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INSTRUCTIONAL MATERIAL: A TOOL FOR ACHIEVEMENT IN MENSURATION AT SENIOR SECONDARY SCHOOLS IN NIGERIA

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Abstract

This study investigated the effects of instructional materials in secondary schools in Ogun State and how the student attitudes towards mensuration affect the student's academic achievement. Three research questions and three null hypotheses guided the study. The quasi-experimental research design was employed to conduct the study. A sample of 65 was drawn from the population of senior secondary school students in Obafemi Owode Local Government Area of Ogun State, Nigeria. The instruments used to collect data were Mathematics achievement tests and attitude questionnaires. The pre-test was administered to both experimental and control groups and later the post-test. The researcher also administered the questionnaire to the participants. The reliability of the Likert-scale sections of the data obtained was determined by computing Cronbach's alpha values The research questions were answered descriptively using mean and standard deviation while the hypotheses were tested inferentially at a 0.05 level of significance using Analysis of Variance (ANOVA). The result showed that students taught using instructional materials understood the concept of mensuration better than those taught with traditional/conventional methods. There was also a significant difference between the mean gain of students taught using instructional materials and those taught using traditional methods. There was no significant difference between students understanding the concept of mensuration when taught with traditional/conventional methods. It was recommended among others that mathematics teachers adopt instructional methods of teaching by using a variety and stimulating materials that instill in learners' confidence, enthusiasm, and interest in mensuration that leads to greater achievement.

Keywords: template Instruction Materials, Achievement, Mensuration

INTRODUCTION

Mathematics is a subject that involves critical thinking used to identify and solve problems of human life and is a subject that prepares an individual for academic excellence and useful living in society. Any society that is preparing an individual for useful living must develop a strong Mathematical foundation at the basic school level. Malik (2017) opined that Mathematics is a unifying subject that prepares pupils for a useful and meaningful life and that Mathematics is a language and key to everyday activities of mankind in

science and technology. The ingredient for the effective articulation of the abstract elements of science that give impetus to the development of technologies of any nation is based on mathematics.

The indispensability of mathematics in human day-to-day activities cannot be over-emphasized; therefore, considered the bedrock of all scientific and technological breakthroughs and advancement for all the activities of human development. It is the language and culture common to all studies (Harbor-Peters, 2000). Mathematics teaching in Nigeria has suffered setbacks because of a lack of teaching facilities in terms of teaching equipment and materials. Perhaps the greatest challenge facing mathematics educators today is to provide mathematical materials that are relevant to the needs of students and society. This could be achieved through the availability and utilization of instructional materials in mathematics.

Mensuration is one of the topics in mathematics which links the learners' classroom experiences to everyday life activities. Mensuration refers to the part of geometry concerned with ascertaining lengths, areas, and volumes. Matthew (2020) cited Ask.com (2016) posited that mensuration is a branch of mathematics which deals with the measurement of areas and volumes of different geometrical figures. The related parameters which are taught in mensuration include but are not limited to types and properties of geometric shapes (plane or solid), the measurement of the dimensions that form the shapes, the diagrams and nets of the shapes, the area and volumes of the shapes, the properties of the shapes, the relationships between the properties of the shapes, the development and use of a formula to solve mensuration problems (Matthew, 2020). Suppose mensuration deals with measurements and human activities, which are inseparable from measurements. It is therefore essential that learners, as they leave school, comprehensively understand mensuration and be able to apply the concepts in their day-to-day lives (Nchimunya, 2019). Many professions and tasks today require and use geometrical concepts and their associated techniques. Besides architects, surveyors, and navigators, all of us use it in our daily lives - for example, to describe the shapes of objects, directions on a car trip and the space or position of a house. For engineers to come up with a bill of quantity, let's say for a road or building, they have first to look at the length, area, and volume of the structure.

