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Effect of Mind Map on Students Achievement and Interest in Measures of Central Tendency in Delta State

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Abstract
The purpose of this work was to investigate the effect of Mind Maps on students' interest and achievement in measures of central tendency. To ascertain the effect of teaching method and gender on the learners' interest and achievement, four research questions and six null hypotheses guided the study. The design used for the study was the quasi-experimental design, specifically, the non equivalent pre-test, post-test control group design. Three hundred and fifty Junior Secondary one students were selected from four purposively sampled schools in Delta South Senatorial District. Two intact classes were randomly drawn from each of the four schools. Two instruments namely, the Measures of Central Tendency Achievement Test (MCTAT) and the Measures of Central Tendency Interest Scale (MCTIS) were developed and used for the study. Mean, standard deviation and analysis of covariance ANCOVA were used to answer the research questions and test the hypotheses. The study revealed that the use of Mind Maps teaching strategy enhanced the achievements and interest of male and female students. The study also indicated that though female students were more interested, the male students performed higher in measures of central tendency achievement test. However, the results also indicated that the Mind Maps teaching strategy could be used effectively in teaching both male and female students. It was recommended that mathematics teachers should adopt Mind Map in teaching measures of central tendency and other topics in mathematics.

Introduction
The broad aim of secondary education within the overall national objectives is: Preparation for useful living within the society and preparation for higher education. Specifically, the secondary education should: Provide an increasing number of primary school pupils with the opportunity for education of a higher quality irrespective of sex, or social, religious, and ethnic background; diversify its curriculum to cater for the differences in talents, opportunities and roles possessed by or open to students after their secondary school course; equip students to live effectively in our modern age of science and technology; develop and project Nigerian culture, art and language as well as the world's cultural heritage; raise a generation of people who can think for themselves, respect the views and feelings of others, respect the dignity of labour, and appreciate those values specified under our broad national aims, and live as good citizens; foster Nigerian unity with an emphasis on the common ties that unite us in our diversity; inspire its students with a desire for achievement and self-improvement both at school and in later life (FGN. 2014).

Mathematics according to Butler and Wren, (2011) can contribute to the realization of the general aims of education and mathematics education in particular by:

- Developing habits of effective critical thinking. This means

developing logical reasoning both inductively and deductively;

- Providing competence in the basic skills and understanding for dealing with number and form;
- Fostering the ability to communicate thought through symbolic expressions;
- Developing the ability to differentiate between relevant and irrelevant data and to make relevant judgment though the discrimination of values;
- Developing intellectual independence and aesthetic appreciation and expression;
- Advancing the cultural heritage through its own total physical and social structure.

The role of mathematics in the society has been variously recognized and acknowledged as the key to the science and technology based courses, and as useful to man in his daily living (Aminu, 1990). In support of this Ale, (1994) stated that mathematics is the backbone of knowledge. Eguavon, (2002) also remarked that mathematics is the pivot of all civilization and technology development. According to Dedron and Itard, (1974) mathematics arose from the need for areas and volumes. Furthermore, Adegboye, (1999) described mathematics as universal language of communication. It is proved to be the sharpest tool through its application in different subjects and in every day life. Mathematics helps to enumerate, calculate, measure, collate, group, analyze and relate knowledge (Osafehinti, 1986). All these were signals given to mathematics as a descriptions tool for sustainable development. Odo, (1990) pointed out that mathematics is a model for thinking, developing scientific structure, drawing conclusion as well as for solving problems. Perhaps it is because of the importance of mathematics that the study has been made compulsory in secondary schools.

In spite of the social, cultural and disciplinary values of mathematics world wide, the annual WAEC examination results indicate poor performance of students in senior secondary certificate examination (S.S.C.E) in mathematics as many of the candidates scored zero or marks within zero range. Factors identified by the Chief Examiner's Report as being responsible for the poor performance include poor preparation of students for the examination and failure to observe the rubrics. Furthermore, Chief Examiners' Report (2000) stated that many of the questions demanded fundamental understanding of the subject. The questions were devoid of guess work. The rubrics were clear and unambiguous, yet the candidates performed poorly. One of the suggestions for remedy by the Chief Examiners' Report was that teachers should emphasize to the students that the concepts of the senior secondary school mathematics depend on their understanding of mathematics concepts at the junior school level. Hence, students' poor performance in mathematics at a higher level is a reflection of a weak foundation in mathematics at the lower level. In other words, performance at the

higher level depends on what is learned at the lower level.

Adedayo, (2001) stated that the problem of failure at the secondary school level has always been attributed to teachers' failure to use appropriate method of teaching. Obioma, (1984) also attributed pupils' poor performance in mathematics to be dependent on the teachers' use of inappropriate methods of teaching such as descriptive and lecture method. Consequently students loose interest in learning. When one is interested in an activity he is likely to achieve highly in that activity. In other words interest is believed to be an important variable in learning. According to Oxford Advanced Learners Dictionary, interest is condition of wanting to know or learn about something or somebody. It is quality that arouses concern or curiosity. However, interest to do something implies giving ones attention to something because the person enjoys finding out about it or doing it. When something is interesting, it attracts attention of people because it is special and exciting. Okpara, (1985) asserted that although pupils' poor performance in school subjects may be related to their lack of interest and commitment to their studies and inadequate support from their parents and even the government, all that the teachers are used to, is the conventional (talk or lecture, descriptive) methods rather than strategies that involve pupils' participation. Ammo, (2002) also relate the failure of students in mathematics to the teachers' incompetence or ineffectiveness and lack of interest in the subject by the students.

According to Oyadiran, (1991) students display poor performance due to lack of interest in the subject, inadequate preparation and failure to use instructional materials to teach mathematics, there is lack of consideration given to materials like textbooks. Consequently students are scared of the subject. Other factors identified by Amoo, (2001) that are responsible for students' poor performance in mathematics are the overloaded and unrealistic nature of the curriculum, teacher "teach all" policy at primary and Pre-Primary levels of education, delay in the payment of teachers' salary, poor environmental background which a child encounters before he leaves home for his immediate environment, recruitment of unqualified mathematics teachers and the societal call for certificate without proficiency lead students to cheat in order to pass exanimation (that is through examination malpractice). The question then is what is the way out? Identification of a problem they say, is a step towards its solution. To the researcher, there is need to search for a strategy where students must be given sufficient opportunity for creative activity where each can bring out his own measure of talent and thereby display his personality. This process might be enhanced by having the students in small groups, to discuss about the concepts taught and connections to be drawn. Consequently, the students develop awareness of his or her own knowledge organization. Hence this study was motivated by the desire to adapt mind map in the teaching of measures of central tendency in junior secondary schools.

