematics using improvised instructional materials significantly achieved better and showed higher interest rate than those who were taught with the conventional method. The researcher recommended among others those Mathematics teachers should be proactive in the provision of improvised instructional materials in the teaching of Mathematics in schools.

**Keywords:** Improved Instructional materials, Mathematics, Academic Achievement.

## INTRODUCTION

The concept of Mathematics is centered on numbers and shapes. It is a science visualized in symbols, logical statements, shapes, numerical quantities and arrangements. Mathematics is an essential tool for human endeavor and as such a subject that students must take very seriously and work towards its understanding for future academic pursuit. It is believed that no student excel without a sound mathematical foundation. Isaac-Oloniyo (2017) believed that a sound background in Mathematics is a pre-requisite for Science and technology courses in tertiary institutions and students' achievement in mathematics in secondary schools usually have a significant effect on their performance in future

studies. In the Nigerian education system, Mathematics is a core subject at the senior secondary school level and is compulsory for all students taking the Senior School Certificate Examination (SSCE) (NPF, 2004). It is necessary for students wishing to pursue academic careers in both Science and Art subjects. In view of these, it is imperative that teachers of Mathematics must be conscious of the methods and materials they choose in the instruction. However, different teaching approaches have emerged based on the various purposes for which Mathematics is used. Instructional materials play a vital role in the teaching and learning of Mathematical concepts as they help to communicate complex concepts through visual aids (Olatin

&Aquiobe, 2007). Furthermore, lack of sufficient funding allocated to education sector hinders the availability of instructional materials in our schools. According to Nwoke and Nwaneri (2020), the presence and sufficiency of teaching materials in schools for Mathematics instruction are influenced by various factors. Some of these factors include inadequate funding for education by relevance authorities, a significant increase in students enrolment, and even when materials are provided, they may not be relevant to the specific mathematical concepts being taught. The lack and insufficiency of instructional materials pose challenges in the teaching and learning of Mathematics which highlights the need for improvisation.

Improvisation, according to Samba and Eriba (2011) in Nwoke and Nwaneri (2020), refers to the process of using alternative resources when there is lack or shortage of proper teaching aids in educational settings. Improvisation involves utilizing local materials and resources to facilitate instruction effectively. Improvisation can also be defined as the act of providing teaching materials from the locality when there is a scarcity of appropriate and standard ones with the aim of achieving the desired objectives during teaching instructions. Thus, improvisation came into place as an alternative measure to procure instructional materials locally or handmade. Improvisation involves creating or modifying learning materials to serve a specific purpose when ready-made materials are unavailable. The use of improvised instructional materials in Mathematics teaching and learning has been found to make classes more engaging and effective (Ikwuka & Usifoh, 2013). Improvisation is done either where the ready-made material is not available or where it is available but could not be relevant to the instructional objectives. These materials facilitate quick understanding, provide hands-on learning experiences, and promote individualized instruction

on self-study. However, there is need therefore; to seek for the improvement on the methods of instruction in Mathematics; one of the best ways of improving mathematical achievement could be the use of instructional methods during teaching and learning of Mathematics.

Achievement refers to the progress students make in school, which is assessed through their scores. It can be seen as a behavior demonstrated within a specific time frame or range. It is the result of the knowledge and skills acquired through exposure to education (Ojo, 2015). One can also view achievement as the expectation of finding satisfaction in mastering challenging and difficult performances. However, the ultimate goal of improvising any instructional material during teaching is to raise student achievement to boost individual's knowledge and increase children's preparedness for future endeavors. Usman and Musa (2015) stated that students' poor achievement at external examinations conducted by West African Examination Council (WAEC) and National Examination Council (NECO) does start at the primary school level. Usman and Musa were of the opinion that the poor achievement could be due to poor teaching of the subjects and non- use of right instructional materials. This implies that right use of instructional materials is likely to improve students' achievement and interest in Mathematics.

Interest is a very strong factor in teaching and learning of Mathematics. It is the attraction which forces or compels a child to respond to stimulus. Ojo ((2015) stated that interest is a feeling of intentness, concern or curiosity about an object. The degree and direction of attitude towards Mathematics are largely determined by the kind of interest developed by students for Mathematics (Ozomadu, 2020). It is however, strongly argued that when one has interest in a particular activity, one is ready to explore it and motivated to carry out activity imposed on him. The implication in the teaching and learning of

Mathematics is that if the materials used for instruction by a teacher are such that appeal to the learner, he/she will put more interest and effective learning will take place.

