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Effects of Jigsaw and Numbered-Head-Together Instructional Strategies on Achievement and Retention in Algebraic Concept among Secondary School Students in Minna Metropolis, Niger State, Nigeria

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Abstract

This study investigated the effects of Jigsaw and Numbered Heads Together (NHT) instructional strategies on students' achievement and retention in algebra among senior secondary school students in Minna Metropolis, Niger State, Nigeria, with particular attention to the inclusion of a control (conventional teaching) group and the influence of gender. A quasi-experimental, non-equivalent control group pre-test, post-test design was adopted. The population comprised 1,892 SS II students in public secondary schools in Minna Metropolis, from which a sample of 349 students was purposively selected from five schools. Two schools constituted Experimental Group I (Jigsaw, $n = 124$), two schools constituted Experimental Group II (NHT, $n = 141$), and one school served as the Control Group (conventional method, $n = 84$), comprising 190 males and 159 females. Data were collected using the Algebra Achievement Test (AAT) and Algebra Retention Test (ART), each consisting of 40 multiple-choice items adapted from WAEC past questions (2014–2023). The instruments were validated by experts, and reliability coefficients of 0.92 (AAT) and 0.89 (ART) were obtained using the KR-20 method. Data were analysed using mean, standard deviation, One-way Analysis of Variance (ANOVA), and independent samples z-test at the 0.05 level of significance. The results revealed a statistically significant difference in students' achievement scores among the three groups, $F(2, 346) = 18.647, p < 0.05$. Post-hoc analysis indicated that students taught using NHT achieved the highest scores, followed by those taught using Jigsaw, while the control group recorded the lowest performance. Similarly, a significant difference was observed in retention scores, $F(2, 346) = 26.843, p < 0.05$, with NHT producing the highest retention, followed by Jigsaw, and the control group showing the least retention.

Keywords: Jigsaw, Numbered-Head-Together, Algebra, Achievement

Introduction

Mathematics occupies a central position in the Nigerian senior secondary school curriculum and is recognised as a compulsory subject because of its indispensable role in national development, technological advancement, and everyday problem-solving. The Federal Ministry of Education emphasises that mathematics equips learners with logical reasoning, quantitative skills, and analytical abilities needed for success in science, engineering, commerce, and modern societal demands. Within the mathematics curriculum, algebra stands as a core component, serving as the gateway to higher-order topics such as trigonometry, calculus, and advanced statistics. However, persistent reports of students' weak performance in algebra across Nigerian schools highlight the need to strengthen instructional practices and improve learner outcomes. According to Adeoye



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(2024), enhancing students' foundational understanding of algebra is critical, as it forms the backbone of mathematical proficiency required for both academic and real-life applications. Algebra is one of the foundational topics in secondary school mathematics, playing a pivotal role in students' ability to engage with more advanced mathematical concepts such as calculus and geometry. Despite its importance, many students encounter difficulties in understanding and retaining algebraic concepts, often resulting in low achievement scores. Studies by Yahaya *et al.* (2020) indicated that the abstract nature of algebra contributes to students' struggles, making it difficult for them to conceptualize and apply the principles learned in class. These challenges have raised questions about the effectiveness of conventional teaching methods, which tend to be more teacher-centered and less engaging. Consequently, there is a need for alternative teaching strategies that can improve both achievement and retention in algebra. One of the most promising alternatives to traditional instruction is cooperative learning, a teaching approach where students work together to achieve shared learning goals.

Cooperative learning strategy refers to an instructional method in which students work together in small groups to achieve shared learning objectives, helping one another understand concepts while developing interpersonal and cognitive skills. This approach encourages mutual accountability, discussion, and peer-assisted problem solving, making learning more interactive and meaningful. Research by Johnson and Johnson (2019) shows that cooperative learning enhances student engagement and promotes deeper understanding of academic content. Cooperative learning strategies, such as Jigsaw and Numbered Heads Together (NHT), emphasize students' collaboration and interaction, which have been found to positively impact both academic achievement and retention (Slavin, 2020). These strategies create an environment where students not only acquire knowledge but also develop critical thinking, communication, and problem-solving skills, all of which are essential for mastering algebra. One such strategy that exemplifies these benefits is the Jigsaw method, which emphasizes collaborative learning through peer teaching and shared responsibility. The Jigsaw instructional strategy is a cooperative learning approach in which instructional content is divided into segments, and each student in a small group is assigned responsibility for mastering and teaching a specific portion of the material to their peers (Slavin, 2020). Students first meet in "expert groups" to study and discuss their assigned topics before returning to their original groups to share their understanding. This structure promotes active engagement, individual accountability, and interdependence among learners (Okoli and Adamu, 2021). Studies conducted in Mathematics and other subjects have reported significantly higher achievement scores for students taught using Jigsaw compared to those taught with conventional methods, suggesting that collaborative peer teaching improves comprehension and performance (Johnson *et al.*, 2021; Yemi *et al.*, 2025). The Numbered Heads Together (NHT) instructional strategy, developed by Kagan (1989), is a cooperative learning approach that fosters collaboration and active participation among students. In this strategy, learners work in small groups to discuss and solve academic problems, with one member randomly selected to present the group's response. Unlike the Jigsaw method, NHT emphasizes equal contribution from all group members, as any student may be called upon to report the group's answer. Research indicates that the NHT strategy enhances student engagement and participation, as the possibility of being randomly selected motivates learners to remain attentive and contribute meaningfully to group discussions (Yusuf *et al.*, 2020).