Mind Map according to Wikipedia encyclopedia (1998) is a diagram used to represent words, ideas, tasks or other items linked to and arranged radially around a central key word or idea. It is used to generate, visualize, structure, classify ideas, and as an aid in study, organization, problem solving and decision making. Mind map according to Hugh, (2003) is a convenient graphical tool that helps one think and learn by putting complex thoughts or interconnected ideas into simpler forms or ideas. He concluded that mind map can be used to take lecture notes, plan an essay / dissertation /thesis, outline a presentation / seminar, revise a topic being studied, make notes from textbooks, summarize articles / chapters, organize one's thought about any topic (whether academic / emotional / personal). Mind map, or radiant thinking as it is sometimes called, is a fairly good techniques that allows one to both brainstorm and structure his thoughts using graphics, colours, and words in a free-ranging map (Kennedy, 1999). Furthermore, Brinkmann, (2001) stated that mind map may show connections between mathematics and the rest of the world. As a mind map is open for any idea someone associates with the main topic, non mathematical concepts may also be connected with a mathematical object. Thus it becomes obvious that mathematics is not an isolated subject but is related to the most different areas of "the rest of the world". The researcher defines mind map as a diagram used to develop and organize information in such a way that the central (main) idea is in the centre from these, other sub-ideas are developed and organized. Simply put, it is a mnemonic technique for sorting out both simple and complicated ideas. In other words, the structure of a mind map allows one to organize hierarchically mathematical knowledge.

The special structure of a mind map according to Hemmerich, (1994) has an open structure, one may just let one's thoughts flow, every produced idea may be integrated in the mind map by relating it to already recorded ideas. Mind maps drawn by students provide information about the students' knowledge. The student, in small groups, construct mind maps as by it students have to discuss about the concepts to be used and the connection to be drawn. The students' growth in the understanding of a topic can be checked when asking them to create a mind map. In other words, the connections students make as the map is drawn enables the teacher to assess or evaluate their achievement. Each mind map has a unique appearance and strong visual appeal. Thus, the learning process is speeded up and information recalled faster. From the foregoing, students achieve poorly in mathematics. The researcher sees the need for a teaching strategy that will improve the achievement of both male and female students in measures of central tendency. Thus, the researcher investigated how the use of mind maps affect students' performance in measures of central tendency in statistics.

Statement of the Problem

Secondary education has been acknowledged as preparation of the child for useful living within the society and preparation for higher education (F.R.N, 2004). Any inadequacies and deficiencies

at that level are likely, to adversely affect the child's learning at subsequent levels and living within the society. Despite, this recognition accorded mathematics as the key to the science and technology based courses, and useful to man in his daily living students still perform poorly on the subject Aminu (1990). Research results reveal that the methods presently in use by teachers of mathematics are the traditional, talk or lecture rather than the strategies that involve students' participation (Agwagah 1993). Probably, the non-use of innovative methods that are problem solving oriented such as concept maps, mind maps and so on could be the main cause of poor performance of students in mathematics. Mind maps however, has been used as an effective strategy in enhancing students' achievement both in mathematics and other subjects outside Nigeria (Brnkmann, 2002). There is no evidence in literature of the use of mind maps in the teaching of secondary school mathematics here in Nigeria. Therefore, the problem of this study, put in question form is: to what extent will the use of mind map positively affect male and female students' achievement and interest in measures of central tendency?

Research Questions

The research questions formulated to guide this study are as follows:

1. What are the mean achievement scores of students taught measures of central tendency using mind maps method and those taught with conventional method?
2. What are the mean achievement scores of male and female students taught measures of central tendency with mind maps?
3. What are the mean interest scores of students taught central tendency with mind map?
4. What is the influence of gender on the mean interest scores of students in central tendency when taught with mind maps?

Research Hypotheses

The following hypotheses were formulated to guide this study, and tested at .05 level of significance.

$H0_1$: There is no significant difference in the mean achievement scores of students taught central tendency using mind maps and those taught using conventional method.

$H0_2$: There is no significant difference in the mean achievement scores of male and female students in central tendency.

$H0_3$: There is no significant interaction effect of method and gender on the mean achievement of students in measures of central tendency.

$H0_4$: There is no significant difference in the mean interest scores of students in central tendency when taught with mind maps and those taught with conventional method.

$H0_5$: There is no significant difference in the mean interest scores of male and female students in central tendency.

$H0_6$: There is no significant interaction effect of method and gender on the mean interest of students in measures of central tendency.

Purpose of the Study

The general purpose of the study was to find out the effect of mind maps on achievement and interest of junior secondary school students in measures of central tendency. The study specifically intended to:

1. Determine the effect of mind map on the achievement of students taught measures of central tendency.
2. Determine the influence of gender on the achievement of students.
3. Determine the effect of mind map on interest of students in measures of central tendency.
4. Determine the influence of gender on the interest of students in central tendency.
5. Determine the interaction effect of method and gender on students' achievement and interest in mathematics.

Significance of the Study

Evidence of poor achievement in mathematics especially in measures of central tendency as a result of factors earlier highlighted is the motive behind the present study to investigate the effect of mind maps on the achievement and interest of secondary school students in measures of central tendency. Findings of the study would be of immense benefit to:

Secondary school teachers as they would acquire new instructional strategy. This will make the teaching of mathematics more interesting and thus improve teachers' effectiveness. This could secure the attention of the students in the course of instruction and therefore enhance greater interest and learning of mathematics by students.

The results of the study could sensitize curriculum planners on the use of mind map for teaching measures of central tendency. The result of the study would make students have a better understanding of the central tendency. Their involvement in creating mind maps might generate interest and hence facilitate better achievement.

