Effect of Jigsaw Instructional Strategy on Students' Achievement and Retention in Carpentry and Joinery in Technical Colleges in Bauchi State

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Abstract

This study investigated the effect of jigsaw instructional strategy on students' achievement and retention in Carpentry and Joinery in Technical Colleges in Bauchi State. The study was based on the Social Constructivism Theory, which emphasizes learning through social interaction and collaboration. Quasi-experimental research design involving pre-test, post-test, and non-equivalent control groups design was adopted. This study was guided by three research questions and three null hypotheses. The population of the study consists all the 384 NTC III Carpentry and Joinery students in the 2025/2026 academic session in Technical Colleges in Bauchi State. A sample of 81 students of two Carpentry and Joinery intact classes were used. Simple random sampling technique was used in selecting two out of the eight Technical Colleges in Bauchi State. Data were collected using Carpentry and Joinery Achievement Test (CJAT) and Carpentry and Joinery Retention Test (CJRT) which were adopted from standardized examination bodies (NABTEB & NECO). A reliability coefficient of 0.73 was obtained using Kuder- Richardson (KR-20). Mean and standard deviation were used to answer the research questions and independent sample t-test was used to test hypotheses at 0.05 level of significance. The findings of the study revealed that students taught using jigsaw strategy achieved significantly higher mean scores and demonstrated better retention than those taught using conventional method. The researcher recommended among others that teachers of Carpentry and Joinery in Technical Colleges adopt jigsaw to improve students' academic achievement and retention.

Keywords: Technical Colleges, Jigsaw Strategy, Carpentry and Joinery and Students' Achievement and Retention

INTRODUCTION

Technical Colleges are institutions aimed at equipping learners with scientific knowledge and skills that leads to gainful employment. Technical colleges are the educational institutions that have the duty of imparting students with the knowledge, mindset and skills that gives them the ability of being self-reliant. According to Oviawe and Anaele (2020 Technical Colleges are institutions aimed at equipping learners with scientific knowledge and skills that leads to gainful employment.), Technical Colleges are the principal vocational institutions in Nigeria,

which gives full vocational training intended to prepare graduates for entry into various occupations such as Carpentry and Joinery, Brick laying and Construction, Auto-mechanics, Metal work, Electrical/Electronic among others. Carpentry and Joinery is one of the technical trades taught at Technical Colleges which involve woodworking aspect that involve building construction including roofing, flooring, stairs etc. Over the years, Carpentry and Joinery has taken a great position in technical education by producing skillful individuals in various fields of furniture making, framing, flooring and crafting. The global change in the 21st century has affected both the society, technological development, economy, and the technical education inclusive which must be adjusted with time.

These days, learning methods based on cooperation are more widely used with the aim of encouraging team work, allowing students to learn to work as part of a team, improving performance and learning to developing interpersonal skills (Baena-Morales, et al. 2020). Researchers have found out that the use of conventional teaching method in Technical Colleges has less impact in the teaching and learning process and has been proved not to be good method in enhancing student's cooperation, performance, achievement and retention. Nwankwo and Okigbo (2021) stated that reliance on the conventional teaching method has been criticized as molding students into passive recipient to information transmitted by the teacher and making them highly dependent on the teachers for much of their learning. According to many researchers, cooperative learning strategies have been proven to be beneficial to both participation and confidence of students. Gillies (2016), opined that cooperative learning is a learning method aimed at organizing classroom exercise into educational and funny learning environment. Thus, there are many benefits for incorporating a cooperative learning strategy into the classroom. Agus, (2017), proved that students involved in cooperative learning group scores higher than those in the conventional teaching group. Therefore, cooperative learning is best in today's learning environment to enable an inclusive classroom which gives the required achievement.

