Effects of Concept Mapping Strategy on Students' Achievement and Retention in Senior Secondary School Mathematics in Ekiti State, Nigeria

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ABSTRACT *This study investigated the effects of Concept-Mapping Strategy on students achievement and retention in Mathematics of senior secondary school two students in Ekiti state, Nigeria. The design for this study was Pretest-Posttest Quasi-Experimental. The population for the study was all the senior secondary class two (SS2) mathematics students in Ado Local Government Area of Ekiti State, Nigeria. The sample comprised fifty (50) students each selected from each of the two co-educational secondary schools in Ado-Ekiti metropolis to make a total of one hundred (100) SS2 students. One of the schools was randomly selected for the experimental group while the other assigned for the control group. The experimental group was taught using Concept-mapping strategy while the control group was taught using conventional method. Three null hypotheses were formulated and tested at 0.05 level of significance to guide the study. The instrument for data collection was forty (40) standardized objective questions tagged : Mathematics Achievement Test (MAT). The data collected were analysed using t-test statistical analysis. The findings showed that: in the pre-test, the obtained mean scores are not significantly different from another which showed that the two groups selected are homogeneous. The obtained post-test mean scores of experimental group was significantly higher than the post-test mean scores of the control group. Also, the obtain retentive-test mean score of experimental group was significantly higher than the retentive-test mean scores of the control group. The findings revealed that, students in concept mapping strategy group performed significantly better than their counterpart of conventional method. It was recommended that mathematics teachers should enlighten their students on the use of the concept-mapping strategy and encourage them to explore the method in their problem-solving capability.*

***Key words*:** concept mapping, strategy, students' achievement, retention.

Introduction

Science is regarded as a foundation upon which the bulk of the present technological breakthrough is built. Through the application of science, Man is assured the longevity of his existence. Mathematics knowledge is needed to make for effective learning and development of science concepts as well as other concepts. Different Mathematical topics such as vectors, calculus, logarithms, arithmetic, rate, summation are applied to solve scientific problems. In physics, area as thermal physics, thermodynamics, quantum physics, electric field, wave, motion and sound require a sound Mathematics knowledge for proper comprehension (Onwuka and Iweka, 2010). Chemist, Biologist, Medical doctor, Pharmacist, Engineer, Physicist and many more need the application of mathematical technique (Onwuka, 1985). Consequently, relationships between variables such as volumes, pressure, and temperature are revealed through the use of mathematical concepts.

The need to acquire knowledge in Mathematics in the world over has become very obvious because of its usefulness in everyday living and in various disciplines. As important as the subject is, the tremendous and persistent failures of Nigerian students in Mathematics has remained a major threat to its learning. Attempt at finding solution to the incessant students failure in Mathematics have led researchers in Mathematics education to consider a number of factors. One of such is inappropriate method of teaching and learning. According to Azuka (2003), the problem of effective teaching and learning of Mathematics in Nigeria secondary schools have eaten deep to the very foundation of the nation's technological growth and needs urgent surgical operation. There is the need to prepare and produce manpower with sound Mathematical background at the secondary school level.

Recently, new curricular have been developed that emphasized the development of autonomous learning capabilities in students which help student learn to learn by developing their generic skills and interest in active inquiry-based constructivist instructional environments. Now, the focus is more on the learner rather than the teacher.

Concept-mapping strategy is a schematic device used to present concepts embedded in a framework. It is a technique used to represent the relationships among concepts in a two-dimensional graph. Concept-mapping as a method to visualize the structure of knowledge was originally developed by Novak (1972) and the members of his research group as a mean of representing frameworks for the interrelationships between concepts and as an instructional and assessment tool to facilitate meaningful learning. This method is predicated on Ausubel's assimilation theory of cognitive learning, which places emphasis on the influence of entry behavior on meaningful learning (Ausubel, 1963). Agwagah and Ezeugo (2000) stated that concept-mapping method helps to make clear to both learners and teachers the small number of key ideas they must focus on for any specific learning task. Concept learning breaks down the task to be learnt into smaller units. These smaller units serve as the key to each segment of the problem, as the learning maps each unit to the key ideas. Concept mapping is a method to visualize the structure of knowledge as a means of representing frameworks for the interrelationship between concepts as an instructional and assessment tool to facilitate meaningful learning.

Research evidence has indicated that pieces of information are better remembered by students when they are communicated and learn verbally and visually. Concept mapping combines visual learning with spatial representation of information to promote meaningful conceptual learning. Adeneye (2011) got a significantly better result when concept mapping was used to teach some concept in mathematics. Similarly, in Awofila (2011) post-test mean score of the students in the concept mapping strategy was found to be significantly different from that of their counterparts in the control group. Also, Adaramola (2012) investigated the effect of concept mapping on performance and interest of students with dyscalculia in secondary school mathematics and found significant difference between the mean scores of experimental and control groups but gender had no significant influence on their understanding.

Esiobu and Soyibo (2009) research report claim that the low correlation between concept mapping scores and convectional tests measure different attributes of students' abilities. Specifically they claim that concept

mappings assess higher-order abilities while convectional assessment assesses lower-order abilities. In cases where lack of understanding of concepts occurs, there could be production of poor maps by students.

