



Effect of Brainstorming Teaching Strategy on Upper Basic Students' Interest in Mensuration in Toto, Nasarawa State, Nigeria

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ABSTRACT

This study determined "Effect of Brainstorming Teaching Strategy on Upper Basic Students' Interest in Mensuration in Toto, Nasarawa State, Nigeria". The study adopted a quasi-experimental research of pre-test, post-test, non-equivalent, non-randomized control group design. The population of 6,435 (3,484 male and 2,951 female) students was used for the study. The Sample size of 96 (56 males and 40 females) students were used. Two research questions were asked and two null hypotheses were formulated and tested. One instrument was used for data collection (Mensuration Interest Rating MIR) which was validated by three experts. The reliability of the instruments was determined using Cronbach's Alpha and found reliable with 0.78 reliability index. Descriptive statistic of mean and standard deviation was used to answer the research questions, while inferential statistic of ANCOVA was used to test the hypotheses at 0.05 level of significance. The findings of this study revealed that; the exposure of students' to Brainstorming teaching strategy enhanced students' interest in mensuration; Brainstorming teaching strategy improves male and female interest in mensuration. It was however, recommended that Mathematics teachers should be encouraged to adopt Brainstorming teaching strategy to teach mathematics; students should always be encouraged to the practical ways of solving problems in mathematics and also work together in heterogeneous (male and female,) groups so as to help reduce gender gap and to enable them imbibe the culture of working cooperatively; students should be placed at center stage in learning and be practical as recommended in the curriculum to improve their creative thinking skills in mathematics.

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INTRODUCTION

Mathematics is the science that deals with the logic of shape, quantity and arrangements. It encompasses everything we do and is the building block of everything in our daily lives, ranging from mobile devices, architecture, art, money and sports (Johnson, 2018). As asserted by George and Zalmon (2019), there can be no science and technology without mathematics. Mathematics is a core subject at the basic and secondary school levels of the Nigerian educational system (Federal Republic of Nigeria

(FRN), 2014). One of the major challenges of mathematics in the school system is how to learn its concepts and effectively retrieve the learned concepts. For learning to take place, students must interact with mathematics ideas in active and constructive way. There is need for students to be proactively involved in their learning, they should not be seen as people with nothing to offer, people who just go to school to receive knowledge from teachers.

Mensuration is the branch of mathematics that studies the measurement of

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geometric figures and their parameters like length, volume, shapes, surface area and lateral surface area. Mensuration as one of the fundamental aspect of geometry has various applications in the home and industry. There is an increasing effect of growing knowledge in mensuration on social and economic life. It is expected that the study of mensuration at the upper basic level should help students in developing some basic skills, knowledge and competence required for problem solving in the environment (Ohodo, 2019). This is because such skills, knowledge and competence acquired will arouse students' critical thinking required for dealing with everyday life situations. The way mensuration is taught had been criticized as lacking quality and at times dull, boring and stereotyped (Akani, 2022).

However, most secondary school students in Nigeria view mensuration as problematic and abstract probably because students have great difficulty in understanding, assimilating and retaining the concept in the classroom, abstract nature, complex formulae, language and terminology, multiple formulas and individual differences (Airissa, 2021). The tendency for most students is to consider the subject as one that is boring, thus, creating lack of interest in mathematics lesson particularly mensuration. Hence, the poor mensuration foundation at the upper basic II level will jeopardize any future effort to enhance student interest in the subject.

Students' poor achievement in mensuration is attributed to lack of interest in the subject, interest increases students' success in learning tasks and that interest in activities tends to increase the likelihood that individuals formulate goals relating to those activities and invest more effort to achieve (Stoica, 2018). The degree and direction of attitude towards mathematics are largely determined by the kind of interest developed by learners. In a classroom setting, interest is required to meet students' cognitive as well as emotional needs. Interest can never be imposed on an individual by external forces, but a teacher with an appropriate instructional strategy that is activity based and promotes critical thinking

could help to increase learners' interest and achievement in a subject.

Teaching is a mental (brain) activity carried out by teacher to achieve desired goals. It has a considerable effect when explaining mathematics achievement because when students attend to information, they try to figure out the relationship between new ideas and previous knowledge. Teaching is a process which should produce desired changes in the behaviour of students. Consequently, the learning situations utilized in the classroom are important for the understanding of the concept taught. Learning occurs when insight is gained, and when the processes are understood, in short when interaction has taken place between the teacher and the learner and between learners and their peers (Azige, 2019). Some teachers still believe that knowledge is transferred to their students but in reality students learn by doing and this is reinforced by the use of innovative teaching strategies. Abdulhamid, Abubakar and Tela (2018) expressed that teaching mathematics requires application of effective methods that bring active learning, but the absence of this makes the students not to participate actively in mathematics class. Amadioha (2019) observed that students learn best by active participation in the teaching and learning process, such pedagogic concept could be engaged through action-oriented communication.

