



*Effect of Jigsaw Strategy on Performance in... Mukhtar, M. S. (2025)*

## **Effect of Jigsaw Strategy on Performance in Plane-Shapes Concept among Secondary School Students in Zuru Metropolis of Kebbi State, Nigeria**

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### **Abstract**

*This study investigates the effect of Jigsaw instructional strategy on performance in plane-shapes concept among junior secondary school students in Kebbi State, Nigeria. The study was guided by two research questions and hypotheses. The researcher adopts pretest-posttest quasi-experimental research design. A sample of one hundred and twenty-eight (128) JSS II Students, purposively selected from a population of one thousand four hundred and fifty-seven (1457) students in the study area drawn from two out of 11 mixed gender public secondary schools within Zuru Metropolis. Data were collected using Plane-shapes Performance Test (PPT) with  $r = 0.73$ . The researcher employed descriptive statistics to answer the research questions and t-test statistics at 0.05 alpha level to test the null hypotheses. The study also aims to ensure the correct implementation of Jigsaw teaching strategy in mathematics classroom through exemplification. Moreover, the study highlights the purpose, basic steps, teacher and student tasks, as well as the advantages and disadvantages of Jigsaw teaching strategy in addition to comparing and briefly explaining the six distinct yet related types of Jigsaw instruction strategies. Research findings revealed that the Jigsaw instructional strategy has a significant positive effect on students' performance in plane-shape concepts and equally gender friendly. Therefore, the Jigsaw instructional strategy does improve not only the academic outcomes of secondary school student, but also promotes equity and inclusivity across gender, thus becoming a valuable tool for diverse classrooms.*

**Keywords:** Performance, Jigsaw Strategy, Plane-Shapes Concept, Mathematics & Students

### **Introduction**

In recent years, teaching strategies are gradually shifting away from the traditional teacher-centered approach towards a student-centered approach. Chu (2014) states that studies involving cooperative learning have emerged as an internationally important area among researchers. The Jigsaw method is a cooperative learning strategy first developed by Elliot Aronson in 1971 and further advanced in assessment practices by Robert Slavin in 1986. Aronson invented this teaching method called (Jigsaw) since it resembles the game (Jigsaw) as a means of assisting students of different cultural backgrounds to minimize the severity of ethnic tensions and also overcome learning gaps in the then-desegregated schools in Austin, Texas (Hamadneh, 2017). Teachers everywhere have been utilizing this strategy and its various components to promote collaboration in secondary through post-secondary classroom settings (Hance, 2016). Several studies investigated the effects of the jigsaw strategy on students' interest and achievement in Mathematics and found that the jigsaw strategy is gender friendly, and improves students' interest and achievement in Mathematics. Timayi, Bolaji, and Kajuru (2015) reveals that students taught using J4CLS performed better than students taught using conventional method. Gender performance was unaffected. The study found the J4CLS gender-friendly and effective for teaching and learning geometry. Areelu and Ladele (2018) reveals that the jigsaw method, gender, and socioeconomic status increase senior secondary students' interest in mathematics. Anaduaka, Olaoye, and Sunday (2018) reveals that Jigsaw-taught students had much higher mean achievement than conventionally-taught students. Jigsaw-taught boys and girls performed similarly. Yemi, Azid, and Ali (2018) indicates that the teaching of mathematics via the Jigsaw strategy is more effective than the traditional teaching method in increasing academic



*Effect of Jigsaw Strategy on Performance in... Mukhtar, M. S. (2025)*

achievement. Okafor and Nwosu (2021) showed that: there was a significant difference in the mean achievement scores of students taught using the jigsaw strategy and those taught using the lecture technique; gender had no significant effect on student accomplishment in mathematics when exposed to the jigsaw approach.

### **Research Objectives**

The following objectives guided the study:

1. To determine the effects of Jigsaw instructional strategy on JSS students' performance in Plane-shapes in Zuru metropolis, Kebbi State, Nigeria.
2. To determine the difference in performance between male and female students taught Plane-shapes using jigsaw instructional strategy

### **Research question**

Two research questions were asked to direct and sharpen the focus this study, they include:

1. How does the use of Jigsaw instructional strategy influence students' performance in Plane shapes in junior secondary schools in Zuru metropolis, Kebbi State, Nigeria?
2. What is the difference in performance between male and female students taught Plane-shapes using Jigsaw instructional strategy?

