Volume 5 Nomor 2 (2024) Pages 173 – 184
Edubase : Journal of Basic Education
Email Journal : edubase.bbc@gmail.com
Web Journal : http://journal.bungabangsacirebon.ac.id/index.php/edubase

Effect of Think-Pair-Share Instructional Strategy on Secondary School Students' Interest in Chemistry

Franklin Nnanna Ibe[1]* Bernadette A. Ezeliora[2] C. F. Okafor[2]

[1] Nwafor Orizu College of Education Nsugbe, Nigeria
[2] Chukwuemeka Odumegwu Ojukwu University, Anambra State, Nigeria

Email : frankibe89@gmail.com

Received: 2024-11-17; Accepted: 2024-12-28; Published: 2024-12-31

Abstract

This study investigated the effect of think-pair-share instructional strategy on secondary school students' academic interest in Chemistry. It covered the topics; acids, bases and acid-base reactions. Two research questions guided the study and two hypotheses were tested at 0.05 level of significance. The quasi-experimental design was adopted. The population of the study was 5,714 senior secondary school year one (SS1) Chemistry students in Awka Education zone in Anambra State. A sample of 192 SS 1 Chemistry students obtained using stratified and simple random sampling techniques was involved in the study. The instruments for data collection were Chemistry Achievement Test (CAT) and Chemistry Interest Scale (CIS) validated by experts. The reliability of the instruments were established using Kuder-Richardson Formula 20 for CAT which yielded coefficient of internal consistency of 0.81 and Cronbach Alpha for CIS with a reliability coefficient of 0.71. Data were collected by administering the instrument. The data obtained were analyzed using mean and standard deviation to answer the research questions; and analysis of covariance (ANCOVA) to test the hypotheses. The findings of the study revealed that there was significant difference in the mean interest scores of the students taught Chemistry using think-pair-share instructional strategy and those taught using lecture method in favour of think-pair share instructional strategy. Moreso, there was no significant difference in the mean interest scores of male and female students taught Chemistry using think-pair-share instructional strategy. Based on the findings, recommendations were made that workshops and seminars should be organized by school heads to orient Chemistry teachers on how to effectively use think-pair-share instructional strategy in the teaching and learning of Chemistry. The study contributed to knowledge such that it has empirically proved and established that use of TPS improves students' interest in Chemistry surpassing lecture method. The study also revealed empirically that use of TPS in teaching Chemistry enhances male and female students' interest

Keywords: *Chemistry, Instructional Strategy, Interest, Lecture Method, Think-Pair-Share*

INTRODUCTION

Education is the bedrock of societal development, and within the educational sphere, teaching methods play a crucial role in shaping students' learning outcomes (Ibe, 2021). In recent years, there has been a growing interest in innovative teaching methods, particularly in the field of Chemistry, due to their potential to enhance students' performance and engagement (Usang, 2021). Chemistry is the study of the composition, properties, synthesis and use of matter. Chemistry as a field of study is interested in how different substances react with one another and the suitable conditions for these reactions. The science of Chemistry is based on the study of atomic and molecular structure of matter to identify the properties of matter quantitatively and qualitatively (Ibe, 2021). It probes into obtaining new beneficial products that can be used in medicine, agriculture, engineering and industry. Chemistry is also based on in treating some environmental problems such as rust, pollution of air, water and soil, the shortage of water and the energy resources. Since the ancient civilization, chemistry has been related to metals, mining, production of colours, medicine and some technical industries like tanning, dyeing clothes and production of glass (Ibe, 2021). Chemistry as a building block for a range of disciplines has the potential to link other sciences together to foster greater scientific literacy (Tera,2018). For instance, in the study of gaseous exchange in secondary school, the gases oxygen (O_2) and carbon (iv) oxide (CO_2) are been exchanged as a result of stereotyped chemical reactions, which have a direct link to the biological production of energy in the mitochondrion of animal and plant cell. This energy could be harnessed and build into a capacity to do work as seen in physics.

