



## Effects of visual instructional Materials on Senior Secondary Two Students' Achievement in Mathematics in Tambuwal Local Government Area of Sokoto State, Nigeria

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### Abstract

This Research Paper investigated the effect of Visual instructional materials on Senior Secondary two students' Achievement in mathematics in Tambuwal's Local Government area of Sokoto state. It was carried out with three research objectives, questions, and null hypotheses formulated. A quasi-experimental design was adopted, which involved two groups: experimental and control groups. The experimental group was taught Mathematics Concepts using visual instructional materials, while the control group was taught without any visual instructional materials. A simple random sampling technique was used to select the sample from 1,784 students. Data for the study was collected using a researcher-made instrument tagged Mathematics Achievement Pre-test and Post-test (MAPP which was validated, and the reliability index was found to be 0.75. Data collected were analyzed using descriptive statistics to answer research questions and inferential statistics of independent t-tests to answer hypotheses. Major findings from the study revealed a significant difference in the academic achievement of students taught mathematics using visual instructional materials compared to those taught the same mathematics concepts without using visual instructional materials. Moreover, the finding showed no significant difference in the academic achievement of boys and girls taught mathematics concepts using visual instructional materials. It was recommended that the Government should provide Visual and other related instructional materials in all Secondary Schools for effective teaching and learning of Mathematics concepts in Sokoto state, Nigeria.

**Keywords** *instructional materials; visual teaching aids; mathematics;*

### INTRODUCTION

We live in a fast-changing world that is becoming more scientific and more technological. As this transformation occurs, education in all forms and in all subjects is not left out. Teaching equipment and materials have changed over the years not only to facilitate teaching-learning situations but also to address the instructional needs of individuals and groups (Ema & Ajayi, 2011). Advances in Technology have brought instructional, especially the projected and electronic materials to the forefront as the most radical tools of globalization and development, which have affected the classroom teaching and learning situation positively and brought about more effective instructions. For instruction to be effective, the teacher should be able to identify the instructional materials to be used. Instructional materials refer to all tools which can easily be used by a teacher to correct wrong impressions and to illustrate things that learners cannot forget easily (Ema & Ajayi 2011). Instructional materials are the different teaching aids or apparatus which a classroom teacher employs to facilitate his or her teaching for the achievement of the stated objective. The use

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of instructional materials in the teaching of mathematics is very important because it provides a concrete basis for conceptual thinking, motivates people to learn, and captures students' imagination if used correctly.

Visual learning aids such as Charts, pictures, posters, models, specimens, realia etc., are often designed to facilitate teaching and learning. The use of visual instructional materials gives the Learner's opportunity to touch, smell, or test objects in the teaching and learning process. Aramide & Balarinde (2015) supportively asserts that any teacher who takes advantage of these resources and learns to use them correctly will find that they make almost an incalculable contribution to instruction. Therefore, the teaching of mathematics as a science subject requires the use of appropriate visual instructional materials and different pedagogical methods that will enhance meaningful teaching and learning of the subject.

Mathematics is the bedrock and essential tool for the scientific, Technological, and economic advancement of any nation (Muhammad, macchiato, & Hassan 2016). Mathematics is the study of size, numbers and patterns. It is the most international of all subjects, and mathematical understanding influences decision-making in all areas of life-private, social and civil. It is the subject that enables scientists and technologists to develop relationships among biological, chemical, geophysical and physical qualities; understand and explain natural phenomena. Mathematics education is key to increasing post-school and citizenship of young people. The knowledge of mathematics is an essential tool in society today. The contribution that mathematical knowledge and skills have made to economics, industrial and technological growths of the modern world are quite obvious to almost everyone. Mathematics is a compulsory subject in the Nigerian educational system right from primary through secondary to tertiary institutions. Hence it cannot be taught effectively without the use of appropriate instructional materials (Muhammad, 2016). Furthermore, the teachings of mathematics in Nigerian secondary schools need to be properly handled. Effective teaching of any subject will not only stimulates students' interest in the subject but also enhance their achievement in the examination.

