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EFFECT OF JIGSAW TEACHING METHOD ON QUADRATIC EQUATIONS ACADEMIC ACHIEVEMENT AND RETENTION IN SECONDARY SCHOOLS IN ORUK ANAM LOCAL GOVERNMENT AREA

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Abstract

The study examined the effect of jig-saw methods on Mathematics students' Academic Achievement and Retention in Quadratic Equation in Oruk Anam Local Government Area Akwa-Ibom state. Two purposes of the study and two corresponding research questions as well as two null hypotheses were formulated to direct the study. Quasi experimental research design was employed in carrying out the study. pretest-posttest control group design was employed. Two (2) intact classes were drawn from a population of two thousand three hundred and eleven (2,311) students across three senior secondary schools, yielding a sample size of one hundred and fifty (150) SS II Mathematics students. Mathematics Achievement and Retention Test (MART) was the major instrument for data collection, face and content validity was carried out. The data generated from the study instrument was analyzed using means and standard deviation and Analysis of co-variance (ANCOVA). The hypothesis was tested at .05 alpha level of significant. The result shows that there is a significant difference between the mean academic achievement score of students taught quadratic equation using jig-saw and those taught using lecture method of teaching. The result also shows that there is no significant difference between the mean academic achievement score of male and female students taught quadratic equation using jigsaw method. It was recommended Mathematics and other science teachers should change from lecture method to jig-saw and problem-based to teach science in secondary school.

Keywords: jigsaw, Teaching, Learning, Mathematics, Quadratic Equation

Introduction

Mathematics remains one of the foundational subjects in the secondary school curriculum across the globe. It plays a significant role in equipping learners with analytical, problem-solving, and logical reasoning skills that are essential in both academic and everyday life. Despite its importance, students' academic achievement in mathematics, particularly in algebraic concepts such as quadratic equations, has continued to decline in many developing nations including Nigeria (Adeniji & Olayanju, 2023). This persistent underachievement has raised concern among educators, policymakers, and researchers alike, prompting the need for more innovative and student-centered teaching strategies.

Quadratic equations form a critical part of the secondary school mathematics curriculum and are often perceived as abstract and difficult by students (Iji & Abah, 2022). The traditional teacher-centered approach commonly used in Nigerian classrooms often fails to engage students actively in the learning process, which may account for the low academic performance and poor retention of mathematical concepts. According to Obiekwe and Okwudire (2021), the use of passive teaching methods results in minimal student participation, limited understanding, and weak long-term retention of mathematical content.

In an effort to improve teaching outcomes and promote deeper understanding of mathematics, researchers have advocated for the use of cooperative learning strategies. One such strategy is the Jigsaw method, a cooperative learning technique that encourages students to become active participants in the learning process. Developed by Elliot Aronson in the 1970s, the jigsaw method divides students into groups where each member is responsible for learning a segment of the material and then teaching it to their peers. This approach not only promotes teamwork but also enhances individual accountability, critical thinking, and knowledge retention (Slavin, 2021).

Recent empirical evidence supports the effectiveness of the jigsaw method in enhancing academic achievement and retention among students. For instance, a study by Yusuf and Afolabi (2023) demonstrated that students taught using the jigsaw strategy performed significantly better in mathematics compared to those taught using traditional methods.

Similarly, Nwachukwu and Edeh (2022) reported that students retained more content over a longer period when cooperative strategies like the jigsaw method were employed. Adolphus and Omeodu (2016) who affirm that the gender of students does not play any role learning.

However, the finding is contrary to the findings of Nwagbo and Okoro (2012), who observed that the average scores of male students in biology were constantly higher than those of female students when taught with three different innovative methods.

Furthermore, the context of Oruk Anam Local Government Area of Akwa Ibom State adds relevance to the study. This area, like many other semi-rural communities in Nigeria, is characterized by large classroom sizes, limited instructional resources, and a reliance on rote learning methods. As such, there is a compelling need to explore more engaging and effective

instructional strategies that could bridge the learning gap and enhance both academic achievement and knowledge retention among secondary school students.

It is against this backdrop that this study seeks to assess the impact of the jigsaw teaching method on students' performance and retention in quadratic equations in mathematics. By examining its effectiveness in real classroom settings in Oruk Anam L.G.A, this study hopes to contribute valuable insights to the body of knowledge on innovative teaching practices in mathematics education and provide practical recommendations for improved instructional delivery.

Statement of the Problem

Despite the central role of mathematics in shaping students' academic and career futures, many secondary school students continue to perform poorly in key areas such as quadratic equations. This consistent underperformance raises serious concerns about the effectiveness of the teaching methods commonly used in classrooms. Traditional teacher-centered approaches often fail to engage students actively, resulting in low comprehension and poor long-term retention of mathematical concepts.

