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Impact of Think-Pair-Share Instructional Strategy on Secondary School Students' Academic Retention in Chemistry

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CONTENT

ABSTRACT

Background: This study investigates the impact of the Think-Pair-Share (TPS) instructional strategy on secondary school students' academic retention in Chemistry, specifically covering topics such as acids, bases, and acid-base reactions. Objective: This study compares the retention scores of students taught using TPS and those taught using the traditional lecture method. Additionally, the study sought to determine whether there was any significant difference in the retention scores between male and female students taught with TPS. Method: A quasi-experimental design was used in this study, involving 192 senior secondary one (SS1) Chemistry students from a population of 5,714 in Anambra State. Stratified and simple random sampling techniques were employed to select the sample. The Chemistry Retention Test (CRT), validated by experts with a reliability coefficient of 0.81 (using Kuder-Richardson Formula 20), was used for data collection. The data were analysed using mean, standard deviation, and analysis of covariance (ANCOVA) to answer the research questions and test the hypotheses. Result: The findings revealed a significant difference in the mean academic retention scores between students taught Chemistry using the TPS strategy and those taught using the lecture method, with TPS proving more effective. Conclusion: The Think-Pair-Share instructional strategy significantly enhances the academic retention of Chemistry students compared to the traditional lecture method. Furthermore, TPS was shown to benefit both male and female students equally in terms of retention. Contribution: This study contributes to the existing body of knowledge by empirically proving that the Think-Pair-Share strategy improves students' academic retention in Chemistry, surpassing the effectiveness of the traditional lecture method.

KEYWORDS
Think-Pair-Share; Instructional Strategy; Secondary School Students'; Academic Retention; Chemistry

1. INTRODUCTION

Science is the study of the natural world using the scientific method. It is acquired by systematic investigation of the natural environment. Application of scientific knowledge to the environment gave rise to technology. Science and technology are the bedrock for national development. Science and technology have led to massive growth (Kwelle et al., 2023). Such growth and development are in electricity, transport, medicine, agriculture, and all of man's inventions are products of science and technology.

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The importance of science and technology to national development in any country's life cannot be overemphasized because knowledge and skills in science and technology are vital for the sustained development of any society (Muogbo et al., 2025). The future of every society will be determined by citizens who can understand and help shape the complex influence of science and technology in the world.

Massive growth in science and technology puts tremendous pressure on the science education system. Any nation's economic and social development depends mainly on the level of its scientific and technological knowledge (Nwuba & Osuafor, 2021). All advanced countries have a strong foundation in scientific education. A close look at the developed countries of the 21st century reveals that, just as they do in the case of science and technology, they transfer their practices in the field of education (Okekeokosisi & Okigbo, 2021).

In Nigeria, the level of scientific development depicts our economic and social development. Okekeokosisi &Anaekwe (2024) opined that a country's well-developed and implemented science and technology education programme will produce a knowledgeable and skilled workforce for the technology workforce and usher in sustainable socio-economic growth and political stability. Therefore, there is a need to improve and raise the standard of achievement, interest and retention of our students in Chemistry education.

Chemistry is one of the fundamental sciences taught in secondary schools, encompassing the study of matter's properties, composition, and structures, as well as the changes that matter undergoes and their implications for human welfare and society. It is the foundation for scientific and technological advancements, influencing nearly every aspect of daily life, from health and agriculture to food, shelter, clothing, and education (Brem et al., 2021). Given its pivotal role, the teaching and learning of Chemistry in schools deserve significant attention. Unfortunately, students' achievement in Chemistry, particularly in the Senior Secondary School Certificate Examination, has been disappointing. This is evident in the fluctuating results from the WAEC examinations over the years.

From the above statistical Chemistry achievement results in WAEC Examination (2019-2023), it was observed that the WAEC statistics of Chemistry students in these years have not shown a consistent upward trend. The WAEC Chief Examiners identified several critical weaknesses among students in their understanding of acids, bases, and acid-base reactions. These weaknesses highlight a pressing need for improved educational strategies in the subject. One of the most significant issues identified is the poor knowledge of acids, bases and acid-base reactions (Jiménez-Liso et al., 2020). Many students demonstrated a fundamental lack of understanding of key concepts, adversely affecting their performance. This deficiency is further compounded by students' inability to accurately report results from acid-base titration experiments, a vital skill in Chemistry that requires both practical ability and theoretical understanding. The consistent failure to write correct chemical equations related to acid-base reactions has also been a significant concern, reflecting a more profound lack of comprehension of essential chemical processes.