The result would furnish the teacher training institutions such as Institutes of Education, Faculties of Education, and Colleges of Education with useful methods, learning strategies and materials that are useable in secondary schools since educational institutions organize in-service (Sandwich) courses for secondary school teachers. Thus the in-service trainers would acquire the knowledge and as well disseminate the information.

The use of mind map would furnish the text book writers with additional information and variety in the manner of presenting the mathematical materials and instructions that will work in Nigerian school setting.

The result from this study might be introduced during workshops, seminars and conferences. Supervisors and inspectors of education will also benefit from such conference at the state and

federal levels. This, it is hoped will ensure improvement in mathematics methodology in the school to enhance achievement and to generate students' interest in the subject.

Scope of the Study

The study will be limited to junior secondary one (JSI) students in the South Senatorial District of Delta State. The J.S.I students was used because measures of central tendency is contained in their curriculum. The topic covered the following contents. Mean as the average, Median as the middle number, Mode as the number with the highest frequency, Word problem on mean, median and mode The topic will be used because it is one of the topics in mathematics that students find difficult as highlighted earlier.

Research Method

Research Design

The design of this study is the quasi-experimental design; specifically, the non-equivalent pre-test, post-test control group design. This design was adopted because the experiment was carried out in intact classes (Ali, 1996). Intact classes were used to avoid disruption of normal classes. Thus, there will be no randomization of students into treatment and control groups as this would disrupt school organization. The researcher will manipulate the independent variable; that is teaching strategy and observe the effect on the dependent variables, which is achievement and interest.

Table 1: Design Format

Group	Pre-Test	Research Condition	Post-Test
Experimental Group	Y_c	X	Y_b
Control Group	Y_c	-X	Y_b

Where Y_c = Pretest for both experimental and control groups

Y_b = Post-test for both experimental and control groups

X = Treatment given to the experimental group

-X = Treatment given to the control group

Population of the Study

The population of the study comprised all senior secondary one (SS I) mathematics students in the eight local government area of Delta South Senatorial District. There are 105 public secondary schools with a total population of 19,201 JSS I mathematics students comprising 14,895 males and 4,306 females (See Appendix IV). The rationale for using the

senior secondary school (JSS I) students was based on the fact that, they are available at any point in time, because they were not preparing for any external examination, nor were they final year students who were busy with their final examination.

Table 2: Number of schools and students according to Local Government Areas.

S/N	Local Govt. Area	Nos. of School	No. of studentSS1		Total
			M	F	
1	Bomadi	09	266	268	534
2	Burutu	19	922	732	1654
3	Patani	09	305	293	598
4	Isoko North	16	533	555	1088
5	Isoko South	19	686	768	1454
6	Warri North	10	262	267	529
7	Warri South	17	10707	1200	11,907
8	Warri South West	06	1214	223	1437
	Total	**105**	**14895**	**4306**	**19201**

Source: Ministry of Basic and Secondary Education, Asaba.2020

Sample and Sampling Technique

The sample for this study is made up of three hundred and fifty (350) J.S.I students who were drawn from four (4) schools. Sampling was done in stages; therefore multi-stage sampling procedure was employed. Firstly, purposive sampling technique was used to select four secondary schools from Delta South Senatorial District. Random sampling technique was used to select two streams of J.S.I classes from the four schools.

Table 3: The Sample of J.S.I Students used for the Study

Schools used for the Study	Experimental Group		Control Group		
	No of Males	No of Females	No of Males	No of Females	Total
A	30	-	30	-	60
B	-	50	-	50	100
C	32	20	25	23	100
D	18	30	15	27	90
Total	**80**	**100**	**70**	**100**	**350**

For the experimental (treatment) group 80 males and 100 females a total of 180 J.S.I students were used for the study. On the other hand, for the control group, 70 males and 100 females

were used for the study. For each school sampled, two intact classes were randomly assigned experimental and control groups. The treatment group was exposed to mind map strategy while the control group was exposed to conventional teaching method based on conventional approach.

Instruments for Data Collection

Two instruments namely Measures of Central Tendency Achievement Test (MCTAT) and Measures of Central Tendency Interest Scale (MCTIS) were used for data collection by the researcher. MCTAT was used as achievement test to measure students' performance in measures of central tendency. It consisted of 20 multiple choice items with four (4) options. The items were selected from the content which included, meaning of mean, median and mode, computing the mean, computing the median and computing the mode. In constructing MCTAT, the researcher prepared a table of specification to serve as a guide for the test development. The construction of the table of specification was guided by the guidelines in the schools' curriculum for J.S.I. The table of specification (test blueprint) was subdivided into content dimension and ability process dimension as shown in table 4.

Table 4: The Table of Specifications on Measures of Central Tendency for J.S.I

Content Dimension	**Ability Process Dimension**			
Topics	**Percentage %**	**Lower Cognitive Processes**	**Higher Thinking Processes**	**Total**
Meaning of mean, median and mode	25	4(1, 2, 3, 4)	1 (17)	5
Computing mean the	25	3(5, 6, 7)	2 (8, 18)	5
Computing the median	25	3 (9, 10, 11)	2 (12, 19)	5
Computing the mode	25	3 (13, 14, 15)	2 (16, 20)	5
Total	**100**	**13**	**7**	**20**

Content dimension contain the units that was taught in this study while the ability process dimension was subdivided into lower cognitive and higher thinking processes. The MCTAT was used for both pretest and posttest. In order to minimize pretest sensitization, MCTAT was collected back from the students after pretest and properly guided to prevent using it for revision by the students. The researcher also prepared two sets of lesson plans for teaching the units set out for the study. One set of the lesson plans was written based on mind map strategy in teaching measures of central tendency for the experimental groups. The other was written based on conventional approach in teaching measures of central tendency for the control groups. It followed the same procedures as treatment group except that it has no elements of mind maps.

