Effects of Using Concept Mapping Strategy on Senior Secondary School Students' Achievement and Retention in Geometry.

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Abstract
The study determines the effects of concept mapping strategy on senior secondary school students' achievement and retention in geometry. A sample of sixty (60) SS II Mathematics students from two secondary schools in Azare metropolis was drawn. An achievement test, Geometry Achievement Test (GAT) was used to measure the sampled students in the learned materials taught to the experimental group using concept mapping strategy and to the controlled group using conventional approach. Mean and standard deviation were used to answer the research questions while T-test was used to test the null hypotheses. The findings of the study revealed that students exposed to concept mapping strategy achieved more in geometry than those taught with conventional approach.; and knowledge of retention was significantly higher in students taught geometry with concept mapping than those who were taught with conventional approach. It was recommended among others that teachers should attend regular in service innovation orientation training and workshop to abreast of new techniques and skills. Concept mapping should be incorporated in the secondary school Mathematics curriculum as a technique in teaching Mathematics.

Introduction

The importance of Mathematics to modern culture of science and technology has been well recognized and accepted worldwide (Eze, 1997; Bajah, 2000; Eguavon, 2002; Fakuade, 1997). According to Ukeje (1997, the increasing importance and attention given to mathematics stem from the fact that without science there is no modern technology and without modern technology, there is no modern society. In other words, Mathematics is the precursor and queen of science and technology and indispensable single element in modern societal development.

However, despite the urgent need for a good output in the Mathematics performance of students, the reverse is the case, as students' performances in Mathematics continue to

deteriorate year after year (Galadima, 1998). Adeniyi (1998) and Ojo (1990) have both attempted to find out some reasons why students' perform poorly in Mathematics. The result of their finding indicated poor quality of instructional techniques employed by teachers as major cause of poor performance among secondary school students in mathematics.

One of the Mathematics concepts that have possible means of de-abstracting Mathematics is geometry, and the teaching and learning of geometry still remain difficult (Galadima, 1998). Also in a study to identify difficult topics in Mathematics, Ochepa (1999) reported that about 89% of secondary school students responded that geometry is difficult.

Various researchers identified different methods that will address the problem of students' poor performance in Mathematics. One of such method is the use of concept mapping. This was developed in an educational setting by Joseph Novak in an effort to design better teaching and learning activities (Novak and Godwin, 1984), they further defined concept mapping as a schematic device for representing a set of knowledge meaning embedded in a framework of propositions. Okebukola (1999) defined concept as perceived regularities in event or objects designated by an arbitrary labels. It is against this background the researchers embarked to find out whether the use of concept mapping strategy will improve significantly on students achievement and retention in geometry at senior secondary school level.

Statement of the problem

Some students have great difficulty in understanding, comprehending and assimilating Mathematical concept taught to them in their classroom. They neither understand the basic computations, logic, fundamental principles not the underlying process that gave rise to Mathematical facts. They therefore, resort to learning by rote, memorization with consistent gross to mass failure of students (Eze, 2008). Based on the foregoing, this study is designed to investigate whether the use of concept mapping strategy would improve significantly students understanding of geometry concepts and hence improve their performance better than the conventional method.

Objective of the study

Specifically, the study sought to achieve the following objectives:

1. To investigate the extent to which the use of concept mapping will improve the performance of students in geometry.
2. To find out whether the use of concept mapping will improve significantly the mean retention of students in geometry.

Research questions

1. Is there any significant difference in the mean achievement score of students taught with concept mapping and those taught using conventional method?
2. Is there any significant difference between the mean retention score of students taught using concept mapping and those taught with conventional method?

Research hypothesis

1. **H_{01}**: There is no significance difference between the mean achievement score of experimental and controlled group at pre-test.

2.   **H_{02}**: There is no significance difference between students achievement in geometry taught using concept mapping strategy and those taught with conventional method.

3.   **H_{03}**: There is no significance difference between students mean retention score taught using concept mapping strategy and those taught with conventional method.

