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EFFECT OF BRAINSTORMING PROBLEM SOLVING TECHNIQUE ON JUNIOR SECONDARY SCHOOL STUDENTS' INTEREST IN MATHEMATICS IN AGBANI EDUCATION ZONE OF ENUGU STATE.

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Abstract
This study was designed to investigate the effect of brainstorming problem solving technique on junior secondary school students' interest in mathematics in Agbani education zone of Enugu State. It was a quasi-experimental study, pretest-post test, non equivalent groups were used. A total of 322 JSSII students were sampled from four secondary schools in Agbani Education zone of Enugu state. The schools were made up of two rural and two urban schools drawn by purposive sampling while eight intact classes were randomly sampled and assigned experimental and control groups. Mathematics Interest Scale (MIS) was used for data collection. The instrument was validated by the expert. A reliability coefficient of .71 was obtained for MIS using Cronbach's Alpha method. Two research Questions and three hypotheses guided the study. MIS was administered to the subjects at the beginning of the study to collect the pretest interest scores. After a treatment period of six weeks, MIS was administered to the subjects for posttest interest scores. Mean and standard deviation were used to answer the research questions while the hypotheses were tested at .05 level of significance using Analysis of Covariance (ANCOVA). Major findings of the study revealed that students in the experimental group taught mathematics with brainstorming problem solving techniques exhibited higher interest in mathematics than those taught with lecture method. There was no significant effect or interaction between teaching methods and school location on students' interest in mathematics. It was therefore recommended that brainstorming problem solving technique should be adopted for teaching junior secondary school mathematics.

Keywords: Effect, Brainstorming Technique, Secondary Education, Mathematics, Enugu State

Introduction

The role of sciences in achieving the functional education required for the attainment of the Nigerian national objectives cannot be over-emphasized. In realization of this fact, the federal government of Nigeria made basic science one of the core subjects at the basic education level (primary 1-JSS1). Regrettably, students' interest in mathematics is very poor. Research evidences have consistently implicated teaching method as a major factor in students' interest in mathematics.

Of all the innovative instructional techniques, problem solving techniques have been widely recommended especially the brainstorming problem solving technique.

Brainstorming is a group creativity technique by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas spontaneously contributed by its members. In other words, brainstorming is a situation where a group of people meet to generate new ideas and solutions around a specific domain of interest by removing inhibitions. People are able to think more freely and they suggest as many spontaneous new ideas as possible. All the ideas are noted down without criticism and after the brainstorming session the ideas are evaluated. According to Banjo (2004) the term was popularized by Alex Faickney Osborn in 1953 book "Applied Imagination". Advertising executive Alex F. Osborn (1953) in Kim (2007) began developing methods for creative problem solving in 1939. He was frustrated by employees' inability to develop creative ideas individually for ad campaigns. In response, he began hosting group-thinking sessions and discovered a significant improvement in the quality and quantity of ideas produced by employees. He first termed the process as organized ideation and was later dubbed by participants as "brainstorm sessions", taking the concept after the use of "the brain to storm a problem."

During the period when Osborn made his concept, he started writing on creative thinking, and the first notable book where he mentioned the term brainstorming is "How to Think Up" in 1942. Osborn outlined his method in the 1948 book Your Creative Power in chapter 33, "How to Organize a Squad to Create Ideas".

One of Osborne's key recommendations was for all the members of the brainstorming group to be provided with a clear statement of the problem to be addressed prior to the actual brainstorming session. He also explained that the guiding principle is that the problem should be simple and narrowed down to a single target. Here, brainstorming is not believed to be effective in complex problems because of a change in opinion over the desirability of restructuring such problems. While the process can address the problems in such a situation, tackling all of them may not be feasible, (Stuz, 2005).

Brainstorming activity conducting Osborn claimed that two principles contribute to "ideative efficacy," these being:

1. Defer judgment,
2. Reach for quantity.

Following these two principles were his four general rules of brainstorming, established with intention to:

- reduce social inhibitions among group members.
- stimulate idea generation.
- increase overall creativity of the group.