Despite the importance of mathematics in human progress, students' achievement in the subject in external examinations such as West African Senior Secondary School Examination Certificates (WSSCE) Chief Examiners Report shows that students' achievement has remained very poor over the years. For instance, WASSCE results in Nigeria and Sokoto state from 2015 to 2020 indicated that in the previous years of 2015, 2016, 2017, 2018, 2019 and 2020, only 38.68%, 52.97%, 59.22%, 49.98%, 64.18% and 86.99% of the candidate passed the mathematics for the respective years which was not encouraging at all. Many factors have been attributed to the low achievement in mathematics by secondary school students. These include, among others, the perceived abstract and difficult nature of mathematics, inadequate learning materials, unqualified or experienced mathematics teachers, poor teaching strategy and inappropriate use of relevant teaching materials.

To achieve effective teaching and learning processes, there is a need for the use of relevant instructional materials. It's on this note that the effect of visual instructional materials on students' academic achievement in mathematics could be determined by their interaction and participation in class, which may be based on the teachers' presentation of mathematics concepts during learning activities. Both achievements could be measured using a test analysis designed. Considering gender cases, gender issue has been the concern of all classes and groups of people all over the world, especially researchers and educators. The issue of gender is considered and treated based on certain facts such as social and cultural beliefs, patterns of life and priorities of individuals. In the colonial days, boys were allowed to attend school while girls remained in the house to do house chores. Today there is no disparity in gender.

It's on this background that the researchers want to investigate whether the use of visual instructional materials in teaching may have an effect on achievement in mathematics among Senior Secondary two students in the Tambuwal area of Sokoto state.

The main objectives of the study were to:

1. To determine the pre-test academic achievements, the mean scores of Senior Secondary two students in both experimental and control groups.
2. To investigate the effect of the use of visual instructional materials on the academic

achievement of Senior Secondary two students in mathematics in the Tambuwal Area of Sokoto State.

3. To examine the gender-related effect of visual instructional materials on academic achievement of Senior Secondary two students in mathematics in Tambuwal Area Sokoto State.

#### *Research Questions*

The following Research Questions were raised to guide this study

1. What is the pre-test academic achievement mean scores of Senior Secondary two students in both experimental and control group?
2. Does the use of visual instructional materials affect the academic achievement of Senior Secondary two students in mathematics?
3. Is there any effect of visual instructional materials on the academic achievement of males and females among Senior Secondary two students in mathematics?

#### *Research hypothesis*

The following null hypotheses were used to guide the study:

1. There is no significant difference between the mean scores of Senior Secondary two students in both the experimental and control groups in the pre-test.
2. There is no significant difference in the mean achievement scores of students taught mathematics concepts using visual instructional materials and those taught without visual instructional materials.
3. There is no significant difference in the mean achievement scores of males and females.

Students taught mathematics concepts using visual instructional materials.

## **LITERATURE REVIEW**

In this chapter, literature relevant to the study was reviewed. Specifically, the chapter was organized and presented under the following sub-headings: - Instructional Materials, visual Instructional Materials, Concept of Mathematics, Achievement in Mathematics, Review of Similar Studies and Summary of Literature Reviewed.

### **Some of the Summary of the Literature Reviewed**

Enohean (2015), a total of 215 candidates sat for school certificate further mathematics involving 181 males and 34 females; the result analysis showed that though the females were much fewer, 16% female, and 34% of males, they relatively performed better.

Johnson (2000) carried out research to investigate the effect of visual learning aids on students' academic performance in secondary public schools in the Magu District. The outcomes showed that students taught using visual learning aids had poor performance than students taught without visual learning aids due to some other factors investigated.

Emma & Ajayi (2011) asserted that "teaching equipment and materials have changed over the years, not only to facilitate teaching and learning situations but also address the instructional needs of individuals and groups."

Okendu (2012) asserted that regular instructional supervision has a significant bearing on students' academic performance. He also affirmed that an adequate supply of instructional resources has a significant effect on students' academic performance.

