EFFECTS OF EXPERIENTIAL LEARNING STRATEGY ON STUDENTS' ACHIEVEMENT AND INTEREST IN CHEMISTRY AMONG SENIOR SECONDARY SCHOOLS IN MINNA, NIGER STATE

ONJEFU, Sunday; Chado, A. M. & Ndatsu, A.
Department of Science Education
School of Science and Technology Education
Federal University of Technology, Minna
Corresponding Author:

Abstract
This study investigated the effects of experiential learning strategy on students' achievement and interest in Chemistry among senior secondary schools in Minna, Niger State, Nigeria. The study was motivated by persistent poor academic performance and declining student interest in Chemistry, often linked to the dominance of traditional teacher-centred instructional methods. A quasi-experimental design involving pre-test and post-test non-equivalent control groups was adopted. The sample comprised selected SSII students from public secondary schools. Two instruments were used for data collection: the Chemistry Achievement Test (CAT) and the Chemistry Interest Inventory (CII). The instruments were validated by experts, while their reliability was established through a pilot study; the CAT yielded a Kuder–Richardson (KR-20) reliability coefficient of 0.93, while the CII also demonstrated acceptable internal consistency. Students in the experimental group were taught using an experiential learning strategy, while the control group received traditional instruction. Data were analysed using mean, standard deviation, t-test, and Mann–Whitney U test at a 0.05 level of significance. Findings revealed that students exposed to an experiential learning strategy achieved significantly higher academic performance than their counterparts. This was confirmed by the t-test result ($t = 9.36$, $p = 0.000$), indicating a statistically significant difference in favour of the experiential learning group. Similarly, students in the experimental group demonstrated significantly higher interest in Chemistry compared to those in the control group ($p = 0.000$). The study further revealed that gender had no significant influence on students' achievement and interest, suggesting that the experiential learning strategy supports inclusive learning. The study concluded that the experiential learning strategy enhances students' understanding, engagement, and positive disposition toward Chemistry more effectively than traditional teaching methods. It was recommended that teachers adopt experiential learning approaches, while stakeholders provide adequate resources and training to support activity-based instruction.
KEYWORDS: Experiential Learning, Strategy, Students', Chemistry Achievement, and Interest,

Introduction
The global emphasis on scientific skills sets the stage for strong and effective science education at the basic and secondary school levels. Science has long been regarded as the backbone of technological progress and national development, shaping how societies understand the natural world and apply knowledge to solve pressing problems. As a discipline, science encourages logical reasoning, systematic inquiry, creativity, and problem-solving skills that are essential for innovation in the modern era. In many countries, advancements in agriculture, medicine, engineering, energy, and environmental protection are driven by a strong scientific literacy among citizens. According to Carlone and Johnson (2023), nations that prioritize the teaching and learning of science tend to build competent human capital capable of driving socio-economic

transformation. Within the broad field of science, Chemistry plays a particularly central role because it explains the composition, structure, properties, and transformations of matter. Chemistry serves as a bridge among physical sciences, biological sciences, and applied technologies, making it indispensable for careers in engineering, medicine, pharmacy, agriculture, manufacturing, and environmental science. As highlighted by Talanquer (2022), Chemistry equips learners to connect microscopic interactions to macroscopic observations, helping them make sense of real-world phenomena such as energy changes, reactions, pollution, and industrial processes. This foundational relevance makes Chemistry a core subject in secondary school curricula worldwide. Highlight the problem with learning chemistry

One instructional approach that is gaining significant attention in recent years is experiential learning, which emphasizes learning through direct experience and meaningful engagement with tasks. The concept draws largely on Kolb's work, which defines learning as a process by which knowledge is created through the transformation of experience. Contemporary researchers such as Ngugi and Kimani (2023) argue that experiential learning supports deeper understanding because students actively participate, reflect, and apply new ideas rather than passively listen to explanations. This makes the strategy particularly valuable for science subjects like Chemistry, where hands-on exploration, experimentation, and real-life application are critical. A strong reason why experiential learning is considered promising is that it aligns naturally with the investigative nature of science. Science is built on curiosity, observation, experimentation, interpretation, and problem-solving processes that match the exact sequence of learning promoted by experiential models. Learners are encouraged to manipulate objects, conduct experiments, simulate chemical processes, observe outcomes, and reflect on what they have done. As pointed out by Adedoyin and Ugwueze (2024), students learn more effectively when allowed to construct meaning in their own ways, especially through practical encounters with scientific concepts. These hands-on experiences encourage the development of scientific skills such as accurate measurement, cautious observation, data recording, inference, and critical evaluation.