1. **Go for quantity:** This rule is a mean of enhancing divergent production, aiming at facilitation of problem solution through the maxim quantity breeds quality. The assumption is that the greater the number of ideas generated the bigger the chance of producing a radical and effective solution.
2. **Withhold criticism:** In brainstorming, criticism of ideas generated should be put 'on hold'. Instead, participants should focus on extending or adding to ideas, reserving criticism for a later 'critical stage' of the process. By suspending judgment, participants will feel free to generate unusual ideas.
3. **Welcome wild ideas:** To get a good long list of suggestions, wild ideas are encouraged. They can be generated by looking from new perspectives and suspending assumptions. These new ways of thinking might give you better solutions.
4. **Combine and improve ideas:** As suggested by the slogan "1+1=3". It is believed to stimulate the building of ideas by a process of association.

Osborn notes that brainstorming should address a specific question; he held that sessions addressing multiple questions were inefficient. Further, the problem must require the generation of ideas rather

than judgment; he uses examples such as generating possible names for a product as proper brainstorming material, whereas analytical judgments such as whether or not to marry do not have any need for brainstorming.

From the foregoing, it is evident that brainstorming problem solving technique is a viable technique, unfortunately, only a few researchers have investigated the effects of brainstorming problem solving technique on junior secondary school students interest in mathematics. It is also evident that researchers have over flooded variables such as gender, school ownership, school type, teachers experience, teacher qualification and students age while little works have looked into school location with regard to students' interest in core subjects like mathematics. This study is a deliberate attempt to bridge the gaps highlighted above. Consequently, the problem of this study put in question form is what is the effect of brainstorming problem solving technique in urban and rural junior secondary school students' interest in mathematics subjects in Agbani education zone of Enugu State?

Purpose of the Study

The purpose of this study was to investigate the effect of brainstorming problem solving technique on junior secondary school students' interest in mathematics in Agbani education zone of Enugu state. Specifically, the study investigated the effects of brainstorming problem solving technique on;

i. junior secondary school students' interest in mathematics
ii. junior secondary school students' interest in mathematics with regard to location of their schools.

Research Questions

The following research questions guided the study

1. What are the mean mathematics interest scores of students taught with brainstorming problem solving technique (experimental) and those taught with lecture method (control) in both pretest and posttest?
2. What are the mean mathematics interest scores of urban and rural students taught with brainstorming problem solving technique in both pretest and posttest?

Hypotheses

The following hypotheses were tested at 0.05 level of significance.

1. There is no significant difference between the mean mathematics interest scores of students in the experimental and control groups.
2. There is no significant difference between the mean mathematics interest scores of urban and rural students in the experimental group.
3. There is no significant interaction between method and location of schools on students' interest in mathematics.

Methodology

The research design adopted in the conduct of this investigation was quasi-experimental design, thus, a pre-test –post test, non equivalent groups design was used. Intact classes randomly assigned to experimental and control groups were used. This justifies the choice of this research design as the researcher cannot manipulate the subjects by way of assigning them randomly to either experimental or control groups. The area covered in this study was Agbani Education Zone of Enugu State consisting of Nkanu East, Nkanu West and Enugu South Local Government Areas. The choice of this Education zone is informed by the fact that it is characterized by lower educational development than other education zones in Enugu State (Agbo, 2004).

The population of the study consisted of all junior secondary two (JSS II) students in the 64 secondary schools in Agbani Education Zone of Enugu State, numbering 21,099 students as at the time of this study. To ensure even representation of the 3 local government areas and the rural and urban status, purposive sampling was used as follows: one secondary school each was randomly

sampled from Nkanu East and Nkanu West Local Government Areas to represent the rural schools while two schools were randomly sampled from Enugu South Local Government Area to serve as urban schools. Furthermore, in each of the four secondary schools two JSS II intact classes were sampled randomly and consequently assigned experimental and control groups randomly also. The total number of 322 students in the eight JSS II intact classes described above constituted the subjects of the study. 163 students out of the sample belonged to the experimental group while 159 were in the control group. In the experimental group, 84 students were from urban schools while 79 students were from rural schools. Mathematics Interest Scale (MIS) was developed by the researcher and used for data collection in the study. MIS was made up of 22 – items with a 4 – point rating scales namely; Strongly Agreed (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SD).

