

EFFECT OF CONCEPT MAPPING AND LECTURE INSTRUCTIONAL APPROACHES ON STUDENTS MATHEMATICS ACHIEVEMENT IN SCHOOLS IN DELTA STATE

By

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Abstract

This study examines the effect of concept mapping and lecture instructional approaches on students achievement in mathematics. One research question and one null hypothesis were raised to guide the study. The design of the study is the non equivalent control group quasi experimental design. The population consisted of all students in senior secondary II in Delta South Senatorial District of Delta State. A sample of 250 students was selected using simple random method sampling from five secondary schools in Delta South Senatorial District. The instrument for the study was the geometry achievement test (GAT). The reliability coefficient of the instrument was achieved through test and was estimated using Kuder Richardson 21 formula and a reliability coefficient of 0.83 was obtained. The data were collected and analyzed using mean standard deviation and analysis of covariance (ANCOVA). The major findings include amongst others that concept mapping approach and lecture has a significant effect on students' achievement with the mean achievement scores of students taught geometry using concept mapping higher than the mean achievement scores of student taught using lecture instructional approach. It is recommended that mathematics teachers should adopt the use of concept mapping instructional approach in the teaching of mathematics at the secondary school level since it ensures students active involvement and ease understanding of complex concepts.

Keywords: concept maps, lecture approach, achievement, geometry.

Introduction

The National Policy on Education (NPE, 2013) had advocated for improvement in the teaching and learning of science related subjects especially mathematics in order to create the foundation of oriented workforce in line with the needs of learning of mathematics. Because of the importance of mathematics to national development the national policy on education has given it the status of a core (compulsory) subject at the primary and secondary levels of education in Nigeria (FGN, 2014).

Though Mathematics is very important and a compulsory subject at the primary and secondary levels of education yet students performance in both internal and external examinations have remained poor and unsatisfactory (Nwachukwu, 2010). This poor achievement have continued to be an issue of concern to stake holders in education including the researchers, teachers, parent, educational administrators amongst others. The Chief Examiner Report (2015) observed that the percentage of students who failed Mathematics at the Senior Secondary Certificate Examinations (SSCE) was due to poor attempt on trigonometry and geometry related questions. The Chief Examiner therefore recommended that mathematics teachers should use inspiring methods of teaching that will reduce students mass failure in mathematics examination. Also Zalmon and Wonu (2017) observed that the poor performance in Mathematics Examinations at SSCE from 2004 to 2016 is due to inappropriate instructional approaches used in teaching mathematics. This study will therefore examine concept mapping and lecture instructional approaches to see if the adoption of any one of them could lead to improved performance in Mathematics.

Mapping is the creative process of organizing content with graphs and diagrams, concepts are represented in a hierarchical way with the most inclusive, most general concept on the top of the map and the less general concept arranged hierarchically below.

Concept maps are a powerful learning tool in teaching mathematics as they are used to clarify, define and specify concepts and their relations. These learners really know what they have to learn from the teaching and learning becomes a connected, non arbitrary process (Novak, 1984). Some of the advantages of concept maps include:

- ❖ Helping students understand complex ideas and clarify ambiguous relationships within concepts (Ajaja, 2009)
- ❖ Concept maps offers a means to create the necessary “mind on” environment
- ❖ Ability to teach a topic using cross links and hierarchical structures
- ❖ Concept mapping instructional approach has a lingering effect that promotes recall of learned materials due to the maps and graphical representation.

Lecturing is the most common and established method of teaching around the world. Lecture method of teaching is passing over knowledge to students or pupils whose role in the learning process is passive and that a pupils mind is a tabula rasa (blank slate), on which knowledge can be written. The major limitation of this approach is that there is relatively little student activity or involvement (Ajaja 2009, Benneth 203, Burich 2004). This limitation experienced with this approach led to the development of other views of teaching science and mathematics like concept mapping teaching approach which is an inquiry method in which the students are part of the teaching/learning process. Studies have shown significant effect on students achievement with the use of concept mapping approach. Rotimi and Kenni (2011) discovered significant effect of concept mapping on students achievement in mathematics and that this strategy had a lingering effect that prompts recall of learned materials.