Jigsaw teaching strategy is a collaborative learning approach, which was first developed by Elliot Aronson and his students at the University of Texas and the University of California in the early 1970s. In jigsaw, each student in a group takes responsibility for one chunk of the content, and then teaches it to the other group members. Jigsaw method is an effective way to increase students' engagement through group work that facilitates peer-to-peer learning. Adodo (2020), stated that jigsaw has the potentials to enable students engage in reflective thinking strategies, help recognize individual differences in learners and encourage them to create their own knowledge at their own pace.

Academic achievement refers to performance outcomes that indicate how far a person has progressed in specific goals of activities in instructional settings such as school.

Academic achievement is a direct manifestation of learning effectiveness and a valid indicator to evaluate the effectiveness of teaching as well as the overall development of students. According to Wilder (2023), academic achievement refers to how well a student is accomplishing their educational goals, often measured by grades or standardized test. Achievement can be attained only if the teachers are employing various strategies that are best for student's participation in the teaching and learning process. Nwaukwa and Okolocha (2020) opined that achievement is dependent on several factors, and top amongst them are instructional strategies.

Retention is the ability to keep and consequently remember things experienced or learned by an individual. Retention of concepts is an important factor in discerning students' achievement in a given problem or assignment. Students should be able to retain knowledge from information obtained from lessons in order to benefit from the learning. According to Chinwendu and Nnoduka (2020), retention measures the duration for which students can remember content from a specific course. Students are more likely to retain what they have learn when they are actively engaged in the lesson and are provided with rich and adequate learning strategies.

In summary, researches have shown that cooperative instructional strategies such as jigsaw enhances students' achievement and retention. Several studies conducted in different areas and on different population have examined cooperative instructional strategies but limited attention is given to the effect of jigsaw on student's achievement and retention in Carpentry and Joinery and in Bauchi State as the area. Therefore, this study seeks to fill the geographical, population and knowledge gaps identified by investigating the effect of jigsaw instructional strategy on student's achievement and retention in Carpentry and Joinery in Technical Colleges in Bauchi State.

Statement of the Problem

The aim of technical education of making learners self-reliant can only become a reality when the learners are engaged by the teachers using an inclusive classroom and full participation. However, Carpentry and Joinery students' achievement is very discouraging and many researches linked that with many factors among which is the method and learning strategies used. According to Zarewa et al. (2024), students' decline in the achievement and retention in Carpentry and Joinery is as a result teaching method used by teachers. Therefore, there is a pressing need to explore instructional strategies that enhance achievement and retention of Carpentry and Joinery. Many students in Technical Colleges perform poorly in Carpentry and Joinery, leading to a high number of white-collar job seekers despite completing the Carpentry and Joinery curriculum. To address this issue, it is essential to focus on the teaching strategy used by teachers who are the implementers of the curriculum.

The achievement rating of the National Business and Technical Education Board (NABTEB) Chief Examiner (2021) as cited in (Nnadi, & Saue 2023) stated that students' scores in Carpentry and Joinery (Bauchi State inclusive) were poor and discouraging. The poor achievement according to the Chief Examiner could be due to several factors among which are lack of appropriate strategies for teaching and learning among others. Therefore, the study seeks to determine the effects of jigsaw instructional strategies on students' achievement and retention in Carpentry and Joinery in Technical Colleges in Bauchi State.

Research Questions

The following research questions were raised to guide the conduct of the study:

1. What is the difference in the pre-test mean achievement scores of students in the experimental and control group in Technical Colleges in Bauchi State?
2. What are the differences in the post-test mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method in Technical Colleges in Bauchi State?
3. What is the difference between the mean retention scores of students in the jigsaw strategy and conventional method in Technical Colleges in Bauchi State?

Research Hypotheses

The following null hypotheses were postulated to guide the study and were tested at 0.05 level of significance.

$H0_1$: There is no significant difference in the pre-test mean achievement scores of students in the experimental and control group in Technical Colleges in Bauchi State

$H0_2$: There is no significant difference in the post-test mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method in Technical Colleges in Bauchi State.

$H0_3$: There is no significant difference in the post-test and delay post-test mean retention scores of students in the jigsaw strategy and conventional method in Technical Colleges in Bauchi State.