Chemistry not only underpins technological breakthroughs but also plays a critical role in daily life, with chemical processes occurring constantly in homes around the world (Okebanama & Umate, 2023. Chemistry is crucial for effective living in the modern age of science and technology. Given its application in industry and many other professions, it is necessary that every student is given an opportunity to acquire some of its concepts, principles and skills. Within this broad framework of Chemistry, acids, bases and acid – base reaction represent fundamental concepts that not only highlight key chemical principles but also connect to various real-world applications, thereby enhancing scientific literacy (Tera, 2018).

Despite the importance of Chemistry, there are a number of observable challenges militating against the teaching and learning of the subject Chemistry, especially among the secondary school students. Various Chemistry educators have raised strong concern over the consistent low academic achievement and interest in the subject over the years (Usang; 2021, Ezeliora et al; 2021, Okebanama & Umate: 2023). Some of these factors reported by some researchers are curriculum inadequacy; problem of funding; poor methods of instructional delivery and a combination of some factors which could be physical, social or psychological. In view of the above, Chemistry education researchers have continued to seek new innovative ways of teaching and learning Chemistry, in order to proffer solutions to the persistent problem of students' poor interest in Chemistry, by exploring the effects of several instructional strategies and tools.

Students' interest in Chemistry is crucial, as it can lead to a deeper understanding of the subject, motivation to pursue scientific careers, and informed decision-making about Chemistry. Incorporating think-pair-share instructional strategy may be powerful approach to foster students' interest in Chemistry. By engaging students in hands-on activities, discussions,

and investigations, they can explore Chemistry concepts in a meaningful way. Collaborations of TPS instructional strategy can provide students with authentic learning experiences and expose them to the latest advancements of learning Chemistry. By incorporating TPS in Chemistry, students can develop a deeper understanding of Chemistry concepts, appreciate their relevance, and cultivate a lasting interest in the field. This approach not only enhances learning outcomes but also inspires students to become curious, creative, and critical thinkers.

In the process of finding remediation toward improving interest in learning, Usang (2021) suggested that more creative approach to Chemistry teaching might get students interest aroused. Also (Yusuf, Owede & Bello 2018) recommended that students should be encouraged to be active participants in their own learning. The persistent challenges faced by students call for the adoption of effective instructional strategies that can enhance academic achievement will help students not only achieve better in external examinations like WAEC but also develop a more robust understanding of Chemistry through using an appropriate instructional strategy in teaching and learning of Chemistry. Therefore, there is a need to adopt the use of Think-Pair-Share instructional strategy, which its features encourage active participation of the learner.

Think-Pair-Share (TPS) is a cooperative learning strategy that fosters student engagement and promotes critical thinking, problem-solving, and effective communication. It was first developed by Frank Lyman in 1981 as a technique to involve all students in class discussions and to encourage active participation through collaborative thinking. Ogunyebi (2018), noted that TPS involves four key components: time for the teacher to pose a question, time for students to think, time for pair discussions, and time for students to share their ideas with the larger group. This method is designed to encourage all students to participate in the learning process, providing a platform for everyone to contribute their ideas and reflections. TPS consists of three main steps*: Think, Pair*, and *Share*. This instructional approach can be applied across various educational settings, including university-level courses, and is particularly effective in science education, including Chemistry.

In the *Think* phase, the teacher begins by posing a thought-provoking question to the class, encouraging students to reflect independently. The purpose of this step is to give students the time to formulate their own thoughts and ideas about the topic without any external influence. The length of time allocated for thinking depends on the complexity of the question and the level of the students' prior knowledge. This period of independent thinking encourages cognitive engagement, allowing students to process the material more deeply.

Once students have had time to think, they move to the *Pair* phase, where they collaborate with a peer to discuss their ideas. Typically, students are paired with partners who have similar or complementary abilities to encourage meaningful dialogue and idea exchange. In this phase, students compare their thoughts, refine their understanding, and collaboratively arrive at a solution or answer to the posed question. Peer-assisted learning, where students help and support each other, is a key aspect of this phase. Pairing students strategically—such as mixing high and low performers—ensures that both students benefit from the exchange, fostering collaborative learning. This interaction also enhances their communication skills, as they must explain and justify their thinking to each other.