### **Research Hypotheses**

The null hypotheses were formulated to guide the study:

- HO<sub>1</sub>:** There is no significant difference between the performance of students taught Plane-shapes using the jigsaw instructional strategy and those taught using conventional method.
- HO<sub>2</sub>:** There is no significant difference between the performance of male and female students taught Plane-shapes using Jigsaw instructional strategy.

### **Literature Review**

In line with the works of Yoo and Son (2015), the Jigsaw teaching strategy seeks to influence mathematics classroom in the following manner: Offer a substitute for reading and lectures as means of introducing new material, Improve the sense of mutuality and interdependence among the members, make students responsible for obtaining, rehearsing and processing own and others learning, Demonstrate an example of high-performing teamwork. The Jigsaw strategy consists of the following basic steps (Weidman & Bishop 2009): Each student in a "home" group receives a subtopic to become an expert on, Subtopic experts from each "home" group meet in an "expert" group to learn and master their subtopics, Experts return to their home group to teach their subtopic to the other members, each student undergoes individual assessments on all subtopics.

The major task of the teacher in implementing the Jigsaw strategy includes (Dhull & Verma, 2019): Carefully select and organize the material to be studied (simple, clear, and precise), Setting up the groups (heterogeneous), Providing a clear cooperative context (outline classroom activities), Supervise to ensure high-quality learning and group workings (monitor students' use of the strategy), Attending to the student's needs (learning gaps). Yoo and Son (2015) opines that students are expected to cooperate to accomplish the following: Learn and become an expert on the material via active reading and consultative review of each expert material, make a plan for teaching the material to the home group members. Creatively elaborate, integrate and individually rehearse the material to be presented, make sure every member is proficient in your material and learn that of all others assigned to your home group. According to Sahin (2011), Jigsaw strategies have the same stages, the distinction is in practices that emerged from making some useful modifications to the original Jigsaw



*Effect of Jigsaw Strategy on Performance in... Mukhtar, M. S. (2025)*

application process. Today's teachers employ any of the distinct, yet related types of Jigsaw strategies in their classes depending on the set of goals they intend to accomplish.

1. Jigsaw practice developed by Aronson in 1978 was realized by forming two small groups the "home group" and "expert group", wherein students from the same "home group" break off to join their peers from other "home groups" who were given the same material in a new group called the "expert group" to collectively learn and master the material and then return to their respective "home groups" to teach it.
2. Jigsaw II developed by Slavin (1986) adds an element of competition among groups to the Jigsaw procedures to strengthen group members' commitment to helping one another in learning the content thoroughly.
3. Jigsaw III developed by Stahl (1994) expands on Jigsaw II by including a cooperative test review of the original Jigsaw procedures in an effort by teachers to assist students with concepts that appears unclear to them.
4. Jigsaw IV developed by Holliday (2002) builds on Jigsaw III by adding an introduction to the lesson, quizzes during the process to identify areas that need further explanation, and supplementary instruction to address such areas.
5. The Reverse Jigsaw developed by Hedeem (2003) is quite similar to the original Jigsaw since it utilizes and relies on small-group guided discussions with each student being responsible for learning and teaching the material. Reverse Jigsaw differs through a highly participatory structure, before joining peers in the expert group to share the highlight of common and divergent themes, each student leads the discussion of the assigned material in his home group, and then the expert group selects a reporter who will deliver the expert material to the entire class (Hedeem, 2003).
6. Subject Jigsaw developed by Doymus (2007) employs a different framework. Cooperative groups first learn and master a given subtopic together before being merged with a group(s) working on another subtopic to exchange subtopic highlights, and then group(s) of students in the merged subtopics are relocated to run new subgroups and work on other subtopics once more as a unit (Doymus, 2022).