Methodology

This study is based on experimental; pre-test and post-test control group design as reported by Sambo (2008). In this design two group of subject are involved, G_1 denote the experimental group and G_2 denote the controlled group. R indicates the randomization of the students, X the treatment. Area of the study covers Katagum local government area of Bauchi state where the schools selected for the study are located. The population of the study comprises of all SS II students in all the ten (10) senior secondary schools in Katagum local government area of Bauchi State. Two senior secondary schools out of the ten (10) were selected using simple random sampling. Thirty (30) SS II students from each selected school were randomly chosen and were assigned as experimental and controlled groups. Hence a total of sixty (60) students formed the sample of the study.

From the design of the study, there are two groups (experimental and controlled groups). The researcher taught the experimental group for two weeks using concept mapping strategy and controlled group with conventional method. Then the Geometry Achievement Test (GAT) was administered to both the two groups. After a period of four weeks, the same Geometry Achievement Test (GAT) was also administered to the students in order to measure the knowledge retention level of the students. Data collected was analyzed using mean and standard deviation to answer the research questions while T-test was used to test the research hypothesis at 0.05 level of significance.

Result and Discussion

Hypothesis I

There is no significance difference between the mean achievement scores of experimental and control group at pre-test.

Table 2: Test analysis of pre-test

Group	N	X	SD	DF	SE	t-Cal	t-crit	Remark
Experimental	30	17.0	4.22	58	2.05	0.65	1.99	Significant
Control	30	18.3	5.25					

From table 2, results show that t-cal (0.65) is less than t-crit (1.99). This shows that the two groups were not significantly different at the pre-test. Hence the hypothesis which states that there is no significant difference between the mean achievements scores of experimental and control group at pre-test is accepted.

Research question 1

Is there any significant difference between the mean achievement score of students taught with concept mapping strategy and those taught with conventional method?

Table 3: Mean and standard deviation of post test

Group	N	X	SD
Experimental	30	37.65	5.85
Control	30	32.45	7.30

Result from table 3 shows that a mean score difference between the experimental and control group of 5.20 was obtained and standard difference of 1.45 was also obtained.

Hypothesis II

There will be no significant difference between students achievement in geometry taught using concept mapping strategy and those taught with conventional method.

Table 4: t-test analysis at post test

Group	N	X	SD	DF	SE	t-Cal	t-crit	Remark
Experimental	30	37.65	5.85	58	1.2	3.46	1.99	
Control	30	32.45	7.30					Significant

Table 4 shows that with df = 58 at 0.05 level of significance, the t-cal (3.46) is greater than t-critical (1.99). Therefore hypothesis 2 which says there is no significant difference between students achievement in geometry taught using concept mapping strategy and those taught with conventional method is rejected.

Research question 2

Is there any significant difference in the mean retention score of students taught using concept mapping and those taught with conventional method?

Table 5: Mean standard deviation after 2 weeks

Group	N	X	SD
Experimental	30	35.65	3.31
Control	30	27.85	4.58

Result from table 5 shows that the experimental group has a mean of 35.65 and standard deviation of 3.31 while the control group has a mean of 27.85 and standard deviation of 4.58 which is lower than that of the experimental group.

Hypothesis III

There is no significant difference between students mean retention score taught using concept mapping strategy and those taught with conventional method.

Table 6: t-test analysis after 2 weeks

Group	N	X	SD	DF	SE	t-Cal	t-crit	Remark
Experimental	30	35.65	5.85	58	1.89	5.25	1.99	
Control	30	27.85	4.58					Significant

Result from table 6 shows that at df = 58 at 0.05 level of significance, the t-cal (5.25) is greater than t-critical (1.99). Therefore, hypothesis which says there is no significant difference between students mean retention score taught using concept mapping strategy and those taught with conventional method is rejected.

Result from table III shows that the mean achievement score of students in Geometry favours the experimental group. This is further confirmed by the result in table III which indicates that the teaching method was a significant factor on students' achievement in the geometric content. Thus, students who were taught using concept mapping strategy performed better than those who were taught with conventional method. This supports Adeniyi's (1998) view that teaching method is a major contributory factor to students achievement in mathematics. It is also confirms Okebukola's (1999) view that students demonstrated greater understanding as a result of exposure to the concept mapping strategy.