METHODOLOGY

The study adopted quasi-experimental design. Specifically, pre-test and post-test non-equivalent control group. The study was conducted in Bauchi State. Bauchi is a North-Eastern State in Nigeria. It has a total land area of 49.119km^2 representing about 5.3% of Nigerian total land mass. Bauchi State is located between latitude 9^0 3″ 12^0 3″ North and Longitude 80^0 50″ east. Specifically, the study was conducted in two Technical Colleges in Bauchi State. The population of the study consist of the entire 384 National Technical Certificate (NTC) III Students in Bauchi State. Going by the design of this study, two intact classes of NTC III Carpentry and Joinery students were used in the study of which Government Day Technical College Jama'are (Experimental Group) with 26 Carpentry and Joinery students and Government Day Technical

College Tafawa Balewa (Control Group) with 55 Carpentry and Joinery students. The unequal number of students used in the jigsaw strategy and control group was as a result of using existing intact classes in the schools because the study adopted a quasi-experimental design in which the researcher could not randomly assign equal number of students to each group. Creswell and Creswell (2018) explained that quasi-experimental design typically use pre-existing groups, which may result in unequal sample size. The instruments used for data collection was Carpentry and Joinery Achievement Test (CJAT) and Carpentry and Joinery Retention Test (CJRT) adopted from NABTEB and NECO examinations. A reliability co-efficient of 0.73 was obtained using Kuder-Richardson (KR-20) Data collected from the study were analyzed using mean, standard deviation and independent sample t-test.

RESULTS

Research Question One: What is the difference in the pre-test mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method in Technical Colleges in Bauchi State?

Table 1: Pre-test Mean Achievement Scores and Standard Deviation of students in the experimental and Control group

Group	Test	N	Mean	SD	Mean difference
Jigsaw Strategy	Pre-test	26	42.62	6.49	0.56
Conventional Method		55	43.18	6.05	

The results in Table 1 revealed that before the treatment, the mean achievement scores of students taught using jigsaw strategy (n = 26) was (M = 42.62, SD = 6.49) and that of their counterparts taught using conventional method (n = 55) was (M = 43.18, SD = 6.05) respectively. The overall mean difference between the two groups was 0.56 in favor of students taught using conventional method. This implies that prior the treatment the mean achievement score of students taught using conventional method was higher than their counterparts taught using jigsaw strategy. The significance of the difference in the pre-test scores between the two groups was further determined by testing the corresponding null hypothesis.

Research Question Two: What is the difference in the post-test mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method in Technical Colleges in Bauchi State?

Table 2: Post-test Mean Achievement Scores and Standard Deviation of Students Taught Carpentry and Joinery using Jigsaw Strategy and those taught using Conventional Method

Groups	Test	N	Mean	SD	Mean difference
Jigsaw Strategy	Post-test	26	65.54	5.67	16.85
Conventional Method		55	48.69	7.79	

Note: N=Number of students, S. D= Standard deviation

The results in Table 2 revealed that after the treatment, the mean achievement scores of students taught using jigsaw strategy (n = 26) was (M = 65.54, SD = 5.67) and that of their counterparts taught using conventional method (n = 55) was (M = 48.69, SD = 7.79) respectively. The overall mean difference between the two groups was 16.85 in favor of students taught using jigsaw strategy. This implies that, after exposure to treatment using jigsaw strategy, students' achievement substantially improved higher than their counterparts taught using conventional method. The significance of the difference in the post-test scores between the two groups was further determined by testing the corresponding null hypothesis.

Research Question Three: What is the difference in the retention mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method?

