

**Effect of Improvised Instructional Materials on Senior Secondary School Students  
Achievement and Retention in Mathematics**

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**Abstract**

*The study investigated the effect of improvised instructional materials on senior secondary school students' achievement and retention in mathematics. The study was carried out in Ngor-Okpala Local Government Area of Imo State, Nigeria. The study was a quasi-experimental type adopting the pre-test post-test non-equivalent control design. A sample of 243 senior secondary school II (SSII) students was used for the study. Data required was collected through a mathematics achievement test (MAT) instrument constructed by the researcher. It had reliability coefficient of 0.84 determined using Kuder-Richardson formula ( $KR_{20}$ ). The experiment group was taught mathematics concept using improvised instructional material while the control group was taught using traditional method. The data generated was analysed using ANCOVA and t-test statistical tools tested at 0.05 level of significance. The result of the study revealed that improvised instructional material improved students' achievement in mathematics, and enhanced retention of knowledge among students. Based on the result, it was recommended that mathematics teachers should adopt improvised instructional materials where standard ones are not available or limited in teaching and learning of mathematics to enhance students' achievement in the subject.*

**Keywords:** *Improvised instruction material, students' achievement, retention, mathematics.*

**Introduction**

Education helps in the development of individual's intellectual ability and functionally in the society. Education prepares individuals to face problem situations and proffer meaningful solutions to them. Ocho(2005) indicated that education is the process of equipping the individuals with appropriate knowledge,

skills and competences for effective functioning in the society. This indicates that there is a total need to improve the quality of education of any nation as to produce quality individuals who will contribute positively towards the development of the nation. Gbolagade, Waheed and Sangoniyi (2013) opined that a complete education otherwise known as qualitative and functional education is the one that equips a man to be vast in literacy

and numeracy thus enabling him to reason logically, critically and apply his affective, cognitive and psychomotor skills thereby contributing positively towards the development of his immediate domain and the nation in general. Adeyanju (2009) in Gbolagade et al (2013) stated that education is an amalgam of multifarious processes, techniques, strategies, references, experiences etc, by which individuals or groups of human beings, male or female, young or old, rich or poor etc are deliberately exposed to a wide and deep field of knowledge, ideas, skills, attitudes, norms and beliefs of their immediate geopolitical environment and those of other cultures near and far. One of those aspects of education where all these are achievable is the mathematics education.

Mathematics as a subject is very important to the daily life of every individual as it aids the development of knowledge and the required skills in problem solving situations. Mathematics is the bedrock of scientific and technological development of any society. Soyemni (2005) indicated that everybody uses mathematics in one way or the other in solving life problems. Mathematics is seen as science of structure, order and relation that has evolved from counting, measuring and describing the shapes of object. It deals with logical reasoning and quantitative calculations. Mathematics nurtures the power of reasoning, creativity, abstract or spatial thinking, critical thinking, problem-solving ability and even effective communication skills (Indiatimes, 2013). Omoniyi (2015) noted that the study of mathematics was established in schools in order to produce competent persons who are skilful in applying mathematical knowledge in solving everyday life

problem. Onwuachu and Nwakonobi (2009) indicated that improvement in the teaching and learning of science, technology and mathematics (STM) is necessary in order to create the basis for technologically sound workforce in line with the nations' developmental needs.

Unfortunately, this all important subject has suffered a lot of neglect and hatred which has resulted in poor performance and given rise to poor quality of students. Kurumeh and Achor (2008) attributed the causes of poor performance to factors such as abstractness of mathematical concepts, the way these concepts are presented to the students and poor foundations, among other things. Esu (2006) attributed the pupils' poor performance in mathematics to factors such as the notion among pupils that mathematics is an abstract and difficult subject, inadequate qualified teachers to teach the subject as specialist, improper method of teaching mathematics, lack of mathematics laboratory, insufficient instructional aids and poor use of instructional materials. This is an indication that the nations wide spread poor performance and negative attitude towards mathematics from students is largely dependent on teachers' lack of use of proper teaching methods. Experience and observation have shown that there are inadequate or total lack of instructional materials for teaching mathematics in secondary schools, this has warranted teachers to depend only on the "chalk and talk" approach in the teaching and learning process. Ogunleye (2000), Okonkwo (2000), Mkpanang (2005) and Obioha (2006) in Onasanya and Omosewo (2011) reported that, there were inadequate resources for teaching of science subjects in

secondary schools in Nigeria. It was noted further that, where there were little resources at all, they are not usually in good conditions, while the few in good condition were not enough to go round those who needed them. Agwagah (2000) in Iji, Ogbale and Uka (2014) noted that mathematics teachers in most cases do not use instructional materials in their mathematics classroom, so most of the concepts are taught abstractly. Fanen (2005) stated that the availability and adequacy of instructional materials in schools for the teaching and learning of mathematics concept was affected by several factors of which some are low level of educational funding in Nigeria, students population explosion and even when provided, they are not related to the mathematical concepts being taught. Insufficiency and lack of instructional materials possess problems in teaching and learning of mathematics and calls for improvisation.

