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Effect of Concept Mapping Strategy on Junior Secondary Education Students' Achievement and Interest in Trigonometry in Southern Kaduna Senatorial Zone, Kaduna State, Nigeria.

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ABSTRACT

The purpose of this study was to determine effect of concept mapping strategy on junior secondary school students' achievement and interest in trigonometry. Also differential effect of gender on achievement in trigonometry was examined. A quasi experimental design of non-equivalent pre-test post-test control group was used. Stratified random sampling technique was adapted in selecting 180 JSS2 students from four schools in two local government areas in southern senatorial zone of Kaduna state. Two research instruments developed by the researchers and used for data collection were: Students' trigonometry achievement test (STAT) and students' interest inventory (SII).Mean and standard deviation were used to answer the three research questions, while three hypotheses were tested at 0.05 error margins using the t-test analysis. The result of the findings showed that there was significant difference in the mean achievement scores and interest rating of students exposed to concept mapping strategy in trigonometry. Also, there was significant effect of gender on achievement of students exposed to concept mapping strategy. The researchers recommended among other things: the integration of concept mapping strategy in the curriculum, adequate training of mathematics teachers on the use of concept mapping strategy in junior secondary school level.

Keywords: concept mapping; achievement; interest; gender.

Introduction

Today, Mathematics is the fundamental base in the task of nations' capacity building in science and technology. Therefore, any short coming in this subject constitute draw back to the achievement of our nations' science and technology objectives.

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Vol. 8 Issue 8
August 2021

Adetola (2012) noted that science and technology have become dominant cultural factor, and any nation that is not alive to this fact is either dead or dying; hence, Mathematics is the cogwheel that moves these science and technology world over.

Tremendous efforts have been made by many Mathematics educators towards improving the teaching and learning of mathematics in Nigerian secondary schools before now. In spite of these efforts, Anyagh and Ok'wu (2010) revealed that Mathematics Education is still in a deplorable state at all levels of the Nigerian education system. This low achievement in Mathematics has been attributed to non utilization of appropriate instructional strategies. In trying to find a solution to this ugly situation of low achievements, some researchers have identified teaching techniques employed by the teachers as some of the contributory factors (Anyagh &Ok'wu, 2010 in Yarima2014).This is because no matter how suitable the educational objectives and content seem to be, the curriculum process remained defective if viable instructional strategies are not employed in teaching and learning process. Trigonometry is an important aspect of Mathematics whose application cut across all branches of Mathematics. Unfortunately, most questions in trigonometry are poorly attempted by students especially in external examination (Nworgu, 2003).

Obodo (2004) defined interest as the state of curiosity and important factor in learning Mathematics. It is any activity that drives or motivates the individual for action. The researcher observed that interest is a very strong factor in the teaching and learning of Mathematics. He further noted that degree and direction of attitude towards mathematics are largely determined by the kind of interest developed by learners for mathematics.

Novak (2008) defined concept mapping technique as a schematic device for representing a set of concept meanings embedded in a frame work of prepositions. Odili (2006) also defined concept mapping as an excellent device that visually represents the historical relationship among concepts within a subject. According to Imoko (2005), concept mapping could be perceived as a process that enables one or group layout ideas on a topic or discipline in picture or map-form. There is a parading shift from the conventional way of passive learning where the teacher dominates in the teaching and learning process to an approach that reduces the teacher to a

mentor/guide. Concept mapping strategy leverages on the abundant rich resources (objects/materials) found in our learning environment used as schematic device for representing a set of concept meanings (Butcher,2011).The lesson could be planned into activity-based around the available learning resources which begins with a problem that engages learners into active thinking and discussion.

Effective teaching requires a thorough understanding of the learning process, characteristics of students at different stages of development, individual differences and factors that influence motivation, interest and retention which all translate to improved achievement. It is in the light of the foregoing that the present study is set to explore the efficacy of concept mapping strategy in trigonometry in a typical Nigerian Junior secondary school class-room setting.

