Journal of CUDIMAC (J-CUDIMAC)
ISSN 0794-4764 (Print) ISSN 2651-6063 (Online)
Vol 6, No.1 2019

Effect of Mnemonic Instructional Strategy on Secondary School Students' Achievement in Mathematics

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Abstract

The study investigated the effect of Mnemonic Instructional Strategy on students' achievement in mathematics. The study was conducted in Owerri Municipal Council of Imo State. Population of the study consists of 3266 senior secondary II students from 9 secondary schools within the local government Area. A sample of 205 students from two purposively selected schools was used for the study. The research adopted the quasi-experimental type and non-equivalent control design was specifically used. The instrument for data collection was a researcher made objective test question titled Mathematics Achievement Test (MAT). It has a reliability coefficient of 0.83 which was determined using Pearson's product moment correlation coefficient. The data generated was analyzed using mean and standard deviation to answer research questions while the hypotheses were analyzed using ANCOVA tested at 0.05 level of significance. The result of the study revealed that, mnemonic instructional strategy was an effective instructional strategy of teaching mathematics. Gender and ability levels were not barriers to achievement among students in Mnemonic instructional strategy group. Based on the result, it was recommended that, teachers should adopt mnemonic instructional strategy in teaching mathematics at secondary school level.

Keyword: Mnemonic, Instructional Strategy, Students Achievement.

Introduction

Mathematics is a very important subject in the academic pursuit of any individual as it cuts across both primary and secondary schools. Alutu and Eraikhuemen (2004) described mathematics as the bedrock of national development and a subject without which a nation cannot move forward scientifically and technologically. Mathematics is the fulcrum on which other science subjects revolve. Amoo and Rahman (2004) noted that, it is the wheel on which science subjects move and the prime instrument for understanding and exploring our scientific, economic and social world. Mefor (2014) indicated that mathematics relates to everything in the universe from the smallest to the largest. This is an indication that the level of scientific and technological development of any nation depends so much on mathematics. Adewumi (2005) stated that, without mathematics there is no science, without science there could be no modern technology.

Considering the relevance of mathematics in scientific and technological development of the nation and the poor state of students' performance in the subject, it becomes pertinent to seek measures of tackling the ugly menace as to position the nation towards the much talked about

technological and scientific development.

Despite the large dependence of scientific and technological development on mathematics, students' performance has continued to be discouraging. Lapid in Balbuena and Buagyan (2015) stated that in the field of mathematics, high school seniors' ability to manipulate numbers and equations (e.g algebra) is weak. Problem solving using mathematical concepts and established logic and equation is poor. Ogena, lania and Sasota (2010) noted that over years, performance levels of students in international assessment tests have indicated unsatisfactory competencies in mathematics and science. Poor performance in mathematics at secondary school level is attributed to several factors which includes teachers teaching strategy among other things. According to Akinsola and Odeyemi (2014), several factors have been identified by researchers that may be responsible for poor performance of students in mathematics over the years. Prominent among these factors are; poor attitude of students in mathematics, the use of traditional or conventional teaching method, non-utilization of available resources, lack of interest on the part of teaching staff, lack of mathematics laboratory (Akinsola and Ifamuyiwal; 2008, Alio, 2000, Ayanniyi 2005 and Obodo, 2004).

The strategy to be used for effective teaching and learning of mathematics is of great concern to teachers and researchers. The consistent use of the lecture method for teaching and learning mathematics in Nigerian secondary schools has been counter-productive as it does not allow the students to actively participate and develop their intellectual capabilities. Akinsola (2000) stated that, this method, though, prevalent in Nigerian secondary schools and most commonly used by teachers, has been shown to be ineffective and has not been yielding the desired results. Seweje (2010) confirmed that the methods adopted by teachers in most cases include the talk and chalk (lecture) with very little concern for practical activities. There is therefore, a need to source for alternative strategies of teaching mathematics that are suitable and efficient in enhancing students' level of achievement in the subject. This situation calls for the application of Mnemonics approach of teaching mathematics which is students centered and may improve their achievements.

Mnemonics are memory aids that assist one in remembering specific information by using a process, strategy, or technique that enables a person to improve memory (Higbee in Maghy;2015). Mnemonics are techniques or devices, either verbal or visual in nature that serve to improve the storage of new information, and the recall of information contained in memory (Solso, 1995). Babara (2005) stated that Mnemonics instruction is a set of strategies designed to help students improve their memory of new information. Its particular use is in developing better ways to take in information so that it will be much easier to remember (Mastropieri and Scruggs; 1992).

Akinsola and Odeyemi (2014) indicated that mnemonic instruction links new information to prior knowledge through the use of visual and/or acoustic cues. Visual cues are pictures or graphics teachers create that link the old and new information in the student's memory. Scruggs and Mastropieri in Balbuena and Buayan (2015) conducted a research on mnemonic instruction with world history classes where the analysis of strategy use data revealed that students employed appropriate strategies, and observational data confirmed that student time on task was higher in the mnemonic condition. Mnemonic strategy improves initial learning and later recall of important math information. Using mnemonic instructional strategy in teaching mathematics would enhance students' memory of basic mathematics facts and ensure quick recovery of important information that would improve academic performance of students (Akinsola et al; 2014).

