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Peer Tutoring Strategy And Senior Secondary Students' Performance In Mathematics In Emohua Local Government Area Of Rivers State Nigeria

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Abstract – This study determined how peer tutoring affected senior secondary students' academic performance and retention in algebra. Two research questions and two null hypotheses were established for the study. Pretest, posttest, and post-posttest were all used in the study's quasi-experimental design. A sample of 114 senior secondary II students in Emohua Local Government Area, Rivers State Nigeria were chosen at random from the population. Data from the study were gathered using a 25-item multiple-choice examination. While the control group received instruction in algebra using the teacher's deductive teaching method, the experimental group received instruction in algebra using the peer tutoring instructional strategy. An internal consistency of 0.81 was obtained using the Kuder Richardson Formula 21. At a significance level of 0.05, the analysis employed the mean, standard deviation, and analysis of covariance. The results revealed a statistically significant difference between the students who were taught algebra using a peer tutoring strategy and those who were taught using the teacher deductive teaching method in terms of performance and retention. It was recommended among others that mathematics teachers should sometimes employ peer tutoring strategy to enhance students' performance and retention in mathematics.

Keywords – Algebra, Peer tutoring, Performance, Tutor, Tutee

I. INTRODUCTION

The role which mathematics plays in the everyday activity of man and the society at large is very vital to undermine the instructional implementation at the classroom level. The outcome of learning when evaluated is usually traced to the implementation stage (Abdul-Aziz et al., 2020). At the classroom implementation level, there are various factors which contribute to its success or failure. One of such factors is the instructional strategy employed to impart mathematical knowledge and skills to the students. Most students are not independent and strategic when it comes to solving problems in mathematics. There is, therefore, need for teachers to arise to the occasion of sieving the instructional strategies that will help students become independent and strategic learners. Main (2017) opined that it is the responsibility of the teacher to select the appropriate instructional strategy to use and also use them effectively to accomplish tasks or meet the set objectives on taught concepts.

The guiding concept of mathematics curriculum is the need to equip students with the knowledge and skills that will enable them to appreciate the nature of mathematics and use them to solve problems in their daily activities. Gemkah and Igwe (2021)

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posited that there are innovative and non-innovative instructional strategies. The innovative instructional strategies are those strategies that the mathematics teacher use in the classroom to arouse/sustain the interest of students, improve the performance and retention of students in mathematics. Alberta (2021) opined that instructional strategies only become effective when the teacher has the capacity to effectively utilize them to deliver mathematics curriculum content. The research evidence of George and Zalmon (2019) had shown that innovative instructional strategies have enhanced students' performance in mathematics.

The Mathematics classroom is a dynamic meeting place that brings together students of various academic abilities, culture, beliefs and personality traits. This makes it important for the mathematics teacher to be effective by been creative and innovative during the implementation of mathematics curriculum. The mathematics teacher should possess the ability to select and use appropriate innovative teaching strategies effectively. The use of innovative teaching strategies helps to meet the needs, interest and individual differences which exist among students. Some effective innovative instructional strategies for classroom are visualization, inquiry-based instruction, differentiated instruction, laboratory-based instruction, use of technology in the classroom, cooperative learning, blended learning and peer tutoring instruction.

Peer tutoring is an innovative instructional strategy that does not require classroom teaching by teacher but rather the students teach themselves. Peer tutoring is a process by which a competent student under the supervision of the teacher helps other students of the same academic grade level to learn a concept. The peer tutoring strategy initiates peer support in learning academic concepts where students act as a tutor and instruct their peers. The role of this strategy is to assist the weaker students improve in their academics. It could involve one or more students instructing the other students. Teach Thought Staff (2022) posited that peer tutoring strategy is a learning strategy that occurs by design. The success of any peer tutoring session depend on the following:

1. Adequate planning and training of the peer tutor
2. Clear statement of the objectives of the strategy
3. Establishment of basic rules to govern the peer tutoring session
4. Thorough supervision of the peer tutor by the teacher

Peer tutoring is a form of mentorship that takes place between a student who is the more knowledgeable other and another student that is experiencing one or more form of disability in mathematics. The more knowledgeable student is referred to as the peer tutor while the student with the learning disability is referred to as the tutee. The peer tutor is selected by the teacher based on factors such as ability, social skills, confidence, sensibility and reliability. Peer tutoring entails teaching that employs students as peer tutors.