In context to teaching, brainstorming is a strategy of teaching used by the teacher in which maximum or all the students participate by responding or presenting views on one topic. This technique encourages new ideas among students which would never have happened under normal circumstances. Brainstorming according to (Unodiaku, 2023) is a teaching strategy in which the teacher conceives self as flexible, permissive, interested in stimulating discussion and seeing others grow. It is a comprehensive strategy which lays emphasis on what students should learn and how they learn it. Lessons in brainstorming strategy are arranged such that each student, ranging from the fastest to the slowest learner, has a contribution to make in a way that each group member serves as a tutor to one another thereby



promoting greater flexibility, permissiveness and acquisition of skills in the mastery of the material in question (Odetola & Salman, 2023).

Furthermore, the shared responsibilities and interactions are likely to generate better intergroup relations, which result in better self-images for students with histories of poor interest. Thus, the individual learner brings out his/her idea which is subjected to constructive criticism by group members (Zullea & Nunu, 2022). Hence it is the free association of different ideas to form new whole ideas. This confirms Ugwu (2018), who viewed brainstorming as a creative tool that can be used by individuals within the group to generate new ideas.

Gender is a variable whose influence is to be determined in this study. The choice of this variable is due to the fact the issue of gender in mathematics is still debatable. Gender, according to Offorma (2019), is the social qualities and prospects associated with being male and female and the relationships between men and women, boys and girls as well as the relations between men and those between women. The issue of gender and its influences on interest in school subjects is yet to be fully resolved due to conflicting research findings from one school subjects to another. Studies earlier conducted reported that males have positive interest than females in mathematics (Offorma, 2019). However, some literature search such as Ariyo and Gbadura (2020) and Adekunle (2021) who reported that students taught Geography and Physics respectively using brainstorming teaching strategy have better interest than those taught using the conventional methods.

While some are of the view that female students have high interest than male students in mathematics (Agha, 2019). No significant difference in the interest of male and female students in mathematics was also reported (AIMutairi, 2021). These reports on male and female superiority in mathematics achievement tests appear inconclusive. It is against this background that the researcher is conducting the study to determine the effect of teaching Mensuration using brainstorming strategy among upper-basic students in Nasarawa State. Given

this background of the study and the paucity of research on teaching mensuration with brainstorming strategy, the need for further investigation becomes worthwhile.

This study is anchored on Lev Semyonovich Vygotsky Social Theory (1978). The Soviet Psychologist Lev Semyonovich Vygotsky (1896-1934) is considered to be the father of modern constructivism because other constructivists in the likes of John Dewey, Jean Piaget, among others used his work as a basis for the theories they propounded. Vygotsky (1978) stated that "knowledge is co-construct" that is, an individual learns from one another. He further stated that it is an essential feature of learning which creates the Zone of Proximal Development (ZPD). That is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers. Once these processes are internalized, they become part of the child's independent developmental achievement". This is unlike the conventional method for instruction where a teacher transmits information to students. Vygotsky theory promotes learning contexts where students play an active role in learning. The result of this study might be of benefit to the stakeholders in education, such as mathematics teachers, policy makers, mathematics curriculum planners, curriculum developers, researchers, teachers training institution and students.

STATEMENT OF THE PROBLEM

Despite numerous strategies used in teaching mathematics, reports are still raging on concerning persistent downward trend on students' poor interest. Mensuration is an aspect of mathematics that students remember with unpleasantness and lack of comprehension probably due to its abstract nature, complex formulae, language and terminologies used, multiple formulas and individual differences. Researches have shown that mathematics teachers use abstract approach in teaching upper basic school mathematics, students therefore cannot visualize their answers and usually see no relationship between mensuration examples and

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their real world experiences. Consequently, this has led students into rote learning without knowing where they are applied in the real world. The resultant effect is lack of interest and poor achievement in mathematics. This lack of interest has been of great concern to parents, teachers, students and stakeholders.

Another issue which has generated much debate in mathematics interest over the years is the question of whether differences exist in the interest of mensuration between male and female students. There has been inconsistent report on gender differences in students' interest in mathematical concepts. There are also opinions in the educational circles over the years that ask questions on whether differences exist in interest of male and female students. There has not been a definite answer to these questions as they seem to be complex.