Studies have shown that female students show less interest in Mathematics and have negative attitude towards Mathematics, hence they perform poorly in lower classes. For instance, Kolawale cited in Ozomadu,(2020) stated that male students show significantly more interest in Mathematics teaching and learning than their female counterparts. Mutemeri and Mugweri (2013) argue that the idea that Mathematics is for boys may result in low motivation in girls and could widen the gap in Mathematics achievement in favour of boys. Agwagah, (2013) lamented on the issue of disparity education in terms of access to education, participation and achievement of girls especially in Mathematics and Science. The implication is that teachers of Mathematics need to know that there are varying strategies and practices that can help when encountering male and female students 'with differing ability to learn and varying levels of pre-requisite knowledge. However, considering the poor academic performance of students in Mathematics, there is a need for teachers to use instructional materials to improve teaching and learning of the subject to both male and female students. Unfortunately, many secondary schools lack these materials.

Study by Miciano in Ikwuka and Usifoh, (2013) show that the use of instructional materials has significant effect on the performance of students in Mathematics. While studies by Ikwuka and Ezigbo (2015) proved that the use of instructional materials enhanced the performance of students in Mathematics. These compelling observations triggered the need for this study, to investigate the effect of improvisation of instructional materials on the academic achievement and interest of senior secondary school students in Mathematics.

### **Objectives of the study**

The study aims to investigate the effect of improvising instructional materials on the academic achievement and interest of senior secondary students in Mathematics. Specifically, the study sought to:

- Investigate the difference in mean achievement scores of students taught Mathematics using improvised instructional materials and those taught with conventional approach.
- Investigate the difference in mean interest scores of students taught Mathematics using improvised instructional materials and those taught with conventional approach.
- Investigate the achievement of male and female students taught Mathematics with improvised instructional materials
- Investigate the interest of male and female students taught Mathematics with improvised instructional materials

### **Research Questions**

The following research questions guided the study.

- ❖ What is the mean achievement score of SS2 students taught Mathematics using improvised instructional materials in the experimental and control groups in posttest?
- ❖ What is the mean interest scores of SS2 students taught Mathematics using improvised instructional materials in the experimental and control groups in both pre- interest and post interest?
- ❖ What is the mean achievement score of male and female SS2 students taught Mathematics using improvised instructional materials in the experimental group?
- ❖ What is the mean interest scores of male and female SS2 students taught Mathematics using improvised instructional materials in the experimental group?

### **Research Hypotheses**

The following null hypotheses were formulated and tested at 0.05 level of significance

1. There is no significant difference in the mean achievement score of SS2 students taught Mathematics using improvised instructional materials and those taught with conventional method
2. There is no significant difference in the mean interest score of SS2 students taught Mathematics using improvised instructional materials and those without it
3. Gender is not significant in the mean achievement score of SS2 students taught mathematics in experimental group.
4. Gender is not significant in the mean interest score of SS2 students taught mathematics in experimental group.

**Methodology**

The study uses a quasi-experimental pre-test, posttest control group design. A population of 1650 students and a sample of 78 SS2 students from public secondary schools in Enugu East Local Government Area of Enugu state were used for the study. The data collection instruments are Mathematic Achievement Test (MAT) and Mathematic Interest Inventory (MII). MAT was used to collect pre-test and posttest achievement scores. It is made up of twenty (20) multiple-choice questions with four options (A-D) each. The items were drawn using a table of specification to ensure adequate coverage of the content area covered in the study as well as maintain even spread across different levels of the cognitive domains tested. The questions which had options (A-D) with each correct option carrying 1mark and incorrect option having 0 marks. The scores were converted to percentages. The items

