UNESA Journal of Chemical Education *ISSN: 2252-9454*
Vol. 15, No. 1, pp. 46–53, January 2026

EFFECTIVENESS OF THINK-PAIR-SHARE STRATEGY IN ENHANCING STUDENTS' ACADEMIC ACHIEVEMENT AND INTEREST IN DIFFICULT CHEMISTRY CONCEPTS

Winifred Ifeoma Esiefa* and Helen Drummond

North-West University, Mahikeng

e-mail: winifeoma@gmail.com

Abstract

The failure rate in the subject chemistry at secondary school is on the increase and this has been attributed to students not understanding most of the difficult concepts which formed the foundation of the subject. The method that teachers adopt in the teaching of the subject and the manner the subject is taught may be factors that are responsible for poor performance. The methodology used is the quasi-experimental design using the pretest post-test non-equivalent control group. Quantitative and qualitative methods were employed. The population of the secondary schools used for the study was 1231, the sample size of 173 was used which was drawn using non-random sampling technique. Chemistry Achievement Test (CAT)Chemistry Interest Inventory (CII) and semi-structured interview were used for data collection. The instruments were test piloted and the internal coefficient obtained was 0.85 while the reliability index was 0.79. Mean and standard deviation were used to provide answers to the research questions and Analysis of Covariance (ANCOVA) was used to test the hypotheses. The students in the experimental group had higher interest levels with M=3.10 and Sd=0/43 for post-test compared to the students who were taught with conventional methods, with interest levels of M=2.77 and Sd=0.64. they also had higher achievement scores for the post-test in difficult chemistry concepts M=75.57 with Sd=13.76 than the control group M=63.40, SD=14.91. The think-pair-share strategy demonstrated an effective instructional approach for increasing student interest in the selected challenging chemistry topics: of solubility, hydrocarbon and metals and their compounds that were taught. The findings therefore underscore how effective this pedagogical strategy is in improving both students' interest and achievement in these difficult chemistry concepts.
Keywords: think-pair-share, achievement, interest, difficult concepts, teaching strategy

INTRODUCTION

Chemistry occupies a prime place in the secondary school curriculum in terms of its contribution to nation building, scientific literacy and technology. Yet, many classroom teachers report the interest of students to study the subject is lacking. Students find chemistry as a subject to be abstract and cognitively demanding in content areas such as solubility, metals and their compounds, and organic chemistry. The failure of students to show interest has resulted in low levels of achievement. The low interest levels and low levels of achievement over the years have generated much concern about the efficacy of conventional teaching approaches in promoting meaningful learning in chemistry. Interest levels have a significant impact on students' learning behaviour. The interest students show in learning determines how well they absorb what they are taught, how they exert effort in the performance of tasks during lessons, and how they interact with concepts they once found challenging. Students with low interest levels in chemistry learning easily forget concepts taught in class. They become uninspired in their class participation, and exhibit low levels of motivation to pursue further studies in science-related fields. From this perspective, it is pertinent to state that high interest levels in chemistry learning can be promoted by teaching practices that focus less on routine teacher-centred activities and more on curiosity, interaction and continuous participation. Achievement denotes goal attainment. Continuous reports of low achievement levels among secondary students in both national and state examinations remains a subject of concern in the chemical sciences.

Empirical findings have established a positive link between low levels of achievement among students in science subjects with the application of ineffective teaching practices [1,2]. However, cooperative learning techniques such as Think-Pair-Share improve students' achievement levels in chemistry lessons by enhancing their understanding of concepts and problem-solving abilities while improving cognitive engagement [3].

The think-pair-share strategy and an arm of a collaborative instructional approach has attracted increasing attention due to its capacity to improve classroom interaction and learning achievement. Under this approach, students are first given time to reflect individually on a problem, sharing their points with their partner before discussing them with other members of the class. This structured sequence encourages to actively participate, supports the development of communication and critical thinking skills, and then strengthens students' confidence and sense of self-efficacy [4-6]. Empirical evidence further suggests that the strategy promotes a supportive and less restrictive learning environment, were students are enabled to interact freely, participate more actively, and make informed decisions during classroom activities [7-9]. In addition, previous studies have reported that the use of think-pair-share improves learners' academic skills and enhances problem-solving abilities, by increasing motivation, engagement, and able to retain across subject areas such as mathematics and the English language [10-12]. In spite of these documented benefits, notable gaps remain in terms of subject focus, specific content areas, and research scope, particularly within secondary school chemistry learning.