Additionally, students have struggled with calculations involving molar and mass concentration and applying gas laws. These skills are critical for success in Chemistry, yet many students displayed significant difficulties executing them effectively (Fletcher et al., 2017). Furthermore, communication skills have proven inadequate, with students often using trivial names instead of chemical formulae, which undermines their ability to articulate scientific ideas clearly and accurately. The inability to provide accurate graphical representations of concepts has also been noted, highlighting gaps in understanding the relationships between different chemical variables. Another recurring issue is students' failure to follow instructions during examinations, which prevents them from fully demonstrating their knowledge and skills. The cumulative effect of these weaknesses indicates a dire need for improvement in the teaching and learning of Chemistry, particularly regarding acids, bases, and acid-base reactions.

The chemistry of acids, bases, and acid-base reactions is a fundamental area of study within the discipline of chemistry, which is vital for understanding both theoretical concepts and practical applications. Acids are substances that can donate protons (H^+ ions) in a solution, leading to distinct properties such as a sour taste and the ability to turn blue litmus paper red. Common examples include hydrochloric acid (HCl) and Tetraoxosulphate (vi) acid (H_2SO_4). Bases, conversely, are substances that can accept protons or release hydroxide ions (OH^-) in a solution. They are typically characterized by a bitter taste and slippery feel, as seen in substances like sodium hydroxide (NaOH) and ammonia (NH_3) (Manian et al., 2022).

The interaction between acids and bases forms the basis of acid-base reactions, central to many chemical processes (Gacek & Berg, 2015). In a typical acid-base reaction, an acid reacts with a base to produce a salt and water, a process known as neutralization. The underlying principles of acid-base Chemistry are governed by theories such as the Arrhenius, Bronsted-Lowry, and Lewis definitions, each providing a framework for understanding how these substances interact. The relevance of this knowledge extends far beyond the laboratory. In a secondary school context, understanding the Chemistry of acids, bases, and acid-base reactions is critical for several reasons. It enhances academic achievement, interest and retention. WAEC Chief examiners' reports from 2019-2023 observed that Chemistry students experienced weakness mostly in these areas of Chemistry due to poor knowledge of the concepts, were unable to report results of acid-base titration experiments, were unable to make calculations on molar concentration and mass concentration, exhibited poor communication skills and used trivial names instead of formulae. The continued evidence of these concepts identified by WAEC Chief Examiners' Reports for several years gave rise to the choice of these topics, leading to poor academic retention in Chemistry (Chigbu et al., 2023).

Retention is the ability to store what has been learnt and recall what has been stored in the memory. Kim et al. (2013) argued that retention is the ability to retain and later remember information or knowledge gained when needed. The nature of the resources to be coded contributes to the level of retention (XXX, 2020). Dos (2015) noted that retention is high when the degree of original information is high. In other words, any means of teaching that may lead to effective coding leads to higher retention. In the context of this study, retention means knowledge retention. Knowledge retention involves capturing and storing knowledge so it can be used later. Some students can retain information for a long time, while others do not have such an ability. This is a function of the memory. A person's memory stores or retains information that is seen, heard, learned or experienced.

Many studies have been done concerning retention. Woldemariam (2024) reported that failure to provide enough application to real-life activities, social usage and poor teaching techniques are strong limiting factors to students' retention in Chemistry. In support of this, Ávalos & Valenzuela (2016) stated that retention depends on the teacher's teaching strategy. In the same vein, Fischer & Hänze (2019) made a case for adopting instructional methods that promote students' involvement and activity in teaching secondary school Chemistry to enhance students' retention. The persistent challenges students face call for effective instructional strategies to enhance academic achievement, interest, and retention. These strategies will help students achieve better in external examinations like WAEC and develop a more robust understanding of Chemistry through an appropriate instructional strategy in teaching and learning Chemistry.

Instructional strategy is a set of teachers' principles and methods to enable student learning. These strategies are determined partly by the subject matter to be taught and partly by the nature of the learner. For a particular instructional strategy to be appropriate and efficient, it has to consider the learner, the nature of the subject matter, and the learning it is supposed to bring about (Gorghiu et al., 2015). Chemistry as a science subject is activity-based. There are two types of instructional strategies: conventional and innovative (Ahmad et al., 2023). Conventional instructional strategy refers to the instruction using chalk and board for teachers, and pen and paper for students. In a conventional instructional strategy, students are not engaged in critical thinking, leading to rote learning with little knowledge transfer. In a conventional instructional strategy, students are very passive. Chemistry teachers often use conventional instructional strategies, including lecture methods, demonstrations, and direct instruction (Ibrahim et al., 2014). For this study, the lecture instructional strategy or method will be considered.

The lecture method (LM) of instruction is a teacher-centred and information-centred approach in which the teacher speaks and students listen. Benefits of the lecture method (LM) include time saving, scalability, every student gets the same thing, suitable for big group learning, provides additional content and a clear plan. Despite these benefits, the teaching method was found to stress more on the transmission of knowledge in a manner that emphasises memorisation; hence, it has been characterised by some educators as a poor method of teaching chemistry and science subjects. (Zendler & Greiner, 2020). Another method of instruction is innovative instructional strategies. Innovative instructional strategies, on the other hand, are new and creative ways of teaching. Innovative instructional strategy includes cooperative learning, brainstorming and think-pair-share (TPS) (Sivarajah et al., 2019). For this study, the think-pair-share instructional strategy is considered.