To understand the value of experiential learning, it is helpful to examine at the nature of the strategy itself. Experiential learning involves four interconnected stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. During concrete experience, learners engage in activities such as mixing reagents, observing a chemical reaction, or testing materials. Reflective observation allows them to think about their experience, compare outcomes with expectations, and identify patterns. In abstract conceptualization, students link what they observed to scientific theories or principles. Finally, active experimentation involves applying the new knowledge to another problem or context. Recent research, such as that by Kasso and Wanjohi (2023), shows that this cyclical process enhances retention and understanding because students learn by doing, thinking, and re-doing.

Improving student achievement requires strategies that help learners connect classroom knowledge with real-life situations. Experiential learning supports this by exposing students to authentic problem-solving tasks. When students observe chemical processes firsthand such as reactions involving heat change, color change, gas evolution, or precipitation, they are more likely to understand underlying principles. This connection between theory and practice ultimately strengthens achievement. According to Badmus and Ajani (2024), hands-on activities stimulate cognitive processing, helping learners build stronger mental models for representing and applying chemical concepts. When students actively participate, their confidence improves, misconceptions decrease, and their ability to recall and apply ideas strengthens.

However, another important variable in the study is student interest, which strongly influences on engagement and long-term learning outcomes. Interest refers to a learner's willingness, enthusiasm, curiosity, and emotional attachment to a subject. Students with high interest are more likely to participate actively, complete assignments, seek additional resources, and pursue further studies in that subject area. On the other hand, low interest often leads to avoidance, anxiety, and reduced performance. As noted by Aluko and Adebisi (2024), interest is a powerful motivational factor that determines how much effort students are willing to invest in learning.

Unfortunately, reports show that students' interest in Chemistry tends to decline as they progress through secondary school. The decline is often linked to how Chemistry is taught rather than the subject itself. When lessons are abstract, overly theoretical, or detached from real-life experiences, students begin to perceive Chemistry as difficult and uninteresting. Researche such as that by Onu and Ogbodo (2023) reveal that students prefer instructional approaches that involve practical demonstrations, field activities, real-world examples, and problem-solving experiments because they make learning more enjoyable and relatable. This highlights the need for strategies like experiential learning, which naturally stimulates curiosity and fosters continuous engagement.

One of the strongest strengths of experiential learning is its ability to ignite interest through activity participation. When students experiment with acids and bases, observe reaction rates, separate mixtures, or explore everyday chemical products, they develop a sense of excitement and connection with the material. Experiences such as observing color changes during titration, constructing simple electrochemical cells, testing water quality, or preparing soap can awaken learners' curiosity and foster lasting interest. According to Yusuf and Ibrahim (2023), students become more emotionally connected to Chemistry when they witness the relevance of chemical principles to real-life situations. This emotional connection fuels both their motivation and determination to understand the subject more deeply.

Moreover, experiential learning aligns with modern educational expectations that encourage critical thinking, creativity, and problem-solving skills. The strategy guides learners through situations that require them to hypothesize, test, and revise ideas skills that are central to scientific literacy. As science education shifts toward building competencies for real-world problem solving, approaches like experiential learning become increasingly relevant. They encourage learners to think beyond memorization and apply knowledge to new and unfamiliar challenges. According to Hassan and Bello (2024), experiential learning equips learners with 21st-century critical thinking skills essential for thriving in technologically driven societies.

As schools continue to seek strategies that can address persistent problems of low achievement and declining interest, experiential learning stands out as a promising approach that integrates hands-on activities, reflective thinking, and real-world application. Understanding how this strategy affects learning outcomes in Chemistry is essential for teachers, curriculum planners, and policymakers aiming to improve science education. It is within this background that the present study becomes relevant. While many researches have emphasized the importance of experiential learning in science education, very few have focused specifically on how the strategy influences both the achievement and interest of secondary school students in Chemistry within local school environments.

Statement of the Research Problem

Chemistry remains a fundamental subject in scientific development and everyday life; however, students' achievement in the subject has continued to decline in many secondary schools. Evidence from recent studies indicates that learners experience difficulties in understanding core concepts such as chemical equations, stoichiometry, electrolysis, and gas laws. These challenges are largely attributed to the abstract nature of instruction, often delivered with minimal hands-on engagement (Chikendu & Ejesi, 2021; Oladejo et al., 2023). As a result, many students are unable to connect theoretical knowledge with observable phenomena, leading to persistent misconceptions and poor academic performance. This situation suggests that conventional teacher-centred instructional approaches may not adequately support students in developing deep and meaningful understanding of Chemistry concepts.