Anchored in constructivist theory of learning, the think-pair-share strategy stresses the social nature of knowledge construction by students. The approach deliberately engages learners to dialogue and share their problem-solving tasks, giving them opportunities for ideas to be initiated rather than receiving them passively. Through this process, students are able to relate new concepts of ideas to their existing knowledge frameworks, which in turn promotes deeper understanding and more durable learning outcomes [13]. Against this backdrop, this research investigates how effective the strategy is in enhancing secondary school chemistry students' interest and achievement in the difficult chemistry concepts in Enugu State. Reports from the National Examinations Council consistently highlight low achievement levels in these areas, largely attributed to students' lack of interest and engagement.

Rote learning is common to traditional teacher dominated methods of teaching chemistry with little scope for intellectual curiosity. The weak relationship found here between the teaching-learning strategies and the learner's needs attributes the reason and generalization of the subject to be abstract and difficult. This also attributes the reason for low interest among some learners which has negative impacts on their achievement. For this reason, to be avoided there is need to change to student-centred teaching-learning strategies for the active involvement of learners so that it can enhance, motivate and build knowledge on the abstract and difficult concepts in chemistry. The think-pair-share strategy is a cooperative learning strategy that promotes cooperation, collaboration and interaction and has been found to increase participation of students. There is however limited research that investigates the impact of this strategy on students' interest in difficult chemistry concepts in Nigerian classrooms. Hence, the focus of this study is to assess the effectiveness of the think-pair-share strategy in teaching difficult concepts in chemistry, and its impact on students' interest and achievement. The objectives will be evaluated using the research questions: 1. What is the difference in the mean achievement scores of students taught difficult chemistry concepts using think-pair-share strategy and those taught using the conventional method and 2. what is the difference in the mean interest ratings of students taught difficult chemistry concepts using think-pair-share strategy and those taught using the conventional method? Two hypotheses will be tested at $p<0.05$ namely: 1. No significant difference in the mean achievement scores 2. No significant difference in the mean interest ratings (of students taught difficult chemistry concepts using think-pair-share

strategy and those taught using conventional methods).

METHOD

A quantitative and qualitative design was utilized in this research the quantitative was a quasi-experimental pre-test-post-test non-equivalent control group design and the qualitative design was on Chemistry Interest Inventory (CII) and an interview from the teachers and the students. The population for this study comprised 1,231 of year 2 chemistry school students across all secondary schools in the Enugu Education Zone. The sample size of 173 chemistry school students was drawn from four boys and girls (mixed) secondary schools in the Enugu Education Zone. Permission was sought to carry out the research from the Post primary Schools Management Board (PPSMB), school administrators of the sampled schools. Consent form was given to the chemistry teachers who agreed willingly to participate in the research, and another letter of consent was given to the students' parents who agreed willingly to participate in the exercise before commencement of the research work. A complete confidentiality was maintained. Given the nature of the study, a multistage sampling technique was employed. CAT and CII were instruments used to collect data. The CII was developed by the researcher; it was an inventory comprising of 30-items which was rated on a four-point Likert scale of very high (4), high (3), low (2) and very low (1) on a positive side and reversing negatively worded items as 1, 2, 3 and 4 while the CAT was constructed and adapted from past questions of the WAEC consisting of 60 multiple-choice questions with four options (A to D). Table of specification was used to develop the items, and it covered the cognitive domains. The instruments used were first scrutinized by face check and validation of the content by three experts, two from department of chemistry education and one from measurement and evaluation department of Enugu State University of Science and Technology. The internal coefficient and reliability of the CAT and CII were determined by administering to 85 students for pilot testing and the scores which were generated were used to calculate the internal coefficient and reliability index using Kuder Richardson formula and Cronbach's Alpha. The internal coefficient was obtained as 0.85 while the reliability index was obtained as 0.79. Chemistry teachers were used as research assistants for the procedures, the schools participating were assigned to either the treatment or control groups randomly, the treatment groups which are the experimental groups received their instructions with the think-pair-share strategy while the control group received using conventional methods. The research assistants implemented the strategy using the selected difficult chemistry topics which are solubility, hydrocarbons and metals and their compounds. Both groups were pretested using the CAT and CII on the first day before the experiment commenced. The researcher modified the pre-test instruments by changing the sequence of the items which were used as post-test. The research assistants received the modified CAT and CII instruments and administered them to the students as post-test, both treatments lasted for six weeks. A semi-structured interview was used for collection of data from the students and the teachers. This helped to support on how the strategy enhanced students' interest and achievement in the study and how teachers viewed the effectiveness of the strategy. The test data were then collected by the researcher for analysis. The research questions were addressed through the use of Mean and Standard deviation, while the research hypotheses were analysed by means of ANCOVA at a significant level of 0.05. while thematic analysis was used for the interview.