Table 3: Retention Mean Scores and Standard Deviation of Students taught Carpentry and Joinery using Jigsaw Strategy and Conventional Method

Group	Test	N	Mean	SD	Mean difference
Jigsaw Strategy	Retention	26	63.85	6.25	18.43
Conventional Method		55	45.42	7.68	

The results in Table 3 revealed that the retention mean scores of students taught using jigsaw strategy (n = 26) was (M = 63.85, SD = 6.25) and that of their counterparts taught using conventional method (n = 55) was (M = 45.42, SD = 7.68) respectively. The overall mean retention difference between the two groups was 18.43 in favor of students taught using jigsaw strategy. This implies that, students taught using jigsaw strategy retained the learned Carpentry and Joinery concepts higher than their counterparts taught using conventional method. The significance of the difference in the retention scores between the two groups was further determined by testing the corresponding null hypothesis.

Null Hypothesis One: There is no significant difference in the pre-test mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method.

Table 4: t-test of Independent Sample Analysis of Pre-test Mean Achievement Scores of Students taught Carpentry and Joinery using Jigsaw Strategy and those taught using Conventional Method

Group	N	Mean	SD	Df	t-value	*P*-value	Decision
Jigsaw Strategy	26	42.62	6.49	79	- 0.384	0.702	Retained
Conventional Method	55	43.18	6.05				

The results in Table 4 revealed the t-test of independent sample analysis of pre-test man achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method. The pre-test man achievement scores of students taught using jigsaw strategy (n = 26) was (M = 42.62, SD = 6.49) and that of their counterparts taught using conventional method (n = 55) was (M = 43.18, SD = 6.05) respectively, the overall mean difference between the two groups was 0.56. The df = 79, t(79) = - 0.384, *P* = 0.702. Since the *P* = 0.702 is greater than the 0.05 level of significance (0.702 >0.05), this implies that the null hypothesis ----- which states that "there is no significant difference in the pre-test mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method" was retained. Therefore, initially, the students from both jigsaw strategy and conventional method were at the same cognitive ability.

Null Hypothesis Two: There is no significant difference in the post-test mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method in Technical Colleges in Bauchi State.

Table 5: t-test of Independent Sample Analysis of Post-test Mean Achievement Scores of Students taught Carpentry and Joinery using Jigsaw Strategy and those taught using Conventional Method

Group	N	Mean	SD	Df	t-value	*P*-value	Cohen's d	Decision
Jigsaw Strategy	26	65.54	5.67	79	9.848	0.000	2.47	Rejected
Conventional Method	55	48.69	7.79					

The results in Table 5 revealed that, the t-test of independent sample analysis of post-test man achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method. The post-test man achievement scores of students taught using jigsaw strategy (n = 26) was (M = 65.54, SD = 5.67) and that of their counterparts taught using conventional method (n = 55) was (M = 48.69, SD = 7.79) respectively, the overall mean difference between the two groups was 16.85. The df = 79, t(79) = 9.848, *P* = 0.000 and Cohen's d value of 2.47 was obtained. Since the *P* = 0.000 is less than the 0.05 level of significance (0.000 <0.05) with very high effect size of 2.47, this implies that the mean of the group taught using jigsaw strategy is

2.47 standard deviation higher than that of group taught using conventional method. Therefore, the null hypothesis two which states that "there is no significant difference in the post-test mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method was rejected''. This implies that, jigsaw strategy is more effective than conventional method in enhancing students' achievement in Carpentry and Joinery.

Null Hypothesis Three: There is no significant difference in the retention mean scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method.

Table 6: t-test of Independent Sample Analysis of Retention Mean Achievement Scores of Students taught Carpentry and Joinery using Jigsaw Strategy and those taught using Conventional Method

Group	N	Mean	SD	df	t-value	*P*-value	Cohen's d	Decision
Jigsaw Strategy	26	63.85	6.25	79	10.674	0.000	2.63	Rejected
Conventional Method	55	45.42	7.68					

