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IMPACT OF THINK -PAIR-SHARE STRATEGY ON STUDENTS' ACADEMIC ACHIEVEMENT AND RETENTION IN BASIC SCIENCE AND TECHNOLOGY FROM SOME SELECTED SCHOOLS IN JAMA'A LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA

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ABSTRACT
The study investigated the Impact Of Think-Pair-Share Strategy on Students' Academic Achievement and Retention in Basic Science and Technology from some Selected Schools in Jama'a Local Government Area of Kaduna State, Nigeria. The study had three objectives, three research questions that guided the study and three hypotheses were formulated and tested at 0.05 level of significance. The study anchored on social constructivist theory of human learning by Vygotsky, 1978. A quasi-experimental design pre-test, post-test non-equivalent control group was used. Population of the study was 1153 JS 2 students offering Basic Science and Technology for 2024/2025 academic section. A sample of 158 JS 2 Basic Science and Technology students from two schools were obtained using random sampling techniques. The instrument used for data collection was Basic Science and Technology Retention Test (BSTRT) . The instrument was validated by three experts, two in the Department of Science Education and Technology and one in the department of Educational Foundations, all from the University of Jos. The reliability was established using Kuder Richardson 20(KR-20) for BSTAT which yielded coefficient of 0.76. The experimental group was taught using think- pair -share strategy while the control group was taught using lecture method. The treatment lasted for six weeks. The students were given post -test and delay post-test. The data collected were analysed using mean and standard deviation to answer the research questions while analysis of covariance (ANCOVA) was used to test the null hypotheses. Findings of the study revealed that there were significance differences in the mean academic achievement scores of students taught using think -pair-share strategy than those taught using lecture method, the findings also revealed that the strategy is gender friendly. It was recommended among others that seminars, workshops and conferences should be organized by school heads to orient Basic Science and Technology teachers on how to used think-pair- share strategy in teaching.

Keywords: Impact, strategy, Academic, Achievement, Retention

INTRODUCTION
From day one, man struggles by making several efforts to make his immediate environment better. This involves some innovative researches and applications of some scientific knowledge to change the environment for better living. By this, the environment will advance from the level man met it to another level. This advancement has a direct impact on the nation's economy as it has impact on every aspects of human endeavor. To every nation with Nigeria inclusive, science and Technology is essential as nation's development largely depends on the level of her scientific and technological development (Ogunyebi 2018). Science as a body of knowledge helps scholars to investigate some natural phenomena with the view of understanding how the universe works. This important facts, call for teaching of basic science and technology in junior secondary schools in Nigeria because they play vital role in shaping the critical thinking levels of young scholars. Owing to their importance, curriculum planners have made Basic science and technology (BST) to be a fundamental component of the Nigeria Junior secondary school curriculum. It is designed to provide students with a broad - based education in science, technology engineering and mathematics (STEM) subjects (federal ministry of Education,2023).Basic science and technology (BST) is a subject taught in junior secondary school as a foundation for a range of subjects in the senior secondary school which

include biology, chemistry ,physics, mathematics, and technology (Adejumo,2017). It is designed to equip students with the knowledge and attitude necessary to participate effectively in an increasingly complex and technological world (Oyinloye,2019). This means that Basic science and technology is essential for national development, as it provides the foundation for scientific and technological innovation.

The 21st century world is focusing on student -centred strategies to facilitate the study of Basic Science and Technology in schools. This is because teacher -centred methods of teaching do not promote the much-required critical thinking and problem-solving skills in students which lead to improved academic achievement. In contrast, student -centred methods according to kingdom -Aaron,Etoken and Okwelle(2019) offer opportunities to students for active involvement in the teaching -learning process, communicating effectively and being proficient in understanding concepts. One of such students -centred methods that have this advantage is the cooperative learning method. Cooperatives learning method involves small groups of students working on a common assignment together so as to achieve specific objectives of that assignment.one of the cooperative learning method by (Josiah 2022) was think-pair-share strategy.