STATEMENT OF THE PROBLEM

The present day teaching and learning of mathematics is far from being satisfactory. This is evident in the persistent poor achievement of Junior and senior secondary schools' external and internal examinations. It is in view of this that the problem of this study sought to determine the extent to which concept mapping influences achievement and interest of junior secondary school students in Mathematics, how does concept mapping solve the problem of gender differences in achievement in mathematics?.

PURPOSE OF THE STUDY

The purpose of this study is to investigate whether junior secondary school students taught mathematics using concept mapping approach would achieve higher in what they learn. In specific terms, the study will:

1. Examine the extent to which concept mapping approach will influence achievement of students in trigonometry.

2. Find out the effect of concept mapping strategy on students 'interest in trigonometry

3. Determine the difference in mean achievement scores between male and female students that are taught trigonometry using concept mapping strategy.

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Vol. 8 Issue 8
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RESEARCH QUESTIONS

The following research questions have been raised to guide the study:

1. What are the mean achievement scores of students taught trigonometry using concept mapping strategy and those taught using conventional method?

2. What is the mean interest rating of students taught trigonometry using concept mapping strategy and those taught trigonometry using conventional method?

3. What are the mean achievement scores of male and female students taught trigonometry using concept mapping strategy?

RESEARCH HYPOTHESES:

Three hypotheses were formulated and tested at 5% level of significance.

1. There is no significant difference in the mean achievement scores of students taught trigonometry using concept mapping strategy and those taught using conventional method.

2. There is no significant difference in the mean interest rating of students taught trigonometry using concept mapping strategy and those taught using conventional method.

3. There is no significant difference in the mean achievement scores of male and female students taught trigonometry using concept mapping strategy.

METHODOLOGY

DESIGN:

The design of the study was the quasi experimental design of non- randomized control group pre-test and post-test. Non-randomized design was adopted since it was not possible for the researchers to randomly sample and assign subjects. The intact classes in the chosen schools were randomly assigned to experimental and control groups. The design is shown below diagrammatically:

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Vol. 8 Issue 8
August 2021

R: $X_E \longrightarrow X_C$

R: $O_E \longrightarrow O_C$

R indicates that the assignment of groups was through randomization.

$X_E \longrightarrow$ pre-test(Data) was collected from experimental group, $X_C \longrightarrow$ pre-test (Data) was collected from control group, $O_E \longrightarrow$ post-test (Data) was collected from experimental group, O_C post-test (Data) was collected from control group.

POPULATION AND SAMPLE OF THE STUDY

The sample size of the study comprised of 180 randomly selected out of the population of 4,456 JS2 in the study area. A stratified random sampling technique was adopted to draw the sample size from the population of the study. In this technique, the researchers grouped all the schools into two strata (single sex and co-education schools) and selection was done at random until co-education schools were chosen. Simple random sampling technique was finally used to draw the sample size.

INSTRUMENT FOR DATA COLLECTION

The instruments used for data collection were students' trigonometry achievement test (STAT) and students' interest inventory (SII) constructed by the researchers. The STAT and SII were divided into two categories each, category one was the pre-STAT and pre-SII which consisted of 20 test items each, while category two was the post-STAT and post-SII which also consisted of 20 test items each. The instruments were validated by two experts, one from measurement and evaluation and the other from mathematics education, Kaduna state college of education Gidan Waya. The instruments were also subjected to psychometric analysis using Richard Kuderson formula 21 and split half method. Reliability coefficients of 0.91 and 0.80 were obtained respectively. This indicated that the instruments were reliable and appropriate for the study.

Two teaching strategies were employed in line with the focus of the study. The subjects were exposed to concept mapping strategy and conventional method respectively. At the end of the four weeks of experiment, the students' trigonometry achievements test (STAT) and students' interest inventory (SII) were administered. Analysis of t-test inferential statistic was used.