RESULTS AND DISCUSSION

Research Question 1: Does the use of the think-pair-share strategy have any effect on the mean academic achievement scores of students?

Table 1. Mean Achievement Scores and Standard Deviations of Students Taught Chemistry Using the Think-Pair-Share Strategy and Conventional Method

Groups	Number	Pre-test		Post-test	
		Mean ($\bar{x}$)	Standard Deviation (s)	Mean ($\bar{x}$)	Standard Deviation (s)
Experimental	84	44.57	11.24	75.57	13.76
Control	89	44.60	11.28	63.40	14.91
Total	173				

The findings revealed that the experimental and control groups enhanced students' achievement. The mean for experimental pre-test M = 44.57, SD = 11.24; for post-test M = 75.57, SD = 13.76 while for control group M = 44.60, SD = 11.28 and post-test M = 63.40, SD = 14.91. Though, those taught with the strategy reported greater gains when compared to their colleagues exposed to the conventional method. The results also disclosed that achievement scores in the conventional group were more widely spread out, suggesting inconsistencies in how students benefited from the method. In contrast, students in the experimental group recorded more clustered achievement scores, which indicates that the strategy was more uniformly effective. This was aligned by [5] that the strategy boost students' achievement.

Research Question 2: Difference in the mean interest scores of students taught using think-pair-share strategy and those taught using the conventional method?

Table 2. Difference in the Mean Interest Scores of Students Taught Using Think-Pair-Share and Those Taught Using the Conventional Method

Groups	Number	Pre-Interest		Post-Interest	
		Mean ($\bar{x}$)	Standard Deviation (s)	Mean ($\bar{x}$)	Standard Deviation (s)
Experimental	84	2.26	0.59	3.10	0.43
Control	89	2.35	0.59	2.77	0.64
Total	173				

The mean interest ratings and standard deviations of the students that were taught chemistry using both the instructional strategy and the conventional method are listed in Table 2. The pre-test mean interest rating of the students that were taught chemistry using the think-pair-share method was M = 2.26 with a SD = 0.59; its post-test mean interest rating was M = 3.10 with a SD = 0.43. The mean interest rating of the students who learned through the conventional method was M = 2.35 and SD = 0.59 prior to the treatment, and SD after the treatment was 2.77 with a 0.64 SD. These results indicated that each of the groups of students had an increased interest in the subject after the treatment; both of the post-test mean scores were higher than the pre-test mean scores. The students who learned through the think-pair-share method, however, had a greater increase in the interest that was demonstrated, as indicated by their higher post-test mean rating of interest in chemistry. The results were as expected according to [14] which described this method's use and application's ability to foster such interest in engaging students learning the material.

Hypothesis 1: There is no significant effect on the academic achievement of students' taught chemistry using the think-pair-share strategy.