Onasanya & Omosewo (2011) confirmed that both standard and improvised instructional materials have the same positive effects on students' academic performance.

Muhammad (2009) confirmed that the use of visual instructional materials in teaching mathematics increases students' achievement.

## **RESEARCH METHOD**

### ***Research Design***

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**Table 2. Research design layout**

Groups	Pre-test	Treatment	Post-test
Experimental	O <sub>1</sub>	X <sub>1</sub>	O <sub>2</sub>
Control	O <sub>1</sub>	X <sub>0</sub>	O <sub>2</sub>

The study adopted a Quasi-experimental design including pre-test and post-test on two equivalent groups selected as experimental and Control Groups. In this design, the experimental group was taught mathematics concepts using visual instructional materials (X<sub>1</sub>), while the control group was taught the same concepts of Mathematics without any visual instructional materials (X<sub>0</sub>). The two groups were pre-tested (O<sub>1</sub>) and post-tested (O<sub>2</sub>) for mathematics achievement.

### **Population**

The population for the study consisted of all Senior Secondary two students in Tambuwal Local Government Area of Sokoto state, Nigeria. The total number of Senior Secondary two students in mathematics is 1,784, drawn from all seven (7) secondary schools of the Local Government Area.

### **Sample and Sampling Technique**

From the population of 1,784, samples of 72 participants were selected for the study. The sample is viable in accordance with the central limit theorem that recommended 30 participants as the minimum sample size for the experimental study (Awotunde & Ugodulunwa, 2004). Two schools were randomly selected out of seven by simple paper folding method; each was selected as an experimental and control group. The choice of schools was made based on the fact that they are all controlled by the same body.

**Table 1. Sample for the Study**

S/N	NAME OF SCHOOL	LOCATION	TYPE	BOYS	GIRLS	TOTAL
1.	A	Jabo	Mix	20	16	36
2.	B	Tambuwal	Mix	25	11	36
<b>TOTAL</b>				45	27	72

Table 1 above shows the distribution of the sample for the study. 72 Students' participated in the study. Thirty-six (36) were taught mathematics concepts using visual instructional materials (Experimental Group A), while (36) were taught the same mathematics concepts without the use of visual instructional materials (Control Group B.)

### **Instrument**

Mathematics Achievement Pre-test and Post-test (MAPP) were used as an instrument for data collection on students' achievement in the study. The instrument consisted of 10 multiple-choice objective items, with each item placed on four option response modes of A, B, C, and D, having only one correct answer.

### **Validity**

The instrument was subjected to the assessment of two experts; these experts were requested to examine the items of the instrument in relation to the suitability for both content and construct validity; the items were modified to 10 items to enhance the face and content validity.

### **Reliability**

The instrument was trial tested by the schools not participating in the study, and a reliability index of 0.75 was obtained.

## RESULTS

### **Research Question one**

What is the pre-test academic achievement mean scores of Senior Secondary two students in both experimental and control group?

*Table 3: Summary of Pre-test Mean Scores and Standard Deviations of Students Taught Using Visual Instructional Materials and Those Taught without them.*

Group:	N	Mean	S D	Mean Difference
STUVIM:	36	5.6	0.8	2.7
STWUVIM:	36	2.9	0.2	

According to the above table, the pre-test mean score of the Students Taught Using Visual Instructional Materials (STUVIM) is 5.6 with a Standard deviation of 0.4, while that of the Students Taught without Using Visual Instructional Materials (STWUVIM) is 2.9 with a Standard deviation 0.2. This means that using visual instructional materials in teaching enables students to achieve more than teaching without using visual instruction.

### **Research Question Two**

How does the use of visual instructional materials affect the academic achievement of Senior Secondary two students in mathematics?