The think-pair-share (TPS) instructional strategy is a cooperative learning strategy that encourages students to work together to solve problems and answer questions on an assigned topic. Think-pair- share, as the name indicates, involves the students thinking about challenging academic tasks given by the teacher individually, with other students by exchanging ideas and sharing the ideas with the larger class (Solheim et al., 2018). In the think-pair-share strategy, every student is an active learner and teacher. In think-pair-share, the teacher produces a chart of students' seating arrangement. Using the chart, students are made to pair up in class to facilitate greater interaction. During the interaction among pairs, students are expected to bring to the pair learning what they think is the solution to the problem, for which the teacher has given them time to think before pairing (Lochhead, 2014).

The student pairs are to examine each other's solution to the problem, criticize or add to the solution or learn from it. The process of collaborative learning, where students in pairs combine previously thought-out ideas to solve a problem, aligns with the principles of human capital development and organizational dynamics. Mbuba (2022) emphasizes equipping individuals with cognitive and collaborative competencies to boost productivity. Similarly, Mbuba (2016) highlights how structured interaction and teamwork contribute to organizational growth and resolution. When applied in the classroom, as seen in the Think-Pair-Share strategy, such collaboration fosters knowledge construction, reflective thinking, and practical communication skills essential for personal and organizational development. The teacher appoints students randomly, looking at the chart to ensure that all the students are involved and that the intelligent ones do not dominate the activities (Xia et al., 2022). After the sharing, the teacher summarises the lesson according to what students should learn. In other words, think-pair-share takes place in three stages: individuals think silently about a question or task presented by the teacher; individuals pair up and exchange ideas; pairs share their views with the whole class. These processes of learning generate a better understanding on the part of students. Some researchers believe that think-pair-share, as one of the innovative instructional strategies, could facilitate learning and teaching the Chemistry subject (Onu & Eze, 2020). Mundelsee & Jurkowski (2021) asserted that think-pair-share (TPS) could be an excellent means to boost the academic achievement of secondary school students in science subjects, including Chemistry. It is believed that students must be appropriately guided through innovative teaching methods like the think-pair-share instructional strategy to facilitate students' understanding of complex Chemistry concepts; acid, base, and acid-base reactions, as discussed by WAEC Chief Examiners' reports. Thus, this study investigates the effect of the think-pair-share instructional strategy on secondary school chemistry students' achievement, interest, and retention, which are influenced by gender.

Gender is defined as the state of being male or female. Gender is an individual's biological sex, which is assumed to be an important determinant factor in science and technology education (Ilo, 2019). Some researchers have shown contradictory evidence on students' academic achievement in science due to gender. Different methods of instruction are either gender sensitive or gender bias. Kollmayer et al. (2018) identified sex-role stereotyping and a masculine image of science as the origin of the differences between male and female achievement in science education. Zhan et al. (2015) report that females performed better than male students when taught Mathematics using cooperative learning. Kebede et al. (2025) averred that think-pair-share effective teaching improves the achievement of male and female integrated science students, especially the female students. These mixed findings are deemed fit to determine whether the think-pair-share instructional strategy will provide an inclusive method to facilitate male and female Chemistry students' achievement, interest, and retention in acid, base, and acid-base reactions. These areas are important in Chemistry teaching and learning and feature prominently in WAEC examination questions. Against this backdrop, the researcher investigates the use of innovative teaching, such as the think-pair-share instructional strategy, on students' retention in Chemistry in senior secondary school in Anambra State.

This study aims to examine the effect of the think-pair-share instructional strategy on secondary school students' retention in Chemistry. Specifically, the study aims to determine two key aspects: first, the mean retention scores of students taught Chemistry using the think-pair-share strategy compared to those taught through the lecture method. Second, the study will investigate the mean retention scores of male and female students taught Chemistry using the think-pair-share instructional strategy. By addressing these points, the study seeks to provide valuable insights into the effectiveness of think-pair-share in enhancing student retention in Chemistry.

2. METHOD

2.1 Research Design

The study employed a quasi-experimental design, specifically the pretest-posttest non-equivalent control group design. The research was conducted in the Awka Education Zone of Anambra State, which encompasses forty-nine government-owned co-educational secondary schools. The study aimed to investigate the impact of the think-pair-share instructional strategy on students' retention in Chemistry.

2.2 Research Subjects

The study population was 5,714 senior secondary one (SS1) Chemistry students (3,173 females and 2,541 males) in the Awka Education Zone. A total of 192 senior secondary one Chemistry students were selected as the sample for the study. Stratified and simple random sampling techniques were used to select the schools and students for participation. Four co-educational schools were chosen, with two schools assigned to the experimental group and two to the control group. The experimental group included 48 male and 54 female students, while the control group comprised 49 male and 41 female students.