Improvisation is the act of producing and using local resources in the absence of real ones in teaching and learning situations. Samba and Eriba (2011) defined improvisation as the act of using alternative materials and resources to facilitate instructions whenever there is lack on shortage of specific first hand teaching aids. Mboto, Ndem and Stephen (2011) sees improvisation as the act of providing teaching materials from our locality when there is shortage or lack of the standard ones. Okafor (2015) indicated that it is a means of making local provision of teaching aids/instructional materials to impact adequate and relevant knowledge, skills, facts and values to the learner for the achievement of stated objectives during teaching/learning instruction. Dada (2006)

opined that improvised instructional materials involve the act of producing and using alternative resources aimed at facilitating instruction. It involves selection and deployment of relevant instructional elements of the teaching and learning process in the absence or shortage of standard teaching and learning materials for meaningful realization of specific educational goals and objectives (Ikwuas & Onwiodiket, 2006).

The use of improvised instructional materials grants the learners a first-hand experience during teaching and learning process and reduces the burden of talking too much on the part of the teachers. It creates a clearer picture of the mathematical concept taught, makes the lesson interesting and less difficult for the learner to understand. Using improvised instructional materials, assists the teacher economically and also allows students interaction. It makes students use their intellectual ability during learning and teaching process (Onasanya et al; 2011). Mboto et al (2011) indicated that the use of improvised instructional materials enhanced teaching of science and improved the lesson effectiveness; it is adequate and relevant to equip learner with proper knowledge, skills and character required for effective performance, to the best understanding of the learner (Okafor, 2005). Improvised material provided the students with concrete experience which they need in order to develop their intellect (Mboto, et al 2011). The application of improvised instructional material in enhances students' participation in the teaching and learning process.

Mathematics teachers at the secondary school level are noted to teach through the unproductive traditional

method of “chalk and talk” this has reduced the quality of students in the subject as their performance has continued to be far below acceptable standard. This situation if allowed to continue will spell doom to the scientific and technological target of the nation.

This study therefore investigated the effect of improvised instructional materials on secondary school students’ achievement and retention of in mathematics.

The purpose of the study was to investigate the effect of improvised instructional materials on secondary school students’ mathematics achievement and retention. Specifically, the study will determine whether:

1. Students taught mathematics concept using improvised instructional materials will differ in achievement with those taught using traditional method.
2. Male and female students taught mathematics concept using improvised instructional will differ in achievement
3. If any difference will exist between the post-test and delayed post-test achievement of students taught mathematics concept using improvised instructional material.

### **Hypotheses**

The following hypotheses were formulated for the guide the study.

Ho<sub>1</sub>: There is no significant difference between the mean achievement scores of secondary school students taught mathematics concept using improvised instructional material and those taught using traditional method.

Ho<sub>2</sub> There is no significant difference between the mean achievement scores of male and female students taught mathematics concept using improvised instructional material.

Ho<sub>3</sub> There is no significant difference between the post-test mean scores and delayed post-test mean scores of students taught mathematics using improvised instructional material.

### **Method**

The study was a quasi-experimental type adopting the pre-test post-test non-equivalent control design. This was adopted to investigate the effect of improvised instructional materials on secondary school students’ mathematics achievement and retention.

The population of the study consisted of all the 1600 senior secondary school II (SS2) students from 13 secondary schools in Ngor-Okpala Local Government Area of Imo State. Three (3) Schools were purposively selected for the study, in each of the 3 schools selected, two intact classes were randomly selected and assigned to control and experiment groups. This gave a total of six classes (3 control and 3 experiment groups) and a total of 243 students consisting of 132 males and 111 females.

The instrument for data collection was a 30-item objective question titled “Mathematics achievement test” (MAT) constructed by the researcher guided by a table of specification. The face and content validity of the instrument was determined by a measurement and evaluation expert and two mathematics teachers. Their inputs were given consideration as the instrument was restructured. The reliability of the

instrument was determined using Kuder-Richardson 20 formula ( $KR_{20}$ ) which gave a reliability coefficient of 0.84 which was acceptable for the study.

The two groups were administered with a pre-test as to determine their background after which the experiment group was taught topics in circle and tangent using improvised instructional material by research assistants who were trained for a week on how to improvise and apply the instructional material in teaching circles and tangents with emphasis on length of Arc, Area of a sector and area of a segment. While the lesson was going on, the researcher monitored the progress and procedure of the lesson to ensure that the lesson plan was maintained. The students were given opportunity to manipulate the

instructional materials improvised as to understand the concepts being taught. The control groups were taught the same topics using traditional “chalk and talk” method by their mathematics teachers. The lessons lasted for two weeks through 3 contacts a week after which a post-test was administered to both groups using a rearranged copy of the pre-test instrument. A delayed post-test was administered after a week with the same instrument to experiment group.

