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EDITORIAL

STEM Journal of Anambra STAN (STEMJAS) is a publication of **Science Teachers Association of Nigeria, Anambra State Chapter.** STEMJAS is developed to disseminate information on Science, Technology, Engineering and Mathematics (STEM) to teachers, teacher-trainers, researchers and other interested persons. Articles that are of relevance to STEM education are published in this journal.

We are grateful to the contributors and hope that our readers will enjoy reading these contributions.

Prof. Ebele C. Okigbo

Editor-in-Chief

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EFFECT OF PEER TUTORING METHOD ON SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN ALGEBRA IN AGUATA EDUCATION ZONE ANAMBRA STATE

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Abstract

*This study investigated into the effect of peer tutoring on senior secondary school student' academic achievement in Algebra in senior secondary schools in Aguata education zone of Anambra state. Two research questions and two hypotheses guided the study. The design of the study was a quasi – experimental research design. Specifically, the design was pre-test post-test non randomized control group design. A sample of 84 SS1 students from a population of 2,684 SSI students from Aguata Education zone were used for the study. The sample size was obtained using multistage sampling technique. The experimental group was taught Algebra using the peer group tutoring method while the control group was taught the same content using the lecture method. The instrument for data collection was Algebra Achievement test which was a 25-item multiple choice question that was validated by two experts in mathematics education and an expert in measurement and evaluation. The reliability co-efficient of the instrument was calculated using Kuder-Richardson formula 20(KR-20) to get 0.89 which indicated that the instrument was reliable. Descriptive statistics of mean was used to answer the research questions while the standard deviation was adopted to ascertain the homogeneity or otherwise of the students' achievement scores. The t-*test *statistics was used to test the formulated hypothesis at 0.05 alpha level. The findings of the study revealed among others that the peer tutoring mode of instruction significantly enhanced the achievement of students in Algebra. Male students had higher mean achievement scores than their female counterpart. The t- test analysis revealed that the difference in the mean achievement scores and of male and female students exposed to peer tutoring method of teaching was significant. Based on the findings, it was recommended among others that mathematics teachers should adopt peer tutoring in teaching of Algebra to enhance the performance of students in Algebra.*

Keywords: Peer Tutoring method, Academic Achievement

Introduction

A secondary school is a school for children between the ages of 11 or 12 and 17 or 18. It is a school intermediate between elementary school and college/polytechnics/ universities. Government schools are those schools that are owned, managed, maintained and funded by the government. For Nigeria to realize her dream in the development of secondary school education and attain the great height in science and technology, the secondary school students must have an outstanding performance in mathematics without credit pass in it no student will be admitted to study any science or science related courses in any higher institution of learning. The main branches of mathematics include; Algebra, statistics, arithmetic, calculus, topology, probability, geometry, trigonometry, number and numeration.

Algebra is a branch of mathematics that is studied from primary through secondary education to tertiary education. Algebra is a branch of mathematics in which letters and other general symbols are used to represent numbers and quantities in formulae and equations. It studies algebraic structures and the manipulation of statements within those structures. Four types of Algebra include; Elementary algebra, advanced algebra, abstract algebra, linear algebra and commutative algebra. Algebra deals with finding the properties of the mathematical objects (Onuorah,2016). At SS1 level, the algebraic content includes Bodmas and simplification of fractions, solving inequalities, simple indicial equations, quadratic expressions etc. Some of these contents form pre-requisites for understanding higher mathematics contents and need to be understood to facilitate better achievement in mathematics and mathematics related courses. Mathematics as described by (Suzu,2021) is an essential part of curriculum that it serves as powerful means of communication, a tool for studying other courses, a discipline through which students can develop their ability to appreciate the beauty of nature, think logically and make sound judgement. Sound knowledge of mathematics is required at every facet of our daily life; mathematics is needed to maintain a steady step while walking, to reason critically, to manage your small resources during this austerity period, to chew and swallow food, mathematics calculations play an important role in architectural activities, precise calculations are made while planning for the development of a new townships, buildings and bridges, etc.