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Vol. 8 Issue 8
August 2021

RESULT:

Research question one:

What are the mean achievement scores of students taught trigonometry using concept mapping strategy and those taught using conventional method?

Table 1: Mean achievement scores of junior secondary school students taught trigonometry using concept mapping strategy and conventional method.

Teaching approach	No of students	mean scores		SD	mean gain
		Pre-test	post-test		
Concept mapping	90	50.71	63.53	7.83	12.82
Conventional	90	46.16	57.49	10.85	11.33
Mean difference		4.55	6.04		1.49
Total	180				

Results in Table 1 shows that both the experimental and control groups improved in their mean achievement scores after the treatment, however, students in the experimental group gained by mean achievement difference of 12.82,while those in control group gained by 11.33 which is lower compared to the experimental group. The difference in mean achievement of the two groups was 6.04 in favour of the experimental group.

Research Question two:

What is the difference in the mean interest rating of student taught trigonometry using concept mapping strategy and those taught using conventional method?

p-ISSN: 2348-6848
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Vol. 8 Issue 8
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Table 2: Mean interest rating of students taught trigonometry using concept mapping strategy and those taught using conventional method.

Teaching Strategy	No of students	mean interest scores		SD	mean gain
		Pre-test	post-test		
Concept mapping	90	43.63	52.29	8.24	8.66
Conventional	90	43.49	50.04	9.36	6.55
Mean difference		0.14	2.25		2.11
Total	180				

The results in table 2 showed that both the experimental and control groups improved in their mean interest rating after the treatment, however , students in the experimental group gained by mean difference of 8.66 while those in control group gained by 6.55 which is lower compared to the experimental group. The overall mean gain in the mean interest rating of the two groups was 2.11 in favour of those taught using concept mapping strategy.

Research Question three:

What is the influence of gender on the achievement scores of students taught trigonometry using concept mapping strategy?

Table 3: Mean achievement scores of male and female students taught trigonometry using concept mapping strategy.

Teaching approach	No of students	sex	mean scores		SD	mean gain
			Pre-test	post-test		
Concept mapping	46	male	50.37	61.91	7.31	11.54
	44	female	51.07	65.23	7.81	14.16
Mean difference			0.7	3.32		2.62
Total	90					

p-ISSN: 2348-6848
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Vol. 8 Issue 8
August 2021

Table 3 shows that both male and female students improved in their achievement after the treatment, however, male students gained by mean achievement difference of 11.54 while that of female was 14.16 which are higher compared to the male group. The difference in mean achievement of the two groups was 3.32 in favour of the female group.

Hypotheses:

The three hypotheses formulated for this study were tested using t-test inferential statistic at 0.05 error margin.

Hypothesis one:

HO_1: There is no significant difference in the mean achievement scores of students taught trigonometry using concept mapping strategy and those taught using conventional method.

Table 4: T-test results of students' mean achievement scores taught trigonometry using concept mapping strategy and conventional method.

Group	N	x	S.D	α	Df	t-cal	t-critical
CPMS	90	63.53	7.85				
				0.05	178	4.32	1.645
CVM	90	57.49	10.85				

From table 4, the calculated t-value is 4.32 at 178 degree of freedom, while t-critical is 1.645. Since the calculated t-value of 4.32 exceeds the t-critical value of 1.645 at 5% level of significance, the hypothesis is rejected. This means there is significant difference in the mean achievement scores of students taught trigonometry using concept mapping strategy and those taught using conventional method.

Hypothesis two:

HO_2: There is no significant difference in the mean interest rating of students taught trigonometry using concept mapping strategy and those taught using conventional method.

Table 5: t-test result of students', mean interest rating of students taught trigonometry using concept mapping strategy and those taught using conventional method.

