EFFECT OF CONNECTIVISM-BASED JIGSAW IV STRATEGY ON SENIOR SECONDARY SCHOOL STUDENTS' ATTITUDE TOWARDS GEOMETRY IN KATSINA STATE, NIGERIA

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Abstract

Negative attitude towards geometry is one of the problems affecting secondary school students in Katsina state. This study investigated the Effectiveness of ConnectivismBased Jigsaw IV Strategy on Senior Secondary School Students_ Attitude towards Geometry in Katsina State, Nigeria. A non-equivalent control group pretest-posttest quasi-experimental research design was used over 6 weeks. The population of the study consists of 90,923 SS II public senior secondary schools_ students during the 2026/2027 academic session in Katsina state. A sample of 221 students was selected from the population using multistage sampling technique. Students_ Attitude towards Geometry Questionnaire (SATGQ) with the reliability coefficient of .87 tested using Cronbach Alpha on pilot sample of 40 students which validated by experts was used for data collection of the study. The research questions were answered using mean and standard deviation, while the hypotheses were tested using ANCOVA and t-test at .05 significance level. The findings revealed that students exposed to Connectivism-Based Jigsaw IV Strategy (CBJ4S) developed significantly more positive attitudes towards Geometry [$F(1, 218) = 53.02$, $p < .001$] than students taught using Traditional method (TRDM) with no

significant difference [$t(132) = .88, p = .38 > .05$] between male and female students. The study concluded that CBJ4S is an effective instructional strategy for improving students_ attitudes towards Geometry. The study recommended that Mathematics teachers may consider piloting CBJ4S in teaching Geometrical concept in Katsina state.

Keywords**:** Connectivism, Jigsaw-4 Strategy, Attitude towards Geometry, Katsina State.

Introduction

Geometry as one of the fundamental branches of Mathematics and serves as a foundation for the development of logical reasoning, problem-solving skills, and spatial visualization. It plays an important role in science, technology, engineering, architecture, and everyday life. Consequently, students are expected to develop both cognitive competence and positive attitudes toward Geometry to facilitate meaningful learning and application of Mathematical concepts (Adamu & Ibrahim, 2021; Bada & Yusuf, 2022; National Council of Teachers of Mathematics [NCTM], 2018). Based on survey made by the researcher, many secondary school students in Katsina State exhibit negative attitudes toward Geometry and Mathematics in general. Students frequently perceive Geometry as abstract, difficult, and irrelevant to their daily experiences. Such perceptions reduce students_ interest and participation during classroom instruction (Bada & Yusuf, 2022; Dauda et al, 2024). Studies have attributed these negative attitudes partly to the continued use of teacher-centered instructional methods that limit student interaction and active engagement (Adamu & Ibrahim, 2021).

Attitude is a critical affective variable that influences students_ interest, participation, motivation, and achievement in learning. According to Okoro (2022), students_ attitudes toward Mathematics significantly determine their willingness to engage in learning activities and their eventual academic success. Positive attitudes encourage persistence and confidence, while negative attitudes often lead to anxiety, disengagement, and poor performance (Sani et al, 2024). Recent educational theories advocate learner-centered instructional approaches that encourage collaboration, interaction, and knowledge construction. One such theory is Connectivism learning theory developed by Seimens and Downes in 2004 (Seimens, 2005). They viewed learning as a process of creating and maintaining networks of information, individuals, and technological resources (Downes & Seimens, 2015). Alzain (2019) added that learning occurs through meaningful connections among learners and information sources. It emphasizes on the importance of learner-centered learning and roles of technology in supporting the approach (Downs, 2019). Therefore, connectivism emphasizes collaborative learning through networks and Jigsaw-4 promotes active peer interaction, few studies have examined their combined influence on students_ attitudes toward Geometry (Sani et al, 2026).