Among the areas based on these consistent reports on students' poor interest in mensuration aspects of mathematics suggests that all methods, strategies and approaches adopted by classroom teachers failed to reverse the constant reports on poor achievement of students on the subject. These situations therefore lead to this research, to determine the effects of brainstorming strategy on upper-basic ii students' interest in mensuration in Nasarawa State, Nigeria.

Objective of the Study

The study sought to determine the:

1. effect of brainstorming teaching strategies on students' interest in mensuration.
2. effect of brainstorming teaching strategy on male and female students' interest in mensuration.

Research Questions

The following research questions guided the study:

1. What are the mean interest ratings of students taught mensuration using brainstorming, strategy and those taught using conventional method?

2. What are the mean interest ratings of male and female students taught mensuration using brainstorming strategy?

Statement of the Hypotheses

The following hypotheses were formulated and tested at $\alpha = 0.05$ level of significance.

H₀₁: There is no significant difference in the mean interest ratings of students taught mensuration using brainstorming teaching strategy and those taught using conventional method.

H₀₂: There is no significant difference in the mean interest ratings of male and female students taught mensuration using brainstorming strategy.

METHODOLOGY

The study adopted a quasi-experimental research of pre-test, post-test, non-equivalent, non-randomized control group design. The population of 6,435 (3,484 male and 2,951 female) students was used for the study. The Sample size of 96 (56 males and 40 females) students were used. Simple random sampling technique was used to select schools for the study. First, two Upper-Basic II schools were randomly selected from Toto Area Educational Quality Evaluation Office. Secondly, in each school, an intact class was randomly sampled for the study using simple random sampling technique. Thirdly, an intact class was randomly assigned to experimental groups while the other one was assigned to the control group through a ballot technique and the number in each class was collected through physical presence of students.

In order to consider gender as one of the moderator variables in this study, stratified random sampling technique was used to stratify male and female students into strata. This sampling technique gives the target population equal opportunity of being selected thereby reducing the bias effect that may interfere with the validity and reliability of the study. Two research questions were asked and two null hypotheses were formulated for the study. One instrument was

used for data collection (Mensuration Interest Rating MIR) which was validated by three experts. The reliability of the instruments was determined using Cronbach's Alpha and found reliable with 0.78 reliability index. Descriptive statistic of mean and standard deviation was used to answer the research questions, while inferential statistic of ANCOVA was used to test the hypotheses at 0.05 level of significance.

RESULTS

Research Question One

What are the mean interest ratings of students taught mensuration using brainstorming strategy and those taught using conventional method?

Table 1: Mean Interest Ratings and Standard Deviation of Students Taught Mensuration Using Brainstorming Strategy and those Taught Using Conventional Method

Teaching strategy	Type of test	No of students	Mean score	Std Dev.
Brainstorming	Pre-Interest	47	28.04	6.220
	Post-Interest	47	60.55	7.012
Control	Pre-Interest	49	24.24	3.666
	Post-Interest	49	39.27	6.937

Table 1 shows that the pre-test mean interest ratings and standard deviation of students taught mensuration using brainstorming was (28.04, 6.220) and post-test mean interest ratings and standard deviation was (60.55, 7.012) respectively, while the pre-test and post-test mean interest ratings and standard deviation of students taught mensuration using control group was (24.24, 3.666) and (39.27, 6.937).

Null Hypothesis One

There is no significant difference in the mean interest ratings scores of students taught mensuration using brainstorming strategy and those taught using conventional method. The test for this hypothesis provided the data on Table 2 .

Table 2: Results of Analysis of Covariance on Students' Interest Ratings Taught Mensuration Using Brainstorming Strategies and those Taught Using Conventional Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	10977.998 ^a	2	5488.999	114.338	.000	.711
Intercept	10496.731	1	10496.731	218.651	.000	.702
PREINTEREST GROUP	106.541	1	106.541	2.219	.140	.023
GROUP	10238.860	1	10238.860	213.280	.000	.696
Error	4464.627	93	48.007			
Total	252452.000	96				
Corrected Total	15442.625	95				

a. R Squared = .711 (Adjusted R Squared = .705)

Table 2 reveals a significant difference in the mean interest ratings of students exposed to brainstorming strategy and control group. $F_{(1, 93)} = 213.28$ was obtained with associated probability value of 0.000. Since the associated probability (0.000) is less than 0.05 set as level of significance, the null hypothesis was rejected. The

result implies that the brainstorming teaching strategy produced a significant effect on the post-test interest ratings of students when covariate effect (pre-test) was controlled. Hence, there was a significant difference among the two groups of brainstorming strategy and control group.