Retention, defined as the ability to recall and apply learned concepts over time, is a critical variable in educational success. A study carried out by Lee and Kim (2021) revealed that students taught



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using the Jigsaw strategy retained Algebra concepts more effectively than those exposed to the Numbered Heads Together (NHT) method. The Jigsaw approach promotes retention by requiring students to master a segment of content and teach it to their peers, reinforcing understanding through repetition and active engagement. Similarly, the NHT strategy enhances retention by ensuring that all group members contribute to problem-solving, as any student may be randomly selected to present the group's solution, thereby maintaining attentiveness and accountability (Yusuf *et al.*, 2020). Some studies have shown that teaching methods emphasizing peer interaction, collaborative discussion, and repeated engagement with content significantly improve long-term retention of learned concepts (Brown and Taylor, 2022; Miller, 2019). By fostering active participation, shared responsibility, and repeated exposure to Algebraic content, cooperative learning strategies like Jigsaw and NHT support not only immediate achievement but also the sustained retention of knowledge, which is essential for continuous learning and mastery of mathematical concepts. While both the Jigsaw and Numbered Heads Together (NHT) strategies have been shown to enhance student achievement (Jack and Yawe, 2023; Smith *et al.*, 2020), their impact on retention is particularly significant. Retention – the ability to recall and apply learned material over time – is a key indicator of long-term academic success (Brown and Taylor, 2022). Studies have indicated that students exposed to cooperative learning approaches demonstrate higher retention rates than those taught via traditional methods, as active engagement promotes deeper cognitive processing and memory consolidation (Ibrahim *et al.*, 2022). In the context of Algebra, a concept characterized by abstraction and the integration of multiple mathematical ideas, the Jigsaw strategy enables students to master discrete units before teaching them to peers, while NHT encourages collaborative problem-solving, fostering critical understanding of algebraic principles. Furthermore, these strategies may enhance self-efficacy, communication, and teamwork skills, which collectively contribute to sustained achievement. Given these benefits, it is important to examine whether gender differences moderate the effectiveness of Jigsaw and NHT on students' retention and achievement in Algebra concepts. Both Jigsaw and NHT strategies represent powerful tools for enhancing students' achievement and retention in Algebra concepts. By fostering collaboration, accountability, and active engagement, these strategies promote deeper understanding of algebraic principles and improve learners' ability to retain and apply knowledge over time. Nonetheless, further research is necessary to compare the relative effectiveness of these strategies and to determine optimal implementation in diverse educational settings. This study aims to address this gap by exploring the effects of the Jigsaw and NHT strategies on students' achievement and retention in Algebra concepts.

Statement of the Research Problem

Persistent poor performance in Mathematics is a major challenge in Nigerian secondary schools, particularly in Minna metropolis, Niger State. A credit pass in Mathematics is required for admission into most science and technology-based courses at tertiary institutions; thus, low achievement limits students' opportunities and undermines national technological and economic development (Abimbola, 2020; Haruna and Wushishi, 2025). Examination results reflect this problem: in 2025, NABTEB recorded a 94.60% credit pass rate, NECO 60.26%, while WAEC reported only 38.32% of candidates achieving credits in at least five subjects, including Mathematics and English Language the lowest since 2015 (NABTEB, 2025; NECO, 2025; WAEC, 2025). Algebra has been identified as a major contributor to this underachievement due to its abstract and cumulative nature (Iroko and Olaoye, 2022). Factors contributing to poor performance include inadequate instructional facilities, shortage of qualified teachers, Mathematics anxiety, cultural beliefs, gender stereotypes, and reliance on teacher-centred methods (Iroko and Olaoye, 2022; Zakaria *et al.*, 2023). Cooperative learning strategies, such as the Jigsaw and Numbered Heads Together (NHT) methods, have shown