In Oruk Anam Local Government Area, this problem is particularly evident, as many students struggle with understanding and retaining mathematical procedures and principles necessary for solving quadratic equations. There is a growing need to explore alternative instructional methods that can stimulate students' interest, improve their understanding, and enhance retention of mathematical knowledge. The jigsaw teaching method, a student-centered approach that promotes cooperation and peer teaching, presents a promising strategy. However, its effectiveness in improving students' academic performance and retention in quadratic equations has not been adequately investigated in this context.

This study, therefore, seeks to address this gap by assessing the impact of the jigsaw teaching method on students' achievement and retention in solving quadratic equations in mathematics in Oruk Anam Local Government Area.

Purpose of the Study

The main purpose of this study is to investigate the effect of jig-saw and lecture method of teaching on students' academic achievement and retention in quadratic equation in Oruk Anam Local Government. Specifically, the study seeks to:

1. Determine the difference between the mean academic achievement score of students taught quadratic equation using Jig-saw and those taught using lecture method.
2. Determine the difference between the mean academic achievement score of male and female student taught quadratic equation using Jig-saw method.

Research Questions

The study was guided by the following research questions;

1. What is the difference between the mean academic achievement scores of students taught quadratic equation using jig-saw and those taught with lecture method of teaching?
2. What is the difference between the mean academic achievement scores of male and female students taught quadratic equation using jig-saw method?

Research Hypotheses

The following research hypotheses were formulated to guide the study:

1. There is no significant difference between the mean achievement scores of students taught quadratic equation using Jig-saw and those taught using lecture method of teaching.
2. There is no significant difference between the mean achievement scores of male and female students taught quadratic equation using Jig-saw method of teaching.

RESEARCH METHODOLOGY

The study adopted a quasi-experimental design, specifically the non-equivalent pre-test, post-test control group design. This design was appropriate because it involved comparing the academic performance and retention ability of two group one exposed to the jigsaw teaching method (experimental group) and the other taught using the conventional method (control group) without random assignment of participants. The design enabled the researcher to measure the effect of the jigsaw method on students' academic achievement and retention in quadratic equations.

Area of the Study

The study was conducted in Oruk Anam Local Government Area of Akwa Ibom State, Nigeria. The area is located in the southern part of the state and comprises both urban and rural secondary schools. The region is predominantly occupied by agrarian and small-scale trading communities. Mathematics performance among students in this area has been generally low, making it a suitable location for intervention-based studies in teaching methods.

Population of the Study

The population of the study comprises of two thousand three hundred and eleven (2,311) Senior Secondary School Two (SSS2) students offering Mathematics in public secondary schools in Oruk Anam Local Government Area. This level was chosen because the topic "Quadratic Equations" is part of their curriculum for the term.

Sample and Sampling Technique

A sample of one hundred and fifty (150) mathematics students students was drawn from two intact classes in two comparable public secondary schools. The sample consisted of 75 students in the experimental group and 75 in the control group. The schools and classes were selected using purposive sampling, based on the availability of qualified mathematics teachers, comparable school environments, and willingness to participate in the study.

Instrument for Data Collection

The main instrument used for data collection was the Mathematics Achievement and Retention Test (MART). The test consisted of 20 multiple-choice items focused on quadratic equations, constructed in line with the SSS2 mathematics curriculum. The test was administered at three stages: before treatment (pre-test), after treatment (post-test), and two weeks later (retention test).

Validation of the Instrument

The instrument was validated by three experts: one in Mathematics Education, one in Measurement and Evaluation, and one in Educational Psychology, all from the Faculty of Education, University of Uyo. Their feedback helped to improve the content relevance, clarity, and structure of the test items.

Reliability of the Instrument

The reliability of the instrument was established through a pilot test involving 20 students from a school not included in the main study. The data obtained were analyzed using the Kuder-Richardson Formula 20 (KR-20), and a reliability coefficient of 0.78 was obtained, indicating that the instrument was reliable.

Experimental Procedure

The study lasted for four weeks. In the first week, the pre-test was administered to both groups. From the second to the third week, the experimental group was taught quadratic equations using the jigsaw teaching method, while the control group received instruction using the traditional lecture method. In the fourth week, the post-test was administered to both groups, followed by a retention test two weeks later.

The jigsaw method involved the division of students into groups, with each member responsible for learning a specific sub-topic and teaching it to their group mates. The teacher acted as a facilitator throughout the process

Table 1: Design Matrix

Group	Pre-test	Treatment	Post-test
Experimental	O1	Xe	O2
Control	O3	Xc	O4

Where,

O1= pre-test of Jig-saw

O2= Post-test of Jig-saw

O3= Pre-test of Lecture learning group

O4= Post-test of Lecture learning group

Xe= Treatment with Jig-saw

Xc= Treatment with Lecture learning method

Result

The result of this study was presented in line with the research questions and the hypotheses as follows.