Therefore, the strategies for learning should be overhaul to enable students improve their performance. The present study through the use of hierarchy maps which have direct relationship with the concepts learned, focused on encouraging students to organize information in a way that is compatible with their understanding of the lessons in order to help them learn Mathematics better.

Purpose of the study

This study is to investigate the effects of Concept-Mapping Strategy on students' achievement in mathematics of senior secondary school two students in Ekiti state, Nigeria. Also, effects of Concept-Mapping Strategy on students' retention in mathematics of senior secondary school two students in Ekiti state, Nigeria.

Research hypotheses

The following null hypotheses were formulated to guide the study:

1. There is no significant difference in the achievement mean scores of students in experimental and control groups before treatment.
2. There is no significant difference in mean academic achievement of the students taught mathematics with concept mapping teaching strategy and conventional method after treatment.
3. There is no significant difference in the mean scores of academic retention of students in experimental and control groups.

Methodology

The design for this study was Pretest-Posttest Quasi-Experimental. The design afforded the researcher the opportunity to collect relevant data which helped to facilitate better understanding and evaluation of the problem under study. The pre-test was used to establish the knowledge baseline of the students as well as the academic homogeneity of the two groups before the commencement of the experiment. The post-test was used to determine the levels of achievement of students within the two groups after the application of treatment.

The population of the study was made up of all senior secondary student class two SS 2 in Ado Local Government Area of Ekiti State. The sample comprised fifty (50) students each selected from each of the two co-educational secondary schools in Ado-Ekiti metropolis to make a total of one hundred (100) SS2 students. The instrument used for the study was forty (40) standardized objective questions tagged: 'Mathematics Achievement Test (MAT)' drawn from the topic (logarithms, approximation, arithmetic and geometric progression) considered for the study.

The teaching covered three weeks with the control group taught using conventional method while the experimental group was taught using concept mapping teaching strategy. Forty (40) objective questions were drawn from the topics with four options (A-D). The tests (Pretest and Posttest) questions were administered to students; each of the tests was marked and scores accordingly.

The three formulated null hypotheses were tested at 0.05 level of significance. The data collected were analysed using inferential statistics of t-test analysis.

Results and Discussion

Hypothesis 1

There is no significant difference in the achievement mean scores of students in experimental and control groups before treatment.

Table 1: t-test analysis of achievement mean scores of students in experimental and control groups before treatment

GROUP	N	$\bar{X}$	SD	Df	t_{cal}	t_{tab}	Result
Experimental	50	18.01	9.67	98	0.015	1.671	NS
Control	50	17.98	10.12				

P > 0.05 (Result Not significant at 0.05 level), NS = Not Significant.

As shown in table 1, when the mean score of students in the experimental and control groups before the treatments (pre-test) were statistically compared, a *t-value* (t_{cal} = 0.015) with p> 0.05 alpha level was obtained, which was not significant at 0.05 level. This implies that there is no significant difference between experimental and control groups in pretest achievement mean score. Consequently, the null hypothesis which states that there is no significant difference in the achievement mean scores of students in experimental and control groups before treatment was accepted.

Hypothesis 2

There is no significant difference in mean academic achievement of the students taught mathematics with concept mapping teaching strategy and conventional method after treatment.

Table 2: t-test comparison of the post- test mean scores of students taught mathematics with concept mapping teaching strategy and those taught through conventional method

GROUP	N	$\bar{X}$	SD	Df	t_{cal}	t_{tab}	Result
Experimental	50	31.52	17.23	98	2.466	1.671	*
Control	50	23.53	15.12				

P < 0.05 (Result significant at 0.05 level), * = Significant.

As shown in table 2, when the mean score of students in the control and experimental groups after the treatments (posttest) were statistically compared, a *t-value* (t_{cal} = 2.466) with P < 0.05 alpha level was obtained, which was significant at 0.05 level. This implies that there exists significant difference between the control and experimental groups' achievement mean scores after the treatment in favour of experimental group. Consequently, the null hypothesis which states that there is no significant difference in mean academic achievement of the students taught mathematics with concept mapping teaching strategy and conventional method after treatment was rejected. As such, the conventional method of instruction used for control group can be said to be less effective compared with concept mapping teaching strategy used in the experimental group.

Hypothesis 3

There is no significant difference in the mean scores of academic retention of students in experimental and control groups.

Table 3: t-test comparison of difference in the mean scores of academic retention of students in experimental and control groups.

GROUP	N	$\bar{X}$	SD	Df	t_{cal}	t_{tab}	Result
Experimental	50	27.67	16.08	98	2.294	1.671	*
Control	50	20.76	13.98				

P < 0.05 (Result significant at 0.05 level), * = Significant.