The final step, *Share*, involves students sharing their paired ideas with the larger class. In this phase, the teacher calls on students from each pair to present their thoughts, either through random selection or by asking students to volunteer. This step not only gives students an opportunity to articulate their ideas publicly but also promotes active listening and critical

reflection as they hear diverse viewpoints. The teacher may record responses on the board and offer feedback or clarification to ensure the accuracy of the information being shared. By involving all students in the class discussion, TPS ensures that each student's voice is heard and that no one is left out of the learning process.

TPS can be particularly valuable in Chemistry. Chemistry, with its complex concepts and abstract ideas, often poses a challenge for students to grasp fully. The TPS strategy provides a means for students to better understand and internalize chemical concepts by fostering collaborative learning. Eze and Obikwe (2018) highlighted that TPS enables students to learn from their peers, which can be particularly beneficial for slow learners and shy students. In the paired discussion phase, these students have the opportunity to build self-confidence by engaging with their peers in a low-stakes environment before sharing their ideas with the larger class. This collaborative aspect of learning not only supports comprehension but also improves retention and student interest, as the task becomes a shared effort rather than an isolated one.

In conclusion, the Think-Pair-Share instructional strategy has proven to be an effective method for fostering active learning and improving student interest, particularly in subjects like chemistry. By providing opportunities for independent thinking, peer collaboration, and class-wide sharing, TPS not only enhances students' understanding of chemical concepts but also helps them develop critical skills in communication, problem-solving, and collaboration. This strategy offers a powerful alternative to traditional lecture-based teaching methods, encouraging students to become active participants in their own learning and better equipping them to apply their knowledge in meaningful ways. Thus, this study investigates the effect of think-pair-share instructional strategy on secondary school Chemistry students' interest influenced by gender.

Gender and its influence on students' interest in Chemistry is a multifaceted issue that has gained considerable attention in educational discourse. Gender, understood as a socially constructed set of roles, behaviors, and attributes prescribed for individuals based on their perceived biological sex, is distinct from biological sex itself. The World Health Organization (2004) defines gender as the cultural norms and expectations placed on individuals based on their gender identity. This concept underscores that gender is not just about the biological distinctions between males and females, but also about how society expects individuals to behave, think, and learn. In the context of education, gender influences how students engage with academic content, particularly in traditionally male-dominated fields such as the sciences, technology, engineering, and mathematics (STEM), including Chemistry

The ongoing debate regarding gender disparities in academic achievement and interest, particularly in Chemistry subject and other science subjects, has been a focal point of research. Studies have documented that male and female students often perform differently in academic disciplines, with some suggesting that males tend to outperform females, especially in STEM subjects. For example, research by Ibe (2021) and Moyegun, (2020) indicated that male students often demonstrate higher achievement and interest in Chemistry, at the secondary school level. This has been attributed to gender role expectations, with males being more socially encouraged to pursue scientific fields, while females are often pushed toward the humanities or social sciences (Owodunn in Nwaukwa, 2020). Gender roles in society often construct science as a male-dominated domain, leading to differential academic experiences and opportunities for boys and girls (Usang, 2021). This has led to significant gaps in students' academic

achievement, as well as in their interest in subjects such as Chemistry. It is against this backdrop that the researcher investigates the use of innovative teaching like think-pair-share instructional strategy on students' interest in Chemistry in senior secondary school in Anambra State.

Purpose of the Study:

The purpose of the study is to investigate the effect of think-pair-share strategy instructional strategy on secondary school students' interest in Chemistry. Specifically, the study seeks to determine:

1. the mean interest scores of students taught Chemistry with think-pair-share instructional strategy and those taught with lecture method.
2. the mean interest scores of male and female students taught Chemistry with think-pair-share instructional strategy.

Research Questions

The following research questions guided the study:

1. What are the mean interest scores of students taught Chemistry with think-pair-share instructional strategy and those taught using lecture method?
2. What are the mean interest scores of male and female students taught Chemistry with think- pair- share instructional strategy?
3.