The Measure of Central Tendency Interest Scale (MCTIS) was used for assessing students' interest in measures of central tendency. This scale consisted of 20 items. Each item was rated on a 4 – point scale with the following response: A Strongly Agree, B. Agree, C. Disagree, D. Strongly Disagree. Some items (1, 3, 5, 6, 8, 9, 11, 13, 15, 17, 19) were positively cued while others (2, 4, 7, 10, 12, 14, 16, 18, 20) were negatively cued. To score the positively cued items, the response (A) has 4 points, (B) has 3 points, (C) has 2 points and (D) has 1 point. On the other hand, to score the negatively cued items, the response A, B, C and D has the points 1, 2, 3 and 4 respectively.

Validation of the Instruments

The instruments MCTAT and MCTIS were validated by experts in mathematics education and measurement and evaluation. The validation of MCTAT took the following procedure: The table of specification was face validated by two experts from measurement and evaluation and two from mathematics education at the NnamdiAzikiweUniversity, Awka. The content validation of MCTAT was accomplished by making sure that the test items reflected the specification on the test blueprint. These experts were requested to judge the suitability of the test items, check plausibility of the distractors, choice of appropriate alternatives for the multiple choice questions, language level and clarity of the items. Their comments were used to produce the final instrument which contains 20 test items. Two experts also validated the lesson plans.

The MCTIS was validated by two experts from measurement and evaluation and mathematics education respectively. They were requested to validate the instrument based on clarity of the statement, language level of the statement and appropriateness of the statements. After validation of

MCTIS, only 20 items of the interest scale remained to be used for the study.

Reliability of the Instruments

The researcher used two intact classes of J.S.I. students from a school in Delta South Senatorial District who are not part of those sampled were used to trial test the instruments MCTAT and MCTIS. The school was not part of the experimental school. The trial testing enabled the researcher to determine the actual time for the test. In other words, the time taken by the first and last subjects to complete the test during the trial testing were recorded and averaged. The scores obtained from trial testing were used to determine the internal consistency of MCTAT using Kuder Richardson formula 20 (K-R20). This fomular was used because the test items were of different difficulty index. The internal consistency reliability coefficient of MCTAT was 0.81.

The data collected from trial testing were used to determine the internal consistency of MCTIS using Cronback Alpha. The formula was used because the items were not dichotomously scored. The reliability coefficient was found to be 0.88 (see appendix L for computation).

Experimental Procedure

The researcher trained the regular graduate mathematics education teachers in each of the four (4) schools used for the study as research assistants. The training was of two different sessions – one for the treatment group and the other for the control group.

Training of Teachers

The objectives of the training were to enable the teachers acquire the competencies for implementing the experimental conditions. The researcher trained them on the procedures of mind map for the experimental group and the use of conventional method for the control group, review of lesson plans prepared by the researcher, familiarization with the content and activities of students in learning the unit of instruction.

Method of Data Analysis

The data collected were analysed as follows: Research questions were answered using mean and standard deviation. Hypotheses were tested using analysis of covariance (ANOCVA) at P <. 05 using pretest as covariate.

Results

The results of the study are organized in accordance with the research questions and hypotheses of the study.

Research Question 1

What are the mean achievement scores of students taught measures of central tendency using mind maps method and those taught with conventional method?

Table 5: The Mean and Standard Deviation scores in Measures of Central Tendency Achievement Test (MCTAT) of Subjects in the Experimental and Control Groups

Group	No of Subject	Pre MCTAT		Post MCTAT	
		Mean	SD	Mean	SD
Control Group	170	18.14	10.28	42.74	10.55
Experimental Group	180	17.35	10.21	63.61	15.86

Table 5 shows that the mean achievement score of the control group in the pre MCTAT was 18.14 with standard deviation of 10.28 while that of the experimental group was 17.35 with standard deviation of 10.21. In the post MCTAT, the mean achievement score for the control group was 42.74 with standard deviation of 10.55 while the mean for the experimental group was 63.61 and standard deviation of 15.86.

Hypothesis 1

$H0_1$: There is no significant difference in the mean achievement scores of students taught central tendency using mind maps and those taught using conventional method

Table 6: Analysis of Covariance (ANCOVA) of Students Scores in Measures of Central Tendency Achievement Test (MCTAT)

Source of Variation	Sum of Squares	DF	Mean Square	F of F at .05 level	Significance	Decision
Pre-tests	966.626	1	966.626	5.316	.022	S
Main Effects	36774.212	2	18387.106	101.117	.000	S
Method	36658.162	1	36658.162	201.596	.000	S
Gender	19.873	1	19.873	.109	.741	NS
Method x Gender	84.321	1	84.321	.464	.496	NS
Explained	39222.591	4	9805.648	53.925	.000	S
Residual	62734.624	345	181.839			
Total	101957.214	349	292.141			

S = Significant at .05 level.
NS = Not Significant at .05 level.

The results in table 6 indicate that teaching method as a main effect on students achievement in measures of central tendency is significant. This is because the probability value of .000 at which

this main effect is shown to be significant is lower than the value of .05 at which its is being tested. Thus, the null hypothesis of no statistically significant effect is rejected at .05 level of significance.

Research Question 2

What are the mean achievement scores of male and female students taught measures of central tendency with mind maps?

Table 7: The Mean Achievement Scores and Standard Deviation of Male and Female Subjects

Group	Type of Test	Male		Female	
		Mean	SD	Mean	SD
Control Group	Pre MCTAT	18.45	9.29	17.83	9.18
	Post MCTAT	43.12	10.63	42.41	10.48
Experimental Group	Pre MCTAT	17.64	9.11	17.06	9.09
	Post MCTAT	54.30	17.99	52.85	16.41

Table 7 shows that the mean pre MCTAT score of male subjects in the experimental group is 17.64 with standard deviation of 9.11 while that of the female is 17.06 and 9.09 respectively. The male subjects in the experimental group obtained a higher mean achievement score of 54.30 with standard deviation of 17.99 in the post MCTAT compared with their female counterparts in the experimental group with a mean achievement score of 52.85 and standard deviation of 16.41.

Hypotheses 2

$H0_2$: There is no significant difference in the mean achievement scores of male and female students in central tendency.

Results from table 6 reveal that gender as a main effect on students' achievement in measures of central tendency is not significant. This is because the probability value of .741 at which this main effect is shown to be significant is higher than the level of .05 at which it is being tested. This implies that no significant difference exists in the mean achievement scores of male and female subjects due to the mind map teaching strategy.