The results in Table 6 revealed the t-test of independent sample analysis of retention mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method. The post-test man achievement scores of students taught using jigsaw strategy (n = 26) was (M = 63.85, SD = 6.25) and that of their counterparts taught using conventional method (n = 55) was (M = 45.42, SD = 7.68) respectively. The overall mean retention difference between the two groups was 18.43. The df = 79, t(79) = 10.674, *P* = 0.000 and Cohen's d value of 2.63 was obtained. Since the *P* = 0.000 is less than the 0.05 level of significance (0.000 <0.05) with very high effect size of 2.63, this implies that the retention mean of the group taught using jigsaw strategy is 2.63 standard deviation higher than that of group taught using conventional method. Therefore, the null hypothesis three which states that "there is no significant difference in the retention mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy and those taught using conventional method", was rejected. This implies that, jigsaw strategy is more effective than conventional method in enhancing students' ability to retained learned carpentry and joinery.

DISCUSSION OF FINDINGS

The result of research question one and its correspondent null hypothesis revealed that there was no significant difference in the pre- and conventional method. This finding is consistent with the work of Yapici (2020) who in his quasi-experimental study, The effect of jigsaw learning on the academic achievement and attitude of students in http://www.shanlaxjournals.com 41 Shanlax International Journal of Education Mathematics class. This implies that, prior to commencement of the study, students' achievement in Carpentry and Joinery was statistically the same and therefore, the

students were at the same cognitive level, hence they were suitable for the study.

The result of research question two and its corresponding null hypothesis indicated that the post-test mean achievement scores of students taught Carpentry and Joinery using jigsaw strategy substantially improved higher than their counterparts taught using conventional method. The t-test of independent samples of analysis hypothesis two presented on table 5 revealed that, the difference was significant .This implies that, jigsaw strategy is more effective than conventional method in enhancing students' achievement in Carpentry and Joinery. This finding was in harmony with that of Yisa and Lewu (2021); Fasasi and Istifanus (2022); Anari et al., (2024); Bello and Mukhtar (2025) who in their separate studies found that jigsaw strategy was more effective than the conventional method in enhancing students' achievement. Based on this finding, it was established that jigsaw strategy was more effective than the conventional method in enhancing students' achievement.

The result of research question three and its corresponding null hypothesis revealed the mean retention scores of students taught Carpentry and Joinery using jigsaw strategy and conventional method. It was revealed that, students taught Carpentry and Joinery using jigsaw strategy retain learned Carpentry and Joinery concepts better than their counterparts taught using conventional method. Therefore, t-test revealed that, the difference in the mean retention scores of students taught Carpentry and Joinery using jigsaw strategy and conventional method was significant. This finding is in harmony with that of Yisa and Lewu (2021); Omoroh and Ijeh (2024); Nneka et al., (2024) Ibe (2025) who in their separate studies found that jigsaw strategy was more effective than the conventional teaching method in enhancing students' retention of learned concepts.

CONCLUSION

Based on the findings and discussions from this study, it was concluded that: the use of jigsaw instructional strategy was proven to enhance students' achievement and retention in Carpentry and Joinery than the conventional method which is frequently utilized by teachers. The study provided evidence that jigsaw strategy enhances retention more than conventional method. The likely expiation for this was that jigsaw ensures learners active participation and creativity compared to the conventional method. Therefore, jigsaw strategy could be used to address the present challenge of students' poor achievement and retention of learned Carpentry and Joinery concepts.

Recommendations

Based on the findings from the study, the following recommendations are put forward.

1. The use of jigsaw instructional strategy enhances students' achievement and retention in the present study. Therefore, Carpentry and Joinery teachers should be encouraged to use such instructional strategy as medium of instruction that they can apply in their classrooms in order to improve their students' achievement and retention of learned concepts.
2. Government and educational stakeholders should organize seminar

and workshops to train technical education teachers on the use of jigsaw strategy in classrooms. In particular, such seminars/workshops should focus on the application of jigsaw strategy in technical classrooms.

3. Nigerian Educational Research and Development Council (NERDC) and the National Board for Technical Education (NBTE) should make jigsaw strategy part of the instructional strategies in the technical education curriculum.

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