Research Hypotheses

The following hypotheses guided the study and are tested at 0.05 level of significance:

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

METHOD

The study employed a quasi-experimental design, specifically the pretest-posttest non-equivalent control group design. The area of the study was Awka Education zone in Anambra state. The population of the study was 5,714 (3,173 females and 2541 males) senior secondary one (SS1) Chemistry students in the forty-nine (49) government-owned co-educational secondary schools in Awka Education Zone of Anambra State. The sample for the study was 192 senior secondary school year one Chemistry students. The sample was obtained using stratified and simple random sampling techniques. Four coeducational schools were selected. From the four schools selected, the schools were randomly assigned to experimental and control groups. Two of the schools were assigned to experimental group consisting of 48 males and 54 females' students who were taught Chemistry concept using TPS and the other two were assigned to the control group consisting of 49 males and 41 females' students who were taught Chemistry concepts using LM. The instrument for the study were Chemistry Achievement Test (CAT) and Chemistry Interest Scale (CIS). The instruments were validated by experts in the Departments of Science Education and Educational Foundations. The reliability of the instruments were established using Kuder-Richardson Formula 20 for CAT which yielded coefficient of internal consistency of 0.81 and Cronbach Alpha for CIS with a reliability

coefficient of 0.71. The two instruments: CAT and CIS were administered to the group as pretest before treatment. After treatment, the subjects were administered the same instruments to determine the difference if any in their interest level. For the treatment of the experimental group, students were taught acid, base and acid-base reactions using Think-Pair-Share instructional strategy while the control group were taught the same concepts using lecture method. The teaching lasted for a period of six (6) weeks. After the completion of the treatment, the same instruments used in the pretest were administered as posttest. The data obtained were analyzed using mean and standard deviation to answer the research questions; and analysis of covariance (ANCOVA) to test the hypotheses. The decision rule is that when P value was less than or equal to 0.05, the null hypotheses were rejected and whenever P value is greater than 0.05, the null hypotheses were not be rejected.

RESULTS AND DISCUSSION

Research Question 1

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

Table 1: Mean and Standard Deviation of Interest Scores of Students Taught Chemistry with TPS and those Taught with LM

Group	Pre-interest		Post-interest			Mean Gain Difference
	N	Mean	SD	Mean	SD	Mean Gain	
TPS	102	33.96	5.06	52.05	4.79	18.09	12.26
LM	90	34.99	5.11	40.82	5.22	5.83	

The result in Table 1 showed that the pre-test and post-test mean interest scores of students taught Chemistry with TPS were 33.96 and 52.05 respectively while the standard deviation scores were 5.06 and 4.79 respectively. On the other hand, the pre-test and post-test mean interest scores of those taught with LM were 34.99 and 40.82 respectively while the standard deviation scores were 5.11 and 5.22. The standard deviation score for the pre-test mean interest score in experimental group (TPS) was higher than that of the post-test. This suggested more variability in the pre-test interest scores of the students than the posttest interest scores in TPS group. Hence, more of the scores were near the mean in the pre-interest than in the post-interest of Chemistry students in TPS group. Moreover, the standard deviation score for the pre-test interest score in control group (LM) was lower than that of the post-test interest score. This suggested less variability in the pre-test interest scores of the students than the posttest interest scores in LM group. So, more of the scores were near the mean in the post-interest than in the pre-interest of students in LM group.

The mean gain score for Chemistry students taught with TPS was 18.09 while that of LM was 5.83. This represented a mean difference of 12.26 in favour of students taught Chemistry with TPS. This implied that TPS was more efficient in promoting students' interest in the Chemistry concepts studied than those taught using LM.