Group	N	x	S.D	α	Df	t-cal	t-critical
CPMS	90	52.29	8.24				
				0.05	178	1.71	1.645
CVM	90	50.04	9.36				

From table 5, the calculated t-value is 1.71 at 178 degree of freedom, while t-critical is 1.654.It is observed from the table that t-calculated is greater than the t-critical at 5% level of significance. Therefore, the hypothesis is rejected. This implies that a significant difference exist in the mean interest rating of students taught trigonometry using concept mapping and conventional method.

Hypothesis three:

HO_3: There is no significant difference in the mean achievement scores of male and female students taught trigonometry using concept mapping strategy.

Table 6. T-test result of male and female students mean achievement scores taught trigonometry using concept mapping strategy.

Group	N	x	S.D	α	Df	t-cal	t-critical
Male	46	61.91	7.31				
				0.05	88	2.08	1.658
Female	44	65.23	7.81				

From table 6, the calculated t-value is 2.08 at 88 degree of freedom, while t-critical is 1.658 which is less than the t-calculated at 5% level of significance. Therefore, the hypothesis is rejected. This means there is significant difference in the mean achievement scores of male and female students taught trigonometry using concept mapping.

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DISCUSSION OF FINDINGS

One of the major findings of this work is that students taught trigonometry using concept mapping strategy achieved higher than those who were taught using conventional method. These findings corroborate with that of Ezeudu (2005) who conducted a research to determine the use of concept mapping approach on students' achievement, interest and retention in organic chemistry found that the use of concept mapping approach helps increase students' achievement and developed high interest than the conventional method. This finding also agrees with that of Esiobo and Soyibo (2005) who conducted a study to verify the efficiency of concept mapping in Ecology and genetics among eight grade (JSS2) students. The result showed that concept map used as advanced organizer resulted in a positive significant difference in achievement between the subjects taught using concept and Vee-mapping and those taught using the conventional approach in favour of those who used the concept and vee-mapping strategies. The similarity in this finding further strengthens the fact that the use of concept mapping strategy can enhance student's achievement in trigonometry.

The study also found that there was significant difference in the mean interest rating of students taught using concept mapping strategy than those taught using conventional method. This study agreed with that of Imoko (2005) who found that students who were exposed to concept mapping technique exhibited greater interest in trigonometry content than those who were not.

It was also found that there was significant difference in the mean achievement scores of male and female students taught using concept mapping strategy. This finding is slightly similar to that of Agwagah (2003) who conducted an experimental study to determine the effect of concept mapping strategy on male and female student's achievement in Algebra in Nigeria. The result reveals that male students performed significantly better than their female counterparts in Algebra achievement test (AAT) using concept mapping method. While this study indicates that male students performed better than their female counterparts, the current study shows that the female students performed better than their male counterparts. This indicates that the approach could be gender sensitive in enhancing female's achievement in mathematics which has always been the general outcry. However, this result is not in agreement with the findings of Imoko and Agwagah (2005) whose findings showed no sex difference among male and female pupils who

were exposed to computer games learning approach. Also the study disagree with the findings of Achor, Imoko and Ajai (2010) who found that male and female learners taught using games and simulations did not differ significantly in their achievement.

CONCLUSION

Based on these findings, the result provided empirical evidence that concept mapping strategy enhances and promote students' achievement in trigonometry much better than the use of conventional method. The use of concept mapping strategy has shown that backwardness in mathematics performance among the female folk could be reduced if appropriate method is used in mathematics class-room.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations are proffered:

1. Concept mapping should be incorporated in the curriculum as a strategy used in teaching in mathematics class-room.

2. Teacher training institutions should include the concept mapping strategy in the mathematics method course content. This will ensure that teachers are adequately trained on how to use the strategy.

3. Federal and state ministries of education, professional bodies, such as the Mathematical Association of Nigeria (MAN), should organized workshops/seminars on the use of concept mapping strategy so as to sensitize mathematics teachers on the benefits derived from using concept mapping strategy.

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