Statement of the Problem

The consistent poor achievement in mathematics among secondary school students has become a major concern among educators and stakeholders. This situation if allowed to continue will endanger the pursuit for scientific and technological development of the nation.

Teachers' method of teaching mathematics which is so much dependent on "talk and chalk" (lecture method) has been seen as the major cause of dismal achievement in mathematics among secondary school students. This strategy of teaching does not allow the students to be active participants in the teaching learning process since it's a teacher centered approach. There is need therefore to find instructional strategies that are students centered and allows for active classroom participation.

Based on this premise, the study was carried out to determine the effect of mnemonic instructional strategy on senior secondary school students' achievement in mathematics.

Purpose of the Study

The main purpose of this study is to investigate the effect of mnemonic instructional strategy on secondary school students' achievement in mathematics. Specifically, the study will determine whether

1. Students taught mathematics using mnemonic strategy will have better achievement than those taught using conventional approach.

2. Male and female students taught mathematics using mnemonic strategy will differ in their achievements.

3. Low and high achievers taught mathematics using mnemonic strategy will differ in their achievements.

Research Questions

The following research questions were drawn for this study:

1. What is the difference between the mean achievement scores of students taught mathematics using mnemonic strategy and those taught using conventional strategy?
2. What is the difference between the mean achievement scores of male and female students taught mathematics using mnemonic strategy?
3. What is the difference between the mean achievement scores of low and high achievers taught mathematics using mnemonic strategy?

Hypotheses

The following hypotheses were formulated for the study.

Ho_1: There is no significant difference between the mean achievement scores of students taught mathematics using mnemonic instructional strategy and conventional strategy.

Ho_2: There is no significant difference between the mean achievement scores of male and female students taught mathematics using mnemonic instructional strategy.

Ho_3: There is no significant difference between the mean achievement scores of low and high achievers taught mathematics using mnemonic instructional strategy.

Methodology

The study was carried out using quasi-experimental design adopting nonequivalent control type. The population of the study consists of 3266 senior secondary school students of the 9 secondary schools in Owerri Municipal Council of Imo State. The sample of 205 senior secondary II (SS2) students from 2 purposively selected secondary schools was used for the study. In each of the 2 schools selected, 2 intact classes were assigned to control and experiment groups. This gave a total of 80 students in control group and 125 in students in experiment group comprising of 93 males and 112 females. The experiment group had 60 males and 65 females while the control group had 33 males and 47 females. Also the experiment group had 81 low achievers and 44 high achievers.

The instrument used for data collection for the study was a researcher made test titled Mathematics Achievement Test (MAT) it was a 30-item objective test with options from A to D. the items were developed using a table of specification. The content validity of the instrument was determined using the table of specification and the face validity by 2 mathematics education experts and one measurement and evaluation expert, their inputs were given consideration as the instrument was restructured. To determine the reliability of the instrument, it was administered to a group of 20 students outside the study sample but with the same characteristics through test-retest method within two weeks. Their result was analyzed using Pearson's product moment correlation coefficient which gave a reliability coefficient of 0.83.

The two groups were pre-tested to determine their cognitive backgrounds. Afterwards, the experiment groups were taught trigonometry by their regular mathematics teacher trained on the use of mnemonic instructional strategy. The group was taught trigonometric ratio using the mnemonics SOHCAHTOA and CAST or ASTC for angles. The students were allowed to memorize and use the mnemonics to determine the concepts Sine, Cosine and Tangent. While CAST, was used to teach signs of 3 functions of trigonometry in the four quadrants. This strategy allowed the students to assimilate the concept taught and allowed them to participate in the class activity producing their own mnemonics as to aid individual memory. The control groups were simultaneously taught same topic by their regular teacher conventionally without being actively involved in the classroom activities. This lasted for two weeks after which they were given a post-test with a rearranged version of the pre-test.

The data collected was analyzed using mean, standard deviation to answer research questions and ANCOVA statistical tool to analyze the hypotheses tested at 0.05 level of significance.

Result

Research Question 1: What is the difference between the mean achievement scores of students taught mathematical using mnemonic and conventional instructional strategy?

Table 1: Summary of students' mean achievement scores

Group	N	Mean ($\bar{x}$)		SD	Mean Gain	Difference in mean
Expt	125	Pre	32.50	8.74	18.25	
		Post	50.75	11.32		16.01
Control	80	Pre	30.79	8.29	2.24	
		Post	33.03	8.73		

Table 1 shows that, the experiment group had a mean gain of 18.25 while the control group had 2.24 this gave a difference in mean of 16.01 in favour of the experiment group taught using mnemonic instructional strategy.