Mathematics Interest Scale (MIS) was validated by three research experts. BSIS was trial-tested by administering it to JSS II Students in a different school outside the education zone used for the study. The scores obtained were used to compute a reliability of .71 for the instrument using Cronbach's Alpha method. Research Questions were answered using mean and standard deviation while test of hypotheses was done using Analysis of Covariance (ANCOVA) at .05 level of significance.

Experimental procedures

The researcher trained the four regular mathematics teachers in the four secondary schools used in the study for a period of two weeks on the use of brainstorming problem solving technique. At first, the MIS was administered to all the subjects of the study as pre-test. Thereafter, the treatment was administered for a period of six weeks. The experimental group in each school was taught basic science using the brainstorming problem solving technique, while the control group in each school was taught the same topics using lecture method. At the expiration of the treatment period, the MIS was re-administered to all the subjects as posttest.

Results

Research Question 1

What are the mean mathematics interest scores of students taught with brainstorming problem solving technique (experimental) and those taught with lecture method (control) in both pretest and posttest?

Table 1: Result of Data Analysis for research question 1

Group	n	Pretest Mean	Standard Deviation	Posttest mean	Standard Deviation
Experimental	163	41.22	1.13	77.8	0.11
Control	159	41.05	1.22	55.2	1.01

The pretest mean interest scores and standard deviations were 41.22 and 1.13 and 41.05 and 1.22 for experimental and control groups respectively. The posttest mean interest scores and standard deviations were 77.8 and 0.11 for experimental group and 55.2 and 1.01 for control group respectively. Interest appreciated in both groups but higher in the experimental group. Also the mean interest score of the experimental group was more reliable as indicated by a lower standard deviation value of 0.11. While a standard deviation of 1.01 for control group indicates that there were more extreme scores in the group.

Research Question 2

What are the mean mathematics interest scores of urban and rural students taught with brainstorming problem solving technique in both pretest and posttest?

Table 2: Result of Data Analysis for research question 2

Group	n	Pretest Mean	Standard Deviation	Posttest mean	Standard Deviation
Urban	84	42.00	1.20	77.21	0.09
Rural	79	40.51	1.03	78.04	0.10

The pretest mean interest scores and standard deviations were 42.00 and 1.20 for urban students and 40.51 and 1.03 for rural students respectively. Also the posttest mean interest scores and standard deviations were 77.21 and 0.09 and 78.04 and 0.10 for urban and rural students respectively. This shows that no tangible difference existed between both groups. Like wise the standard deviations showed that the means for both groups were equally reliable.

Hypotheses

1. There is no significant difference between the mean mathematics interest scores of students in the experimental and control groups.
2. There is no significant difference between the mean mathematics interest scores of urban and rural students in the experimental group.
3. There is no significant interaction between method and location of schools on students' interest in mathematics.

Table 3: ANCOVA Analyses of Hypotheses 1, 2 and 3

Source of Variance	Sum of squares	Df	Mean squares	F-calc.	Sig	Decision
C0-variates	18.001	1	18.001	0.0284	0.859	
Pretest	21.4403	1	21.4403	0.0338	0.859	
Main effects	9321.111	1	9321.111	14.7077	0.000	
Method	419.560	1	419.560	0.6620	0.000	Significant (Reject hyp)
Location	713.222	1	713.222	1.1253	1.3001	Not Significant (Do not reject hyp)
Method*Location	993.06	1	993.06	1.5669	1.7111	Not Significant (Do not reject hyp)
Other interactions	80.222	1	80.222	0.1265	0.586	
Explained	9771.419	1	9771.419	15.4182		
Residual	198999.000	314	633.755			
Total	**220337.0353**	**322**				