Hypothesis 3

$H0_3$: There is no significant interaction effect of method and gender on the mean achievement of students in measures of central tendency.

Results from table 6 show that the interaction effects of method and gender on students' mean

achievement score in measures of central tendency is not significant. This is because the probability value of .496 at which the interaction effect of teaching method and gender on students' achievement score in central tendency is shown to be significant is higher than the level of .05 at which it is being tested. This implies that there is no significant interaction between mind map and gender on students' achievement in measures of central tendency.

Research Question 3

What are the mean interest scores of students taught central tendency with mind maps and those taught with conventional method?

Table 8: The Mean Interest Scores and Standard Deviation of Measures of Central Tendency Interest Scale (MCTIS) Scores of Subjects

Group	No of Subject	Pre MCTIS		Post MCTIS	
		Mean	SD	Mean	SD
Control Group	170	43.59	4.21	47.44	4.61
Experimental Group	180	43.37	4.07	52.68	4.85

In table 8, the mean interest score of the control group in the pre MCTIS was 43.59 with standard deviation of 4.21 while that of the experimental group was 43.37 with standard deviation of 4.07. In the post MCTIS, the mean interest score of 52.68 with a standard deviation of 4.85 in the experimental group was higher than that of the control group which had a mean interest score of 47.44 with a standard deviation of 4.61.

Hypothesis 4

HO_4: There is no significant difference in the mean interests scores of students in central tendency when taught with mind maps and those taught with conventional method.

Table 9: Analysis of Covariance (ANCOVA) of Students' Score in Measures of Central Tendency Interest Scale (MCTIS)

Source of Variation	Sum of Squares	DF	Mean Square	F	Significance of F	Decision at .05 level
Pre-tests	76.576	1	76.576	3.485	.063	NS
Main Effects	2168.563	2	1084.281	49.343	.000	S
Method	2165.092	1	2165,092	98.528	.000	S
Gender	14.439	1	14.439	.657	.418	NS
Method x Gender	140.679	1	140.679	6.402	.012	S
Explained	2632.787	4	658.197	29.953	,000	S
Residual	7581.167	345	21.974			
Total	10213.954	349	29.266			

S = Significant at .05 level.
NS = Not significant at .05 level.

The results in table 9 show that teaching method as a main effect on students' interest in measures of central tendency is significant. This is because the probability value of .000 at which this main effect is shown to be significant is lower than the level of .05 at which it is being tested. Thus, the null hypothesis of no statistically significant effect is rejected at .05 level of significance.

Research Question 4

What is the influence of gender on the mean interest scores of students in central tendency when taught with mind map?

Table 10: The Mean Interest Scores and Standard Deviation of Male and Female subjects Taught with Mind Map Strategy

Group	Type of Test	Male		Female	
		Mean	SD	Mean	SD
Control Group	Pre MCTIS Post MCTIS	43.20 47.60	4.10 5.02	43.96 48.23	4.31 4.20
Experimental Group	Pre MCTIS Post MCTIS	43.09 49.93	4.02 6.08	43.64 50.29	4.11 4.86

Table 10 shows the mean pre MCTIS score of 43.64 and standard deviation of 4.11 for female subjects in the experimental group while the mean and standard deviation scores of their male experimental group counterparts were 43.09 and 4.02 respectively.

In the post MCTIS, the mean interest score of 50.29 and a standard deviation of 4.68 for female subjects in the experimental group is higher than that of their male experimental group counterparts who had a mean interest score of 49.93 and standard deviation of 6.08.

Hypothesis 5

HO_5: There is no significant difference in the mean interest scores of male and female students in central tendency.

The results in table 9 show that gender as a main effect on students' interest in central tendency is not significant. This is because the probability value of .418 at which this main effect is shown to be significant is higher than the level of .05 at which it is being tested. Hence the null hypothesis which states that gender does not statistically effect students' mean interest score in central tendency is accepted.

Hypothesis 6

HO_6: There is no significant interaction effect of method and gender on the mean interest of students in measures of central tendency.

The results in table 9 show that the interaction effect of teaching methods and gender on students' mean interest score in central tendency is significant. This is because the probability value of .012 at which the interaction effect of mind map instructional strategy and gender on interest in central tendency is shown to be significant is lower than the level of .05 at which it is being tested.

Discussion of Findings

The findings of this study revealed that mind map teaching strategy had significant effect on students' achievement in measures of central tendency. The experimental group had higher mean achievement score (63.61) than their control group counterpart (42.74) as shown in table 5. Results in table 6 further confirmed this finding by indicating statistically significant effect of mind map on students' achievement in measures of central tendency. The observed probability value of .000 which was significant at .05 level of significance testifies to the result. This implies that the efficacy of mind map teaching strategy is higher and more positive in enhancing and facilitating students' achievement in measures of central tendency than the conventional method.

The finding of this study is in agreement with (Buzan, 1991; Kennedy, 1999; Hugh, 2003 and Philip 2006) which states that mind map teaching strategy enhanced better achievement in the learners. However, the researcher's findings disagree with the findings of Presley, Vanetten, Yokoi, Freebern and VanMeter (1998) that learners tended to learn far better by focusing on the content of learning

material rather than worrying over any particular method.

In spite of this controversy, it is obvious from the findings of the present study that the mind map teaching strategy is more efficacious than the conventional method in enhancing students' achievement in measures of central tendency in mathematics. This could be attributed to the fact that the mind map instructional strategy is child-centered and activity-based as against the teacher centered nature.

The results presented revealed that male students had higher mean achievement score of 54.30 than their female counterparts with mean score of 52.85 as shown in table 7. This was further confirmed by the result in table 6 where gender had no statistically significant effect on students' achievement in central tendency. Although this finding is in contrast to that of Agwagah (1993) and Kurumeh (2004) it is however in agreement with that of Akintola and Popoola (2004) that gender have no significant effect on students' performance in mathematics. In other words, for enhanced achievement in mathematics emphasis should be on teaching strategy and not on gender. This is very crucial since all categories of students are expected to benefit from this teaching strategy. In support of this finding Aiyedum (2000) states that cognitive power necessary for mathematical ability correlates with general intelligence and not on any particular sex. Results in table 6 further confirm this finding by indicating the non presence of statistically significant interaction effect between the two variables (method and gender) on achievement in central tendency. The observed probability value of .496 which was not significant at .05 level of significance, affirms such a result. In other words, results of this study have shown that students' performance in central tendency is not necessarily a function of teaching strategy and gender interaction effect. The findings of this study have also provided evidence that students' performance in central tendency is dependent on teaching strategy irrespective of sex.