Jigsaw IV Strategy is a cooperative learning approach originated by Holliday in 2000. The strategy requires students to work collaboratively in expert groups and home groups, where each learner becomes responsible for mastering and teaching specific learning content to peers (Sam, 2019; Sani et al, 2025). The strategy promotes active participation, peer interaction, accountability, and social learning. All members of the group gain a comprehension of their own work as well as the conclusions drawn from topic-specific group discussions from the final individual presentations (Birt, 2023). Moreover, in Jigsaw IV strategy the teacher presents the content, followed by discussions and quizzes for the expert and home groups. Also, the teacher re-teaches the uncovered part of the topic (Downes, 2022). This strategy goes a long way in developing students_ mathematical communication builds confidence in learning and encourages them to be responsible for their learning. Students can practice and work in groups through cooperative learning activities. Thus, integrating connectivism principles with Jigsaw IV cooperative learning (autonomy in home group, diversity in expert group, openness in quiz and connectedness in re-teach activities) create learning environments that foster students_ interest, confidence, and positive attitudes toward Geometry.

Thus, this research work is to embark upon the investigation on the effect of Connectivism-based jigsaw IV strategy on senior secondary school students_ attitude towards geometry in Katsina State, Nigeria.

Statement of the Problem

Students_ attitudes toward Geometry in secondary schools in Katsina State remain a source of concern among educators and curriculum planners. Many students perceive Geometry as difficult, abstract, and challenging, resulting in low interest, reduced participation, and lack of confidence in learning geometric concepts (Bada & Yusuf, 2022; Dauda et al, 2024). Negative attitudes toward Geometry have been associated with poor engagement and lower achievement in Mathematics (Okoro, 2022). Additionally, evidence showed that geometry is one of the students_ areas of weakness (West African Examination Council [WAEC], 2023, 2024, 2025).

The predominance of conventional lecture methods in many Mathematics classrooms contributes to students_ passive learning experiences and limited opportunities for collaboration and interaction (Adamu & Ibrahim, 2021). Consequently, students often fail to develop positive dispositions toward Geometry and Mathematics generally. Although several innovative instructional approaches have been recommended to improve students_ attitudes toward Mathematics, there is limited empirical evidence regarding the effectiveness of combining Connectivism Theory and Jigsaw IV Strategy in Geometry instruction, particularly in Katsina State as attempted by Sani et al. (2026) whose don_t consider the students_ gender effect. To address the issue, there is need to determine whether Connectivism-Based Jigsaw IV Strategy could significantly promote the students_ attitudes toward Geometry with respect to gender effect, which inspire the researchers to conduct this research work in order to explore the effectiveness of the strategy in the study area.

Objectives of the Study

This study aimed to investigate the effectiveness of Connectivism-based Jigsaw IV strategy on senior secondary school students_ attitude towards geometry in Katsina State. Specifically, it intends to achieve the following objectives:

1. to investigate the effect of Connectivism-based jigsaw-4 strategy on the students_ attitude towards geometry;
2. to determine the difference in attitude between male and female students taught Geometry with Connectivism-based jigsaw-4 strategy.

Research Questions

The following questions were drawn up to guide the study:

1. What is the difference between the mean attitude towards geometry scores of the students taught using Connectivism-based jigsaw IV strategy and those taught same concept using traditional method?
2. What is the difference between the mean attitude towards geometry scores of the male and female students taught using Connectivism-based jigsaw IV strategy?

Research Hypotheses

The following null hypotheses were formulated and tested at .05 significance level:

$H0_1$: There is no significant difference between the mean attitude towards geometry scores of the students taught using the Connectivism-based jigsaw IV strategy and their counterpart taught same concept using traditional method.

$H0_2$: There is no significant difference between the mean attitude towards geometry scores of the male and female students taught geometry using the Connectivism-based jigsaw IV strategy.

Methodology

The study adopted Quasi-experimental research design in order to establish an effect relationship between the variables. The study population consists of 90,923 (48,723 males and 42,200 females) SS II public senior secondary schools_ students during the 2026/2027 academic session in Katsina state (Katsina Ministry of Basic and Secondary

Education, 2026). A sample of 221 students was selected from two schools of two Zonal Education Quality Assurance out of twelve in the state, using multistage sampling technique and used two intact classes as suggested by Aliyu (2016) that, quasiexperimental research design permits the use of intact class. One of the classes as experimental class consisting 134 (53 males and 81 females) students taught using CBJ4S while the other as control group class consist 87 (31 males and 56 females) students taught using traditional method, since the classes were from different schools.