2.3 Data Collection

The instrument used for data collection was the Chemistry Retention Test (CRT), which consisted of 50 multiple-choice questions covering the concepts of acids, bases, and acid-base reactions. The questions were designed based on a table of specifications representing different levels of knowledge. Each correct response earned two marks, yielding a total score of 100 marks. Experts in the Departments of Science Education and Educational Foundations validated the instrument. Reliability was established using the Kuder-Richardson 20 (KR-20) formula, yielding a reliability coefficient of 0.81 after administration to a sample of 30 SS1 Chemistry students outside the study area.

2.4 Data Analysis

The data collected were analysed using mean and standard deviation to address the research questions. An analysis of covariance (ANCOVA) was conducted to test the hypotheses. The decision rule was that the null hypothesis would be rejected if the p-value were less than or equal to 0.05. The null hypotheses would not be rejected if the p-value was greater than 0.05.

The experimental procedure included two phases: training of research assistants and the treatment phase. The training phase involved the research assistants from the sampled schools, who were Chemistry teachers. The training covered the experimental group's think-pair-share strategy and the control group's lecture method. The treatment phase lasted six weeks, with four weeks allocated for pretest and posttest administration and two weeks for the retention test.

In the treatment phase, the pretest was administered first, followed by the orientation of students on the think-pair-share strategy. The teacher modelled the selection of pair partners and explained how students would work in pairs for the entire treatment period. Weekly lessons on the chemistry concepts were conducted, and students were challenged to answer questions and present their findings. Random participation was ensured by randomly selecting students to answer questions during each lesson. After the treatment, the same instruments were used for the posttest and a retention test, which was administered two weeks later.

3. RESULT AND DISCUSSION

3.1 Result

a) Research Question 1

What is the difference in the mean retention scores of students taught Chemistry with think-pair-share instructional strategy and those taught using lecture method?.

Table 1. Mean and Standard Deviation of Retention scores of Students Taught Chemistry with TPS and those Taught Using LM

Group	N	Post-test		Retention		Mean Loss	Mean Loss Difference
		Mean	SD	Mean	SD		
TPS	102	73.55	4.24	69.18	5.38	4.37	5.52
LM	90	63.11	5.10	53.22	5.88	9.89	

Table 1 showed that the post-test and retention test mean scores of students taught Chemistry with TPS were 73.55 and 69.18, respectively, while the standard deviation scores were 4.24 and 5.38, respectively. On the other hand, the post-test and retention test scores of those taught with LM were 63.11 and 53.22, respectively, while the standard deviation scores were 5.10 and 5.88. The standard deviation score for the post-test in the experimental group (TPS) was lower than that of the retention-test. This suggested less variability in the post-test scores of the students than the retention test scores in the TPS group. Hence, more scores were near the mean in the retention test than in the post-test of Chemistry students in the TPS group. Moreover, the standard deviation score for the post-test in the control group (LM) was lower than that of the retention test. This suggested less variability in the post-test scores of the students than the retention test scores in the LM group. So, more scores were near the mean in the retention test than in the post-test of students in the LM group.

The mean loss scores for Chemistry students taught with TPS were 4.37, while those of LM were 9.89. This represented a mean loss difference of 5.52 in favour of students taught Chemistry with TPS. This implied that students with TPS had better academic retention in chemistry than those taught with LM.

b) Research Question 2

What is the difference in the mean retention scores of male and female students taught Chemistry with think-pair-share instructional strategy?.

Table 2. Mean and Standard Deviation of Retention Scores of Male and Female Students Taught Chemistry with TPS

Group	N	Post-test		Retention		Mean Loss	Mean Loss Difference
		Mean	SD	Mean	SD		
Male	48	73.92	4.19	69.42	5.23	4.50	0.24
Female	54	73.22	4.30	68.96	5.55	4.26	

Table 2 showed that the posttest and retention test mean scores of male students taught Chemistry with TPS were 73.92 and 69.42, respectively, while the standard deviation scores were 4.19 and 5.23, respectively. On the other hand, the posttest and retention test mean scores of female students taught Chemistry with TPS were 73.22 and 68.96, respectively, while the standard deviation scores were 4.30 and 5.55. The standard deviation score for the posttest among male students taught Chemistry using TPS was lower than that of the retention test. This suggested less variability in the posttest scores of the students than in the retention scores of male Chemistry students. Hence, more scores were near the mean in the retention test than in the posttest of male students using TPS. Moreover, the standard deviation score for the posttest among the female students taught Chemistry using TPS was lower than that of the retention test. This suggested less variability in the posttest scores of the female students than in the retention scores. So, more scores were near the mean in the retention test than in the posttest of female students using TPS.