Table 3. Analysis of Covariance (ANCOVA) on the Achievement Scores of Students Taught Chemistry Using Think-Pair-Share Strategy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Decision
Corrected Model	6397.135a	1	6397.135	31.010	.000	.154	S
Intercept	834646.013	1	834646.013	4045.936	.000	.959	
STRATEGY	6397.135	1	6397.135	31.010	.000	.154	
Error	35276.010	171	206.292				
Total	872795.000	173					
Corrected Total	41673.145	172					

The ANCOVA was performed on the mean achievement scores of the students who were taught the chemistry subjects with think-pair-share method strategies, was shown in Table 3. Strategy as the first main treatment effect was F – value of 31.010, which was significant at 0.000, in the table results. Strategy significantly affected students' achievement, $F(1,171) = 31.101$, $p,<.05$. Therefore, the obtained probability value p=.000 was less than level of significance so H1 was supported. There was a significant difference between the mean achievement scores of students taught chemistry with the think-pair-share strategy and those who were taught with the conventional teaching method after controlling for their pre-test scores. The .154 partial eta squared value is sufficiently large to indicate effect size. 15.4% of the students' achievements could be attributed to the think-pair-share strategy. The difference in students' achievements was therefore in favour of the students taught with the think-pair-share strategy which confirmed it as an effective teaching strategy for improving students' achievements in the chemistry subject.

Hypothesis 2: There is no significant effect on the students' interest when they are taught using the think-pair-share strategy.

Table 4. Analysis of Covariance (ANCOVA) on the Mean Interest Ratings of Students Taught Chemistry Using Think-Pair-Share Strategy and Those Taught Using Conventional Methods

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Decision
Corrected Model	4.724a	1	4.724	15.580	.000	.084	S
Intercept	1490.140	1	1490.140	4914.115	.000	.966	
STRATEGY	4.724	1	4.724	15.580	.000	.084	
Error	51.853	171	.303				
Total	1543.114	173					
Corrected Total	56.578	172					

The mean interest ratings of students taught chemistry using the technique and those taught using conventional methods were analyzed using the Analysis of Covariance (ANCOVA) as presented in Table 4. The result showed a significant main effect of the strategy on students' interest in chemistry, $F= 15.580$, $p<.05$. Since the significance value ($p<.000$) was less than 0.05, H2 was rejected. The partial eta squared value of 0.084 indicates a moderate effect size, implying that approximately 8.4% of the variance in students' interest ratings was attributable to the strategy. This finding suggests that students taught using the think-pair-share strategy demonstrated significantly higher interest in chemistry than those taught using the conventional method, in favour of the experimental group.

Insights from teacher interviews further reinforced these outcomes. Many teachers observed that the think-pair-share strategy provided students with the opportunity to process information more thoroughly by discussing with peers before attempting tasks individually. One teacher observed that, *"Students who shared their ideas in pairs gained knowledge and had a better understanding of the concepts which reflected in their test performance"* Another teacher also noted that, *"Students interest was boosted as a result of*

the strategy through interaction with peers, students' suddenly showed interest and was able to participate fully when they were paired and no longer saw the subject as boring and abstract."

Teachers in contrast reported that students' achievements were uneven in conventional methods. While a few students who achieved higher had a good performance, a good number of students were left behind due to inadequate opportunities for students to interact and get more clarification from peers during the lesson. As one teacher noted, "O*nly a few students was able to grasp the lesson in the conventional method as others did not get the chance to talk through the problems."* This pattern helps to explain why achievement scores in the conventional group were more widely dispersed than those recorded for students taught using the strategy.

Further qualitative evidence also provided insight into gender-related patterns observed in the quantitative results. Teachers consistently reported that female students appeared more responsive to the strategy, largely because it creates a supportive and non-threatening environment for expression. A teacher explained that *"The girls were more engaged when they discussed in pairs, their confidence was higher in solving problems when they must have explained the concepts to each other, this was reflected in their test scores."* Again, another teacher stated that female students showed intense insistence when attempting questions that where difficult during pairing activities, this could also be reason for their comparatively stronger performance.

Also, teachers noted that, for the male students', many benefited from the strategy, but some tended to dominate without involving their partners in the discussion. This behaviour may have contributed to the wider spread of achievement scores within the male group. In the conventional teaching method, there was an uneven gain in the participation with a few high-performing students excelling while others particularly male students struggle to keep pace. These observations reinforced the quantitative findings that the conventional instructional approach produced less consistent gains in students' achievement and interest.