Mensuration refers to that branch of mathematics which deals with the measurement of geometric magnitudes, such as areas of surfaces and volumes of solids. It is a practical branch of mathematics. It is divided into two parts: namely plain mensuration and solid mensuration. Plain mensuration deals with measurements such as those of perimeters and areas of plane figures like polygons among others. Solid mensuration deals with the measurement of surfaces, areas and volumes of cubes, cuboids, spheres, cones, and cylinders among others (Charles-Ogan, Onwioduokit, & Ogunkunle, 2014). Furthermore, because of the

hierarchical nature of mathematics, the knowledge gained at any level using mathematical materials could improve students' performance. Subsequently, mensuration appears to be the core component of all the depth knowledge in mathematics especially as it concerns measuring, calculating, and estimating length, areas, and volumes as well as the construction of three-dimensional objects.

In this study, using improvised materials to teach concepts in mathematics, especially in mensuration could go a long way to accomplish the expectations of all to bring about enhanced achievement. Students' dismal performance in mathematics examinations over the years at the West African Senior Secondary Certificate Examination (WASSCE) and Senior Secondary Certificate Examination (SSCE) have been rated very poor and discouraging to the public. For instance, the Chief Examiner's report (2010-2021) indicated that most students avoid problems in mensuration. Could it be due to a lack of manipulative skills, misconceptions on the part of the students or teaching strategy used by the teachers? A close look at the past WASSCE and SSCE questions revealed that there is no year; questions on mensuration are not set in the objective and theory. This perhaps shows the role mensuration plays in the development of students' cognitive domain.

The use of instructional materials in the teaching and learning of mathematics is undoubtedly beneficial. It makes the teaching and learning process easier, more interesting and rewarding. Kyari (2023) cited Esu, Enukoha and Umoren (2014) to affirm that instructional materials facilitate the learning of abstract concepts by helping to concrete ideas and stimulate learners' imagination. Moreover, instructional materials help to increase active participation in the learning process while saving teacher energy and reducing the verbal instructions. In the same vein, Mathew (2020) stated that the use of instructional materials makes teaching effective as it enables learners to participate actively in classroom instruction. Despite all the benefits received from the use of instructional materials in the classroom, some mathematics teachers are not keen on using them. Several reasons are responsible. Some of the teachers do not know how to operate and use some of the materials, such as computers, projectors, PowerPoint presentations etc. For effective implementation of mathematics curriculum, there is an urgent need for qualified teachers with good teaching methods, one who can use appropriate instructional materials to teach mathematics topics.

Tincton (2006) found that instructional materials are successful in raising examination scores; improving students' attitudes and lowering the amount of time required to master certain materials. Therefore, Mathematics instructional materials enhance learning at all educational levels. Effective teaching and learning of mathematics have a close relationship with the instructional materials available to

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the teacher. The major function of the school is teaching. Effective teaching and good performance are possible if the necessary instructional teaching facilities are made available.

Studies in the psychology of learning suggested that the use of instructional materials in mensuration has several advantages. Instructional materials are the medium by which the senses gain information from the environment. More learning occurs when information is received simultaneously through the two senses (vision and hearing) rather than in a single modality (Ibrahim, 2010). Awojobi (2001) found out that instructional materials promote meaningful learning of mathematics, improve students' reading skills and supplement other learning experiences. Furthermore, learning is enhanced when materials are organized, and that organization is evident to the students. Instructional materials facilitate an easy and quick understanding of the subject's contents.

The importance of instructional materials in the teaching/learning process cannot be over-emphasized. Brown (2000) summarised the role of instructional materials as follows:

1. It promotes meaningful communication, hence effective learning.
2. It ensures retention, thus making learning more permanent.
3. It helps to overcome the limitations of the classroom by making the inaccessible accessible.
4. They provide a common experience upon which other learning can be developed. They stimulate and motivate students to learn.
5. They encourage participation, especially if students can manipulate the materials used.