Method as main effect gave an f value of 0.6620 and this is significant at 0.000. Since 0.000 is less than 0.6620 this means that at .05 level of significance, the f value of 0.6620 is significant. Therefore, hypothesis 1 is rejected as stated. This indicates that there is significant difference between the mean mathematics interest scores of students in the experimental and control groups. Location as main effect gave an f value of 1.1253 and this is significant at 1.3001. Since 1.3001 is greater than 1.1253 this means that at .05 level of significance, the f value of 1.1253 is not significant. Therefore, hypothesis 2 is not rejected as stated. This indicates that there is no significant difference between the mean mathematics interest scores of urban and rural students in the experimental group.

Main interaction (Method*Location) as main effect gave an f value of 1.5669 and this is significant at 1.7111. Since 1.7111 is greater than 1.5669 this means that at .05 level of significance, the f value of 1.5669 is not significant. Therefore, hypothesis 3 is not rejected as stated indicating that

there is no significant interaction between method and location of schools on students' interest in mathematics.

Summary of Findings

The results of this study revealed the following:

1. The students taught mathematics with brainstorming problem solving technique showed higher interest in mathematics than those taught with lecture method.
2. There is no significant difference between the mean interest scores of urban and rural students taught mathematics with brainstorming problem solving technique.
3. There is no significant interaction between teaching method and location of schools on students' interest in mathematics.

Discussion of Findings

Table 1 results testified that both experimental and control groups showed similar interest in mathematics in the pretest, however, the experimental group exhibited higher interest after treatment (posttest). The result of hypotheses testing further authenticated this finding by showing a significant difference between the mean interest scores of both groups in the favour of the experimental group. Also the mean interest score of the experimental group was more reliable as shown by the lower standard deviation value. This result showed that brainstorming problem solving techniques generated higher interest in the students than the lecture method. This further affirms the findings of Kim (2007) and Jimoh (2014) who, in their separate studies found brainstorming problem solving technique very useful in generating and sustaining interest in mathematics among junior secondary school students. However, the findings are not in agreement with the findings of Ajom (2012) and Akpoviano (2015) who found the contrary.

The pretest and posttest mean interest scores and standard deviations as shown in table two show that no tangible difference existed between urban and rural students taught mathematics with brainstorming problem solving technique. Likewise, the standard deviations showed that the means for both groups were equally reliable. This result shows that when handled properly, the brainstorming problem solving technique can yield good results irrespective of location of schools. Table 3, shows that there existed no significant interaction between method of teaching and location in students' interest in mathematics. Hence school location did not affect students' interest in mathematics significantly. These results agree with the findings of Ude (2011) and Ajom (2012) that there is no significant effect or interaction between location of schools, teaching methods and students' interest in mathematics. Conversely, the results contradicted the claims of Adeolu (2012) and Jimoh (2014) in their various studies where they held that school location is a major player in students' interest in junior secondary school mathematics. Possibly, manipulation of extraneous variables may have accounted for the conflicting results.

Conclusion

Based on the findings stated above, the following conclusion was drawn:

1. Brainstorming problem solving technique elicits higher interest in mathematics among secondary school students.
2. Students taught mathematics with Brainstorming problem solving technique exhibited equal interest in mathematics irrespective of location of their schools, hence, Brainstorming problem solving technique influences interest of students in mathematics equally in urban and rural secondary schools.
3. Efficacy of Brainstorming problem solving technique with regard to interest of students in mathematics may not likely depend on location of schools.

Recommendations

Consequent upon the findings of this study, the following recommendations are deemed necessary;

1. Brainstorming problem solving technique should be used in teaching mathematics in junior secondary schools.
2. Mathematics teachers should be trained adequately on the use of brainstorming problem solving technique.

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