Think-Pair-Share is a cooperative learning strategy that encourages individual thinking, peer interaction, and class-wide discussion. It is widely used to foster student engagement, collaboration, and critical thinking in various educational settings, including Basic Science and Technology classrooms. This strategy, developed by Frank Lyman in 1981, has continued to evolve, with recent researches highlighting its effectiveness in enhancing student achievement, especially in complex subjects like Basic Science and Technology .The Think-Pair-Share strategy consists of three key phases .Think: The teacher poses a question or problem, and each student is given time to think and reflect individually before responding. This phase encourages independent thinking and allows students to organize their ideas. Pair: After thinking individually, students pair up with a partner to discuss their thoughts, share their responses, and listen to each other's ideas. This phase promotes peer learning, communication, and collaborative problem-solving. Share: Finally, each pair shares their findings or ideas with the entire class. This phase fosters whole-class interaction, and the teacher can guide the discussion, clarify misconceptions, and facilitate deeper understanding. The Think-Pair-Share strategy has several advantages, especially in promoting engagement, enhancing learning outcomes, and fostering a collaborative classroom environment.

Retention is a term used to demonstrate that learning has taken place and is maintained over time. This can be displayed through recognition or recall. According to Okolocha and Chukwudi (2020), retention is a factor of the mind that preserves information learned. For performance to improve, child-centered teaching approaches which give students the ability to retain what they have learned should be employed in teaching. The researchers have attributed poor retention to inappropriate teaching strategies employed by Basic Science and Technology teachers. This has opened doors for debate and there is a need to investigate the Impact of Think-Pair-Share Strategy on Students' Academic Achievement and Retention in Basic Science and Technology, and that is exactly what the researchers are out to do.

Aim and Objectives of the Study

The aim of this study is to investigate the impact of the think-pair-share strategy on the academic achievement and retention in two junior secondary school students in Basic Science and Technology in Jema'a, Kaduna state, Nigeria and the objectives are:

i. To find out the post-test and posttest mean retention scores of students taught Basic Science and Technology using think-pair-share strategy.
ii. To ascertain the difference in the mean retention scores of junior secondary two students in the experimental and control group.
iii. To investigate the interaction effects of gender and think -pair-share strategy on students' retention in BST.

Research Questions

The following research questions guided the study

i. What is the post-test and retention mean scores of JS two students in BSAT in the experimental and control groups?
ii. What is the post-test and retention mean scores of JS two male and female students taught Basic Science and Technology using think-pair-share strategy?
iii. What is the interaction effect of treatment and gender on student's retention in Basic Science and Technology?

Research Hypotheses

The study tested the following hypotheses at 0.05 level of significance

i. H_{01}: There is no significant difference in the post-test and retention mean scores of JS two students in experimental and control groups.
ii. H_{02}: There is no significant difference in the post-test and retention mean scores of JS two male and female students taught Basic Science and Technology in the experimental group.
iii. H_{03}: There is no significant interaction effects of treatment and gender on students' retention in BSAT.

METHODOLOGY

The design of the study was quasi-experimental, specifically the pretest-posttest non-equivalent control group design. The area of the study was junior secondary schools in Jama'a, Kaduna state. The population of the study was 1153(male 636 and female 587) JS 2 students offering Basic Science and Technology in 10 public junior secondary schools in Jama'a.The sample for the study was 158 junior secondary school students obtained from the two sample schools using simple random techniques. The schools were randomly assigned to experimental and control groups. The experimental group has 75 students (40 male and 35 female) while control has 83 (43 male and 40 female). The instrument used for the study was Basic Science and Technology Retention Test (BSTRT). BSTRT was made of 25 questions drawn from the two topics Human respiratory system and human circulatory system from JS 2 curriculum to ensure adequacy of questions in the content areas taught, a table of specification was used to determine the number of questions in the low and high order cognitions. Also, lesson plans were prepared on the contents for the treatment group using think-pair-share strategy. The control group lesson plan was on lecture method of teaching. The instrument was validated by lecturers in the Departments of Science Education and Educational Foundations. The reliability of the BSTRT was established using Kuder-Richardson 20(KR-20). BSTAT was administered once to 40 JS2 Basic Science and Technology students in a school outside the area of the study and data generated was used to compute the internal consistency which yielded 0.76.The instruments were administered as post-test and delay posttest. The data generated from the tests were organized and analyzed. The analysis was based on the hypotheses. The hypotheses were tested at 0.05 alpha level using Analysis of Covariance (ANCOVA). The decision rule is that when p-value was less than or equal to 0.05, the null hypotheses was rejected and whenever p-value is greater than 0.05, the null hypotheses was not be rejected.

Research Question one

What is the post-test and retention mean scores of JS two students in BSAT in the experimental and control groups?