The major objective of peer tutoring instruction is to provide support and reinforcement to students in the learning process. There abound some mathematics topics that are termed difficult. To learn such difficult topics in mathematics can be successful when students teach and learn among themselves. Students learn at ease when taught by their peers. When they study mathematics concepts together, it allows for higher rates of students' response and feedback which leads to more interaction and better academic achievement in students. Peer tutoring comes in varied forms which include the following: Cross-Age Tutoring (CAT), Peer-Assisted Learning Strategy (PALS) and Reciprocal Peer Tutoring (RPT).

Algebra is an area of mathematics that deals with symbols which are connected by mathematical operators to form expressions or equations that needs to be resolved. Odogwu (2015) posited that eighty percent of students at the secondary school exhibit phobia when solving problems in algebra. Algebraic concepts at the senior secondary school level become a bit complex for most students to solve on their own. It therefore becomes imperative that algebra should be taught using strategies that can make the students with mathemaphobia learn without struggling. This is important because every other branch of mathematics such as number and numeration, trigonometry, coordinate geometry, calculus, geometry and mensuration uses algebra. Incorporating peer tutoring to teach algebraic concepts can help improve the academic performance and retention of students. Employing the peer tutoring strategy may not be a bad idea. There are calls for instructors to use dynamic teaching strategies to support the growth of students' general mathematical skills. Therefore, it was important to investigate if peer tutoring might be used as an alternative to the traditional approach of teacher tutoring to assist students to improve in their learning outcomes for mathematics. Alegre et al. (2020) conducted research and found that the use of peer tutoring instructional strategy improved the academic

performance of students across the educational system. The research evidence of Moliner and Alegre (2020) revealed that the peer tutoring strategy had the capability to enhance the performance of students with mathematics anxiety. The academic achievement of undergraduate students in mathematics was improved upon when peer tutoring strategy was employed (Abdelkarim & Abuiyada, 2016).

Therefore, it is essential to promote the adoption of active techniques that let students take part in the learning process. It is vital to offer secondary school practitioners (teachers, researchers, and other relevant parties) practise guidelines that may assist them optimize students' academic outcome for the reasons stated and given the established potentiality of peer tutoring in mathematics.

II. Statement of the Problem

Academic tutoring entails that students should be taught by subject teachers. The mathematics teacher is the primary implementer of the mathematics curriculum at the classroom level. It is expected that when mathematics is taught by the teacher using the appropriate instructional strategies, teaching materials and principles of teaching and learning the subject, that students should learn better and improve on their academic performance and retention.

This is because the expectation of the society is that the teacher should possess the capability of imparting mathematics curriculum content to make students succeed in mathematics. But it has been observed by the researchers that despite the inputs made by the mathematics teachers, students have continuously performed poorly in mathematics examinations. Peer tutoring is an instructional strategy that consists of students' partnership in the teaching and learning of curriculum contents. Peer tutoring strategy entails the use of students as tutors and also tutees. Since students have continued to perform low when taught by their mathematics teachers. The researchers therefore decided to employ the peer tutoring strategy to investigate if students' performance and retention in mathematics can be improved upon when they partner and link up by teaching and learning from each other.

III. Objectives of the Study

3.1. To determine the performance mean score of senior secondary students who were taught Algebra with and without peer tutoring strategy.

3.2. To ascertain the retention mean score of senior secondary students who were taught Algebra with and without peer tutoring strategy.

IV. Research Questions

4.1. What is the difference in the performance mean score of senior secondary students who were taught Algebra with and without peer tutoring?

4.2. What is the difference in the retention mean score of senior secondary students who were taught Algebra with and without peer-tutoring strategy?

V. Hypotheses

H_{01}: There is no significant difference between the performance mean score of senior secondary students who were taught Algebra with and without peer tutoring strategy.

H_{02}: There is no significant difference between the retention mean score of senior secondary students who were taught Algebra with and without peer tutoring strategy.

VI. Research Design

One experimental group and one control group were used in the study's quasi-experimental research design**.**

VII. Population of the Study

All 3,711students in senior secondary school two (SSII) from the 24 public co-educational senior secondary schools in Emohua Local Government Area of Rivers State made up the study's population. (Source, Zonal Post-Primary Schools Board, Emohua Education Zone, 2022).