The researchers got permission from management of the selected schools for the treatments and data collection of the study. All the activities carried out in study were explained to the study participants. The obtained data was treated with confidentiality and measured accordingly.

The instrument used for data collection in the study was 4-point Likert scale type consisting 25 positive items related to Geometry assigned 1 to 4 points. It was adapted from Suleiman (2022), named Students_ Attitude Towards Geometry Questionnaire (SATGQ) with the reliability coefficient of .87 tested using Cronbch_s alpha on pilot sample of 40 students which was validated by experts from Mathematics Education, Measurement and Evaluation, and Psychology departments. The instrument was administered two times as pretest before the treatments and posttest after 6 weeks of treatments. All the research questions were answered using mean and standard deviation, while the hypotheses were tested using ANCOVA and t-test at .05 significance level.

Results

Research Question 1

What is the difference between the mean attitude towards geometry scores of the students taught using Connectivism-based jigsaw-4 strategy and the other group taught same concept using traditional method?

To answer the research question 1, SATGQ post-test scores of students taught geometry through CBJ4S and those taught using TRDM were subjected to descriptive statistics of mean and standard deviation in Table 1

Table 1

Mean and Standard Deviation of Students' Attitude towards Geometry Scores of the CBJ4S and TRDM

Strategy	*N*	*M*	*SD*	*MD*
CBJ4S	134	45.02	20.41	9.69
TRDM	87	35.33	14.77	

Key: *N* = Total Number, *M* = Mean, *SD* = Std. Deviation, and *MD* = Mean Difference

In Table 1 the mean and standard deviation attitude scores of students taught geometry using the CBJ4S, (*M* = 45.02, *SD* = 20.41) was higher than the other group taught using TRDM, (*M*

= 35.33, *SD* = 14.77) with difference of 9.69 mean score. To investigate whether the difference is significant or not, null hypothesis one was tested and the result presented in Table 2.

Hypothesis 1

$H0_1$: There is no significant difference between the mean attitude towards geometry scores of the students taught using the Connectivism-based jigsaw-4 strategy and their counterpart taught same concept using traditional method. This hypothesis was tested and presented in Table 2.

Table 2

Analysis of Covariance on Mean Students' Attitude towards *Geometry Scores of the CBJ4S and TRDM*

Source	Type III Sum of Squares	*df*	Mean Square	*F*	Sig.
Corrected Model	87299.056[a]	2	43649.528	302.829	.000
Intercept	350.125	1	350.125	2.429	.120
Test	79747.492	1	79747.492	553.267	.000
Group	7641.538	1	7641.538	53.015	.000
Error	62844.694	218	144.139		
Total	800813.000	221			
Corrected Total	150143.749	220			

Note. *R* Squared = .581 (Adjusted *R* Squared = .580)

Table 2 revealed that there was significant difference in the mean attitude towards geometry scores of the students taught using CBJ4S and those taught through TRDM,

$F(1, 218) = 53.02$, p

< .001. Hence, the null hypothesis was rejected.

Research Question 2

What is the difference between the mean attitude towards geometry scores of the male and female students taught using Connectivism-based jigsaw-4 strategy? The question was answered using mean and standard deviation in Table 3

Table 3

Descriptive Result of Students' Attitude towards Geometry Scores of the Male and Female Student Taught using CBJ4S

Gender	*N*	*M*	*SD*	*MD*
Male	53	48.72	16.40	2.42
Female	81	46.30	15.42	

Table 3 showed that the difference between mean attitude towards geometry scores of males (*M*

= 48.72, *SD* = 16.40) and females (*M* = 46.30, *SD* = 15.42) students taught using the Jigsaw-4

Strategy is 2.42, in favour of the male students. To determine whether this difference was significant or not, hypothesis two was tested using Independent-sample t-test analysis. The result was presented in Table 4.