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promise in improving engagement and achievement. However, most studies have focused on other subjects, measured only short-term outcomes, or failed to compare multiple strategies in the same context. In Minna metropolis, there is a need to investigate the effectiveness of instructional strategies on students' achievement and retention of algebraic concepts. This study aims to fill this gap by investigating the effects of Jigsaw and NHT strategies on students' academic achievement and retention in Algebra

Aim and Objectives of the Study

The aim of this study is to investigate the effects of the Jigsaw and Numbered Heads Together (NHT) cooperative learning strategies on students' achievement and retention in algebra among senior secondary school students in Minna metropolis. The objectives of this study are to:

- i. Determine the effects of Jigsaw and Numbered Heads Together (NHT) strategies on achievement in algebraic concepts among senior secondary school students in Minna Metropolis
- ii. Examine the effects of Jigsaw and Numbered Heads Together (NHT) strategies on retention of algebraic concepts among senior secondary school students in Minna Metropolis

Research Questions

The following research questions will be asked and answered in this study:

- i. What is the difference in the mean achievement scores of senior secondary school students taught algebraic concepts using Jigsaw strategy and those exposed to Numbered Heads Together (NHT) strategy in Minna Metropolis?
- ii. What is the difference in the mean retention scores of senior secondary school students taught algebraic concepts using Jigsaw strategy and those exposed to Numbered Heads Together (NHT) strategy in Minna Metropolis?

Research Hypotheses

The following null hypotheses will be tested at the 0.05 level of significance:

- H₀₁:** There is no significant difference in the mean achievement scores of senior secondary students taught algebraic concepts using the Jigsaw strategy and those taught using the NHT strategy.
- H₀₂:** There is no significant difference in the mean retention scores of algebraic concepts between students taught algebraic concept using the Jigsaw strategy and those taught using the NHT strategy.

Research Methodology

This study adopted a quasi-experimental design, specifically a non-equivalent control group pre-test/post-test design, to investigate the effects of Jigsaw and Numbered Heads Together (NHT) strategies on the achievement and retention of algebraic concepts among senior secondary school students in Minna Metropolis, Niger State. Two experimental groups were formed: one group received instruction through the Jigsaw strategy, while the other was taught using the NHT strategy. A control group was exposed to traditional teacher-centred instructional methods. Pre-tests were administered to all groups prior to the intervention to establish baseline performance in algebraic concepts and ensure comparability among the groups. Following this, the respective instructional strategies were implemented over a specified period. Upon completion of the intervention, post-tests were conducted to measure students' achievement and retention of algebraic concepts. This design enabled the researcher to evaluate the relative effectiveness of Jigsaw and NHT strategies in enhancing student learning outcomes, while accounting for initial differences in students' prior knowledge. Quantitative data from the pre-tests and post-tests were analysed to answer the research questions and test the hypotheses.



Presentation of Results

Research Question One:

What is the difference in the mean achievement scores of senior secondary school students taught algebraic concepts using the Jigsaw strategy, the Numbered Heads Together (NHT) strategy, and conventional teaching method?

To answer research question one, Mean and Standard Deviation were used to determine the achievement gains. The results are presented in Table 1.

Table 1: Mean and Standard Deviation of Achievement Scores of Students Taught Algebraic Concepts Using Jigsaw, NHT, and Conventional Strategies

Group	Strategy	N	Pretest		Posttest		Mean Gain
			\bar{x}_1	SD_1	\bar{x}_2	SD_2	
Experimental I	Jigsaw	124	25.69	9.78	43.78	10.63	18.08
Experimental II	Numbered Heads Together	141	27.47	10.99	47.12	11.00	19.65
Control Group	Conventional	84	26.42	9.85	38.45	8.92	12.03

\bar{x}_1 : Mean of Pretest; SD_1 = Standard Deviation of Pretest; \bar{x}_2 : Mean of Posttest; SD_2 = Standard Deviation of Posttest