Table 1: Post-test and Retention Mean Scores of Students in BSAT in the Experimental and Control Groups

Group	Post-test		Delayed Post-test		Mean	Mean
	N	Mean	SD	Mean	SD	Mean Gain	Gain Difference
Experimental	75	63.89	11.36	61.04	8.85	2.85	

							3.47
Control	83	46.10	6.73	39.78	8.61	6.32	

Table 1 presents the post-test and retention (delayed post-test) mean scores of students in both the experimental and control groups in BSAT. The experimental group had a post-test mean of 63.89 (SD = 11.36) and a retention mean of 61.04 (SD = 8.85), showing a mean loss of 2.85. The control group recorded a post-test mean of 46.10 (SD = 6.73) and a retention mean of 39.78 (SD = 8.61), resulting in a mean loss of 6.32. Although both groups experienced a slight decline in scores over time, the experimental group retained more knowledge than the control group. The smaller mean loss of the experimental group (2.85 compared to 6.32) implies that the think-pair-share strategy promoted better long-term retention of Basic Science and Technology concepts compared to the lecture method.

Hypothesis one

H_{01}: There is no significant difference in the post-test and retention mean scores of JS two students in experimental and control groups

Table 2: ANCOVA Result on Retention Mean Scores of Students of JS two in the Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	17952.386[a]	2	8976.193	118.742	.000
Intercept	13502.961	1	13502.961	178.625	.000
Posttest	149.894	1	149.894	1.983	.161
Group	10877.656	1	10877.656	143.896	.000
Error	11717.083	155	75.594		
Total	422672.000	158			
Corrected Total	29669.468	157			

a. R Squared = .605 (Adjusted R Squared = .600)

The ANCOVA result on Table 2 shows that the effect of group on retention scores is significant, with an F-value of 143.896 and a p-value of .000, which is less than .05. This indicates that students in the experimental group retained the learned material significantly better than those in the control group. The covariate, post-test scores, is not significant (p = .161), meaning the differences in retention are not explained by differences in post-test scores but rather by the treatment itself. With an Adjusted R^2 of .600, the model explains 60% of the variance in retention scores, showing a strong effect. This implies that there is a significant difference in retention between the experimental and control groups.

Research Question two

What is the post-test and retention mean scores of JS two male and female students taught Basic Science and Technology using think-pair-share strategy?

Table 3: Post-test and Retention Mean Scores of Male and Female Students in the Experimental Group

Group			**Post-test**		**Retention**			**Mean**
	Gender	**N**	**Mean**	**SD**	**Mean**	**SD**	Mean **Gain**	Gain Difference
Experimental	Male	40	64.40	9.57	62.40	8.38	2	1.82
	Female	35	63.31	13.24	59.49	9.23	3.82	

Table 3 shows the post-test and retention mean scores of male and female students in the experimental group. Male students had a post-test mean of 64.40 (SD = 9.57) and a retention mean of 62.40 (SD = 8.38), resulting in a mean loss of 2.00. Female students recorded a post-test mean of 63.31 (SD = 13.24) and a retention mean of 59.49 (SD = 9.23), giving a mean loss of 3.82. From these results, both male and female students showed a slight decline in performance during the retention test. However, male students had a smaller mean loss, suggesting that they retained the learned concepts marginally better than female students. Nevertheless, the difference in retention between both genders is small, implying that the think-pair-share strategy supports knowledge retention effectively for both male and female learners.

Hypothesis two

H_{02}: There is no significant difference in the post-test and retention mean scores of JS two male and female students taught Basic Science and Technology in the experimental group.

Table 4: Retention Mean Scores of JS Two Male and Female Students Basic Science and Technology in the Experimental Group

Source	Type III Sum of Squares	Df	Mean Square	F	P-value
Corrected Model	263.215[a]	2	131.607	1.713	.188
Intercept	10365.796	1	10365.796	134.921	.000
Covariate	104.678	1	104.678	1.362	.247
Gender_	170.765	1	170.765	2.223	.140
Error	5531.665	72	76.829		
Total	285236.000	75			
Corrected Total	5794.880	74			

a. R Squared = .045 (Adjusted R Squared = .019)

The finding that there is no significant difference in the post-test and retention mean scores of JS Two male and female students taught Basic Science and Technology in the experimental group is supported by the ANCOVA results presented in Table 4. The effect of gender on retention was not significant, as shown by an F-value of 2.223 and a p-value of .140, which is greater than the .05 significance level. This indicates that male and female students in the experimental group retained the learned material at similar levels after the treatment. Additionally, the covariate (post-test scores) was also not significant (p = .247), suggesting that differences in post-test performance did not influence retention outcomes. The Adjusted R^2 value of .019 further showed that gender explains only about 1.9% of the variation in retention, which is very small. Overall, the results confirm that the instructional strategy benefited both male and female students equally, with no meaningful gender-based differences in retention scores within the experimental group.