*Table 4. Mean and Standard Deviation Summary of students Taught Using Visual Instructional Materials and Those Taught without them.*

Group:	N	Mean	S D	Mean Difference
STUVIM:	36	13.7	0.9	3.7
STWUVIM:	36	10.0	0.3	

According to the table above, the Mean score of the Students Taught Using Visual Instructional Materials (STUVIM) is 13.7 with a Standard deviation of 0.9, while Students Taught without Using Visual Instructional Materials (STWUVIM) is 10.0 with a Standard deviation of 0.3. Therefore, using visual instruction enhances Students Learning.

### **Research Question Three.**

Is there any effect of visual instruction on the academic achievement of males and females among Senior Secondary two students in mathematics?

*Table 5: Mean and Standard Deviation Summary of male and female students Taught Using Visual Instructional Materials and Those Taught without them.*

Group:	N	Mean	S D	Mean Difference
Male:	20	11.6	0.6	-0.7
Female:	16	12.3	0.4	

Table 5 shows that the mean score of 11.6 with a standard deviation of 0.6 for the male students taught using visual instructional materials is slightly lower than the mean score of 12.3 with a standard deviation of 0.9 for the female students taught using visual instructional materials.

A T-test of the independent sample was used to test hypotheses based on 1 to 3. All the hypotheses were tested at a 0.05 level of significance.

**Ho<sub>1</sub>:** There is no significant difference between the mean scores of Senior Secondary two students in both the experimental and control groups in the pre-test.

**Table 6: t-test Analysis of the Pre-test Mean Scores of the Experimental and Control Groups**

Group:	N	mean	S D	DF	t <sub>cal</sub>	t <sub>cri</sub>	Remarks
Control:	36	2.94	0.47				
				70	-0.15	1.980	significant
Experimental:	36	5.64	0.85				

At the significance of  $\alpha \leq 0.05$

Table 6, it shows that  $t_{cal}$  (-0.15) is less than the  $t_{cri}$  (1.98). Since  $t_{cal}$  (-0.15) is not in the critical region, the null hypothesis is therefore retained. This indicated that there was no significant difference between the pre-test mean scores of the experimental and control group. It was concluded that all the groups were the same in achievement before the treatment. The homogeneity in the achievement of students in each group propelled the study further.

**Ho<sub>2</sub>:** There is no significant difference in the mean academic achievement scores of students taught mathematics concepts using visual instruction and those taught without visual instruction.

**Table 7: t-test Analysis of the Post-Test Mean Scores of the Experimental and Control groups.**

Group:	N	mean	S D	DF	t <sub>cal</sub>	t <sub>cri</sub>	Decision
Control:	36	10.03	0.54				
				70	-9.9	1.980	Reject
Experimental:	36	13.72	0.96				

A significance level of  $\alpha = 0.05$

Table 7. Shows that  $t_{cal}$  (-9.9) is greater than  $t_{tab}$  (-1.980) at  $\alpha$  (-0.05) for the two-tail test with DF (70). Hence the null hypothesis is rejected. Therefore, there is a significant difference between post-test achievement mean scores of students taught mathematics concepts using visual instruction and those taught without it.

**Ho<sub>3</sub>:** There is no significant difference in the mean achievement scores of male and female students taught mathematics concepts using visual instruction.

Group:	N	mean	S D	DF	t <sub>cal</sub>	t <sub>cri</sub>	Remarks
Male:	20	11.75	0.68				
				34	-0.9	2.021	Not significant
Female:	16	12.31	0.87				

**Table 8: t-test analysis of Post-test Mean Scores of Male and Female Students in the Experimental**

**Group Exposed to Instructional visual materials.**

Group:	N	mean	S D	DF	$t_{cal}$	$t_{cri}$	Remark
Male:	20	11.75	0.68	34	-0.9	2.021	Not significant
Female:	16	12.31	0.87				

**Table 8** also shows that  $t_{cal}$  (-0.9) is less than  $t_{cri}$  (2.021) at  $\alpha$  (0.05) for the two-tail test with DF (34).

Hence the result of this analysis has provided an empirical basis not to reject the null hypothesis. Therefore, there is no significant difference between the mean achievement scores of male and female mathematics students when taught mathematics concepts using visual instruction.