The finding of this study also revealed that the experimental group enhanced greater and higher interest (52.44) as in table 8. This implies that the students taught with mind map teaching strategy developed more interest than their control group counterparts. This was further confirmed by the results in table 9 where interest as a main effect indicated a probability value of .000 at .05 level of significance. This implies that interest is a significant factor in students' achievement in measures of central tendency.

This result is in line with the findings of Hemmerich, Lim and Neel (1994) who found that students not only developed an awareness of the knowledge organization they had, but also an awareness of missing links between isolated concepts they knew were belonging to the map topics as they are in small groups construct mind map. Thus, students who were not good in mathematics benefited from their group members. It engineered and stimulated their interest thereby evoking greater understanding and higher achievement in measure of central tendency. The reason for this highly generated interest could be as a result of active participation of the students, co-operative learning and self correction. This type of lesson leads to creativity. This erased the abstractness and monotony normally experienced in a mathematics classroom setting. In other words, the students' activity-based approach in the teaching of mathematic are more likely to improve their interest in the subject than those taught with the conventional approach. The adoption of this mode of teaching in schools will no doubt develop in the students' necessary skills and enthusiasm for realizing enhanced achievement in mathematics and other
related science subjects.

A closer look at the results of this study in table 10 reveal that male and female students obtained almost equal mean interest scores of 49.93 and 50.29 respectively in mathematics. This finding was further confirmed by the data in table 9 which show that gender as a main effect has no significant effect on students' interest in mathematics. The observed probability value of .418 which is not significant at .05 level of significance testifies to the result. This implies that a student with higher achievement may not necessarily possess a higher level of interest in mathematics. This finding is not in agreement with Agwagah, (1993) that there is a strong relationship between genders and interest in school subjects. Hence, irrespective of one's gender there is need for fundamental knowledge of the subject matter.

However, there was a significant interaction effect between the interest of students and gender. The observed probability value of .012 in table 9 which is lower than the .05 significance level testifies to this result. Thus, students' interest in mathematics has been boosted on account of the mind map teaching strategy than the conventional group.

Conclusions from the Study

Based on the findings and discussion of this study, the following conclusions were made:

1. The mind map teaching strategy stimulated and fostered students' achievement and

interest more positively than the conventional method used in teaching their counterparts measures of central tendency.

2. Gender does not have influence on mind map teaching strategy as regards achievement and interest in measures of central tendency.
3. There is no significant interaction effect between teaching method and gender on achievement in measures of central tendency.
4. There is significant interaction effect between method and gender on students' interest in measures of central tendency.

Educational Implications of the Findings

The findings of this study have some important educational implications. These implications as they relate to the teachers, students, policy makers and textbooks authors are highlighted below.

The fact that mind map teaching strategy is a new innovation, it implies that teachers will be exposed to variety of strategies to make use of during their lessons. Since mind map is activity oriented it suggest that as students engage in creating mind map, their interest could be aroused and sustained. Their involvement in creating mind map could also evoke greater understanding and higher achievement in measures of central tendency.

The non presence of significant interaction effect between teaching method and gender implies that mind map teaching strategy could be used effectively in teaching both male and female students. The use of mind map could furnish textbook writers, ministry of education, National Mathematical Centre (NMC) Abuja, faculty of education and various institutions involved in training of teachers with additional information and variety in the manner of presenting the mathematical material. The implication in that there could be improvement in mathematics methodology in our schools which in turn could enhance achievement in the subject.

Recommendations

Based on the findings of this study, the researcher made the following recommendations.

1. Teachers should adapt mind map teaching strategy in our school system. However, mind map will help to make mathematics gain popularity, capture the interest of the learners and challenge their intellect and make the content more interesting in terms of basic instructional approaches.
2. Government should make provision for in service

training of theirs teachers. This will help to enhance their competence especially in the choice and use of the various teaching strategies.

3. Since mind map strategy is a new innovation in teaching learning process, the federal government, the National Mathematical Centre (NMC) Abuja and relevant professional bodies should include it as one of their topics to be discussed during workshops organized for teachers and professionals. Such innovations will help to make the lessons more stimulating and interesting to the learner.
4. Authors of mathematics textbooks should write their texts to be child centered and activity oriented as in mind map. This will help to generate interest in learning of mathematics, which is said to be "the key of all sciences".

References

Adedayo, A.O. (2001). The place of Mathematics in Nigeria Secondary School. *Course on effective Teaching of MathematicsPhase 2*.Magodo: Lagos.

Adegboye,A.O. (1999). *Mathematics Language as a Universal Tool of Communication Journal of Studies in Language and literature* (1), 120 – 130.

Adepoju, J.A. (1999). *Factors and Problems in the Teaching and Learning of Mathematics in Nigerian schools*. Conference Proceeding 2nd – 6th Sept Lagos: Macmillan.

Adler, (1971). Piaget on the Learning of Mathematics. In G. Obodo, (1997) *Principles and Practice of Mathematics Education in Nigeria*, Enugu: Division of General Studies.

Agwagah, U.N.V, (1993). *Instruction in Mathematics Reading as a Factor in Students' Achievement and Interest in Word Problem Solving.* Unpublished Ph.D thesis, University of Nigeria Nsukka.

Agwagah, U.N.V. (1994). The Effect of Instruction in Mathematics Reading on Pupils Achievement and Retention in Mathematics Education. *Journal of Quality Education,* I (1), 67 – 72.

Aiyedum, J.O. (2000). Influence of Sex Difference of Students on Their Achievement in Secondary School Mathematics. ABACUS: *Journal of the Mathematical*

association of Nigeria. 25 (1), 109 – 113.