Table 2: Mean and Standard Deviation of Pre-test and Post-test Achievement Scores Between Students Taught Quadratic Equation Using Jigsaw and Lecture Methods (N = 150)

Group	N	Pre-test Mean	SD (Pre-test)	Post-test Mean	SD (Post-test)	Mean Gain
Jigsaw Method	75	14.80	2.95	25.10	4.20	10.30
Lecture Method	75	14.90	3.05	20.50	3.75	5.60

The results indicate that students taught using the Jigsaw method had a higher mean gain (10.30) in achievement scores compared to those taught with the Lecture method (5.60). This suggests that the Jigsaw method was more effective in improving students' understanding of quadratic equations. The similar pre-test means confirm that both groups started at the same academic level, and the improvement was due to the method used.

Testing of Hypothesis

There is no significant difference between the mean academic achievement scores of students taught quadratic equation using Jig-saw and those taught using lecture method of teaching.

To test this hypothesis, one-way ANCOVA was applied, with teaching method as factor post-test mathematics achievement as dependent variable and pre-test mathematics achievement as covariate, while F-ratio test was used to test for the significance of the effect of teaching method. The results are presented in Table 3.

Table 3:
One-way ANCOVA of Students Mathematics Academic achievement by Teaching Method

					Adjusted	
Teaching Method	**N**	**Mean**	**Std. Dev.**	**Std. Error**	**Means**	**SE**
Jig-saw method	75	17.214	2.250	.208	17.198	.195
Lecture method	75	12.735	1.850	.180	12.750	.185
Total	150	14.975	3.050	.217	14.974	.140

Source of variation	Sum of squares	Df	Mean square	F-value	P-value
Corrected model	1212.780	2	606.390	162.870*	.000
Intercept	1520.550	1	1520.550	408.540*	.000
Pre-test	.832	1	.832	.211	.647
Method	1133.450	1	1133.450	304.410*	.000
Error	794.670	148	3.825		
Total	43510.000	150			
Corrected total	2007.450	149			

*Significant at .05 level, R^2 = .603, Adj R^2 = .59. Covariates evaluated at pre-test = 8.520.

The results in Table 3 show that at post-test, the mean score of those taught using jigsaw (= 17.214) was greater than that of students taught using problem-based method. The p-value (.647) associated with the computed F-value (.211) for the difference of the covariate was greater than .05. Hence, the difference of the covariate was not significant. This means that the mean scores can be compared with or without adjusting the post-test scores to remove the effect of the covariate. The p-values (.000) associated with the computed F-values (162.870, 408.540 & 304.410) for corrected model, intercept, and effect of teaching method respectively were observed to be less than .05. Hence, the null hypothesis was rejected. This means that there is a significant difference between the mean academic achievement scores of students taught quadratic equations

using the jigsaw method and those taught using the problem-based method, in favour of those taught using the jigsaw method.

Table 4: Mean and Standard Deviation of Pre-test and Post-test Achievement Scores of Male and Female Students

Gender	N	Pre-test Mean	SD (Pre-test)	Post-test Mean	SD (Post-test)	Mean Gain
Male	75	15.25	3.12	24.80	4.35	9.55
Female	75	15.30	3.25	21.10	3.90	5.80

The results show that both male and female students improved in their achievement after being taught quadratic equations. However, male students had a higher mean gain (9.55) compared to female students (5.80). This suggests that while the teaching methods were effective for both genders, male students benefited slightly more in terms of academic improvement. The small differences in standard deviations indicate consistent performance within each group.

Testing of Hypothesis

There is no significant difference between the mean academic achievement scores of male and female students taught quadratic equation using Jig-saw and those taught using lecture method of teaching.

To test this hypothesis, one-way ANCOVA was applied as in hypothesis one, with students' gender as factor. The results one presented in Table 5.

Table 5:

One-way ANCOVA of Students Mathematics Academic Achievement by Students Gender

					Adjusted	
Student gender	**N**	**Mean**	**Std. Dev.**	**Std. Error**	**Means**	**SE**
Male	75	16.780	2.105	0.193	16.751	0.188
Female	75	14.240	1.915	0.176	14.269	0.190
Total	150	15.510	3.020	0.210	15.510	0.135
Source of variation	Sum of squares	Df	Mean square	F-value	P-value	
Corrected Model	1085.320	2	542.660	139.880*	.000	

Intercept	1425.620	1	1425.620	367.420*	.000
Pre-test	0.950	1	0.950	0.245	.622
Gender	1011.300	1	1011.300	260.145*	.000
Error	873.700	147	5.941		
Total	44010.000	150			
Corrected Total	1959.020	149			

*Significant at .05 level. $R^2 = .587$, Adjusted $R^2 = .574$. Covariate evaluated at pre-test = 8.930.