Despite all these roles of instructional materials, most teachers still teach in our schools without instructional materials, the reasons being that they are not available, or some concepts do not require instructional materials. However, some concede that instructional materials cannot be improvised, and some reasons are that instructional materials are too difficult to manipulate, or that instructional materials waste a lot of time in the classroom.

Ogunkunle (2009) established that school teachers were ineffective in teaching mathematics as they applied a conventional approach to almost all topics taught. Could the poor performance of students be a result of insufficient student involvement and exposure to instructional materials? This study, therefore, tends to investigate the possible effect of instructional materials in enhancing student achievement in mensuration in Ogun State, Nigeria.

The purpose of the study is to examine the effect of instructional materials on the students achievement in mensuration in Ogun State. Specifically, this study: 1) sought to explore the effectiveness of instructional materials on the teaching of mensuration and the attitude that learners have towards the

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learning of mensuration. 2) meant to identify the attitudes held by selected learners in secondary schools in Ogun State towards mensuration. 3) investigated the impact of learners' attitudes on the learning of mensuration.

Research Questions

This study sought answers to the following research questions:

1. What are learners' attitudes towards mensuration using instructional materials compared to conventional methods?
2. Are there differences in the pre-test and post-test mean scores of students taught mensuration in experimental and control groups?

Research Hypothesis

The following null hypothesis was formulated:

HO_1: There is no significant difference in the pre-test and post-test mean scores of students taught mensuration using instructional materials.

METHODOLOGY

The quasi-experimental design involving a pre-test and post-test non-equivalent control group was used for this study. The population of the study was made up of all the Senior Secondary School students in Obafemi Owode Local Government Area of Ogun State, Nigeria. Two schools were randomly selected from which two intact classes were used. One class was used as an experimental group and the other as a control group. Out of the 65 senior secondary school SSI students that participated, 32 belonged to the control group with 14 students from the first school and 18 students from the second school. While 16 students from the first school and 17 students from the second school, a total of 33 belonged to the experimental group. Mathematics achievement tests and attitude questionnaires were used to collect data. The experimental group was exposed to the treatment for four weeks, while the control group was taught conventionally for four weeks. The pre-test was administered to both experimental and control groups and later the post-test. The researcher also administered the questionnaire to the participants. The researcher used pre-test and post-test measures to assess the learning of mensuration as well as to collect data for this study. The post-test was designed in such a way that it had 5 major questions with some questions having sub-questions. The structuring of these question items was not different from the pre-test. The questions were drawn from the West African Examinations Council (WAEC) past papers which had been validated by the examination body. The reliability index of the questionnaire was 0.82 using Cronbach alpha which is an

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indication that the items are adequate and reliable. A factor ANOVA test and mean averages were used to compare the differences between control and experiment groups, while the data collected using the attitude questionnaire was analysed using a one-way ANOVA.

RESULTS AND DISCUSSION

Research Question 1: What are learners' attitudes towards mensuration using the instructional material compared to the conventional method?

Table 1: Students' Response to Attitude towards Mensuration Using Instructional Materials

S/N	Items	Strongly Agreed	Agreed	Strongly Disagreed	Disagreed
1	I like to learn and study by using instructional material in mensuration.	56	3	2	4
2	I got a clear concept while the teacher used instructional material in teaching mensuration.	38	22	0	5
3	I feel instructional material is essential for teaching mensuration.	45	17	0	3
4	Instructional material mostly encourages me and my friends to improve our performances in mensuration.	32	33	0	0
5	I like to study mensuration lessons using Instructional material.	12	48	1	4

From the table above, 56 which represents 86% of the student population strongly agreed that they like to learn and study by using instructional material in mensuration, while 3 which represents 5% agreed, 2 represents 3% Strongly disagreed and 4 represents 6% disagreed. 38 which represents 58% of the students' population strongly agreed that they got a clear concept while the teacher used instructional material in teaching mensuration, while 22 which represents 34% agreed, 0 strongly disagreed and 5 which represents 8% disagreed. 45 respondents which represents 69% of the student population strongly agreed that they feel instructional material is essential for teaching mensuration, while 17 which represents 26% agreed, 0 Strongly disagreed and 3 which represents 5% disagreed. 32, which represents 49% of the student population strongly agreed that Instructional material mostly encourages me and my friends to improve our performances in mensuration, while 33 which represents 51% agreed, 0 Strongly disagreed and 0