Some benefits of the Jigsaw strategy, according to Aronson & Patnoe (2011), are: Fuels positive educational outcomes, help students improve their social skills, Boost students' self-esteem, confidence, and interest in learning, make students responsible for the teaching and learning of their peers, allow teachers to be facilitators or directors in the classroom. Every approach to teaching and learning has benefits and drawbacks, but Jigsaw has more advantages than disadvantages. Some disadvantages include: The Jigsaw strategy is a time-consuming classroom activity, The absence of one or more students has an impact on the entire class, Teachers' movement from one group to another to observe the process might be unbearable.

### **Exemplary Implementation of Jigsaw Instructional Strategy**

**Environment:** Conducive environment in which students may converse in small groups face-to-face e.g. cafeterias, seminar rooms, or any other conducive space as classrooms with immovable desks don't accommodate small face-to-face group discussions (Hedeem, 2003).

**Class size:** Minimum and maximum limits and the ability to divide the class by the number of subtopics. For an effective exercise, at least a minimum of three groups comprising three students each, to address three subtopics (3x3x3) and one (Hedeem, 2003). Two parallel but separate Jigsaw processes can be run for large classes to avoid unwieldy exercise (Gonzalez, 2015).

Table 1: Class Description



*Effect of Jigsaw Strategy on Performance in... Mukhtar, M. S. (2025)*

Topic:	<b>Plane Shapes</b>
Number of Students:	32
Class Level:	JSS1
Application Time:	4 weeks

i. **Determination of Subtopics:** Topics are divided into subtopics as the number of students in each small group (Doymus, 2022).

Table 2: Determination of Subtopics

Circles
Triangles
Quadrilaterals
Regular/Irregular shapes

ii. **Grouping:** The teacher creates heterogeneous groups with a certain degree of flexibility taking into account the class size and diversity in gender, ethnicity, and student level of knowledge through past exams or assessments. Two or three groups can take an additional member in classes with an uneven number of students or a habitual absentee. (Holliday, 2002; Gonzalez, 2015; Seyhan, 2021; Doymus, 2022).

Table 3: Creation of Home Groups

Jigsaw Class One	Jigsaw Class Two
Group 1 (A1, B1, C1, D1)	Group 1 (P1, Q1, R1, S1)
Group 2 (A2, B2, C2, D2)	Group 2 (P2, Q2, R2, S2)
Group 3 (A3, B3, C3, D3)	Group 3 (P3, Q3, R3, S3)
Group 4 (A4, B4, C4, D4)	Group 4 (P4, Q4, R4, S4)

iii. **Guidelines:** The teacher should provide clear instructions to students about what to do and the working process or functions of the groups. (Dhull & Verma, 2019; Doymus, 2022).

Table 4: Group Workings

Expert Group	Home Group
Learn about and become expert on the material.	Teaching area of expertise to other group members.
Plan and practice how to teach the material to Home Group members.	Learning all the materials being taught by other group members.

iv. **Roles:** The teacher assigns each student in a small group, a role to be played on a rotation basis. Each group determines the leader to manage the task, the server to record the group's work, the printer to compile the needed material and the speaker to present the group's work. Other roles could be Devil's advocate, encourager, etc. (Holliday, 2002; Doymus, 2022).

Table 5: Expert Group Roles

Jigsaw Class One	Jigsaw Class Two
A (Leader)	P (Leader)
B (Server)	Q (Server)
C (Printer)	R (Printer)
D (Presenter)	S (Presenter)

v. **Time:** Determine equal time checks on tasks, to help keep groups on the same pace and allow for a clean transition between steps throughout the Jigsaw activity (Holliday, 2002; Hedeem, 2003).



*Effect of Jigsaw Strategy on Performance in... Mukhtar, M. S. (2025)*

Table 6: Implementation Plan

Week One	Week Two	Week Three	Week Four
Determination of subtopic	Experts come up with a comprehensive material to master.	Experts return to home groups to teach their materials.	Experts learn all materials taught by others members.
Experts study their unique subtopic	Experts rehearse how to teach the material.	Experts take turns teaching their assigned material.	Students undergo assessment on all subtopics.

vi. **Expert Sheet:** Expert sheet is simply a direction sheet or time saving tool to help students answer and gather information about a particular subject. The sheet should be simple, unambiguous, straight forward and accessible, such that can easily be broken into smaller chunks, and has a unifying theme that can be used to combine the smaller chunks Yoo and Son (2015).