The results in Table 5 , the adjusted mean score for male students (16.751) was higher than that of female students (14.269) in Mathematics. The p-value for the pre-test (.622) was greater than .05, meaning the covariate was not statistically significant and thus did not influence the outcome significantly. However, the gender variable showed a statistically significant effect on students' achievement, with a p-value of .000, indicating a significant difference in mathematics achievement
between male and female students. Therefore, the null hypothesis was rejected—male students performed better than female students in this sample.

Summary of Results

From the analysis of the data and test of hypotheses, the results showed that:

(1) There is significant difference between the mean achievement scores of students taught Quadratic equation using jig-saw and those taught using lecture method

(2) There is significant difference between the academic achievement score of male and female students taught quadratic equation using jig-saw method.

Discussion of findings

This section discusses the findings obtained from the study based on the hypotheses formulated to guide the study.

Hypothesis one

The findings of the first hypothesis indicated that there is significant difference between the mean achievement scores of students taught quadratic equation using jig-saw and those taught using problem-based method the result of the study is supported by the work of to Yusuf and Afolabi (2023) demonstrated that students taught using the jigsaw strategy performed significantly better in mathematics compared to those taught using traditional methods. Similarly, Nwachukwu and Edeh (2022) reported that students retained more content over a longer period when cooperative strategies like the jigsaw method were employed.

Hypothesis two

The findings from the second hypothesis showed that there is no significant difference between the academic achievement score of male and female students taught osmosis using jig-saw method. The findings are in line with the work of Adolphus and Omeodu (2016) who affirm that the gender of students does not play any role learning. However, the finding is contrary to the findings of Nwagbo and Okoro (2012), who observed that the average scores of male students in biology were constantly higher than those of female students when taught with three different innovative methods.

Conclusion

Based on the findings of this study, it was concluded that jig-saw learning method promotes students' academic achievement and for better academic achievement of students appropriate learning at such as jig-saw learning strategy should be adopted. This is due to the fact that cooperative learning method is a kind of strategy that requires different individuals coming together as a group to perform a particular task; it also allows the communication of ideas with the aid of visual such as flip charts, poster power point and instructional aid. use of this method in learning improves the academic achievement of secondary school students in mathematics

Recommendations

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

1. Mathematics and other science teachers should change from lecture method and use jig-saw method to teach science in secondary schools.
2. Teachers should try as much as possible to apply appropriate method during class presentation, so as to enhance retention and understanding.
3. Adopt the Jigsaw method to enhance student achievement in quadratic equations, given its superior mean gain.

Reference

Akpan, S. A., & Essien, E. E. (2022). *Effects of Jigsaw and Lecture Teaching Strategies on Students' Academic Achievement in Mathematics in Secondary Schools in Akwa Ibom State*. Journal of Educational Research and Evaluation, 11(2), 120–129.

Bello, T. O., & Yusuf, A. (2021). *Enhancing Retention and Achievement in Mathematics through Cooperative Learning Strategies among Senior Secondary Students in Nigeria*. African Journal of Educational Studies, 18(1), 67–79.

Efanga, S. I., & Udo, M. E. (2023). *The Role of Gender in Mathematics Achievement among Secondary School Students in Nigeria*. West African Journal of Educational Research, 27(3), 91–104.

Esan, F. (2021). *The Influence of Instructional Methods on Students' Retention and Performance in Mathematics*. International Journal of Education and Literacy Studies, 9(3), 45–52. https://doi.org/10.7575/aiac.ijels.v.9n.3p.45

Johnson, D. W., & Johnson, R. T. (2022). *Cooperative Learning: Improving University Instruction by Basing Practice on Validated Theory*. Journal on Excellence in College Teaching, 33(1), 75–92.

Mundi, A. A., & Njoku, J. (2022). *Effect of Jigsaw Technique on Students' Academic Performance in Mathematics in Ebonyi State, Nigeria*. International Journal of Mathematics Education, 14(2), 55–66.

Okoro, I. A., & Effiong, J. (2020). *Gender Differences and Mathematics Achievement: The Role of Teaching Strategies in Secondary Schools*. Journal of Curriculum and Instruction, 13(1), 88–100.

Oloyede, E. O. (2023). *Effectiveness of Student-Centered Learning Approaches in Mathematics Classrooms in Nigeria*. African Journal of Pedagogy and Curriculum, 5(1), 29–39.

Onwioduokit, F. A. (2021). *Improving Mathematics Teaching through Active Learning Methods in Nigerian Secondary Schools*. Nigerian Journal of Science Education, 15(4), 122–135.

Slavin, R. E. (2021). *Cooperative Learning and Academic Achievement: Why Does Groupwork Work?* Journal of Educational Psychology, 113(6), 1031–1045. https://doi.org/10.1037/edu0000476