Despite the global importance of mathematics in economic, technological development of a nation and its unique importance as an anchor for enhancing students' achievement in other subjects, students' achievement in mathematics continue to decline. This is attested by Mathematics chief Examiners' report from 2016 to 2020 that students show weaknesses in algebraic content of the examination questions. The statistics of performance of students in mathematics attested to students' poor performance. In 2016, 52.6 percent made credit pass, in 2017 59.22, in 2018 it was 49.98 percent etc. The students' poor performance was also attested by Usuman and Musa (2015) who observed that one aspect of mathematics in which students' problems are dominant is Algebra. This was in line with Usuman and Musa who previously observed that one aspect of mathematics in which students' problems are dominant is Algebra. In the same vein, Martin (2010) observed that Algebra is one of the branches of mathematics that many secondary school students find difficult to comprehend. Researchers have attributed students' poor language of instruction (Okeke,2021; Igbojinwaekwu and Dorgu,2015, Awofala etal,2012, Ball. 2010), poor teaching method (Cheng, 2016) etc. Some other researchers in a quest to improve achievement have pointed out many strategies and methods for effective teaching of mathematics and science which includes inquiry-based teaching approach, mathematical games and analogies, use of advance organizers, use of effective students' centred approach that involve students' interaction and involvement during teaching and learning process such as peer tutoring approach. Despite introduction of the innovative strategies, students' performance does not improve, this may be as neglect of use of improved methods of teaching and adoption of traditional method. Oyedeji (2012) stated that traditional method of teaching whereby a

teacher dominates the teaching-learning process, projects himself as the instructor declines learning. Among different approaches of instruction, peer tutoring is the economical method which could enhance the rate of academic achievement of students (Mushtaq & Khan,2010). In the same line, Khattak(2012) posited that peer tutoring is the method which can improve academic learning,

Peer tutoring is an effective strategy where the mathematics teacher can group students in pairs or small groups to practice academic skills and master content. The teacher may group intelligent students with dull ones where the more intelligent students act as tutors, helps to explain facts, principles and concepts to low achieving students at their own level. The teacher can also group students of equal abilities to work together each taking turns being tutor and tutee. The teacher can use peer tutoring method to assist students with diverse abilities, attentions and concentrations that needs individual attention which can be provided by their co students who acts as tutors. When using peer tutoring, the classroom teacher chooses the best student that will act as a tutor in each group, peer tutors will explain concepts, answer questions, give feedback on assigned tasks. The teacher's work is to bring up a problem, divide students into small groups of similar or diverse abilities, guide the students during working, ask them questions and assist them if they demand his/her attention.

Statement of the Problem

The students' unabated poor performance in mathematics both at internal and external examinations has called for concern from mathematics educators and the society at large. Different teaching methods and strategies have been used to teach mathematics but the improvement in students' academic achievement is not forthcoming. This poor performance is confirmed from Mathematics Chief examiner's report from (2016 – 2020), which asserted that continual teaching of mathematics (Algebra) with methods that does not involve interaction among students can result to students' decline in academic achievement. In order to abate the persistent poor performance in mathematics, it becomes imperative that mathematics teachers should resort to innovative teaching methods/strategies that are students oriented and students centred to teach mathematics, such teaching strategies include peer tutoring approach and others. With this trend of persistent poor performance, more efforts are needed to reduce the rate of failure in algebra particularly at the secondary school level. To this effect, the researchers sought to investigate if these students' achievement in mathematics will be improved if peer tutoring method is used to teach the students.

Purpose of the Study

The study determined the effect of peer tutoring method of teaching on the achievement of SS1 students in Algebra in Aguata educational zone of Anambra State. Specifically, it sought to determine the;

1. Difference in the pre-test mean achievement scores and post-test mean achievement scores of the experimental group taught Algebra with peer tutoring method and the control group taught lecture method.
2. Difference in the pre-test mean achievement scores and post-test mean achievement scores of male and female SS1 students taught mathematics with peer tutoring method.

Research Questions

The following research questions guided the conduct of this study;

1. What is the difference between the mean achievement scores of SS1 students taught algebra using peer tutoring method of teaching (PTMOT) and the control group taught with the lecture method of teaching (LMOT)?
2. What is the difference between the mean achievement scores of male and female SS1 students taught algebra using peer tutoring method of teaching?

Hypotheses

The following null hypotheses were formulated for the study and tested at o.05 alpha level

HO_1: There is no significant difference in the mean achievement scores of students taught algebra using peer tutoring method of teaching and those taught using lecture method of teaching.

HO_2: There is no significant difference in the mean achievement scores of male and female students taught algebra using peer tutoring method of teaching,

Method

The research design adopted for this study was a quasi- experimental research design. Specifically, it was a pre-test, post-test non- equivalent control group design. This design was used because the students already existed in intact classes, any attempt to randomize the students will disorganize the classes and no school management could allow that, hence intact classes were assigned to control and experimental groups.