Research Question 2

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

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

		Pre-interest		Post- interest			
Gender	N	Mean	SD	Mean	SD	Mean Gain	Mean Gain Difference
Male	48	33.71	5.11	52.60	5.26	18.89	1.52
Female	54	34.19	5.06	51.56	4.32	17.37	

The result in Table 2 showed that the pre-test and post-test mean interest scores of male students taught Chemistry with TPS were 33.71 and 52.60 respectively while the standard deviation scores were 5.11 and 5.26 respectively. On the other hand, the pre-test and post-test mean interest scores of female students taught Chemistry with TPS were 34.19 and 51.56 respectively while the standard deviation scores were 5.06 and 4.32. The standard deviation score for the pre-interest among male students taught Chemistry using TPS was lower than that of the post-interest. This suggested less variability in the pre-interest scores of the students than the post-interest scores of male Chemistry students. Hence, more of the scores were near the mean in the post-interest than in the pre-interest of male students using TPS. Moreover, the standard deviation score for the pre-interest among the female students taught Chemistry using TPS was higher than that of the post-interest. This suggested more variability in the pre-interest scores of the female students than the post-interest scores. So, more of the scores were near the mean in the pre-interest than in the post-interest of female students using TPS.

The mean gain interest score for male Chemistry students taught with TPS was 18.89 while that of their female counterpart was 17.37. This represented a mean difference of 1.52 in favour of male students taught Chemistry using TPS. This implied that male students had a slightly higher mean interest score than their female counterpart when taught with TPS.

Hypothesis 1

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

Table 3: Analysis of Covariance (ANCOVA) of Chemistry Students' Mean Interest Scores between Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	6334.330[a]	4	1583.582	66.757	0.000	
Intercept	5751.642	1	5751.642	242.466	0.000	
Preinterest	148.019	1	148.019	6.240	0.013	
Groups	6053.109	1	6053.109	255.174	0.000	S
Gender	1.543	1	1.543	0.065	0.799	NS
Groups * Gender	78.921	1	78.921	3.327	0.070	NS
Error	4435.915	187	23.721			
Total	431053.000	192				
Corrected Total	10770.245	191				

S= Significant, NS = Not Significant

The result in Table 3 showed that there was a significant difference in the mean interest scores of students taught Chemistry using TPS and those taught using LM, F (1, 187) = 255.174, p = 0.000. Since the obtained p-value was less than the stipulated 0.05 level of significance, the null hypothesis which stated that there was no significant difference in the mean interest scores of students taught Chemistry with think-pair-share instructional strategy and those taught using lecture methods was rejected. This implied that the mean interest score of students taught with TPS was significantly higher than the mean interest score of those taught with LM.

Hypothesis 2

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

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

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	139.994[a]	2	69.997	3.183	0.046	
Intercept	7675.779	1	7675.779	349.098	0.000	
Preinterest	112.052	1	112.052	5.096	0.026	
Gender	22.850	1	22.850	1.039	0.310	NS
Error	2176.761	99	21.987			
Total	278645.000	102				
Corrected Total	2316.755	101				

NS = Not Significant

The result in Table 4 showed that there was no significant difference in the mean interest scores of male and female students taught Chemistry using TPS, F (1, 99) = 1.039, p = 0.310. Since the obtained p-value was higher than the stipulated 0.05 level of significance, the null hypothesis which stated that there was no significant difference in the mean interest scores of male and female students taught Chemistry with think-pair-share instructional strategy was

upheld. This implied that the use of TPS significantly enhanced the mean interest scores of both male and female students in Chemistry.

DISCUSSION

The findings of the study showed that students taught Chemistry using TPS instructional strategy develop interest more than those taught using lecture method. This finding was in consonance with the findings of Usang and Okoli (2021) who found superiority in Chemistry interest among experimental group taught using TPS instructional strategy compared to control group taught using lecture method. These findings also agreed with the finding of Moyegun (2022) that think-pair-share instructional Strategy significantly improved students' achievement in Chemistry. Since students meaningfully learnt the material either on their own when thinking or during the pairing stage or sharing stage from others, their interest was aroused. The learning was made interested by the very fact that all students equally had a role to play in the learning process. Each student learnt and shared with the pair and with the class and felt they had a role in each other's learning. This thought that each student has to learn to the point of being able to teach the pair and the class sustained the interest to continue to learn. Ahmed-Hamdan (2018) emphasized that some students felt safer and more relaxed when talking in small groups, rather than having to speak in front of the entire class. The think-pair-share activity gave them the opportunity to feel more comfortable sharing their thoughts.