were developed to reflect the topics including mensuration, trigonometry, and geometry. MII was a 20-item interest scale developed by the researcher. It has a four-point response scale namely strongly agree (SA), agree (A), disagree (D) strongly disagree (SD). This is meant to determine the interest of students in Mathematics topics with improvisation approach. The respondents indicated their degree of agreement or disagreement of statements. The MII was made up of twelve positive and eight negative statements. Negative items were reversed scores. The instruments and instructional materials were validated by three specialists, one from measurement and evaluation and two from Mathematics education all from Godfrey Okoye University Enugu. The instruments were trial-tested using 40 students from a school not meant for the actual experiment. The reliability index of the instruments was established using Kudar- Richardson20 (K-R 20) since the items of MAT are dichotomously scored. A reliability coefficient of 0.75 was obtained. Similarly, MII yielded a reliability of 0.65 using Cronbach’s Alpha formula since the items are not dichotomously scored. The study covered a period of five weeks, during which the experimental group is taught with improvised instructional materials and the control group with conventional method. Data analysis includes means, standard deviation and t-test analysis.

**Results**

The initial performance of both the experimental and control group was measured through a pre-test.

**Table 1 presents the mean and standard deviation (SD) scores of the academic achievement in Mathematics for SS2 students in both groups (pretest)**

Group	N	Mean (x)	Standard Deviation
Experimental	38	11.50	2.84
Control	40	10.84	3.10

Table 1 display the mean scores of 11.50 and 10.84 for experimental and control groups respectively, as

well as the corresponding standard deviation scores of 2.84 and 3.10 for the pretest. The purpose of the

pretest was to establish the academic comparability of the experimental and control groups in Mathematics prior to the start of instruction. According the table, there is no noticeable disparity in the mean scores between the two groups. The outcome indicates that in terms of their prior understanding of the subjects, the students in both

the experimental and control groups were on equal footing before the intervention began.

**Research Question 1:** What is the mean achievement score of SS2 students taught Mathematics using improvised instructional materials in the experimental and control group in post-test?

**Table 2: Mean and standard deviation scores for the achievement of SS2 students in Mathematics for the experimental and control groups (post-test)**

Group	N	Mean(X)	standard deviation
Experimental	38	23.84	3.65
Control	40	14.63	4.32

Table 2 display the mean scores of 23.84 and 14.63 for the experimental and control groups respectively, in the post-test. The experimental group achieved a higher mean score compared to the control group. Additionally, the standard deviation score of 3.65 for the experimental group is lower than the control group's score of 4.32. This suggests that the

experimental group had a better level of dispersion in their scores compared to the control group.

**Research Question 2:** What is the mean interest score of SS2 students taught Mathematics using improvised instructional materials in the experimental and control groups in post interest?

**Table 3: Mean and standard deviation of Interest rating of SS2 students in Mathematics for the experimental and control groups in post-interest**

Group	N	Mean(X)	standard deviation
Experimental	38	12.54	2.98
Control	40	10.84	3.26

Table 3 displays the mean interest rating of 12.54 and 10.84 respectively, in the posttest. The experimental group showed a higher interest scores in Mathematics after treatment. Additionally, there is a higher standard deviation value of 2.98 in experimental and 3.26 in the control at the post-test. This suggests that the extreme rating were more in the experimental group than in the control group.

**Research Question 3:** What is the mean achievement score of male and female SS2 students taught Mathematics using improvised instructional materials in the experimental group?

**Table 3: Achievement of SS2 male and female students in Mathematics for experimental**

N	Pre-test	Post-test	Gain score	Gender
	Mean (X)	Mean (X)	Mean (X)	
12	12.32	24.00	11.68	Male
18	11.78	23.67	11.89	Female

Table 3 shows the mean scores of 12.32 and 11.78 for male and female students’ experimental group for pre-test, then 24.00 and 23.67 for post-test. The mean gain scores show 11.68 and 11.89 for male and female students respectively indicating that both males and females performed better in Mathematics when exposed to improvised instructional materials. Thus, gender has no significant effect on the achievement of male and female students who were taught with improvised instructional materials.

**Research Question 4:** What is the mean interest rating of male and female SS2 students taught Mathematics using improvised instructional materials in the experimental group?