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Research Question Two

What are the mean interest ratings of male and female students taught mensuration using brainstorming strategy?

Table 4: Mean Interest Ratings and Standard Deviation of Male and Female Students Taught Mensuration Using Brainstorming Strategy

Gender	Type of test	No of students	Mean score	Std Dev.
Male	Pre-Interest	29	29.86	6.885
	Post-Interest	29	60.28	7.497
Female	Pre-Interest	18	25.11	3.445
	Post-Interest	18	61.00	6.334

Table 4 shows that the pre-test mean interest ratings and standard deviation of male students taught mensuration using brainstorming was (29.86, 6.885) and post-test mean interest ratings and standard deviation was (60.28, 7.497), while the pre-test and post-test mean interest ratings and standard deviation of female students taught mensuration using brainstorming was (25.11, 3.445) and (61.00, 6.334) respectively.

Null Hypothesis Two

There is no significant difference in the mean interest ratings of male and female students taught mensuration using brainstorming strategy. The test for this hypothesis provided the data on Table 5.

Table 5: Results of Analysis of Covariance on Male and Female Students' Interest Ratings Taught Mensuration Using Brainstorming

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	118.390 ^a	2	59.195	1.215	.306	.052	
Intercept	8976.673	1	8976.673	184.289	.000	.807	
PREINTERES	112.566	1	112.566	2.311	.136	.050	
GENDER	3.044	1	3.044	.063	.804	.001	
Error	2143.227	44	48.710				
Total	174596.000	47					
Corrected Total	2261.617	46					

a. R Squared = .052 (Adjusted R Squared = .009)

Table 5 reveals that, there was no significant difference in the mean interest ratings of male and female students exposed to brainstorming strategy. $F_{(1, 44)} = 0.063$ was obtained with associated probability value of 0.804. Since the associated probability (0.804) is greater than 0.05 set as level of significance, the null hypothesis was not rejected. The result implies that there is no gender difference in students' interest in mensuration when they are taught with brainstorming teaching strategy.

RESULTS

The result of the study reveals the following:

1. The exposure of students' to Brainstorming teaching strategy enhanced students' interest in mensuration.
2. Male and female students exposed to Brainstorming strategy have same interest in mensuration.



DISCUSSION OF FINDINGS

The findings of this study revealed that brainstorming teaching strategy enhanced interest of students in mensuration in mathematics. The results of hypothesis one revealed a significant difference between the Interest of students in brainstorming teaching strategy and conventional method in favour of brainstorming teaching strategy. The findings on students' interest in brainstorming teaching strategy compared to those using conventional method are in agreement with the findings of Ariyo and Gbadura (2017) and Adekunle (2020) who reported that students taught Geography and Physics respectively using brainstorming teaching strategy have better interest than those taught using the conventional methods.

Similarly, the study also revealed that male and female students who were exposed to brainstorming teaching strategy exhibited equal interest in mensuration. This finding is in agreement with the earlier findings of AlMutairi (2021) that found out that students taught mathematics using brainstorming teaching strategy favoured both male and female students and however, disagreed with the findings of Agha (2019) who found that female students have high interest than male students in mathematics and (Offorma, 2019) who found that male students have high interest than female students in mathematics.

The trend of improved interest by the treatment groups could be as a result of the enabling learning environment provided where students were subjected to critical thinking (brainstorming) and collaborated through sharing, helping one another, explaining and encouraging one another to learn. Another reason for better interest experienced by the treatment groups could be because the students were captivated more focused, attentive and interested in what they were doing. This no doubt offered slow learners opportunity to catch up with the fast learners. The interest of students in mensuration could greatly be improved if they are allowed to take charge of their learning. Interaction among the students provides a better opportunity to develop cognition. As provided by Vygotsky

(1978) social learning theory, knowledge is the result of social interaction and learning can occur in groups of similar skilled individuals if they are exposed to what they can think and manipulate.

RECOMMENDATIONS

The following recommendations are made based on the findings of the study:

1. Mathematics teachers should be encouraged to develop and adopt brainstorming strategy in teaching mathematics.
2. Mathematics students should be encouraged to work together in heterogeneous (male and female) groups so as to help reduce gender gap.
3. Pre-service teachers should be trained on how to develop and employ the use of brainstorming strategy to teach mathematics.
4. Periodic and regular training through seminars and workshops should be organized for in-service teachers to update their knowledge on current and innovative teaching strategies at lower and upper levels of education by state government.
5. Mathematics teachers should constantly look for current and innovative methods of teaching mathematics that would be more effective.

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