Research Question three

What is the interaction effect of treatment and gender on students retention in Basic Science and Technology?

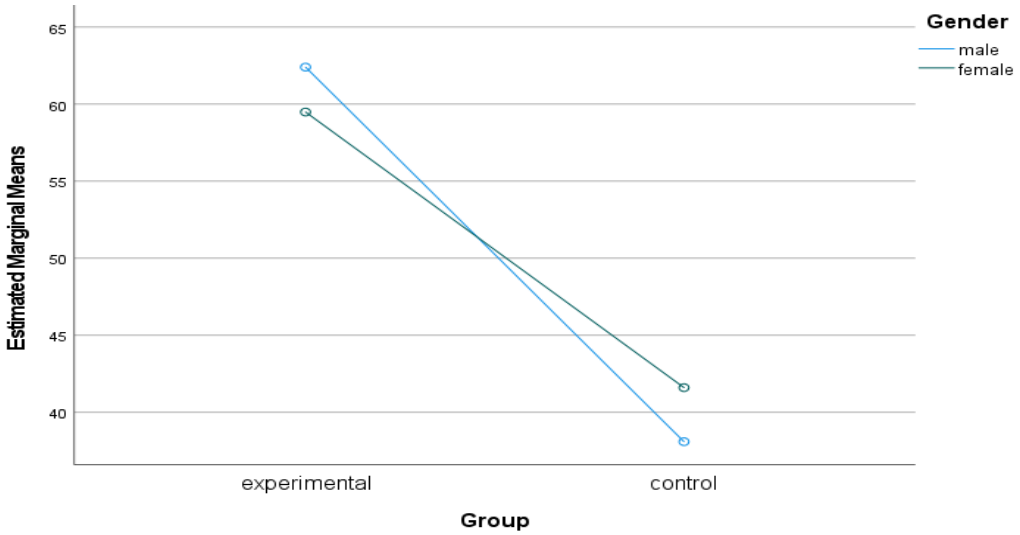

Figure 1: Showing interaction effect of Treatment and Gender on Retention of students in BSAT

Figure 1 displays the interaction effect of treatment and gender on students' retention in Basic Science and Technology concepts. Unlike the previous graph, the lines representing male and female students intersected between the treatment and non-treatment groups. This crossing of lines suggests the presence of an interaction effect between treatment and gender on students' retention. In practical terms, this means that the impact of the think-pair-share strategy on retention varied slightly between male and female students. While both genders benefited, the pattern of knowledge retention differed between them, indicating that gender influenced how effectively students retained what they learned

Hypothesis three

H_{03}: There is no significant interaction effects of treatment and gender on students' retention in BSAT

Table 5: Interaction Effect of Treatment and Gender on Retention of Students' Retention in BSAT

Source	Type III Sum of Squares	Df	Mean Square	F	P-value
Corrected Model	18344.846[a]	4	4586.211	61.961	.000
Intercept	13191.157	1	13191.157	178.218	.000
Posttest	128.948	1	128.948	1.742	.189
Group	10537.520	1	10537.520	142.366	.000
Gender	.639	1	.639	.009	.926
Group * Gender	389.342	1	389.342	5.260	.023
Error	11324.623	153	74.017		
Total	422672.000	158			
Corrected Total	29669.468	157			

. R Squared = .618 (Adjusted R Squared = .608)

The hypothesis stating that there is no significant interaction effect of treatment and gender on students' retention in Basic Science and Technology (BSAT) is not supported by the results in Table 5. The interaction term, Group × Gender, produced an F-value of 5.260 with a p-value of .023,

which is less than the significance level of .05. This indicates that the effect of the teaching treatment on students' retention depends on gende**r**, meaning that male and female students retained the material differently under the experimental and control conditions. The main effect of **group** was significant ($F = 142.37$, $p < .05$), confirming that the treatment itself had a substantial impact on retention. The main effect of **gender** alone was not significant ($F = 0.009$, $p = .926$), suggesting that there was no overall gender difference in retention across groups. The covariate (post-test scores) was also not significant ($p = .189$), indicating that differences in post-test performance did not significantly influence retention outcomes. With an Adjusted R^2 of .608, the model explains about 61% of the variance in retention scores, indicating a good model fit. The findings show that there is a significant interaction between treatment and gender, meaning that the impact of the instructional method on retention varied between male and female students.