More so, the findings of the study showed that there was significant difference in the mean interest scores of students taught using think-pair-share instructional strategy and those taught using lecture method in favour of think-pair-share instructional strategy. The findings supported that of Orngueze and Joseph (2023) that students taught with think-pair-share instructional strategy obtained significantly higher posttest mean scores than those in the lecture method. Also, think-pair-share removed fear out of class discussion by allowing students to think carefully about their answers and talked about them with a partner before they were randomly called on to present to the whole class. It offered a lot of help for shy students who were introverts, who do not volunteer to answer questions in the class and also increased the students' interest in the subject matter. In addition to fostering social skills, this strategy also improves students' speaking and listening skill. When they feel safe about sharing their taught whether correct or wrong and had the impression that they could be guided by their pair to learn more, students' interest rose to a great extent. By the virtue of this study, this study had joined the group of knowledge that observed a significant difference in the mean interest scores of students taught Chemistry using TPS instructional strategy and those taught using lecture method in favour of those taught using TPS instructional strategy.

The findings of the study showed that male students developed more interest than female students taught Chemistry using TPS instructional strategy. This was not in line with Orngueze and Joseph, (2023) who revealed that the mean interest scores for female students were higher than that of the males in the use of TPS instructional strategy but in line with Bamiro, (2015) who confirmed that male students developed more interest than their female counterpart in the use of TPS instructional strategy in learning Chemistry in secondary school. The finding that male students developed more interest than their female counterpart in use of TPS instructional strategy in Chemistry could be linked to various factors, including societal influences, confidence levels, and cognitive strategies. Studies suggest that gender effects exist in learning Chemistry, with males potentially exhibiting greater engagement due to cultural

expectations or prior experiences that fostered confidence in Chemistry concept. Additionally, females have shown different cognitive strategies and levels of interest, which may have affected how they approached corporative learning in this subject area (Bamiro, 2015).

The finding of the study showed no significant difference in the mean interest scores of male and female students taught Chemistry using TPS instructional strategy. This was in consonance with Moyegun, (2022) who reported no significant difference in the mean interest scores of male and female students taught Biology using instructional scaffolding strategy. Similarly, the finding agreed with Usang and Okoli, (2021), who found out that using cooperative instructional strategies enhanced students' interest irrespective of gender. This result indicated that Think-pair-share instructional strategy had highly stimulating effect, transforming difficult and boring concepts into easy and pleasurable experiences thereby increasing students' interest in Chemistry. The no significant difference in the mean interest scores of male and female students taught Chemistry using TPS instructional strategy could be as a result that the learning strategy have engaged students effectively, leading to similar levels of interest regardless of gender. Additionally, it may be as a result of educational environment in the sample schools used in the study, including teacher effectiveness, relevance of the curriculum, and student support systems might play a significant role in sustaining interest across genders. It was also possible that individual learning preferences and past experiences with Chemistry could mitigate significant differences in interest scores. As a result of this finding, this study had joined the group of knowledge that observed no significant difference in the mean interest scores of male and female students taught Chemistry using TPS instructional strategy..

CONCLUSION

The conclusion drawn from the findings of the study revealed that think-pair-share instructional strategy is an effective strategy for the teaching and learning of Chemistry concept. It can also be concluded that when Chemistry teachers adopted think pair-share instructional strategy, student to student interaction increases making students to take responsibility for their learning.

BIBLIOGRAPHY

Ahmed-Hamdan, R. K. (2018). The effect of think -pair- share strategy on the achievement of third grade student in sciences in the educational district of Irbid. Journal of Educational and Practice, 8(9), 88-95.

Asyari, M. (2018). Improving critical thinking skills through the integration of problem-based learning and group investigation. State University of Malang, Indonesia, 5 (1), 36-44.

Bamiro, A. O. (2015). Effects of guided discovery and think-pair-share strategies on secondary school students' achievement in chemistry. SAGE open. The International Journal of Technologies in Learning, 21 (1): 1 - 7.

Enebechi, R. I. (2016). Effects of two instructional scaffolding strategies on secondary school students' achievement and interest. [Unpublished PhD Dissertation, University of Nigeria]. https://unn.org/uc/item/1t39b6g3

Eze, G.N & Obiekwe, P.C. (2018). Think-pair-share instructional strategy: a variety tool for

enhancing students' achievement in secondary school chemistry. African Journal of Science, Technology and Mathematics Education, 4(1), 64-71.