Again from table V the mean achievement score in knowledge retention among mathematics students taught geometry by use of concept mapping is 37.75 and 27.85 for those taught with conventional method. The result showed significant higher retention ability for students taught with concept mapping than for those taught without the use of concept mapping. This finding was supported by Edalu (2002) who pointed that instructional strategy contributed much to students' retention. Also this finding is in agreement with Okebukola (1999) that students taught with concept mapping scored significantly higher than those taught without the use of concept mapping.

Concept mapping is significantly a very useful instructional strategy which provides meaningful understanding of concept, higher retention and more recall of concept in geometry.

Conclusion

From the findings of the study, the researchers concluded that the use of concept mapping strategy in teaching mathematics enhances students' performance more than the conventional approach. Engagement of students in concept mapping participation activities will equally enable students to develop proper mathematics skills, knowledge, attitude and values, which they can apply in a future for sustainable living.

Implication

The use of concept mapping strategy in teaching geometry proved to be more effective approach in teaching mathematics. Therefore, a student who intends to read Mathematics education after finishing secondary school as a career, he/she would have find it easy if taught in the secondary school using concept mapping strategy. This implies that many students in the secondary school run away from mathematics career due to the fact that the method or approach used by mathematics teachers affects students' ability in the subject.

Recommendations

The result of this study gave rise to the following recommendations:

a. Teachers should adopt concept mapping approach in teaching mathematics topics/concept.
b. Concept mapping instructional strategy should be embedded in the teacher education curriculum. This will ensure the training of pre-service mathematics teacher on the use of concept mapping strategy.
c. Teachers should attend, on regular basis, in-service innovation orientation workshops to keep abreast to new techniques and skills development.
d. There should be a well-planned programme or concept mapping in teacher preparation level.
e. Suitable source books on concept mapping should be made available to all secondary schools.

References

Adeniyi, N.T. (1998). Mathematics in secondary schools. *Journal of Mathematical Association of Nigeria (MAN)* 18(91), 89-106.

Bajah, S.T. (2000). Emerging global issue in education, a lead paper presented at National Conference on curriculum innovation in the 21st century held at Abuja.

Eguavon, O.J. (2002). Mathematics: The heartbeat of information Technology Implication for Secondary Education. *Journal of mathematical Association of Nigeria (MAN)* 27(1), 10-12.

Eze, J.E. (1997). The Relevance of Mathematics to Science and Technology. *Bichi Journal of Education.* 2 (1), 82-88.

Fakuade, R.A. (1977). Mathematics as a Science Subject. *Journal of Science Teachers Association of Nigeria* 16(1) 82-95.

Fakuade, R.A. (1977). Mathematics, an Effective Articular of the Abstract elements of natural sciences for technological development. ABACUS, *the Journal of MAN,* 19(1): 75-77.

Galadima, I. (1998). Some Aspects of Students. Problem Solving Difficulties in Secondary School Mathematics. The Pioneer: A *multi-disciplinary Journal of Education Department of Education ABU, Zaria.* 2 (2), 111-119.

Novak, J.D. and Godwin B.D. (1984). **Learning how to learn.** New York Cambridge University Press.

Ochepa, I. A. (1999). Effect of practical mathematics on secondary schools achievement in Bauchi state. Doctorate thesis, ATBU, Bauchi.

Okebukola, P.A. (1999). An Examination of the Potency of Concept Mapping Technique. *Journal of Researching Science Teaching* 25(5), 85-92.

Okebukola, P.A. and Ojo, O.J. (1998). Cognitive Preference and Learning Mode as Determinant of Meaningful Learning Through Concept Mapping. Science Education 72(4), 489-500.

Ojo, M.O. (1990). Maximum students learning mathematics through students interaction pattern. A paper presented at Abubakar Tafawa Balewa University, Bauchi September.