**Table 4 : Mean and standard deviation of interest ratings of male and female students in experimental group in pre-interest and post-interest**

Gender	Pre-test Mean (X) N	Post-test Mean (X)	Gain score Mean(X)
Male	12      12.32	24.00	11.68
Female	18      11.78	23.67	11.89

Table 4 shows the mean interest scores of 23.42 and 24.34 for male and female students’ experimental group for pre-interest, then 32.61 and 33.54 for post-interest. The mean gain scores show 9.19 and 9.20 for male and female students respectively indicating both males and females indicating interest in Mathematics when exposed to improvised instructional materials. Thus gender has no

significant disparity in Mathematics interest when exposed to improvised instructional materials.

**Research Hypotheses**

Ho1      There is no significant difference in the achievement of SS2 students taught Mathematics using improvised instructional materials and those taught with conventional.

**Table 5: t-test comparison of the achievement of SS2 students who were taught Mathematics with improvised instructional materials and those taught without it.**

Source of variation	N	Mean (X)	SD	df	t-cal	t-crit	P 0.05
Experimental Group	38	23.80	3.62	76	9.87	1.68	Reject
Control	40	14.42	3.83				

Table 5 indicated that the calculated t-value of 9.87 is greater than the critical t- value of 1.68 at 0.05 significant, so, hypothesis 1 was rejected. Thus, there is significant difference in the achievement of SS2 students who were taught Mathematics with improvised instructional materials with mean scores of 23.80 and those taught without it with mean scores of 14.42. Those who were taught Mathematics

with improvised instructional materials performed better than those taught without it.

H02      There is no significant difference in the interest rating of SS2 students taught Mathematics using improvised instructional materials and those without it

**Table 5: t-test comparison of the interest rating of SS2 students who were taught Mathematics with improvised instructional materials and those taught without it.**

Source of variation	N	Mean Interest	SD	df	t-cal	t-crit	P 0.05
Experimental Group	38	32.45	2.72				Reject
Control Group	40	24.65	3.83	76	10.49	1.68	

Table 5 shows that the calculated t-value of 10.49 is greater than the critical value of 1.68 at 0.05 significant, so, hypothesis 2 was rejected. Thus, there is significant difference in the level of interest displayed by SS2 students who were taught Mathematics with improvised instructional materials with mean rating of 32.45 and those taught without it with mean score of 24.65. Those who were taught Mathematics with improvised instructional materials showed more interest than those taught without it. The implication is that performance is enhanced.

H03 There is no significant difference in the achievement of male and female SS2 students taught Mathematics using Improved instructional materials.

**Table 6: t-test comparison of male and female SS2 students' achievement in Mathematics**

Source of variation	N	Mean Interest	SD	df	t-cal	t-crit	P 0.05
Experimental Group	38	23.43	5.23				Fail to reject
Control Group	40	18.75	6.53	76	0.11	1.68	

Table 6 showed that the calculated t-value of 0.11 is less than the critical value of 1.68 at 0.05 significant, so, hypothesis 3 was not rejected. Thus, there is no significant difference in the level of interest shown by male and female SS2 students who were taught Mathematics with improvised instructional materials with mean rating of 23.43 for male and 18.75 for female. This suggests that male and female students showed equal interest when it comes to Mathematics learning.

H04 Gender is not significant in the mean achievement scores of SS2 students taught mathematics in experimental group.

**Table 7; t-test comparison of interest rating of male and female SS2 students taught with improvised instructional materials.**

Source of variation	N	Mean (X)	St.Dev.	df	t-value	t-crit	p-value
Male	12	24.00	3.24				Reject
Female	18	20.17	3.68	28	3.00	1.70	

Table 7 indicates that the calculated t-value of 3.00 is greater than the critical value of 1.70 at 0.05 significant, so, hypothesis 3 was rejected. Thus, there is significant difference in the level of interest shown by male and female SS2 students who were taught Mathematics with improvised instructional materials with mean rating of 24.00 for male and 20.17 for

female. This suggests that male and not female showed more interest

**Results**

In a quest to find the best method to improve the teaching and learning of Mathematics in our schools, the researcher carried out a study to investigate the effect of improvised instructional materials on senior

secondary school students' achievement and interest in Mathematics. The results showed that the participants who were taught Mathematics using improvised instructional materials significantly achieved better and showed higher interest than those taught with the conventional method (Table 2&3). These are in agreement with other researchers who argued that improvised instructional materials improved students achievement and interest in Mathematics (Ikwuka & Usifoh, 2013; Ikwuka & Ezigbo, 2013). Also, as regards to gender, both male and female students showed significantly better in achievement and interest when exposed to improvised instructional materials in teaching Mathematics (Table 4&5).