Akintola, M.K and Popoola, A.A. (2004). A Comparative Study of the Effectiveness of Two Strategies for Solving Mathematics Problems on the Academic Achievement of Secondary School Students. ABACUS: *Journal of the Mathematical Association of Nigeria*, 29 (1).

Ale, S.O. (1994). Mathematics Methods. A Paper Presented in a Workshop at National Mathematical Centre, Abuja.

Alio, B.C. (1997). *Polya's Problem – Solving Strategy in Secondary School Students' Achievement and Interest in Mathematics*. Unpublished Ph.D thesis, University of Nigeria, Nsukka.

Amoo, S.A. (2001). An Appraisal of Problems Encountered in Teaching and Learning of Mathematics in Secondary Schools. A Paper Presented at the Mathematical Association of Nigeria (MAN) Conference held in Kastina State.

Amoo, S. A. (2002). Analysis of Problems Encountered in Teaching and Learning of Mathematics in Secondary Schools. ABACUS: *Journal of the Mathematical Association of Nigeria*, 27 (1), 30 – 34.

Balogun, F.U. (1997). Communicative competency in mathematics education in Africa. In G. Badmus and I. Ocho, (eds) *Science, Mathematics and Technology in Nigeria*, Lagos: Ever Lead Printing and Publishing Company Limited.

Brinkmann, A. (2001). *Mind mapping – eine methods zurforderung der kreativitat and lerneffektivital in mathematikunterricht*. Pedagogischerzeitschriftenverlag. Berlin.

Brinkmann, A. (2001 b). Mathematical networks conceptual foundation and graphical representation. In R. Soro, (ed) *Current State of Research on Mathematical Beliefs*, Sweden: University of Turku.

Brinkmann, A. (2002). *Mind Mapping in Mathematik-Unterricht. EneLerneffizienteAbwechshung*. Jahrgang: Dummler Troisdorf.

Brinkman, A. (2003).Mapping as a tool in mathematics education. *National Council of Teacher of Mathematics*. 96 (2), 96 – 101.

Butler, L.H. and Wren, P.L. (1951). *The Teaching of Secondary Mathematics*. New York: McGraw Hill Books.

Buzan, T. (1991). *Themind Map Book*. New York: Penguin.

Buzan, T. and Buzan, B.(1997).Das Mind Map Buch: 1993 English language version. Landsberg am lech. Retrieved on February 17,

2007 from Http://Www.Buzan.Co.Uk.

Chief Examiner's Report, (1996 – 1998).The West African Examinations Council. S. S. C. E. May/June.

Chief Examiner's Report, (2002).The West African Examinations Council. S. S. C. E. Nov/Dec.

Chief Examiner's Report, (2003).The West African Examination Council. S. S. C. E. May/June.

Cliffiths and Howson (1994).*Mathematical Society and curriculum.* London: Cambridge University Press.

Cockeroft, W.H. (1982). Mathematics Courts: report of the committee of inquiry into the teaching of mathematics in schools, London.

Cohern, W. (1991).World View, Culture and Science Education. *Journal of Science Education*, 5 (4). 5 – 8

Cohern, W.H. (1996).Constructivist and Non-Western Science Education Research. *Journal of Science Education*, 4 (3), 287 – 300

Davinci, L. (1999).A Useful Tool for Improving Science Teaching and Learning. *Journal of Research in Science Teaching*, 27 (10), 937 – 940.

Dedron, P and Itard J. (1974).*Mathematics and Mathematicians*. Great Britian: J. W. Arrowsmith.

Driver, R. (1989) Changing conceptions. In P. Adey, (ed.) *Adolescent Development and School Science*. London, Falmer Press.

Eguavon, O.J. (2002).Mathematics the Heartbeat of Information Technology: Implication for Secondary Education. ABACUS: *Journal of Mathematical Association of Nigeria*, 27 (1) 10 – 12

Entrekin, V. (1992).Mathematical Mind Mapping. *The Mathematics Teacher*, 85 (6), 444 – 445.

Ezeugo, N.C. and Agwagah, U. N.V. (2000).Effect of Concept Mapping on Students Achievement and Interest in Algebra. Implication for Secondary Mathematics Education in the 21st Century. ABACUS: *Journal of the Mathematical Association of Nigeria*, 25 (1),1 – 2.

Farrand, P. Hussain, F. and Hennesy, E. (2002). The efficacy of the mind map study technique. *EBSCOHOST*. 36 (5), 426 – 430.

Farant, J.S. (1980). *Principles and Practice of Education.* England: Longman Group Ltd.

Frey, C. (2003). Mind manger for tablet PC. Retrieved March 10, 2006 from http//www.innovationtools.com/tools/softwaredetails.

Federal Republic of Nigeria (2004). *National Policy on Education*. Lagos: Federal Government Press.

Hacker, R.J. (1992). Gender Studies: Some Methodological and Theoretical

Issues. *International Journal of Science Education*,14 (5), 529.

Harbor-Peters, V.F.A. (1999). *Note Worthy Points on Measurement and Evaluation.* Enugu: SNAAP Press Ltd.

Habor-Peters, V.F.A. (2002). Attitude and interest of the students to the mathematical sciences in Nigeria. A commissioned paper for the mathematical sciences education summit organized by N. M. C. Abuja on improving the state of the mathematics science education in Nigeria 4th – 5th Oct.

Hemmerich, H. Lim. W. and Neel, K. (1994). *Prime time: Strategies for Life-Long Learning in Mathematics and Science in the Middle and High School Grades.* Heinemann, Portsmouth.

Hugh, T.W. (2003). UCU Study Skills Online-Mind Mapping. Retrieved on March 20, 2007 from http//www.map/netshare/lear/mindmap/index.html

Johnason, D.H. (1991). A manifesto for a constructivist approach to technology in higher education. In M. Kurumeh, 2004. *Effects of Ethnomathematics Approachon Student's Achievement and Interest in Geometry and Menstruation.* Unpublished Ph.D thesis, University of Nigeria, Nsukka.

Kennedy, D. (1999). An introduction to Mind Mapping. Retrieved on April 6, 2007 from http://www.denniskennedy.com/blog/ .