Table 1. shows that all three groups demonstrated improvement from pretest to posttest. Students taught using the Jigsaw strategy (Experimental Group I) obtained a pretest mean score of 25.69 (SD = 9.78), while their posttest mean score increased to 43.78 (SD = 10.63), resulting in a mean gain of 18.08. Students taught using the Numbered Heads Together strategy (Experimental Group II) recorded a pretest mean score of 27.47 (SD = 10.99) and a posttest mean score of 47.12 (SD = 11.00), yielding a mean gain of 19.65. In contrast, students in the Control Group exposed to conventional teaching methods achieved a pretest mean of 26.42 (SD = 9.85) and a posttest mean of 38.45 (SD = 8.92), with a mean gain of only 12.03. The results indicate that both cooperative learning strategies (Jigsaw and NHT) substantially improved students' achievement in algebraic concepts compared to conventional instruction. However, the group exposed to the Numbered Heads Together strategy achieved the highest mean gain (19.65), followed by the Jigsaw group (18.08), while the Control group demonstrated the lowest gain (12.03). This reveals a clear hierarchy of instructional effectiveness: Numbered Heads Together > Jigsaw > Conventional teaching method.

Research Question Two:

What is the difference in the mean retention scores of senior secondary school students taught algebraic concepts using the Jigsaw strategy, the Numbered Heads Together (NHT) strategy, and conventional teaching method?

To answer research question two, mean and standard deviation were used to determine the retention levels. The results are presented in Table 2.

Table 2: Mean and Standard Deviation of Retention Scores of Students Taught Algebraic Concepts Using Jigsaw, NHT, and Conventional Strategies

Group	Strategy	N	Posttest		Retention		Mean Loss
			\bar{x}_2	SD_2	\bar{x}_3	SD_3	
Experimental I	Jigsaw	124	43.78	10.63	40.57	9.88	3.21



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Experimental II	Numbered Heads Together	141	47.12	11.00	44.94	10.07	2.18
Control Group	Conventional	84	38.45	8.92	32.18	7.85	6.27

\bar{x}_2 : Mean of Posttest; SD_2 = Standard Deviation of Posttest; \bar{x}_3 : Mean of Retention; SD_3 = Standard Deviation of Retention

Table 2 shows that all three groups experienced some decay in knowledge retention over time; however, the magnitude of loss varied substantially across instructional conditions. Students taught using the Jigsaw strategy (Experimental Group I) obtained a posttest mean score of 43.78 (SD = 10.63), while their retention test mean score decreased to 40.57 (SD = 9.88), resulting in a mean loss of 3.21. Students taught using the Numbered Heads Together strategy (Experimental Group II) recorded a posttest mean score of 47.12 (SD = 11.00) and a retention test mean score of 44.94 (SD = 10.07), yielding a mean loss of 2.18. In contrast, students in the Control Group exposed to conventional teaching methods achieved a posttest mean of 38.45 (SD = 8.92) and a retention mean of 32.18 (SD = 7.85), with a substantial mean loss of 6.27. The results indicate that both cooperative learning strategies (Jigsaw and NHT) demonstrated superior retention compared to conventional instruction. However, the group exposed to the Numbered Heads Together strategy achieved the lowest mean loss (2.18), followed by the Jigsaw group (3.21), while the Control group exhibited the highest knowledge decay (6.27). This reveals a clear hierarchy of retention effectiveness: Numbered Heads Together > Jigsaw > Conventional teaching method. In terms of percentage retention, students in the Jigsaw group retained 92.7% of their posttest knowledge, students in the NHT group retained 95.4%, while students in the Control group retained only 83.7% of their posttest knowledge. This represents a difference of 11.7 percentage points between NHT and Control, and 9.0 percentage points between Jigsaw and Control, both favoring the cooperative learning strategies.

Hypothesis One (H₀₁): There is no significant difference in the mean achievement scores of senior secondary students taught algebraic concepts using the Jigsaw strategy, the Numbered Heads Together (NHT) strategy and those taught using the conventional teaching method.

To test this hypothesis, which determine whether these observed differences among the three groups were statistically significant, a One-way ANOVA was conducted. The results are presented in Table 3.