Research Question 2: What is the difference between the mean achievement scores of male and female students taught mathematics using mnemonic instructional strategy?

Table 2: Summary of male and female students' achievement

Gender	N	Test	Mean	SD	Mean Gain	Mean diff
Male	60	Pretest	33.12	8.77	17.22	0.05
		Posttest	50.34	11.30		
Female	65	Pretest	33.03	8.74	17.17	
		Posttest	50.20	11.35		

Table 2 shows that, a difference in mean of 0.05 exists between the mean achievements scores of male and female students taught mathematics using mnemonic instructional strategy.

Research Question 3: What is the difference between the mean achievement scores of low and high achievers taught mathematics using mnemonic instructional strategy.

Table 3: Summary of mean achievement scores among levels of achievers

Achievers	N	Test	Mean	SD	Mean Gain	Mean diff
High	44	Pretest	32.69	8.47	18.73	2.30
		Posttest	51.42	11.07		
Low	81	Pretest	32.70	8.36	16.43	
		Posttest	49.13	16.76		

Table 3 shows that, a difference in mean achievement score of 2.29 exists between high and low achievers taught mathematics using mnemonic instructional strategy.

Hypothesis One: There is no significant difference between the mean achievement scores of students taught mathematics using mnemonic instructional strategy and conventional strategy.

Table 4: Summary of ANCOVA analysis

Source	Type III sum of squares	df	Mean Square	F	Sig
Corrected model	20259.999	9	2251.111	21.473	.000
Intercept	9784.483	1	9784.483	93.33	.000
Covariate	278.852	1	278.852	2.660	.105
Method	17305.573	2	8652.786	82.538	.000
Gender	103.026	1	103.026	.983	.323
Achievers	224.644	1	224.644	.143	.145
Method *gender	86.938	1	86.938	.829	.364
Method * Achievers	.000	1	.001	.000	.998
Total	418974.000	205			
Corrected	40702.605	204			

Table 4 shows that F-ratio was 82.54 with associated probability value of 0.00. Since the associated probability value of 0.00 was less than 0.05 set benchmark for decision, the null hypothesis is rejected. This implies that there is a significant difference between the mean achievement scores of students taught mathematics using mnemonic instructional strategy and conventional strategy

Hypothesis Two: There is no significant difference between the mean achievement scores of male and female students taught mathematics using mnemonic instructional strategy.
Table 4 shows that F-ratio was .983 with associated probability value of .323. Since the associated probability value of .323 is greater than 0.05 set benchmark for decision, the null hypothesis is upheld.

Hypothesis Three: There is no significant difference between the mean achievement scores of low and high achievers taught mathematics using mnemonic instructional strategy.
Table 4 shows that F-ratio was .143 with associated probability value of .145. Since the associated probability value of .145 is greater than 0.05 set benchmark for decision, the null hypothesis is upheld.

Discussion of Findings

The result of the study revealed that there is a difference between the mean achievement scores of students taught mathematics using mnemonics and conventional instructional strategy in favour of the experimental group. The difference was found to be significant at 0.05 level of significance. This implied that, the students in mnemonic instructional strategy class had better mean achievement scores than those in the conventional strategy class. This is suspected to be as a result of the strategy allowing the students to remember conceptual information that was taught them. They also had the opportunity to construct their own mnemonics which also aided conceptual understanding. This result is in line with the findings of Maghy (2015), Akinsola and Odeyemi (2014) which variously showed that, students in mnemonic group had a better achievement in mathematics when compared

with those in conventional strategy.

The result revealed that gender was not a barrier in students' achievement in mathematics when taught with mnemonic strategy. This was evident in their mean score achievements which showed no significant difference female students. This result is not in consonant with that of Akinsola and Odeyemi (2014) which showed a significant difference in male and female students' achievement in mathematics when taught with mnemonic instructional strategy.

Finally, the study revealed that low and high ability students in the mnemonic class had equal achievements as no significant difference was found between their mean achievement scores. This could be richly attributed to the fact that the strategy allowed the students to learn according to their face and also formed mnemonics according to their remembering ability. This result is in tandem with the finding of woodward and Baxter (1997) which showed no statistical difference between low ability and high ability students taught mathematics through innovative approaches.

Conclusion

The result of this study revealed that, students taught mathematics using mnemonic instructional strategy had better achievement than those taught using the conventional strategy. The improvement in the students' achievement was irrespective of gender and ability levels. This indicates that, Mnemonic Instructional Strategy is an effective method of teaching mathematics at secondary school level.

Recommendations

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

1. Teachers should adopt Mnemonic Instructional Strategy in teaching mathematics in secondary schools as to improve their achievement.
2. Workshop and seminars should be organized for teachers as to be abreast with innovative approaches of teaching mathematics at secondary school level.
3. Teachers should understand their students in the classroom so that they will know the appropriate strategy to be applied when teaching mathematics.

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