Taken together, the convergence of quantitative and qualitative evidence indicates that the strategy not only enhanced students' overall achievement in chemistry but also produced a more sustained active engagement, Altogether, the integration of quantitative and qualitative evidence suggests that the think-pair-share strategy not only enhanced students' overall achievement in chemistry but also ensured a more consistent distribution of performance across learners. The strategy enabled both high-and low-achieving students to attain better learning outcomes by promoting peer collaboration and sustained active engagement than those observed under the conventional teaching methods.

The quantitative results of the study also revealed that the students who received think-pair-share chemistry instruction exhibited significantly greater interest and achieved higher mean achievement scores in comparison to the students who received conventional chemistry instruction. The significantly established difference supports the assertion that the think-pair-share learning strategy was effective at increasing achievement in academic lessons. The effectiveness of the strategy at increasing achievement in academic lesson likely resulted in the decreased reliance on rote learning. Instead, the strategy increased the students' comprehension of difficult topics through peer explanation and shared reasoning. Additionally, the interactive element of the think-pair-share learning strategy creates a favorable learning environment that prevents boredom, encourages diverse input, and removed passive learning, replacing it with active cognitive engagement. The interest-related findings were also similar in that the students who experienced think-pair-share chemistry instruction achieved higher interest mean scores compared to students who received conventional teaching strategies. Thus, the think-pair-share learning strategy has been proven effective at increasing both achievement in and interest for the subject matter. These findings support previously reported findings of increased lesson enjoyment that resulted from implementing the think-pair-share learning strategy during lessons [14]. These related findings have also established that the same

strategy increases students' self-esteem, enhances communication skills between learners, fosters a positive attitude towards learning, all of which have increased the interest of students [5, 15, 16].

These results confirm the earlier studies emphasizing how the think-pair-share strategy per se promotes achievement through learning by doing, thinking critically, solving problems, and collaboratively constructing knowledge [6, 7, 17]. Thinking alone, sharing with peers, and presenting to the whole class provides numerous engagement, clarification and feedback opportunities that lead to strong conceptual grasp and achievement. Other science and math-related activities have shown similar benefits [1, 18]. Qualitative interviews also provide support for the findings, as teachers noted that when students share with peers, they emerge with a clearer understanding of challenging concepts, increased levels of interest, and higher levels of achievement.

CONCLUSION

The implications of these findings related to the education of secondary school students are also far-reaching. For students, the implementation of the think-pair-share strategy can lead to the development of active learning and problem-solving skills that can improve the long-term retention of the material. For educators, the implementation of this strategy can have a flexible structure that can be used to better tailor instruction towards students and their misconceptions. Additionally, administrators of secondary school chemistry programs can also utilize these findings of the study to direct greater focus onto the use of the think-pair-share strategy in these programs. However, limitations did exist for the study and its implementation. Limitations existed with regard to the availability of materials for chemistry instruction, in differences in the activities of teachers that participated in the study, limitations that were based on time, and limitations that were based on course requirements.