The mean retention score for male Chemistry students taught with TPS was 4.50, while that of their female counterparts was 4.26. This represented a slight mean loss difference of 0.24 in favour of female students taught Chemistry using TPS. This implied that female students had a slightly higher mean retention score than their male counterparts when taught with TPS.

c) Hypothesis 1

There is no significant difference in the mean retention scores of students taught Chemistry with think-pair-share instructional strategy and those taught with lecture method.

Table 3. Analysis of Covariance (ANCOVA) of Chemistry Students' Mean Retention Scores between Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	15715.282[a]	4	3928.820	299.238	0.000	
Intercept	4.477	1	4.477	0.341	0.560	
Posttest	3537.004	1	3537.004	269.396	0.000	
Groups	836.443	1	836.443	63.708	0.000	S
Gender	8.713	1	8.713	0.664	0.416	NS
Groups * Gender	18.114	1	18.114	1.380	0.242	NS
Error	2455.197	187	13.129			
Total	749044.000	192				
Corrected Total	18170.479	191				

S= Significant, NS = Not Significant

Table 3 showed a significant difference in the mean retention scores of students taught Chemistry with TPS and those taught using LM, $F(1, 187) = 63.708$, $p = 0.000$. Since the obtained p-value was less than the stipulated 0.05 level of significance, the null hypothesis was rejected, which stated that there was no significant difference in the mean retention scores of students taught Chemistry with the think-pair-share instructional strategy and those taught with the lecture method. This implied that the mean retention score of students taught with TPS was significantly higher than that of students taught with LM.

d) Hypothesis 2

There is no significant difference in the mean retention scores of male and female students taught Chemistry with the think-pair-share instructional strategy.

Table 4. Analysis of Covariance (ANCOVA) of Mean Retention Scores of Male and Female Students Taught Chemistry with TPS

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	2071.414[a]	2	1035.707	120.430	0.000	
Intercept	30.385	1	30.385	3.533	0.063	
Posttest	2066.184	1	2066.184	240.251	0.000	
Gender	2.118	1	2.118	0.246	0.621	NS
Error	851.409	99	8.600			
Total	491032.000	102				
Corrected Total	2922.824	101				

NS = Not Significant

Table 4 showed no significant difference in the mean retention scores of male and female students taught Chemistry using TPS, $F(1, 99) = 0.246$, $p = 0.621$. Since the obtained p-value was higher than the stipulated 0.05 level of significance, the null hypothesis was upheld, which stated that there was no significant difference in the mean retention scores of male and female students taught Chemistry with the think-pair-share instructional strategy. This implied that using TPS significantly improved the mean retention scores of male and female students in Chemistry.

3.2. Discussion

The study's findings showed that students taught Chemistry using the TPS instructional strategy retained more than those taught Chemistry using the lecture method. This aligned with Freedberg et al. (2019), who reported that by using instructional strategy, high-ability and low-ability students could retain concepts taught in the Chemistry class. In agreement, Munir et.al. (2019) reported that students taught Chemistry using the Cooperative instructional method significantly retained more than those taught the same using the conventional lecture method. This study reveals that students taught Chemistry using the TPS instructional strategy retained more than those taught Chemistry using the lecture method. It could be that the TPS instructional strategy enhanced retention by tailoring instruction to meet the unique needs of each learner.

The findings further showed that the TPS instructional strategy significantly affected students' retention in Chemistry when compared with those taught with LM. These findings were not far from the assertion of Chigbu et al. (2023), who discovered that the mean retention scores of students taught Chemistry using an improvised instructional method significantly remained higher than those of students taught using a conventional method. The significant improvement in retention ability of students exposed to the TPS instructional strategy, as revealed in this study, could be linked to the fact that the TPS instructional strategy recognized the unique nature of Chemistry and the learner's individuality. Thus, it encourages active participation, creative thinking, and problem-solving, improving students' retention ability. Additionally, the efficacy of the TPS instructional strategy in enhancing students' retention ability more than the lecture method could be credited to the fact that students participate actively at every stage of the instructional model.

Furthermore, it may be attributed to students' encouragement to work together as a team to attain group goals, the autonomous discovery of knowledge and taking control of their study with active facilitation of the teacher. Hong & Yu (2017) affirmed that the difference in the retention ability of the experimental and control groups arose from the fact that the TPS instructional strategy encouraged students to collaborate and share ideas among peers more frequently about a particular subject. Additionally, Chiu & Mok (2017) reported that the TPS instructional strategy allowed the development of retention ability among Mathematics students. This increase is attributed to the interaction and motivating effect of the TPS instructional strategy. This study has joined the group of knowledge that observed a significant difference in the mean retention scores of students taught Chemistry using the TPS instructional strategy and those taught using the lecture method in favour of those taught using the TPS instructional strategy.