DISCUSSION

The ANCOVA results demonstrated that TPS had a significant effect on students' retention of material. The group variable was statistically significant, indicating that students who received the experimental treatment retained content better than the control group. Interestingly, the covariate (post-test scores) did not significantly influence retention, implying that improvements were due to the TPS intervention itself rather than students' immediate post-test performance. This supports prior studies showing that TPS promotes deeper understanding and long-term learning. For example, Ibe (2025) found that TPS enhanced chemistry retention among secondary school students, and Bassey (2023) reported similar effects in the teaching of chemical bonding and molecular structure. These results suggest that TPS helps consolidate learning through interaction, discussion, and cognitive engagement, which are more effective for retention than passive instructional approaches.

The minimal gender difference observed in both achievement and retention highlights TPS as a gender-inclusive strategy**.** Zainab and Tyavbee (2025) reported that TPS significantly improved academic performance while reducing gender gaps in secondary school chemistry. Such findings suggest that TPS not only boosts overall learning outcomes but also supports equitable access to quality education for both male and female students.

The results of this study indicate that both male and female students experienced only a slight decline in scores from the post-test to the retention test, with male students showing a marginally smaller decrease. This suggests that males retained the material slightly better than females, but the difference is minimal. The findings imply that the think-pair-share (TPS) strategy was effective in promoting retention for both genders. The statistical analysis further confirmed that gender did not have a significant influence on retention outcomes, indicating that male and female learners benefited equally from the instructional approach. Additionally, post-test scores did not significantly affect retention, which implies that students' retention levels were not determined by their immediate post-test performance but rather by the TPS intervention itself. These findings align with prior research demonstrating that TPS enhances both learning and retention while minimizing gender disparities. For instance, Mbanefo, Ozoji, and John (2023) and Ejigbo, Agbo, and Ozoji (2024) reported that students retained content better when TPS was employed, regardless of gender, highlighting the strategy's inclusive effectiveness. Similarly, Zainab and Tyavbee (2025) found that TPS improved academic performance and retention for both male and female students, supporting the conclusion that this approach fosters equitable learning outcomes across genders.

The analysis of the interaction effect between treatment and gender on students' retention of Basic Science and Technology concepts revealed a different pattern from that observed for achievement. The profile plot showed that the lines representing male and female students intersected between the experimental (think-pair-share, TPS) and control (lecture) groups, indicating a significant interaction effect. This suggests that while TPS improved retention for both genders, the magnitude and pattern of improvement varied slightly depending on gender. In practical terms, the effectiveness of TPS on retention was influenced by the combination of students'

gender and the instructional method, showing that each gender responded differently to the strategy.

Although post-test performance did not significantly affect retention in the present study, and the model explained a substantial portion of the variation in retention scores, the observed interaction indicates that gender can moderate how students internalize and retain content when using TPS. These results indicate that TPS is broadly effective for enhancing retention, but educators should be mindful that male and female students may respond differently, and additional support may be necessary to ensure equitable learning outcomes across genders (Mbanefo, Ozoji, & John, 2023; Ejigbo et al., 2024)

CONCLUSION

The findings of this study demonstrate that the think-pair-share (TPS) instructional strategy is more effective than the traditional lecture method in enhancing students' achievement and retention in Basic Science and Technology. While both the experimental and control groups showed improvement, students in the TPS group exhibited significantly higher gains, highlighting the benefits of active, collaborative learning. The strategy facilitated deeper understanding, better application of concepts, and long-term retention, confirming the value of interactive instructional methods over teacher-centered approaches. Additionally, the results indicate that TPS promotes equitable learning outcomes across genders. Although minor differences were observed, male and female students benefited almost equally in both achievement and retention, suggesting that TPS can reduce gender disparities in academic performance. The interaction analyses further reveal that while TPS is broadly effective, slight variations in retention by gender may occur depending on the subject context, emphasizing the need for mindful implementation. The study confirms that TPS is an inclusive, student-centered teaching strategy that enhances academic performance, supports retention, and fosters equitable learning experiences, making it a valuable approach for science education.