. The t-test analysis showed better academic performance in Mathematics by the experimental group because of the use of improvised instructional materials. This suggests that the use of improvised instructional materials has enhanced the teaching and learning of Mathematics among senior secondary students resulting in higher achievement gains by the learners. This finding is in agreement with the findings of Ikwuka and Usifoh (2013), Ikwuka and Ezigbo (2015) who found that the use of instructional materials improved academic performance of students in Mathematics. The result of research question two revealed that students who were taught with improvised instructional materials showed a higher interest rating in Mathematics after treatment. Also, the t-test analysis of hypothesis two showed an improved interest rating in Mathematics when students are taught with improvised instructional materials. This suggests that there is significant difference in the level of interest displayed by students who were taught Mathematics with improvised instructional materials. The finding is in agreement with the finding of Ozomadu (2020) who argued that male students showed significantly more interest in Mathematics than their female counterparts.

## **Conclusion**

. The result of the study revealed that improvised instructional materials enhanced better achievement and interest than those taught with conventional method. Also the use of Improvised instructional materials in teaching Mathematics is gender friendly.

## **Recommendations**

Based on the findings of the study, the following recommendations were made:

1. Mathematics teachers should be proactive in the provision of instructional materials in the teaching and learning of Mathematics in schools where standard ones were not available or limited to enhance achievement and interest.
2. Government should try to provide funds to secondary school teachers to enable them improvise instructional materials for teaching Mathematics.
3. Workshops and seminars should be organized for secondary school Mathematics teachers to train them on improvisation of instructional materials.
4. Mathematics teachers should encourage both male and female students to be actively involved in learning Mathematics.
5. Students should be encouraged to provide those local resources needed to improvise instructional materials for teaching of Mathematics.

## **References**

- Federal Republic of Nigeria (2004). *National Policy on Education* (Revised Edition) Lagos: NERDC Press.
- Ikwuka, O.I. & Ezigbo, P.N. (2015). Use of instructional materials in teaching social studies in basic secondary education in Idemili South Local Government Area. *UNIZIK Journal of Education Graduates*, 2(1), 74-79
- Ikwuka, O.I. & Usifoh A 1 (2015) .Effect of Improvised Instructional Materials on Senior Secondary Students' Academic Achievement

in Mathematics in Oshimili South Local Government Area. *UNIZIK Journal of Education Graduates*, 2(1), 74-79

Makurdi: His masters' servant media apostolate publication.

Isaac- Oloniyo, F.O. ((2017). Effects of External Examinations Feedback Approach on Students' performance in Mathematics in Central Senatorial District of Ondo State, Nigeria. *Abacus: The Journal of the Mathematical Association of Nigeria*.42(2). 324- 333.

Usman,M.A.&Musa, D.C..((2015). Effect of Inquiry Teaching method on Students' achievement in Algebra in Bauchi Local Government Area of Bauchi, State, Nigeria. *Abacus A Journal of the Mathematical Association of Nigeria*. 40(1). 70- 76

Nwoke, B.I.& Nwaneri, O.M. (2020). Effects of Improvised Instructional Materials on Senior Secondary School Students Achievement and Retention in Mathematics. *International Technology Research Journal (INTERJ)*. 4(1). 2- 10

Ojo, S.G. (2015). Effects of Animated Computer-Based Instructional Packages on Achievement and interest of junior Secondary school students' in Nigeria. (Unpublished Doctoral dissertation). University of Nigeria, Nsukka.

Olatin, A.Y. & Aguiobe, R. (2007). *The place of instructional materials in teaching and learning process*. Onitsha: African FEP Publisher Ltd.

Ozomadu, E.A. (2020).Effects of Two Modes of Computer- Assisted Instructional Packages on Junior Secondary School Students' Achievement, Interest and Retention In Geotry in Enugu State. (Unpublished Doctoral Dissertation). Enugu State University of Science and Technology,(ESUT) Enugu.

Samba, R. M.O. & Eriba, J.O. (2011). *Laboratory Techniques and the Art of improvisation*.