The study findings showed that female students retained more than male students taught chemistry using the TPS instructional strategy. This aligned with Putz et al. (2020), who indicated that female students retained more than their male counterparts in using instructional strategies. This also aligned with Munir et al. (2018), who reported that female students retained more than their male counterparts in cooperative learning. Female students retained more than male students taught Chemistry using the TPS instructional strategy in the study because female students benefited more from collaborative environments that promoted engagement and self-esteem. Alternatively, cooperative learning often fosters a supportive atmosphere that has enhanced female students' confidence. Cooperative learning strategy may address specific needs or preferences in learning among female students, leading to better retention in the secondary school Chemistry concept used in this study.

The result also showed no significant difference in the mean retention scores of male and female students taught Chemistry using the TPS instructional strategy. This was in line with Abimbade et al. (2023), who observed no significant difference between male and female students taught Biology with the think-pair-share and Brainstorming strategy. The finding was also in conformity with Oladejo et al. (2023), who reported that gender differences did not exist in Chemistry retention of students in secondary school. The lack of a significant difference in mean retention scores between male and female students taught Chemistry through the TPS instructional strategy could be that the learning strategy was equally effective for diverse learners. It indicated that the learning strategies utilized catered to various learning styles or that the instructional quality was consistent across both groups. Other factors such as motivation, prior knowledge, teaching experience, and classroom environment also play a role in achieving similar retention outcomes. This result indicated that using the TPS instructional strategy enables both male and female students to gain, retain and motivate them highly and offer them the opportunity to develop their creative ability through interaction with their pairs, irrespective of gender and thus recall what they learnt. This finding has joined the body of knowledge and has found no significant difference in the mean retention scores of male and female students taught Chemistry using the TPS instructional strategy.

4. RESEARCH IMPLICATIONS

The findings of this study have significant implications for science education, particularly in Chemistry instruction at the secondary school level. The observed improvement in students' academic retention through the Think-Pair-Share (TPS) strategy suggests that student-centred, interactive teaching methods can significantly enhance long-term knowledge retention compared to traditional lecture-based approaches. This highlights the need for curriculum developers and policymakers to consider integrating TPS into official instructional guidelines, as it has proven effective in fostering deeper learning and better retention.

Furthermore, the study's results emphasise incorporating collaborative learning strategies such as TPS into teacher education programs. Educators should be trained to implement these approaches to promote active student engagement and improve learning outcomes. By equipping teachers with the skills to use TPS and similar methods, educational institutions can foster a more interactive and inclusive learning environment that supports students' retention and understanding of complex subjects like Chemistry.

This study contributes to the growing body of research advocating for active learning strategies in secondary education. It provides empirical evidence that can guide future educational practices, curriculum reforms, and teacher training programs to address better the evolving needs of students in the 21st century.

5. FUTURE RESEARCH DIRECTIONS

The findings of this study highlight the positive impact of the Think-Pair-Share (TPS) strategy on students' academic retention in Chemistry, suggesting that student-centered, interactive teaching methods improve long-term knowledge retention more effectively than traditional lecture-based approaches. This emphasizes the need for curriculum developers to integrate TPS into instructional guidelines and for teacher education programs to train educators in collaborative learning strategies. By equipping teachers with these methods, schools can foster a more engaging and inclusive learning environment. Overall, the study contributes to the growing advocacy for active learning strategies and provides evidence to guide future educational practices, curriculum reforms, and teacher training to meet the evolving needs of students.

6. CONCLUSION

The findings of this study suggest that the Think-Pair-Share (TPS) instructional strategy significantly enhances the teaching and learning of Chemistry concepts. By fostering a more interactive classroom environment, TPS makes learning more engaging for students, directly contributing to their academic retention. This strategy encourages students to actively participate in their learning process by engaging in meaningful discussions with their peers, allowing them to understand better and retain complex Chemistry concepts. As students are given opportunities to reflect on their understanding, collaborate with their peers, and share their thoughts, they are more likely to internalise the material.

Another critical conclusion drawn from this study is that the adoption of TPS by Chemistry teachers promotes increased student-to-student interaction. This interaction encourages students to take more responsibility for their learning, as they actively discuss, challenge, and refine their ideas. The collaborative nature of TPS allows students to learn from each other, improving both their comprehension and retention of the subject matter. This peer-to-peer exchange creates a more dynamic and supportive learning environment, where students can engage with content in a way that fosters more profound understanding.

Based on these findings, it is recommended that Chemistry teachers incorporate the Think-Pair-Share strategy more regularly into their instructional practices. By doing so, they can create student-centred learning environments that encourage active participation and engagement, leading to more meaningful learning experiences. Teachers should prioritise strategies that allow students to take an active role in their education, as this approach enhances retention and helps develop critical thinking and collaboration skills. The results of this study highlight the importance of adopting interactive teaching methods like TPS to improve students' academic performance in Chemistry and foster a more engaging and participatory classroom culture.

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AUTHOR CONTRIBUTION STATEMENT

The author declares that the entire research and writing process for this article was conducted independently. The author takes full responsibility for all data associated with this research. No other individual contributed as a co-author or made any significant contribution to the content of this work.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest or potential conflicts related to the research, writing, and/or publication of this article.