RECOMMENDATIONS

Based on the findings of the study, it was recommended that:

1. Teachers of Basic Science and Technology should incorporate the think-pair-share (TPS) strategy into their instructional practices, as it has been shown to significantly improve students' achievement, understanding, and retention compared to traditional lecture methods.
2. Schools and educational authorities should provide professional development programs to train teachers on the effective implementation of TPS and other cooperative learning
3. strategies. This will help educators facilitate meaningful student interactions and maximize learning outcomes.
4. Curriculum developers should consider integrating TPS and other active learning strategies into lesson plans and teaching guides, particularly in subjects like science and mathematics, where conceptual understanding is critical.
5. Future research should explore the application of TPS across different subjects, age groups, and educational contexts. Studies could also examine additional factors such as students' self-efficacy, engagement, and attitudes to provide a more holistic understanding of TPS's impact.

Schools should foster an environment that encourages collaborative learning by providing adequate resources, classroom space, and opportunities for peer interaction, ensuring TPS activities are effectively implemented

REFERENCES

Adejumo, G. A. (2017). "Challenges in the implementation of basic science and technology curriculum in Nigerian junior secondary schools." *International Journal of Education and Research, 5*(9), 181-190.

Bassey, T. (2023). The impact of think-pair-share on students' understanding of chemical bonding and molecular structure. *Chemistry Education Research Journal*, 18(1), 33–49.

Ejigbo, S., Agbo, R., & Ozoji, E. (2024). Collaborative instructional strategies and retention in science: Gender perspectives. *African Journal of Science Education*, 21(1), 12–28.

Federal Republic of Nigeria. (2013). National policy on education. Lagos: NERDC Press.

Ibe, T. (2025). Effects of think-pair-share on retention in chemistry among secondary school students. *International Journal of Science Education Research*, 5(2), 55–71.

Jack, G.U. & Jinadu G.Y. (2023). Effect of cooperative learning with focus on jigsaw mod On secondary school students' Academic Achievement in chemistry. Journal of economics Education Research (IJEER), 6(1), 63-71.

Josiah, M.M. (2022), Jigsaw iv cooperative learning strategy and students' motivation towards senior secondary physics in Jos metropolis, Nigeria. *International Journal of Research Findings in Engineering, Science and Technology, 7*(5),1-11.

Kagan, S. (2014). *Kagan cooperative learning* (3rd ed.). San Clemente, CA: Kagan Publishing.

Kingdom-Aaron, G.I., Etolere, I.S, & Okwelle, P.C. (2019). Effect of cooperative learning Strategy on biology students' Academic performance in senior secondary school in River state. Journal of scientific Research and Report. 23(6), 1-11.

Lyman, F. (1981). The responsive classroom discussion. in A. S. Anderson (ed.), Mainstreaming digest (pp 109-113) college pack. M D: university of Maryland College of Education.

Mbanefo, C., Ozoji, E., & John, A. (2023). Think-pair-share and gender differences in genetics achievement. *Nigerian Journal of Science Education*, 20(1), 44–58.

Ogbaga, O.A & Osuafor,A.M (2022). Effect of brainstorming and think-pair-share instructional strategies on secondary school student's achievement in biology*. UNIZIK Journal of STM Education, 5*(1), 2-9.

Ogunyebi, T.H. (2018). Enhancing science performance through think -pair-share strategies among college of education students in integrated science in Ekiti state, Nigeria. *Education, 4*(4) 2489-0073.

Okolocha, C. C. & Nwaukwa, F. C. (2020). Effect of Think-pair-share instructional strategy on secondary school students' academic achievement and retention in financial accounting in Abia State. International Scholars *Journal of Arts and Social Science, 2*(1), 269.

Oyinloye, A. A. (2019). "The impact of basic science and technology curriculum on students' technological and scientific literacy in Nigeria." *Journal of Science Education and Technology, 28*(2), 153-163.

Zainab, H., & Tyavbee, K. (2025). Think-pair-share and gender-inclusive strategies in chemistry education. *International Journal of STEM Education, 12*(1), 1–17.