Ezeliora, B.A, Ibe, F.N & Obikezie, M.C. (2021). Comparative effects of teaching with improvised instructional materials and standard instructional materials on secondary school students' academic achievement in Chemistry. International Journal of Research in Education and Sustainable Development, 1(8), 27-40.

Federal Republic of Nigeria (2013). National policy on education (6th Ed.). Nigerian Educational Research and Development Council (NERDC) E Press.

Ibe F. N. (2021). Comparative effects of teaching with improvised instructional materials and standard instructional materials on secondary school students' academic achievement and retention in chemistry. [An Unpublished Master's Thesis] Chukwuemeka Odumegwu Ojukwu University.

Ibe, F. N, Obikezie, M. C. & Chikendu, R. E. (2021). Effects of improvised instructional materials on Chemistry students' academic retention in secondary school. International Journal of Research in Education and Sustainable Development, 1(5), 19-31.

Igboanugo, B. I (2018). Interactive effects of science-technology-society instructional approach, teacher experience, gender and school location on students' achievement and interest in chemistry. [Unpublished Ph.D. Dissertation] University of Nigeria.

Imam M. (2018). Improving students' reading skills through knowledge strategy. [Unpublished Ph.D. Dissertation] Ar-Raniry State Islamic University.

Moyegun, O. (2022). Effect of think-pair-share instructional strategy on secondary on students' academic achievement and interest in Chemistry. [An Unpublished M.sc Thesis] University of Abuja.

Nwaukwa, F. C. (2020). Effect of think-pair-share instructional strategy on secondary school students' academic achievement, retention and self-efficacy in financial accounting. [An Unpublished PhD Dissertation] Nnamdi Azikiwe University.

Ogunyebi, T. H. (2018). Enhancing science performance through think-pair-share strategies among college of education students in integrated science. International Journal of Education and Evaluation, 7(5), 24-35.

Okafor, C.F. & Nzomiwu, C.C. (2021). Effect of think-pair-share instructional strategy on secondary school students' academic achievement in Algebra. Chukwuemeka Odumegwu Ojukwu University Journal of Science Education & Allied Discipline, 3(1), 21-32

Okebanama, C. I &Umate, B.A. (2023). Assessing the effectiveness of think-pair-share and know-want-to-know-learn instructional strategies on students' academic achievement in Chemistry. Proceedings of the 63rd Annual Conference Science Teachers Association of Nigeria. 217-229.

Ornguze, K.K. & Joseph, S. (2023). Effect of lecture method enriched with think-pair-share techniques on interest in matter concepts among basic science students. Academic Journal of Education Research, 11(6), 133-138

Ribhi, K. A. H. (2017). The effect of think-pair-share strategy on the achievement of third grade students in sciences in the educational district of Irbid. Journal of Education and Practice, 8(9), 88-95.

Tera, G.M. (2018). The importance of physics classes for a career in STEM. The Hechinger

Report. https://givingcompass.org/article/the-importance-of-physics-classes-for-a-career-in-stem.

Usang, F. P. (2021). Effect of think-pair-share instructional strategy on secondary school students' academic achievement and interest in Chemistry. [An Unpublished M.Sc Thesis]. Nnamdi Azikiwe University.

Usang, F.P & Okoli, J.N. (2021). Effect of think-pair-share teaching strategy on secondary school students' achievement in Chemistry in Cross River state. IOSR Journal of Research & Method in Education, 11(2), 42-48.

Vygotsky, L. (1978). Interaction between learning and development. Readings on the Development of Children, 23(3), 34-41.

West African Examination Council (2015), (2016), (2017), (2018), (2019), (2020), (2021), (2022). Chief Examiners' Reports. Amao Press Ltd.

Yusuf, A.R, Owede, V. C & Bello, M. B. (2018). Effect of think-pair-share instructional strategy on students' achievement in civic education. Antolian Journal of Education, 3(2), 47-62