REFERENCES

Abimbade, O. A., Olasunkanmi, I. A., Akinyemi, L. A., & Lawani, E. O. (2023). Effects of two modes of digital storytelling instructional strategy on pupils' achievement in social studies. *TechTrends*, *67*(3), 498-507.

Ahmad, Z., Ammar, M., Sellami, A., & Al-Thani, N. J. (2023). Effective pedagogical approaches used in high school chemistry education: a systematic review and meta-analysis. *Journal of Chemical Education*, *100*(5), 1796-1810.

Ávalos, B., & Valenzuela, J. P. (2016). Education for all and attrition/retention of new teachers: A trajectory study in Chile. *International Journal of Educational Development*, *49*, 279-290.

Brem, A., Viardot, E., & Nylund, P. A. (2021). Implications of the coronavirus (COVID-19) outbreak for innovation: Which technologies will improve our lives?. *Technological forecasting and social change*, *163*, 120451.

Chigbu, G. U., Emelogu, N. U., Egbe, C. I., Okoyeukwu, N. G., Eze, K. O., Nwafor, C. K., ... & Okwo, F. A. (2023). Enhancing ESL students' academic achievement in expository essay writing using digital graphic organisers: Mixed-methods research. *Heliyon*, *9*(5).

Chigbu, G. U., Emelogu, N. U., Egbe, C. I., Okoyeukwu, N. G., Eze, K. O., Nwafor, C. K., ... & Okwo, F. A. (2023). Enhancing ESL students' academic achievement in expository essay writing using digital graphic organisers: Mixed-methods research. *Heliyon*, *9*(5).

Chiu, T. K., & Mok, I. A. (2017). Learner expertise and mathematics different order thinking skills in multimedia learning. *Computers & Education*, *107*, 147-164.

Dös, B. (2015). Creating online storylines for increasing the knowledge retention. *Procedia-Social and Behavioral Sciences*, *195*, 1051-1056.

Fischer, E., & Hänze, M. (2019). Back from "guide on the side" to "sage on the stage"? Effects of teacher-guided and student-activating teaching methods on student learning in higher education. *International Journal of Educational Research*, *95*, 26-35.

Fletcher, A. J., Sharif, A. W. A., & Haw, M. D. (2017). Using the perceptions of chemical engineering students and graduates to develop employability skills. *Education for Chemical Engineers*, *18*, 11-25.

Freedberg, S., Bondie, R., Zusho, A., & Allison, C. (2019). Challenging students with high abilities in inclusive math and science classrooms. *High Ability Studies*, *30*(1-2), 237-254.

Gacek, M. M., & Berg, J. C. (2015). The role of acid–base effects on particle charging in apolar media. *Advances in colloid and interface science*, *220*, 108-123.

Gorghiu, G., Drăghicescu, L. M., Cristea, S., Petrescu, A. M., & Gorghiu, L. M. (2015). Problem-based learning-an efficient learning strategy in the science lessons context. *Procedia-social and behavioral sciences*, *191*, 1865-1870.

Hong, S., & Yu, P. (2017). Comparison of the effectiveness of two styles of case-based learning implemented in lectures for developing nursing students' critical thinking ability: A randomized controlled trial. *International journal of nursing studies*, *68*, 16-24.

Ibrahim, N. H., Surif, J., Hui, K. P., & Yaakub, S. (2014). "Typical" teaching method applied in chemistry experiment. *Procedia-Social and Behavioral Sciences*, *116*, 4946-4954.

Jiménez-Liso, M. R., López-Banet, L., & Dillon, J. (2020). Changing how we teach acid-base chemistry: A proposal grounded in studies of the history and nature of science education. *Science & Education*, *29*(5), 1291-1315.

Kebede, Y. A., Zema, F. K., Geletu, G. M., & Zinabu, S. A. (2025). Cooperative Learning Instructional Approach and Student's Biology Achievement: A Quasi-Experimental Evaluation of Jigsaw Cooperative Learning Model in Secondary Schools in Gedeo Zone, South Ethiopia. *Sage Open*, *15*(1), 21582440251318883.

Kim, J. W., Ritter, F. E., & Koubek, R. J. (2013). An integrated theory for improved skill acquisition and retention in the three stages of learning. *Theoretical issues in ergonomics science*, *14*(1), 22-37.

Kolb, D. A., & Fry, R. (1975). Toward an applied theory of experiential learning. In C. Cooper (Ed.), *Theories of Group Process*. London: John Wiley.

Kollmayer, M., Schober, B., & Spiel, C. (2018). Gender stereotypes in education: Development, consequences, and interventions. *European journal of developmental psychology*, *15*(4), 361-377.