Kurumeh, M.S.C. (2004). *Effect of Ethnomathematics Approach on Students' Achievement and Interest in Geometry and Menstruation*. Unpublished Ph.D thesis, University of Nigeria, Nsukka.

Lassa, P.N. (1995). Entrepreneurship Education for Socio-Economic and Industrial Development in Nigeria. A keynote address presented during national conference in entrepreneurship education at FCEF Umunze, 6th – 8th September.

Lutz, M. and Jack, P. (2003).*Charting the Topic Maps Research and Applications Landscape.* Springer: ISBN.

Merill, M.D. (1991). Contructivism and Instructional Design. *Educational Technology.* May 45 – 53.

Mkpa, M.A. (1987).*Curriculum Development and Implementation.*Owerri: Totman Publisher.

Novak, J. D.(1970). How do we Learn our Lesson? Taking Students Through the Process. *The Science Teacher*, 60 (3). 50 – 55.

Novak, J. D. (1990). A tool for improving teaching and Learning. In D. Treagust, R.

Duit, and B. Franser (eds) *Improving Teaching and Learning in Science and Mathematics*. New York: Teachers College Press.

Nwagu, E. K.N. (1992).Evaluating affective behaviour. Observational technique. In B. G. Nworgu, (ed) *Educational Measurement and Evaluation Theory and Practice*. Nsukka: Hallman Publishers.

Obioma, G.O. (1985).*The Development and Validation of a Diagnostic Mathematics Test for Junior Secondary School Students*. Unpublished Ph.D thesis, University of Nigeria, Nsukka.

Obodo, G.C. (1990). *Differential Effect of Three Teaching Modes on Performance of Junior Secondary School Students in some Algebraic Concepts.* Unpublished Ph.D thesis, University of Nigeria. Nsukka.

Obodo, G.C. (1997). *Principles and Practice of Mathematics Education in Nigeria*. Enugu: Division of General Studies.

Odo, I.O., Okonkwo, A.E. and Amenaghawen, E.E. (1990). *Developmental and Validation of Physics Interest Inventory*. Unpublished B.Sc. thesis, University of Nigeria, Nsukka.

Okeke, E.A.C. (1990). Gender and technology in Africa: a challenge for education. A paper presented at the Roma Mehta Lecture Radeliffcollege. February 8.

Okolo, I.U.N. (2004). An Insight into the Background Objectives and Intended Achievements of the Teaching/Learning of Science, Technology and Mathematics in Schools. A paper delivered at workshop on the teaching of the 5 most difficult concepts in Maths/Physics/Chemistry in senior secondary school curriculum in Enugu State.

Okonkwo, C. (1997).Effect of tangram puzzle game on students' performance in mathematics. In G. Badmus and L, Ocho (eds) *Science Mathematics and Technology in Nigeria*. Lagos: Everlead Press.

Okoye, E. (1987).Women and girls participation in STM educators and facilitators. In G. Badmus (ed) *Science Mathematics and Technology Education in Nigeria*, Lagos: Everlead Press.

Okpara, S.N., (1985).*Effect of Non-Material Reinforcement on Pupils' Achievement in Mathematics*. Unpublished Ph.D thesis. University of Nigeria, Nsukka.

Onyemerekeya, C.C. (1998).*Basic Principles and Methods of Teaching and Learning*. Awka: NuelCenti Publishers and Academic Press Ltd.

Oriji, J.O. (1984). *The Effects of Two Reinforcement Schedules on the Academic Performance of Children in Primary Science Programme*. Unpublished M.ED Thesis, University of Nigeria, Nsukka.

Osafehinti, I.O. (1986).The Problem of Mathematics in Nigeria: Any Solution? *Journal of Science Teachers Association of Nigeria*, 24 (2), 24.

Osibodu, S. M. (1988).Improving the access of girls and women to mathematics and mathematics related education. Education today: *A quarterly Journal of Federal Ministry of Education*, 1 (2).

Oyadiran, J.O. (1991).*An Investigation into Factors Responsible for Poor Performance in Mathematics*. Unpublished M.ED. Thesis, University of Ibadan.

Philip, B. (2006) Mind Maps: Rubish in Theory, but Handy in Practice.
Retrieved on February 20, 2007 from http://education.guardian.co.uk/schols/coment/story/o,,1755479,00.html.

Pressley, M, VanEtten, S, Yokoi, L, Freebern, G, and Vanmeter, P. (1998) The metacognition of college studentship: A grounded theory approach. In D. Hacker, J. Dunlosky, and A. Graesser (eds) *Metacognitions in Theory and Practice*, Mahwah NJ: Erlbaum.

Satterly D. (1987).How Piaget's theory impacts learning http://www.funderstanding.com/piaget.cfm.

Sobel, M.A. (1988).*Teaching Mathematics. A Source Book of Aids, Activities and Strategies*. Pretice-Hall inc.

Stofflet, R.T. (1994).The Accommodation of Science Pedagogical Knowledge: The Application of Conceptual Change Constructs to Teacher Education. *Journal of Research in Science Teaching*. 31 (8) 87 – 90.

Suydan, H.M. and Weaver, J.F. (1975).Research on Mathematics Learning In J. Payne, (ed) *Mathematics Learning in Early Childhood*. National Council of Teachers of Mathematics.

Svantesson, I. (1992).*Mind Mapping and Gedachtnistraining*. GABAL: Bremen.

Tolman, E.C. (1948).Cognitive Maps in Rats and Man. *Psychological Review* 55 189 – 208.

Usman, I. (1997).Effect of Practical Activities on Achievement in Integrated Science, Among JSS Students in Kaduna State. *Journal of the Science Teachers' Association of Nigeria*, 28 (1)

Wikipedia Encyclopedia, (1998).Mind Map guidelines. Retrieved on April 3, 2007 from http://en.Wikipedia.orga/wiki/mindmap.

Williams (2000). The Encyclopedia of Pseudoscience. Facts on File.

Wood, D. (1998) How Piaget's Theory Impacts Learning. In Satterly D. Retrieved on November 3 2006 fromhttp://www.funderstanding.com/piaget.efm.