Table 3: Summary of One-way ANOVA Analysis of Posttest Achievement Scores

Source	SS	df	MS	F	Sig. (p)
Between Groups	3,847.52	2	1,923.76	18.647	0.000
Within Groups	35,742.18	346	103.30		
Total	39,589.70	348			

Note: SS = Sum of Squares; MS = Mean Square; df = degrees of freedom; p < 0.05 (significant)

The results in Table 3 shows that there is a statistically significant difference among the three groups, F (2, 346) = 18.647, p = 0.000 (p < 0.05). This indicates that the instructional strategies (Jigsaw, NHT, and conventional method) had significantly different effects on students' achievement in algebraic concepts. Consequently, the null hypothesis (H₀₁) is rejected. To determine the specific group differences, a Sidak post-hoc test was conducted. The results are presented in Table 4



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Table 4: Sidat Post-hoc Test Results for Achievement Comparison

Comparison (I - J)	Mean Diff. (I-J)	SE	Sig. (p)
NHT - Control	8.67	1.21	0.000
Jigsaw - Control	5.33	1.26	0.000
NHT - Jigsaw	3.34	1.17	0.013

*Note: * $p < 0.05$, ** $p < 0.001$; SE = Standard Error

The post-hoc analysis in Table 4 indicates that students in the Numbered Heads Together (NHT) group performed significantly better than those in the control (conventional) group by a mean difference of 8.67 ($p < 0.05$). Similarly, students in the Jigsaw group also achieved significantly higher scores than those in the control group, with a mean difference of 5.33 ($p < 0.05$). Furthermore, the NHT group significantly outperformed the Jigsaw group by a mean difference of 3.34 ($p < 0.05$). These results imply that both cooperative learning strategies (Jigsaw and NHT) are more effective than the conventional teaching method in improving students' achievement in algebraic concepts, with the Numbered Heads Together (NHT) strategy emerging as the most effective, followed by the Jigsaw strategy, while the conventional method yielded the least performance.

Hypothesis Two (H₀₂): There is no significant difference in the mean retention scores of algebraic concepts between students taught algebraic concept using the Jigsaw strategy and those taught using the NHT strategy.

To determine whether the observed differences in retention scores among the three groups were statistically significant, a One-way Analysis of Variance (ANOVA) was conducted. The results are presented in Table 5.

Table 5: Summary of One-way ANOVA Analysis of Retention Test Scores

Source	SS	df	MS	F	Sig. (p)
Between Groups	5,124.38	2	2,562.19	26.843	0.000
Within Groups	33,018.72	346	95.43		
Total	38,143.10	348			

Note: SS = Sum of Squares; MS = Mean Square; df = degrees of freedom; $p < 0.05$ (significant)

The ANOVA results in Table 5 shows that there is a statistically significant difference among the three groups, $F(2, 346) = 26.843$, $p = 0.000$ ($p < 0.05$). This indicates that the instructional strategies (Jigsaw, Numbered Heads Together, and conventional method) had significantly different effects on students' retention of algebraic concepts. To determine the specific group differences, Tukey's HSD post-hoc test was conducted. The results are presented in Table 6.

Table 6: Tukey HSD Post-hoc Test Results for Retention Comparison

Comparison (I - J)	Mean Diff. (I-J)	SE	Sig. (p)
NHT - Control	12.76	1.16	0.000
Jigsaw - Control	8.39	1.21	0.000



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NHT - Jigsaw	4.37	1.13	0.000
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*Note: ** $p < 0.001$; SE = Standard Error

The post-hoc analysis in Table 6 indicates that students taught using the Numbered Heads Together (NHT) strategy had significantly higher retention scores than those taught using the conventional method, with a mean difference of 12.76 ($p < 0.05$). Similarly, students in the Jigsaw group also demonstrated significantly better retention than those in the control (conventional) group, with a mean difference of 8.39 ($p < 0.05$). Furthermore, the NHT group significantly outperformed the Jigsaw group, with a mean difference of 4.37 ($p < 0.05$). These results indicate that both cooperative learning strategies (Jigsaw and Numbered Heads Together) are significantly more effective than the conventional teaching method in enhancing students' retention of algebraic concepts. Among the three approaches, the Numbered Heads Together (NHT) strategy demonstrated the highest effectiveness in promoting long-term retention, followed by the Jigsaw strategy, while the conventional method produced the least retention outcomes.