REFERENCES

1. Muhfahroyin, Rachmadiarti, F., Mahanal, S., Zubaidah, S., and Siagiyanto, B. E. 2023. Improving Critical Thinking of Low Ability Students through TPS and PBL Integration in Biology Learning. *Journal of Turkish Science Education*, Vol. 20, No. 4, pp. 606–618.
2. Mamba, D., and Putsoa, B. 2018. Secondary School Science Teachers' Knowledge and Implementation of Effective Teaching Strategies in High-Performing Schools in Swaziland. *African Journal of Research in Mathematics*, *Science and Technology Education,* Vol. 22, No. 1, pp. 14–26.
3. Thongkorn, P., and Cojorn, K. 2025. Enhancing Students' Collaborative Problem Solving Competency through Creativity-Based Learning Combined with Collaborative Learning in Chemistry Learning. *Jurnal Penelitian dan Pembelajaran IPA,* Vol. 11, No. 1, pp. 78–97.
4. Rehman, A. U., Nadeem, H. A., and Rafiq, M. 2021. Effect of Think-Pair-Share Teaching Strategy on Understanding the Concept of Science in Students at Elementary Level. *Harf-o-Sukhan*, Vol. 5, No. 3, pp. 333–345.
5. Nasrulloh, M. F., Khoiron, A., Zuhriawan, M. Q., and Hidayatulloh, F. 2024. The Implementation of the Cooperative Learning Model Type Think Pair Share (TPS) on Eighth Grade Students in Terms of Student Self-Confidence. *APPLICATION: Applied science in Learning Research*, Vol. 4, No. 2, pp. 45–50.
6. Ismail, F. A., Bungsu, J., and Shahrill, M. 2023. Improving Students' Participation and Performance in Building Quantities through Think-Pair-Share Cooperative Learning. *Indonesian Journal of Educational Research and Technology*, Vol. 3, No. 3, pp. 203–216.
7. Alsmadi, M. A., Tabieh, A. A. S., Alsaifi, R. M., and Al-Nawaiseh, S. J. 2023. The Effect of the Collaborative Discussion Strategy Think-Pair-Share on Developing Students' Skills in Solving Engineering Mathematical Problems. *European Journal of Educational Research*, Vol. 12, No. 2, pp. 1123–1135.
8. Apriyanti, D., and Ayu, M. 2020. Think-Pair-Share: Engaging Students in Speaking Activities in Classroom. *Journal of English Language Teaching and Learning*, Vol. 1, No. 1, pp. 13–19.
9. Sumekto, D. R. 2018. Investigating The Influence of Think-Pair-Share Approach Toward Studentsâ€™ Reading Achievement. *Lingua Cultura*, Vol. 12, No. 2, pp. 195–202.

10. Tarigan, E. F. 2021. Implementation of Think Pair Share (TPS) Learning Strategies to Improve Students' Mathematical Communication Skills on Integer Materials in Class VII SMP Negeri 1 Tigabinanga 2014/2015 Academic Year. *IJEMS: Indonesian Journal of Education and Mathematical Science,* Vol. 3, No. 1, pp. 12–17.

11. Supakit, H., and Suksawat, J. 2024. Utilizing Integrated Think-Pair-Share and SSCS Techniques to Enhance Problem-Solving Skills in Mathematical Set Among 10th Grade Student. *Journal of Curriculum and Teaching,* Vol. 13, No. 4, pp. 295–303.

12. Tabassum, R., and Sadiq, A. H. B. 2024. Exploring the Impact of Think-Pair-Share Cooperative Learning Strategy on English Language Acquisition and Academic Performance of as English as Second Language (ESL). *Tahan Tahqeeq,* Vol. 7, No. 1, pp. 61–71.

13. Rotgans, J. I., and Schmidt, H. G. 2018. How Individual Interest Influences Situational Interest and how both are Related to Knowledge Acquisition: A Microanalytical Investigation. *The Journal of Educational Research,* Vol. 111, No. 5, pp. 530–540.

14. Fernández, M., Quintana, J., Dominic, W., Darius, L., and Alexandra, W. 2022. Think-Pair-Share Method as a Tool to Increase Student Interest and Learning Outcomes. *World Psychology*, Vol. 1, No. 3, pp. 141–159.

15. Permadi, U. I. M., Marhaeni, Putra, A. A. I. N., and Jaya, I. N. A. 2013. The Effect of Think Pair Share Teaching Strategy to Students'Self-Confidence and Speaking Competency of the Second Grade Students of SMPN 6 Singaraja. *Jurnal Pendidikan Bahasa Inggris Indonesia*, Vol. 1.

16. ASSOSA, E. 2022. *The Use of Active Learning Technique Think-Pair-Share in Urban Land Use Class*. Fifth Year Surveying Engineering.

17. Alfian, R. 2018. Increasing of Critical Thinking Students through Cooperative Learning Model Tps Type (Think-Pair-Share) in Social Studies Learning (Classroom Action Research in Class VIII-1/Ibnu Thufail Fitrah Insani II Junior High School). *International Journal Pedagogy of Social Studies*, Vol. 2, No. 2, pp. 46–52.

18. Ifamuyiwa, A. S., and Onakoya, S. K. 2013. Impact of Think-Pair-Share Instructional Strategy on Students' Achievement in Secondary School Mathematics. *Journal of Science Teachers Association of Nigeria (JSTAN)*, Vol. 48, No. 1, pp. 26–34.