The study was conducted in Aguata education zone of Anambra state. The population of the study was 2,684 SSI student from Aguata Education zone of Anambra state. The sample size of 84 SS1 students were obtained using multistage sampling technique. Simple random sampling techniques was used to select two local government areas from the three local government areas that made up Aguata education zone, purposive random sampling technique was used to select one coeducational secondary school from each of the local government area already selected then simple random sampling technique was used to select one class of SS1 students from each of the schools which were randomly assigned experimental and control group respectively. The instrument for data collection was Algebra Achievement test (AAT). AAT was used as both pre-test and post-test. Pre-test was used to measure the entry performance level of the students before the treatment while the post test was used to measure the achievement level of the students after the treatment. It was validated by two experts in mathematics education and an expert in measurement and evaluation. The reliability co-efficient of the instrument was calculated using Kuder-Richardson formula 20 to get 0.89 which indicated that the instrument was reliable

The research assistants were the classroom teachers of the experimental and control groups. The teachers of both groups were trained in two different schools during the evening periods from 3pm to 5pm twice a week. The teachers for the experimental group were trained with lesson plan that incorporates use of peer tutoring. They were taught how to group the students in small groups of mixed intelligent ability and how to select and direct the smart and intelligent students to act as tutors in their groups. The classroom teachers of the control group students were also trained for two weeks at the same period and time but in different schools. The teachers in this group act as instructors and teach the whole topic using lecture method.

The teacher in the experimental group used the lesson plan that sets the students as tutors and learners as tutees while the teacher in the control used the lesson plan that placed the teacher as an instructor and teaches the whole content. The study was conducted in the school classroom at the time of normal classes. A pre-test was administered to both experimental and control groups before the commencement of the treatment. In the experimental group, peer tutoring method was used to teach SS1 students algebra while the control group was taught the same topic using the lecture method. The experiment was conducted during the normal school period and it lasted for four weeks.

At the end of four weeks teaching period, post-test was administered to the experimental and control groups. The test items in the post test instrument remain the same with the pre-test but the items in the

post test are re-arranged starting with even number item from the bottom then followed by odd numbers from the bottom. The Algebra achievement test administered to both groups as pre-test before the experiment were collected and scored. After the treatment, the post-test scripts were collected and scored. Each question carries 4 marks; hence the 25 questions carry 100 marks.

Results

Research Question 1: What is the difference between the mean achievement scores of SS1 students taught algebra using peer tutoring method of teaching (PTMOT) and the control group taught with the lecture method of teaching (LMOT)?

Table 1: Difference between the mean achievement scores of SS1 students taught Algebra using peer tutoring method of teaching (PTMOT) and the control group taught with the lecture method of teaching (LMOT)

Group	N	Pretest		Posttest		Mean gain
		Mean	SD	Mean	SD	
Experimental	43	19.06	2.64	68.88	14.46	49.82
Control	41	20.00	2.24	45.81	10.03	25.81
Mean Difference		-0.94		23.07		24.01

Table 1 shows that the students taught Algebra using peer tutoring method (PTMOT) had a mean achievement score of 19.06 and standard deviation of 2.64 in the pre- Algebra achievement test and mean achievement score of 68.88 and standard deviation of 14.46 in the post-test, making the mean achievement gain of experimental group to be 49.82. On the other hand, the control group had mean achievement score of 20.00 in the pre-test with standard deviation of 2.24 and mean achievement score of 45.81 with standard deviation of 10.03 in the post-test making the gain in mean achievement score of the control group to be 25.81. Thus, the difference in the mean achievement scores of students in the two groups was 24.01. This implies that secondary school students taught mathematics with peer tutoring method of teaching achieved higher than those taught with the lecture method. The above information therefore shows that use of peer tutoring mode of instruction is more effective in enhancing academic achievement of secondary school students in Algebra than the lecture method.

Research Question 2: What is the difference between the mean achievement scores of male and female SS1 students taught algebra using peer tutoring method of teaching?

Table 2: Difference between the mean achievement scores of male and female SS1 students taught mathematics (algebra) using peer tutoring method of teaching?