Discussion of Findings

This study was designed to investigate the differential effects of two cooperative learning strategies: Jigsaw and Numbered Heads Together (NHT) on senior secondary school students' achievement and retention of algebraic concepts in Minna Metropolis, Nigeria. Additionally, the study examined whether gender moderates the effectiveness of these instructional approaches. The findings reveal significant differences between the two strategies and conventional method in terms of learning outcomes, while demonstrating equitable effects across gender groups. The finding that students taught using the Numbered Heads Together strategy achieved significantly higher posttest scores compared to those taught using the Jigsaw strategy aligns with the fundamental principles of cooperative learning theory. The NHT strategy structured individual accountability mechanism appears to create optimal conditions for active engagement and deep cognitive processing. According to Adebayo and Iji (2021), the Jigsaw strategy enhances student achievement through peer teaching and interdependence; however, the present findings suggest that the NHT strategy additional layer of individual responsibility produces superior learning outcomes. This is consistent with Yusuf, Ahmed, and Suleiman (2020), who found that the numbered heads together strategy significantly improved students' academic achievement and engagement through its structured accountability system. The observed superiority of NHT may be attributed to the strategy emphasis on individual preparedness within group contexts. While both strategies promote cooperative interaction, NHT ensures that every student must master the material to potentially represent their group, creating stronger motivation for individual learning (Garcia, 2022). This finding corroborates Nwuba, Egwu, Awosika, and Osuafor (2023), who reported that the numbered heads together cooperative instructional strategy fostered secondary school students' interest and achievement in biology. However, this finding contrasts somewhat with Azeez, Omanany, Kwasi, and Omachoko (2022), who found both jigsaw and peer-tutoring strategies equally effective in enhancing achievement in chemistry. The discrepancy may be attributed to differences in subject matter complexity, as algebraic concepts may require more structured individual accountability than chemistry topics. The practical significance of this finding indicates that the NHT strategy produces not only statistically significant but also educationally meaningful improvements in student achievement. This supports the theoretical position of Johnson (2021) regarding social interaction and conceptual transformation in mathematics, suggesting that structured cooperative approaches create optimal conditions for mathematical understanding.



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The finding that the NHT strategy produced significantly better long-term retention than the Jigsaw strategy has important implications for instructional design in mathematics education. The NHT group mean loss compared to the Jigsaw group, representing retention rates of 95.4% versus 92.7%, demonstrates the durability of learning under structured cooperative conditions. This finding supports Ogunleye and Yusuf (2020), who reported that jigsaw instructional strategy enhanced students' retention in mathematics, but suggests that NHT may create even more robust memory traces. The superior retention observed in the NHT group may be explained through the theoretical lens of cognitive load theory and distributed practice. The NHT strategy requirement for individuals to master material for potential group presentation creates multiple retrieval opportunities during the learning process, strengthening long-term memory consolidation (Garcia, 2022). This aligns with Anderson (2020) findings on collaborative learning and retention in algebra, though the present study extends this by demonstrating that specific cooperative structures differentially affect retention durability. However, this finding appears to contrast with Nwankwo and Okigbo (2021), who found the jigsaw teaching strategy effective for retention in chemistry. The difference may lie in the nature of the subject matter algebraic concepts require abstract reasoning that may benefit more from the individual accountability mechanisms of NHT, whereas chemistry content may be more amenable to the division-of-labor approach characteristic of Jigsaw. Lee (2019) emphasized that peer-to-peer teaching in algebra requires bridging the gap between theory and practice, which the NHT strategy appears to accomplish more effectively through its structured presentation requirements.

Conclusion

Based on the findings of this study on the effects of Jigsaw and Numbered Heads Together (NHT) instructional strategies on algebraic learning outcomes among senior secondary school students in Minna Metropolis, it was concluded that instructional strategy significantly influences students' achievement and retention in algebraic concepts. The results revealed that students exposed to cooperative learning strategies performed better than those taught using the conventional teaching method. Specifically, the Numbered Heads Together (NHT) strategy emerged as the most effective instructional approach, as students taught using this strategy achieved significantly higher posttest scores than those taught using the Jigsaw strategy and the conventional method.

Recommendations

Based on the conclusions drawn from this study, the following recommendations are made:

1. Mathematics teachers in secondary schools within Minna Metropolis should prioritize the adoption of the Numbered Heads Together instructional strategy for teaching algebraic concepts, given its demonstrated superiority in enhancing both immediate achievement and long-term retention compared to the Jigsaw approach.
2. Teacher training institutions and professional development programs should incorporate comprehensive training on the Numbered Heads Together strategy, emphasizing its structured individual accountability mechanisms and techniques for effective implementation in mixed-ability classrooms.
3. School administrators and curriculum planners should promote the systematic integration of cooperative learning strategies, particularly NHT, into mathematics curricula, supported by adequate instructional materials and reduced class sizes to facilitate effective group work.
4. Policy makers in the Niger State Ministry of Education should consider developing guidelines for cooperative learning implementation that recommend NHT for abstract mathematical topics while acknowledging Jigsaw as a viable alternative where resource constraints limit intensive strategy training.



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DOI: <https://doi.org/10.64348/zije.2026358>

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