VIII. Sample and Sampling Technique

One hundred and fourteen (114) senior secondary School two (SSII) students formed the sample for this study. The simple random sampling technique was used to select the sample for the study. This sampling technique was in three stages. Stage one was the random sampling of two schools from the school population which was 24 in number. The second sampling stage was the assignment of each sampled school to experimental group and control group. The third sampling stage was the random selection of one intact class from each of the sampled school.

IX. Instrument for Data Collection

The instrument used for the data collection was titled Mathematics Performance Test (MPT). The instrument was made up of 25 multiple-choice test items with options A to D. The test items were generated from the taught contents. MPT was in three versions based on reshuffling of the items to avoid memorization of the items on the part of the students. The first version tagged MPTA was used for pretest, MPTB was used for posttest while MPTC was used for post posttest. All three versions of the instrument had 25 parallel test items.

Each test item in MPT had three distractors and only one correct answer. Each correct answer was allotted 4 marks while each incorrect answer was allotted zero mark. The total mark for MPT was 100 marks. A table of specification was prepared to evenly distribute the taught contents into Bloom's lower and higher order cognitive domain.

Two lesson plans were prepared for the study. One set of lesson plan was prepared for the experimental group using the peer tutoring instructional strategy while the other set of lesson plan was prepared for the control group using the teacher tutoring strategy.

X. Validation of the Instrument

The face and content validity of the instrument was carried out by three experts in mathematics education.

XI. Reliability of the Instrument

The internal consistency of MPT was established by carrying out a trial testing on a sample of 20 students who were not part of the sample for this study. The students were administered MPT once without any form of teaching with regards to the study. The answer scripts were retrieved, marked and graded in percentage. Reliability was computed using Kuder Richardson formula 20 (K-R 20) which yielded a reliability coefficient of 0.81. This reliability index showed that MPT was reliable for the conduct of the investigation.

XII. Method of Data Collection

The researchers prepared the lesson plans for the two groups with respect to the study curriculum content. The lesson plan for each group was prepared to have same specific instructional objectives and same content. The difference in the lesson plans was the teaching methods. The peer tutoring instructional strategy was used to teach the students in the experimental group while the teacher tutoring strategy was used to teach the control group. Thus, the researcher employed the intact class mathematics teachers and a peer tutor as research assistants to deliver the lessons. These teachers and the tutor were trained for two days by the researcher on the modality of the instruction.

The students in the two different groups were first given a pre-test of MPT tagged MPTA without any form of prior teaching. After the pre-test, the research assistants taught their respective group with the assigned lesson plans. To prevent a deviance from the study's objective, the researcher attentively monitored the research assistants during the lesson. Algebra was taught to the experimental group by the peer tutor, and the intact class instructor taught the control group..

A post-test of MPT tagged MPTB was given to the two groups after the teaching. The scripts for both pre-test and post-test was collated, marked and graded in percentage. The sample students were allowed for a period of two weeks without teaching after which a post post-test of MPT tagged MPTC which measured retention were administered to the two groups. The scripts for post posttest was also collated, marked and graded in percentage. The three sets of scores for each group were organized before subjecting for analysis using Statistical Package for Social Sciences (SPSS) version 23.

XIII. Method of Data Analysis

To provide descriptive answers to study questions, mean and standard deviation were employed. Analysis of Covariance was used for the study's null hypotheses testing at 0.05 level of significance.

XIV. Results

Table 1: Performance of students taught Algebra with and without PTIS

		Pre-test		Post-test		Performance Gain	
Group	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
PTIS	53	32.58	7.42	59.64	9.53	27.06	8.54
TIS	61	33.19	7.85	51.25	8.11	18.06	6.72

PTIS =Peer Tutoring Instructional Strategy

TIS = Teacher Instructional Strategy

Table 1 shows the mean and standard deviation on the difference in the performance of students taught Algebra with peer tutoring instruction and those taught with teacher instructional strategy. The result indicated that the students that were taught Algebra with peer tutoring instruction had a mean gain performance of 27.06, SD = 8.54 while those taught by the teacher had a mean gain performance of 18.06 SD = 6.72. This implies that the performance of students who were taught Algebra with peer tutoring instruction was higher than those taught with teacher instructional strategy.