Group	N	Pretest		Posttest		Mean gain
		Mean	SD	Mean	SD	
Experimental	19	18.84	2.06	74.53	9.68	55.46
Control	24	19.21	2.95	67.42	11.11	48.21
Mean Difference		-0.37		7.08		7.25

Table 2 shows that male pupils had mean achievement score of 18.84 with the standard deviation of 2.06 in the pre-test and mean achievement score of 74.53 with standard deviation of 9.68 in the post-test making the gain in mean achievement score to be 55.46. Their female counterparts had mean achievement score of 19.21 with standard deviation of 2.95 in the pre-test and mean achievement score of 67.42 with standard deviation of 11.11 in the post-test making the gain in mean achievement score to be 48.21. Since the gain in mean achievement score of male students (55,46) is greater than that of female students (48.21). The male had higher mean gain. Hence, the difference in the mean achievement scores of students by gender is 7,25 in favour of male students. It means that male students achieved higher than female students when taught algebra in mathematics using peer tutoring method.

$H0_1$: There is no significant difference in the mean achievement scores of students taught algebra using peer tutoring method of teaching and those taught using lecture method of teaching.

Table 3: The t-test of the Significant Difference in the Mean Achievement Scores of students taught Algebra using Peer tutoring method and Lecture method

Group	Frequency	Mean(x)	Standard Deviation	Degree of Freedom	t-cal	t-critical	Decision
Experimental	43	68.88	14.46	82	8.614	1.960	Rejected
Control	41	45.58	10.03				

Table 3 indicated that the t-calculated was 8.614 and the t-critical was 1.960 with 82 degree of freedom. Since the calculated value of t is greater than the critical value, the HO_1 stated above was rejected and the alternative hypothesis upheld thus: There is a significant difference in the mean achievement scores of pupils taught algebra using Peer tutoring method and those taught with lecture method in Aguata education zone of Anambra state. The difference in mean of 24.01 from table 1 is in favour of the group taught with peer tutoring method.

HO_2: There is no significant difference in the mean achievement scores of male and female students taught algebra using peer tutoring method of teaching

Table 4: The t-test Analysis Showing the Significant Difference in the Mean Achievement Scores of male and female students taught Algebra using Peer tutoring method

Gender	Frequency	Mean($\bar{x}$)	Standard Deviation	Degree of Freedom	t-cal	t-critical	Decision
Experimental	19	74.53	9.68	41	2.25	1.960	Rejected
Control	24	67.42	11.11				

Table 4 indicates that the calculated t- value is 2.25 and the critical t-value is 1.960 at 41 degrees of freedom. From the analysis both male (x =74,53) and female (x= 67.42) performed better when taught with peer tutoring method, Also t- calculated of 2.25 is greater than t- critical of 1.960 indicating that HO_2 stated above was rejected. Therefore, male and female students differ significantly in their achievement in algebra.

Discussion

The results of the study reveal the following-There was a significant difference in the mean achievement scores of students in experimental group taught algebra using peer tutoring method and students in control group taught with conventional method. It further shows that the use of peer tutoring method of teaching mathematics concepts is a significant factor in academic achievement of students in favour of the experimental groups. This implies that use of Peer tutoring method is more effective in enhancing academic achievement of students in mathematics (Algebra). The finding of this study was buttressed by Abdelkarim and Abuiiyada(2016) who found out Peer tutoring method of teaching enhances undergraduate students' achievement in mathematics

The research also revealed that male students taught mathematics using peer tutoring method performed better than the female counterpart, The result from table 2 indicated that the male students outperformed their female counterparts with mean difference of 7.25. The result of t-test statistics revealed that the difference in mean achievement score of 7.25 is significant in favour of males, hence male students performed better than their female counterparts in algebra when taught with Peer tutoring method. This shows that gender has an influence in the achievement of male and female students when taught with PTMOT.

Conclusion

Based on the findings of the study, the researchers concludes that the use of peer tutoring method in teaching secondary school algebra is an effective strategy that enhances academic achievement of students in algebra. Also there is gender influence on students' academic achievement in mathematics (algebra). This implies the use of peer tutoring method of teaching enhances male students' achievement than their female counterparts.

Recommendations

The following recommendations were made based on the findings;

1. Secondary school teachers in Anambra State should be sensitized on the effect of peer tutoring method in the teaching and learning of Algebra, branch of Mathematics.
2. School administration, stakeholders and government should encourage the use of peer tutoring method in the teaching of algebra in secondary school in Anambra State.

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