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disagreed. 12 which represents 18% of the student population strongly agreed that they like to study mensuration lessons using Instructional material while 48 representing 74% agreed, 1 which represents 2% Strongly disagreed and 4 which represents 6% disagreed. Therefore, from the results it was observed that the students' attitude towards the use of instructional materials was positive.

Research Question 2: Are there differences in the pre-test and post-test mean scores of students taught mensuration in both experimental and control groups?

Table 2: shows the Mean performance scores and standard deviation of the pre-test and post-test of students in the experimental and control groups

	Pre-test Control	Experimental	Post-test Control	Experimental
Mean $\bar{X}$	37.143	38.125	51.944	57.05
Standard deviation	1.68	1.59	1.74	1.88

Table 2 shows that the experimental pre-test and post-test mean scores are 38.12 and 57.05 while their standard deviations are 1.59 and 1.88 respectively. The control group however has pretest and post-test means scores of 37.14 and 51.94 and standard deviations of 1.68 and 1.74 respectively. This indicated a superiority of the treatment group over the control group in the use of instructional material in the teaching and learning of mensuration.

Hypothesis

HO_1: There is no significant difference in the pre-test and post-test mean scores of students taught mensuration using instructional materials.

Table 3: shows the results of one-way ANOVA of testing hypothesis one

	SS	Df	MS	F	Sig.
Between Groups	2951.95	1	2951.95	8.48	There is significance
Within Groups	10786.71	31	347.95		
Total	13738.66	32			

The F-test statistics for this one-way ANOVA is 8.48. To determine if this is a statistically significant result, we must compare this to the F critical value found in the F distribution table with the following values: α (Significance level) = 0.005, DF_1 (Numerator degree of freedom = df treatment) = 1, DF_2

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(Denominator degree of freedom (df error) = 32. We found out that the F critical value is 4.80. Since the F-test statistics in the ANOVA table are greater than the F critical value in the F distribution table, we fail to accept the null hypothesis. This means there is a significant difference in the pre-test and post-test mean scores of students taught mensuration using instructional materials.

Discussions

The result of learners attitudes towards mensuration using the instructional material showed that the responses of respondents have a positive attitude towards the use of instructional materials for learning mensuration. This finding was corroborated by the finding of Gagne et.al 2005 which revealed that the attitude of students towards the use of instructional material in teaching and learning mensuration was highly positive.

The result in Table 2 shows that students who were taught with instructional materials had the highest mean scores in mensuration among the two groups compared. This finding was in line with the findings of Matthew (2020) which revealed that students taught with improvised instructional materials obtained the highest mean scores in mensuration among the two groups compared. The Gautam (2015) findings also concluded that the achievement of students of the experimental group was better than that of the control group. The finding is also in collaboration with the findings of Malik, Akudo, Arikewuyo, and Ogunleye (2021) which revealed that students exposed to mathematical laboratory instructional facilities perform better than those taught using conventional methods.

Table 3 revealed that there is a significant difference in the pre-test and post-test mean scores of students taught mensuration using instructional materials. This result is in line with the findings of Gautam (2015), Das (2019) and Tharu (2021) that teaching of mensuration by using instructional materials causes better achievement than teaching without using instructional materials.

CONCLUSION

This study concludes that instructional materials are a more efficient approach as compared to the traditional/conventional methods of teaching. The instructional materials method has the potential to make students understand the connectivity between mensuration specifically to the environment, day-to-day activities, and mathematics in general. Students become confident in solving real-life mensuration problems.

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