As shown in table 3, when the mean score of students in the control and experimental groups after the treatments (posttest) were statistically compared, a *t-value* (t_{cal} = 2.294) with P < 0.05 alpha level was obtained, which was significant at 0.05 level. This implies that there exists significant difference in the mean scores of academic retention of students in experimental and control groups in favour of experimental group. Consequently, the null hypothesis which states that there is no significant difference in the mean scores of academic retention of students in experimental and control groups was rejected. As such, the conventional method of instruction used for control group can be said to be less effective compared with concept mapping teaching strategy used in the experimental group.

Discussion

The result of this study revealed that the pre-test mean scores of the students in the Concept mapping strategy was not significantly different from that of those exposed to conventional method. The implication of this is that the two groups involved in the study exhibited comparable characteristics. Thus, they both entered the instructional experiment on equal strength and ability which showed that the two groups were suitable for the study when comparing Concept mapping with tradition conventional method on achievement and retention in Mathematics. The result of the study revealed a relative increase in the post-test mean score of the students in the concept mapping group over those taught with the traditional conventional method. Thus confirmed that concept mapping strategies are learner-centered and capable of making remarkable impart on instructional practices.

Likewise, the result of the finding of treatment on the students' retention scores of achievement in Mathematics shown a significant difference gave credence to the use of concept mapping for a better understanding and remembering. Since understanding comes from meaningfulness, things that are understood are better retained and recalled than things that are not meaningful. The finding though not in agreement with the outcome of similar studies conducted by Esiobu and Soyibo (2009), is however corroborating the studies of Adeneye (2011), Awofila (2011), Adaramola (2012), which showed that concept mapping strategy was more effective in increasing students' achievement than the tradition conventional method. These

outcomes showed that the students exposed to the concept mapping strategy achieved better than those exposed to the conventional method at all level of cognition. Even though Esiobu and Soyibo (2009) are of the opinion that concept mapping not significant at lower level of cognition, the present finding revealed a contrary considerable significant difference.

Conclusion

This study was carried out to determine the effect of concept mapping on secondary school students' achievement and retention in mathematics. The study discovered that students taught using concept mapping recorded better and significant post achievement and retention scores than those taught using conventional method.

The study however found no significant difference between the achievement of male and female students in Mathematics when concept mapping was used as strategy of instruction. This implied that there is no gender inequality in the use of concept mapping if properly handled.

The study also investigated the effect of concept mapping strategy on students' achievement in all the level of cognitive abilities at senior secondary school level. This was found to be significant at all cognitive level. The result of the study showed that concept mapping is an effective strategy for teaching and learning Mathematics in our secondary school level.

Recommendations

Consequent upon the finding of this study, it was recommended that:

Concept mapping assessment should be practically applied to classroom situations. Teachers should use concept mapping strategy to arouse the interest of their students in mathematics teaching. They should be trained and encourage to use concept mapping strategy. Principals of secondary schools should encourage their Mathematics teachers through sponsorship to attend refresher courses and other forms of in-service training to enable them acquire the needed skill that can help them use or apply different strategies in the classroom teaching and learning. Thus help eradicate mediocrity among Mathematics teachers and expose them to a wide range of methods which can enhance their teaching in classroom situation. Authors of Mathematics textbooks should present the content and concepts alongside the worked examples using concept mapping approach.

References

1. Adaramola, M.O. (2012): Effect of Concept Mapping on Performance and interest of students with dyscalculia in secondary school Mathematics in Nigeria. *ABACUS: The Journal of Mathematics Association of Nigeria* 37(1),195-207.
2. Adeneye, O.A.A. (2011): Effect of Concept Mapping Strategy on students' Achievement in Junior Secondary School Mathematics. *International Journal of Mathematics Trend and Technology*. 2(3), 11-17.
3. Agwagah, U.N.V. & Ezeugo, N.C. (2000): Effect of concept mapping on students' Achievement in Algebra. *ABACUS: The Journal of Mathematics Association of Nigeria.* 25(1), 1-11.
4. Ausubel, D.P. (1963): The Psychology of Meaningful Verbal Learning. New York. Grune and Stratton.
5. Awofila, M. N. (2011): Effective Teaching: A book of reading; Onitsha, Kimensu Educational Publisher.
6. Azuka, B.F. (2003): The challenges of Mathematics in Nigeria economic and technical development; implication for tertiary education. *ABACUS: The Journal of*

Mathematics Association of Nigeria. 28(1), 18-26.

7. Esiobu, G.O. & Soyibo, K. (2009): Effect of concept mapping under three learning Modes on on students' cognitive achievement in Genetics. *Journal of National Association for research in Science Teaching.* 23(1), 971-989.
8. Novac, J.D. (1972): Audio-tutorial techniques for individualized science instruction in the elementary school. In H. Trienzenberg (Ed). *Journal of National Science Teacher Association.* 2(1), 14-30.
9. Onwuka, P.I. (1985): Importance of Mathematics in Science subject. Unpublished thesis, College of Education, Abraka.
10. Onwuka, F.O., Onwuka, P.I. & Iweke, S (2010): Remediation of Mathematics in Physics as an enhancement strategy for achievement in Physics education. *Abacus: Journal of Mathematics Association of Nigeria.* 35(1), 120-126.

An educated people can be easily governed.
~ Frederick The Great