Table 7: Expert sheet

1.	What is a (circle, triangle, and quadrilateral, regular and irregular shapes)?
2.	Identify the properties of a (circle, triangle, quadrilateral, regular and irregular shapes)
3.	Determine the perimeter of a (circle, triangle, quadrilateral, irregular shapes)
4.	Determine the area of a (circle, triangle, quadrilateral, irregular shapes)

vii. **Assessment:** The assessment takes the form of self-evaluation and peer evaluation to ensure everyone’s active participation in the expert and home group activities whilst the teacher prepares quizzes and tests to record the student's individual and group performance using items aligned (not the same) with those on the expert sheet (Holliday, 2002; Dhull & Verma, 2019).

Table 8: Assessment

1.	Define a (circle, triangle, and quadrilateral, regular and irregular shapes)?
2.	Differentiate the properties/types of a (circle, triangle, quadrilateral, and irregular shapes)
3.	With the aid of a diagram, determine the perimeter of a (regular and irregular shapes)
4.	With the aid of a diagram, determine the area of a (regular and irregular shapes)

## Methodology

The study adopted Pretest-Posttest quasi-experimental research design which afforded the researcher the opportunity to collect relevant data and facilitate better evaluation of the problem under study. The pretest was administered before treatment to determine the homogeneity of the two groups and the posttest was administered after treatment to determine the students’ performance. The population of the study comprises of all JSS II students in the 13 public secondary schools within Zuru metropolis, with a total of 1757 students. A purposive sampling technique was employed for safety reasons to select two mixed gender schools: Government Day Secondary School (GDSS) Tudun Wada and Bahago Gomo Day Secondary School from the population, making the sample size 107 in Kebbi State, Nigeria. The sample for the study constitutes 128 students (64 male and 64 female) randomly drawn from two public secondary schools ensuring equal gender access. Twenty (25) standardized questions in multiple choice tagged “Plane-shapes Performance Test (PPT)” ( $r = 0.73$ ) were considered for the study. The treatment covers a period of six (6) weeks. The data collected were analyzed used descriptive to answer the research question and t-test statistics at 0.05 alpha level to test the null hypotheses (All analysis is done using SPSS).

## Presentation of Results

**Research Question 1:** How does the use of Jigsaw instructional strategy influence students’ performance in Plane shapes in junior secondary schools in Birnin Kebbi, Nigeria?



*Effect of Jigsaw Strategy on Performance in... Mukhtar, M. S. (2025)*

**Table 9:** Mean and Standard Deviation for Performance of Students in Experimental and Control Groups

Groups	N	Mean	S. D	M D
Experimental	64	80.53	2.73	
Control	64	61.39	2.28	19.14

The result in Table 9 above shows a substantial performance gap between the two groups. The experimental group being the group taught using Jigsaw instructional strategy scored 80.53 and 2.73 mean and standard deviation respectively while that of the control group pulls 61.39 and 2.28 respectively, with the mean difference of 19.14 respectively. This result revealed that students in the experimental group scored higher than their peers in the control group.

**Research Question 2:** What is the difference in performance between male and female students taught Plane-shapes using Jigsaw instructional strategy?

**Table 10:** Mean and Standard Deviation of Male and Female Students in the Experimental Group

Gender	N	Mean	S. D	M D
Experimental	32	80.34	2.78	
Control	32	80.72	2.71	- 0.38

The result in Table 10 above shows a slight difference in performance between the male and female students scores in favor of the female students. As the male students scored 80.34 mean score and 2.78 Standard deviation while the female students scored 80.72 mean scores and 2.71 standard deviation, with the mean difference of - 0.38 respectively.

**HO<sub>1</sub>:** There is no significant difference between the performance of students taught Plane-shapes using the jigsaw instructional strategy and those taught using conventional method.