Lecture method of teaching is often used to teach organized bodies of knowledge which is an important part of the school curriculum at all levels and have continued as a primary form of instruction in colleges, universities and even at different school stages (Grodod, 1984). Some of the advantages of lecture approach include:

- ❖ Planning time is devoted to organizing the content, rather than the teaching strategy.
- ❖ It is flexible and can be adopted to a wide range of subjects
- ❖ Can be effectively used for a large class and teacher can cover a large content area

In a study to determine the effect of concept mapping approach on student achievement in mathematics, the study revealed a difference in the post test mean achievement scores of male and female students in favour of the male students. The results of the study Nwoke 2015 agrees with the work of Ahmed 2010, Candan 2006, whose results revealed no statistical significant difference observed between gender due to concept approach.

Gender according to revealed literature has effect on achievement and males, retention with reported difference between male and female achievement. Some researchers reported that female performing better than the male, others reported that males achieve better than the females in sciences while others show that gender has insignificant effects on science achievement

The inconsistent results on student achievement have generated the need for this study. This is the gap this study intends to fill ..

Statement of the Problem

The poor performance of students in Mathematics has been a source of concern to parent, researchers, mathematics educators and, the ministry of education.

The Chief Examiner Reports (2015) on Mathematics achievement in the senior secondary school examinations (SSCE) have identified inappropriate teaching approaches as among the factors affecting students poor achievement in Mathematics. Mathematics is a hierarchical subject in which new knowledge generally must be linked to existing knowledge of pre-requisites, so it cannot be taught in isolated bits. This study will therefore examine concept mapping and lecture instructional approaches and observe their differential effects on students achievement in Mathematics.

Purpose of the Study

The main purpose of the study is to examine the effects of concept mapping and lecture instructional approaches on students' achievement in mathematics. Specifically, the study seeks to:

1. Find out the effects of concept mapping and lecture instructional approaches on students achievement in geometry.

Research Questions

1. Is there any effect of concept mapping and lecture instructional approaches on students' achievement in geometry?

Hypotheses

The following hypothesis were formulated to guide the study

Ho₁: There is no significant effect of concept mapping and lecture instructional approaches on students' achievement in geometry.

Methods

The study adopted, the quasi-experimental design of the non-equivalent control group design. The population of the study consisted of all Senior Secondary School II in Delta South Senatorial District. A sample of 250 students comprising of 137 males and 113 females were randomly selected from five (5) intact SSII classes in five schools in Delta South Senatorial District. The instrument used for the study is the Geometry Achievement Test (GAT) which was constructed by the researcher which consisted of 50(fifty) multiple choice test items drawn from geometry. The instrument was validated by three senior mathematics teachers in Warri South Local Govt. Area and the reliability of the instrument was achieved by trial testing it on 40 SSII students who were not part of the main study. The reliability coefficient of 0.83 was computed using Kuder Richardson (KR -21) formula.

The instrument was used as pretest on the sampled students and also used as post test after 6 weeks of study, the results were analyzed using mean, standard deviation and analysis of co-variance(ANCOVA).

Discussion of Results

Research question 1: is there any effect of concept mapping and lecture instructional approaches on students achievement in geometry.