Kwelle, C. O., Onyeka, E. C., & Okafor-Agbala, U. C. (2023). Experiential learning strategy and students' performance in mathematics on the cognitive domain of Bloom's taxonomy in Rivers State, Nigeria. *UNIZIK Journal of STM Education*.Nnamdi Azikiwe University Journals

Lochhead, J. (2014). Teaching Analytic Reasoning Skils Through Pair Problem Solving. In *Thinking and learning skills* (pp. 109-131). Routledge.

Manian, A. P., Braun, D. E., Široká, B., & Bechtold, T. (2022). Distinguishing liquid ammonia from sodium hydroxide mercerization in cotton textiles. *Cellulose*, *29*(7), 4183-4202.

Mbuba, F. (2016). Organizational conflict and business growth: An appraisal. *COOU Journal of Public Administration, 1*(2).

Mbuba, F. (2022). The Bravo of Human Capital Development and Empolyee Productivity in the Ministry of Information, Awka. *International Journal of Academic Information Systems Research (IJAISR).* 5(2). 82-92

Mundelsee, L., & Jurkowski, S. (2021). Think and pair before share: Effects of collaboration on students' in-class participation. *Learning and Individual Differences*, *88*, 102015.

Munir, M. T., Baroutian, S., Young, B. R., & Carter, S. (2018). Flipped classroom with cooperative learning as a cornerstone. *Education for chemical engineers*, *23*, 25-33.

Munir, M. T., Baroutian, S., Young, B. R., & Carter, S. (2018). Flipped classroom with cooperative learning as a cornerstone. *Education for chemical engineers*, *23*, 25-33.

Muogbo, U. F., Okafor , T. U., Okafor, C. F., (2025). Experiential Learning Strategy as a Predicator of Male and Female Students Interest in Computer Studies in Nnewi Education Zone, Anambra State, Nigeria. *IRASS Journal of Arts, Humanities and Social Sciences,2(5)112-116*

Nwuba, I. S., & Osuafor, A. M. (2021). Effect of experiential learning approach on secondary school students' academic achievement in biology in Awka Education Zone. *South Eastern Journal of Research and Sustainable Development*, 4(2).GPH Journal+2SEJRS School District+2SEJRS School District+2

Okafor, C. J. (2018). Effect of experiential learning strategy on students' academic achievement and retention in Computer Studies. *Nigerian Journal of Educational Technology*, 18(1), 55-63.

Okekeokosisi, J.O.C. & Okigbo, E. C. (2021). Effect of activity-based instructional strategy on secondary school students' interest in computer studies in Anambra State, Nigeria. Puissant-A Multidisciplinary Journal, 2;133-143

Okekeokosisi, J.O. C &Anaekwe, M. C.(2024). Impact of individualized learning strategy on students' interest in data processing in Nnewi education zone of Anambra State, Nigeria. *Nigerian Online Journal of Educational Sciences and Technology (NOJEST), 6(2), 15-2*5

Oladejo, A. I., Nwaboku, N. C., Okebukola, P. A., & Ademola, I. A. (2023). Gender difference in students' performance in chemistry–can computer simulation bridge the gap?. *Research in Science & Technological Education*, *41*(3), 1031-1050.

Onu, V. C., & Eze, P. A. (2020). Gender and experiential learning in secondary school science classrooms: An empirical analysis. *African Journal of Science Education*, 7(2), 122–134.

Putz, L. M., Hofbauer, F., & Treiblmaier, H. (2020). Can gamification help to improve education? Findings from a longitudinal study. Computers in Human Behavior, 110, 106392.

Sivarajah, R. T., Curci, N. E., Johnson, E. M., Lam, D. L., Lee, J. T., & Richardson, M. L. (2019). A review of innovative teaching methods. *Academic radiology*, *26*(1), 101-113.

Solheim, K., Roland, P., & Ertesvåg, S. K. (2018). Teachers' perceptions of their collective and individual learning regarding classroom interaction. *Educational Research*, *60*(4), 459-477.

Woldemariam, D. Y., Ayele, H. S., Kedanemariam, D. A., Mengistie, S. M., & Beyene, B. B. (2024). Effects of technology-assisted chemistry instruction on students' achievement, attitude, and retention capacity: A systematic review. *Education and Information Technologies*, *29*(11), 13763-13785.

Xia, Q., Chiu, T. K., Lee, M., Sanusi, I. T., Dai, Y., & Chai, C. S. (2022). A self-determination theory (SDT) design approach for inclusive and diverse artificial intelligence (AI) education. *Computers & education*, *189*, 104582.

Zendler, A., & Greiner, H. (2020). The effect of two instructional methods on learning outcome in chemistry education: The experiment method and computer simulation. *Education for Chemical Engineers*, *30*, 9-19.

Zhan, Z., Fong, P. S., Mei, H., & Liang, T. (2015). Effects of gender grouping on students' group performance, individual achievements and attitudes in computer-supported collaborative learning. *Computers in Human Behavior*, *48*, 587-596.

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