Table 2: Retention of students taught Algebra with and without PTIS

		Posttest		Post-Posttest		Retention	
Group	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
PTIS	53	59.64	9.53	85.11	12.64	25.47	8.91
TIS	61	51.25	8.11	60.83	13.92	9.58	6.03

Table 2 shows the mean and standard deviation on the difference in the retention of students taught Algebra with peer tutoring instruction and those taught with teacher instruction. The result indicated that the students that were taught Algebra with peer tutoring instruction had a mean retention gain of 25.47, SD = 8.91 while those taught with deductive teaching method had a mean

retention gain of 9.58, SD = 6.03. This implies that the retention of students who were taught Algebra with peer tutoring instruction was higher than those taught without peer instruction.

Table 3: Summary of ANCOVA on the performance of students taught Algebra with and without PTIS

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4847.40[a]	2	2423.70	38.52	.00	.42
Intercept	6772.02	1	6772.02	107.63	.00	.25
Group	100.52	1	100.52	1.60	.43	.06
Pretest	4662.46	1	4662.46	74.10	.00	.40
Error	7613.38	111	62.92			
Total	461264.00	114				
Corrected Total	12460.77	113				

a.R Squared = .425 (Adjusted R Squared = .406)

Table 3 displayed the summary of the analysis of covariance (ANCOVA) on the performance differences between students who learned algebra via peer tutoring instructional strategy and without PTIS. Table 3 shows a significant difference in performance mean scores between students who received peer tutoring instruction and those who received deductive instruction (F1, 111=1.60, p =.03, p<.05, partial eta squared =.40). Due to the fact that the p-value was less than.05, H_{O1} was rejected.

Table 4: Summary of ANCOVA on the difference in the retention of students taught Algebra with and without PTIS

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	9386.62[b]	2	4693. 31	236.01	.00	.40
Intercept	999.89	1	999.89	50.28	.00	.27
Group	574.81	1	574.81	28.91	.00	.54
Posttest	8145.29	1	8145.29	409.59	.00	.38
Error	2406.25	111	19.89			
Total	559620.00	114				
Corrected Total	11792.87	113				

Group = PTIS

R Squared = .583 (Adjusted R Squared = .529)

Table 4 displayed the result of analysis of covariance (ANCOVA) summary that compared the retention rates of students who learned Algebra through peer tutoring vs those who learnt through the teacher instruction. Table 4 indicates that there is a significant difference in retention ability mean scores between students who received peer tutoring instruction and those who received teacher instruction (F1, 111=28.91, p =.00; p<.05, partial eta squared =.38). Due to the fact that the p-value was less than.05., HO2 was rejected.

XV. Discussion of Findings

The results of this study showed a substantial difference between those who learnt Algebra through peer tutoring instruction and those who used a deductive teaching style by the teacher. Hence, students taught Algebra using PTIS had higher performance

than their counterparts taught by the teacher. This finding could be due to the fact that the tutor and tutees were able to communicate freely with their peers in terms of asking and answering questions during the peer tutoring instruction. This finding agrees with Anidi and Obumeke-Okeke (2020) who found out in their study that students who were taught using peer tutoring instructional strategy had 88% positive effect on academic performance. Also in support of this finding was Gan (2008) whose study found that in order to promote active participation of students, teachers should adjust their teaching style to a more learner-centered one. One possible way is the peer tutoring teaching strategy. The likely explanation for this outcome may be connected to the fact that the PTIS helped the students to construct their own understanding since there is an interaction between previous knowledge and new knowledge.

The finding of this study in hypothesis two showed that there is a significant difference between the retention ability mean score of students who were taught with peer tutoring instruction and those who were taught with deductive teaching method by the teacher. This finding agrees with Oba (2019) who found in the study that the use of peer tutoring improved the retention of students than the use of teacher tutoring strategy, though with a statistically significant difference. In support of the finding also is Ujala and Kayadim (2017) who found in their study that the students who were both taught with reciprocal peer tutoring and class wide peer tutoring had a higher retention than the students that was taught with teacher tutoring strategy. This demonstrated that the performance of the experimental groups and the control group differed statistically significantly**.**

XVI. Conclusion

The use of peer tutoring as an instructional strategy was shown to be successful in raising senior secondary students' academic achievement and retention in Algebra. Compared to the usage of the deductive teaching approach, the instructional strategy has the potential to improve students' performance and retention in Algebra.

XVII. Recommendations

The recommendations below were made based on the results that were presented in this study.

1. Mathematics teachers should sometimes use the peer tutoring instruction to teach some mathematics concepts to enhance students' performance.
2. Mathematics teachers should be trained on how to use the peer tutoring instructional strategy to deliver mathematics concepts so that students' improved performance can be retained.

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