Table 1 : Mean and standard deviation of pretest and posttest achievement scores of students taught geometry using concept mapping and lecture instructional approaches

| Group | N | Pre-test Mean | SD | Posttest Mean | SD | Mean Difference |
|-------|---|---------------|----|---------------|----|-----------------|
|-------|---|---------------|----|---------------|----|-----------------|

| | | | | | | |
|-------------------|-----|-------|------|-------|-------|-------|
| Concept Mapping | 158 | 21.03 | 7.98 | 59.58 | 11.74 | 38.55 |
| Lecture (control) | 92 | 22.65 | 7.33 | 53.72 | 10.38 | 31.07 |

Table 1 shows a pre-test mean achievement score of 21.03, with a standard deviation of 7.98, for students taught geometry using concept mapping instructional approach had and a pre-test mean achievement score of 22.65, with a standard deviation of 7.33, for students taught geometry using lecture instructional approach. As indicated in Table 1, students taught geometry using concept mapping instructional approach had a posttest mean achievement score of 59.58, with a standard deviation of 11.75, while students taught geometry using lecture instructional approach had a post-test mean achievement score of 53.72, with a standard deviation of 10.38. Table 1 shows that the two groups (concept mapping and lecture instructional approach) had a higher post-test mean achievement scores compared to pre-test mean achievement scores. This implies that concept mapping and lecture instructional approaches have effect on students' academic achievement in geometry.

Hypothesis I: Hypothesis 1

There is no significant difference in the students' academic achievement in geometry for the concept mapping group and lecture group.

Table 2: ANCOVA of the effect of instructional approaches on students' achievement in Geometry

| Tests of Between-Subjects Effects | | | | | | |
|-----------------------------------|-------------------------|-----|-------------|---------|-------|---------------------|
| Dependent Variable: posttest | | | | | | |
| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
| Corrected Model | 16048.333 | 2 | 8024.166 | 82.919 | 0.000 | 0.402 |
| Intercept | 34556.647 | 1 | 34556.647 | 357.095 | 0.000 | 0.591 |
| Pretest Score | 14052.674 | 1 | 14052.674 | 145.215 | 0.000 | 0.370 |
| Groups | 3184.677 | 1 | 3184.677 | 32.909 | 0.000 | 0.118 |
| Error | 23902.567 | 247 | 96.772 | | | |
| Total | 864215.000 | 250 | | | | |
| Corrected Total | 39950.900 | 249 | | | | |

a. R Squared = 0.402 (Adjusted R Squared = 0.397)

An analysis of covariance was conducted to determine the difference in achievement scores of students based on the instructional approaches used. The result as presented in Table 2 shows that after adjusting for the effect of the pretest scores, there was a significant difference between the teaching approaches (concept mapping group and the lecture group) on their post test scores on geometry [$F(1, 247) = 32.909$; $p = 0.000$]. The partial eta squared of 0.118 indicates that magnitude of the difference between the two groups is 11.8%. In determining the effect of the pretest scores on the posttest scores Table 2 shows that there is a significant relationship [$F(1, 247) = 145.21$; $p = 0.00$; partial eta squared = 0.370] between the pretest and posttest scores. The partial eta squared indicates that the pretest influenced the students score in the post test by 37%.

In determining which of the teaching methods had an effect on the students score in geometry, the mean scores (statistics) for the pretest and posttest was computed and it is presented in Table 2

Discussion

The study revealed that there is a significant effect of concept mapping and lecture instructional approaches on students achievement in geometry. This is due to the increased

scores post test compared to their pretest scores. This suggest that both teaching approaches (concept mapping and lecture) have the capacity to cause learning to occur at varying degrees (Ajaja,2013). This findings further agrees with Adeneye and Adeleye (2011) who reported that concept mapping teaching approach enhanced students achievement in mathematics. The higher mean achievement scores earned by students in concept mapping group may be due to the active participation of students in the concept mapping group unlike the lecture group where the students are passive.

Conclusion

Concept mapping and lecture instructional approaches significantly enhanced students achievement in Mathematics. Concept mapping group had a higher mean achievement scores than the lecture group.

Recommendation

1. Mathematics teachers should adopt the use of concept mapping instructional approach in the teaching of Mathematics at the secondary level of Education as it ensures students active involvement and understanding of complex concepts.
2. Mathematics teachers should be trained by the government and other stakeholders in Education on how to develop functional concept maps.

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