**Discussion of Findings**

This study investigated the Effects of visual instructional materials on senior secondary two students' Achievement in Mathematics in Tambuwal Local Government Area of Sokoto state, Nigeria. Statistical analysis of the pre-test and post-test of this Research employed a t-test for independent samples to answer the Research Hypothesis (two groups aimed at determining whether or not significant differences exist between different samples of the study. All the tests were done at a 95% confidence level ( $\alpha = 0.05$ ). Three hypotheses were tested, and the results obtained are discussed in the following paragraphs: -

**HO<sub>1</sub>:** the result indicated no difference between the experimental group (students taught using visual instruction and the control group (students taught without using visual instruction) in mathematics achievement before treatment. Hence it was assumed that all the groups started out at about the same level as far as their knowledge of mathematics concepts is concerned, and the conclusion is that they were homogeneous in mathematics achievement before the treatment.

**HO<sub>2</sub>:** Analysis of post-test scores of experimental and control groups using t-test revealed that students who were exposed to the use of visual instructional materials in the teaching of mathematics concepts significantly performed better than those not exposed to the use of visual instructional materials. This means that the use of visual instructional materials in the teaching of mathematics concepts increased students' academic achievement in the subject. These findings are in conformity with that of Johnson (2000) and Abdu-Raheem (2016), who found that teachers' use of instructional materials in teaching improved students' achievements.

**HO<sub>3</sub>:** This hypothesis centres on whether male and female students exposed to Visual instructional materials differ significantly in their academic achievements in the subject. The result did not reveal any significant difference in the academic achievements of the male and female students in the experiment. Hence it revealed that both male and female students receive the same impact when exposed to the use of visual instructional materials in the teaching and learning of Mathematics. This finding is in support of the Moudumogu and Yisa (2013) and Bulama et al. (2021) results which found that gender has no significant effects treatment on the academic achievement of students in physics and geography, respectively, and it is also contrary to that of Joseph (2000), which reported that girls are intellectually inferior to boys in Science and Mathematics.

The findings, however, agree with the report of Ifamuyiwa (2013) and Beatrice, Felicia & Oji (2015), who observed that male participation in Science was higher but that the male and female performances were basically the same in terms of academic achievement.

**CONCLUSIONS**

From the results of the study, it is clear that the use of visual instructional materials in teaching mathematics at Senior Secondary Schools has an important effect on the student's academic achievements. It is therefore concluded that using visual instructional materials ominously increases students' academic achievements in Senior Secondary two students in Mathematics in Tambuwal Area of Sokoto State, Nigeria.

The following conclusions were drawn from the findings of the study: -

1. The use of visual instructional materials in teaching Mathematics concepts increases students' Academic Achievement.
2. Students taught using visual instructional materials perform better than those who were taught without the use of visual instructional materials.
3. The use of visual instructional materials has no significant difference in the ability of both male

and female students.

### LIMITATIONS

As the study's sample size was slight, it needs to be accompanied by larger-scale studies to show the effects of visual instructional materials.

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### IMPLICATIONS FOR FURTHER STUDY

With regard to the findings emanating from this Research, the following recommendations were made: -

1. The Ministry of Education should provide visual and other related instructional materials in all Secondary Schools to effectively teach and learn Mathematics concepts in Sokoto.
2. Parents and other Stakeholders should also make an effort to encourage Teachers and students to provide teaching materials to schools through improvisation.
3. Teachers should be fully and adequately trained on how to make use of visual instructional materials and some other related tools through regular workshops and seminars.
4. Teachers need to be monitored and should be discouraged from teaching without relevant and appropriate teaching aids during the teaching and learning process.
5. Teachers should get the learners involved in activities that will enable them to develop and fit in socially and morally wise.
6. In addition, this experimental study was conducted with Public Secondary Schools students of Tambuawal LGA and may also be replicated with Public Secondary Schools students from other LGAs of Sokoto State. Such studies may also include basic school students to obtain a larger perspective.

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