**Table 11:** Summary of Independent sample t-test for Experimental and Control Groups

Groups	N	Df	Mean	S. D	T-value	P-value
Experimental	64	126	80.34	2.78	43.5	0.0000
Control	64		80.72	2.71		

Table 11 above shows the t-test of the mean scores of experimental and control groups. The table indicate significant difference in performance between the two groups since p is less than 0.05, therefore, the hypothesis is rejected. This implies that the Jigsaw instructional strategy had a significant positive effect on student's performance in Plane-shapes compared to conventional teaching methods.

**HO<sub>2</sub>:** There is no significant difference between the performance of male and female students taught Plane-shapes using Jigsaw instructional strategy.

**Table 12:** Summary of Independent sample t-test for male and female students in experimental Groups

Gender	N	Df	Mean	S. D	T-value	P-value
Male	32	62	80.34	2.78	- 0.5461	0.5869
Female	32		80.72	2.71		

From table 12 above, the p-value (0.5869) is greater than 0.05, indicating that there is no significant difference in the mean scores between male and female students in the experimental group. Therefore, the hypothesis if accepted, which suggest that the Jigsaw instructional strategy was equally effective for both genders. This showed that gender did not influence performance outcomes under the Jigsaw method.



*Effect of Jigsaw Strategy on Performance in... Mukhtar, M. S. (2025)*

## Discussion of Findings

The main objective of this study is to determine the effects of Jigsaw instructional strategy on JSS students' performance in Plane-shapes and the findings from the t-test provide compelling evidence on the effectiveness and inclusivity of the Jigsaw instructional strategy in teaching Plane-shapes to Junior Secondary Schools students. The findings of this study strongly support Anadauka, Olaoye, & Sunday (2018); Yemi, Azid, & Ali (2018); and Okafor & Nwosu (2023) study, confirming that the Jigsaw teaching strategy significantly enhances mathematics achievement among secondary school students in Abuja. The study is also in line with Areelu & Ladele (2018) study which shows that the Jigsaw instructional strategy significantly improves students' interest and engagement in mathematics with no gender bias among secondary school students in Lagos. The study is also in support of Anadauka, Olaoye, & Sunday (2021) study that found no significant gender difference in mathematics achievement among students taught using Jigsaw strategy.

## Conclusion

The findings reveals that the Jigsaw instructional strategy significantly enhances students' academic performance in Plane-shapes compared to conventional teaching methods, affirming the effectiveness of the Jigsaw approach in promoting deeper understanding and active engagement in mathematics classroom. In addition, the absence of a significant difference in students' performance across gender suggest that Jigsaw strategy is equitably and inclusively gender friendly.

This study also exemplifies Jigsaw teaching strategy as cooperative learning strategy capable of transforming mathematics classrooms from a place of passive reception of knowledge into a dynamic active learning abode where students take complete ownership of their learning moving equitably between being learners to becoming teachers, in an attempt to deepen their mathematics process and conceptual understanding, while developing communication and collaborative skills essential for lifelong learning. The Jigsaw teaching strategy serves as an effective and scalable model for improving not only students' performance in mathematics among secondary school students but also is efficient for strengthening and deepening students conceptual understanding, communication, and cooperative skills in mathematics and other related disciplines. Furthermore, the study produced a coherent framework that shifts classroom dynamics from teacher-centered to student-driven ensuring each and every student active participation as they struggle to prove their worth to their peers.

## Recommendations

The following recommendations were made based on the findings from this study:

1. Jigsaw instructional strategy should be used in teaching and learning of mathematics since this method is proved effective in enhancing students' academic performance compares to the conventional methods.
2. Mathematics teachers should be patient while using this strategy in order to obtain better results since it is time consuming.
3. Creation of Mathematics laboratories should be emphasized in all secondary schools for effective students' engagement.



*Effect of Jigsaw Strategy on Performance in... Mukhtar, M. S. (2025)*

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*Effect of Jigsaw Strategy on Performance in... Mukhtar, M. S. (2025)*

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