The data generated from the study was collated and analysed using analysis of covariance (ANCOVA) and t-test statistical tools tested at 0.05 level of significance.

## **Result**

**H<sub>01</sub>:** There is no significant difference between the mean achievement scores of secondary school students taught mathematics concept using improvised instructional material and those taught using traditional method.

**Table 1: Summary of ANCOVA analysis**

<b>Source</b>	<b>Type III sum of squares</b>	<b>df</b>	<b>Mean square</b>	<b>F</b>	<b>Sig</b>
Corrected model	21910.629	5	4382.126	52.528	.000
Intercept	12369.830	1	12369.830	148.276	.000
Pre-test	12.458	1	12.458	149	.700
<b>Method</b>	<b>21114.369</b>	<b>2</b>	<b>10557.185</b>	<b>126.548</b>	<b>.000</b>
<b>Sex</b>	<b>536.847</b>	<b>1</b>	<b>536.847</b>	<b>6.435</b>	<b>.012</b>
Method*Sex	112.765	1	112.765	1.352	.246
Error	19771.552	237	83.424		
Total	496337.000	243			
Corrected total	41682.181	242			

Table shows that, f calculated value 126.548 is greater than the table value

3.84 also,  $p = 0.000$  is less than  $\alpha = 0.05$  ( $p < 0.05$ ). Based on the result, the null

hypothesis is rejected and the alternative accepted at 0.05 level of significance. This implies that, there is a significant difference between the mean achievement scores of senior secondary school students taught mathematics concept using improvised materials and those taught using traditionally method.

**H<sub>02</sub>:** There is no significant difference between the mean achievement scores of male and female students taught mathematics concept using improvised instructional material.

Table 1 shows that the f calculated value of 6.435 is greater than table 3.84 also,  $p = 0.012$  is less than  $\alpha = 0.05$  ( $p < 0.05$ ). Based on the result, the null hypothesis is rejected and the alternative accepted at 0.05 level of significance. This implies that there is a significant difference between the mean achievement scores of male and female students taught mathematics concept using improvised instructional material.

**H<sub>03</sub>:** There is no significant difference between the post-test mean scores and delayed post-test mean scores of students taught mathematics using improvised instructional material.

**Table 2: Summary of t-test analysis of post-test and delayed post-test**

Test	N	Mean ( $\bar{x}$ )	SD	df	t-cal	t -0.05
Pest-test	128	52.12	9.23			
Delayed post-test	128	51.10	9.20	254	0.887	1.645

Table 2: show that the t-calculated 0.887 is less than t critical value (1.645) at 0.05 level of significance and degree of freedom 254. Based on the results, the null hypothesis is upheld at 0.05 level of significance.

### **Discussion of Findings**

The result of the study revealed that improvised instructional materials improved students achievement in mathematics as the result revealed a statistical significant difference between the mean achievement scores of senior secondary II (SS2) students taught mathematics using improvised instructional material and those taught using traditional method. The improvised material improved

students' interest, allowed them to be active participants and learn at their own pace without pressure. This result is in agreement with Mboto et al (2011), Akinbobola (2007) and Otor, Ogbeba and Ityo (2015) which variously showed that the experimental group taught with improvised materials achieved higher than the control group. Iji et al (2014) in a research concluded that the adoption of appropriate method(s) of teaching generally and in particular, at the mathematics classroom has shown that subjects exposed to such methods improved upon their mathematics achievement.

The study also revealed that, a significant difference existed between male

and female students treated with improvised instructional material. The post hoc analysis indicated that the difference in achievement was in favour of female students. The difference in achievement could be attributed to the fact that, improvised instructional material liberalized the learning process, increased understanding, motivation and interest towards the concept taught among the female students. The result is in agreement with that of Aknisola and Igwe (2002) which indicated a significant difference between male and female students after treatment and that of Mboto et al (2011) which also showed that female students achieved higher than their counterparts after treatment.

Finally, the study revealed no significant difference between the post-test and delayed post-test mean achievement scores of students after treatment. This is an indication that the instructional method sustained the knowledge gained after treatment; the result is in agreement with Ubana (2009) which showed that scientific concepts are retained better and learning tend to become more meaningful and interesting when learning materials are used.

### **Conclusion**

The study revealed that improvised instructional material improved students' achievement in mathematics enhanced female students' achievement and enabled retention of knowledge in mathematics. The quest for quality assurance in mathematics education requires that improvised instructional materials be used in mathematics classroom.

### **Recommendation**

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

1. Mathematics teachers should adopt improvised instructional materials where standard ones are limited or not available in teaching and learning to enhance students' achievement in the subject.
2. Workshops and seminars should be organized for secondary school teachers to train them on improvisation of instructional materials.
3. Students should also be encouraged to provide those local resources needed for improvisation of instructional materials.

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