Hypothesis 2

$H0_2$: There is no significant difference between the mean attitude towards geometry scores of the male and female students taught using the Connectivism-based jigsaw-4 strategy. The result was presented in Table 4

Table 4

Independent-Samples t-test Analysis of Students' Attitude towards Geometry *Scores of the*

Male and Female Student Taught using CBJ4S

Gender	*N*	Mean	*SD*	*Df*	*t*-value	*P*	Decision
Male	53	48.72	16.40	132	.88	.38	Not Sig.
Female	81	46.30	15.42				

Table 4 showed that the difference between the mean attitude towards geometry scores of male (M = 48.75, SD = 16.40) and female (M = 46.30, SD = 15.42) students taught geometry using CBJ4S is not significant, $t(132) = .88$, $p = .38 > .05$. Hence, the null hypothesis was retained. This implies that there is no statistically significant difference in attitude between male and female students taught using CBJ4S. **Discussion of the Findings**

The first finding in Table 1 and 2 revealed that the students taught geometry using connectivismbased jigsaw-4 strategy had significantly positive attitude towards geometrical concept than their counterparts taught using the traditional method. From this finding, it could be inferred that the

CBJ4S offered them an opportunity to interact with their team members, which led to students more positive attitude towards the concept. This finding is in line with the findings of Sani et al (2026), Siller and Ahmad (2024) and that of Suleiman et al (2020) which revealed that the students attitude towards geometry was significantly higher than that of lecture method. Similar results were reported by Tagle & Cabigan (2022) for online collaborated learning and that of Suleiman et al (2020) in their study

—Investigation into secondary school students_ attitude towards learning of geometry in Zamfara State, Nigeria‖, which revealed that student_s attitude towards geometry was significant and positively high than those taught using traditional method.

The second finding in Table 3 and 4 revealed that there was no significant difference between the students_ attitude towards geometry based on gender. This is in line with the findings of Suleiman et al (2020) and that of Adebayo and Okeke (2020) which revealed that the male and female students taught geometry using jigsaw IV instructional strategy were attitudinally Gender friendly. These were evident that students taught geometry using CBJ4S developed more positive attitude towards geometry than those treated using TRDM irrespective of gender. Therefore, CBJ4S helped students to improve their attitude towards geometry. However, one of the key features of connectivism is that students are actively involved in the learning process; they share information and ideas in their group to work as a team through cooperative work to create new knowledge. Kilag et al (2023), added that connectivism-based instruction is among the best approaches to enhance students learning in the 21st century.

Conclusion

The main aim of this study was to examine the effect of connectivism-based jigsaw IV strategy on senior secondary school students_ attitude towards geometry in Katsina state.

Based on the study findings, it could be concluded that Connectivism-Based Jigsaw IV Strategy was associated with significantly more positive attitudes towards Geometry among the sample students. The strategy promotes collaboration, interaction, learner engagement, and positive learning experiences, which contribute to favorable attitudes toward Geometry and reduced high interdependency of students on teachers. Since, the study was conducted on public senior

secondary students in Katina state, on students_ attitude towards Geometry. Therefore, other studies should be conducted on different school type, level, location variables, and concepts or even similar for comparison.

Recommendations

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

1. CBJ4S should be integrated into mathematics curricula as effective strategy for teaching Geometrical concept in Secondary Schools in Katsina state.
2. Government and school administrators should provide technological resources that support networked and collaborative learning in our secondary schools.
3. Senior secondary school mathematics teachers should be encouraged to use the strategy (CBJ4S) in teaching geometry and other related concepts.
4. Professional bodies like Mathematics Association of Nigeria (MAN) and other educational management bodies should encourage the use of the strategy in the study area.
5. Workshops, conferences and seminars should be organized for mathematics teachers on how to adopt the strategy in teaching their students in order to promote the students_ attitudes towards the study concept.

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