In addition to low achievement, declining student interest in Chemistry has become a persistent concern. Studies have shown that many learners perceive the subject as difficult, abstract, and disconnected from real-life experiences, resulting in reduced motivation and engagement (Onu & Ogbodo, 2023; Yusuf & Ibrahim, 2023). Interest plays a critical role in learning, as it influences students' willingness to participate, sustain attention, and overcome academic challenges. When instructional practices fail to provide concrete and relatable learning experiences, students' interest diminishes, thereby further affecting their academic performance. This trend underscores the need for instructional approaches that not only enhance understanding but also stimulate learners' interest in the subject.

Although previous studies have advocated for activity-based and learner-centred strategies in science education, there is still limited empirical evidence on the combined effects of experiential learning strategy on both achievement and interest in secondary school Chemistry. While some studies in other science disciplines have reported positive outcomes, research focusing specifically on Chemistry—particularly within the context of Minna, Niger State—remains insufficient (Kasso & Wanjohi, 2023; Badmus & Ajani, 2024). This gap in literature raises the question of whether experiential learning strategy can provide a more effective means of improving students' learning outcomes. It is against this backdrop that the present study seeks to determine the effects of experiential learning strategy on students' achievement and interest in Chemistry among senior secondary schools in Minna, Niger State.

Aims and Objectives of the Study

The aim of this study is to examine the effects of experiential learning strategy on students' achievement and interest in Chemistry among senior secondary school in Minna, Niger State. The specific objectives are to:

1. Determine the effect of the experiential learning strategy and traditional teaching method on students' academic achievement in Chemistry.
2. examine the effect of the experiential learning strategy and traditional teaching method on students' interest in Chemistry.

Research Questions

The following research questions were answered in this study:

1. What is the difference in the mean academic achievement of students taught Chemistry using an experiential learning strategy and those taught with a traditional teaching method?
2. What is the difference in the mean rank interest in Chemistry of students taught using an experiential learning strategy and those taught with a traditional teaching method?

Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

H_{O1}: There is no significant difference in the mean achievement scores of students taught Chemistry with experiential learning strategy and those taught with the traditional teaching method.

H_{O2}: There is no significant difference in the mean interest scores of students taught Chemistry with experiential learning strategy and those taught with the traditional teaching method.

Methodology

Quasi – experimental research design was used for this study. The target population for this study comprised all the Senior Secondary School Two (SSII) students offering Chemistry in Secondary Schools in Minna, Niger State. Eight secondary schools were purposively selected for this study from the larger number of secondary schools in Minna that offer SSII Chemistry. Purposive sampling was applied at the school level to ensure that only schools with functional SSII Chemistry classes and complete student registers for the 2024/2025 academic session were selected. Two instruments were used for data collection in this study: the Chemistry Achievement Test (CAT) and the Chemistry Interest Inventory (CII). The Chemistry Achievement Test (CAT) and Chemistry Interest Inventory (CII) were subjected to face and content validation by three experts from the Department of Science Education, Federal University of Technology, Minna. During the validation process, the experts reviewed the instruments to ensure that the items were clearly stated, logically arranged, and appropriate for assessing students' achievement and interest in chemistry. The reliability of the instruments for this study was established through a pilot test conducted on Thirty (30) SSII Chemistry students at Government Secondary School, Maikunkele, which was part of the population but not part of the sample. The Chemistry Achievement Test (CAT) was administered once, marked, and its internal consistency was determined using the Kuder–Richardson 20 (KR-20) formula, yielding a reliability coefficient of 0.93, which indicated that the instrument was reliable for the study. The study will be carried out during the normal school timetable, and all activities will take place within regular lesson periods to maintain the natural classroom setting. The Chemistry teachers serving as research assistants administered both the pre-test and post-test in their respective schools. During the pre-test, the Chemistry Achievement Test (CAT) and the Chemistry Interest Inventory (CII) was administered to the students assigned to the Experiential Learning Strategy and the Traditional Teaching Method. For the CAT, students were required to select the option they believe represents the correct answer. For the CII, students ticked (√) the response option that best represents their level of agreement or disagreement with each item. After the six-week intervention, the same instruments (with reshuffled options) were administered again as the post-test to assess changes in achievement and interest attributable to the two instructional strategies. The data collected through the administration of the Chemistry Achievement Test (CAT) and the Chemistry Interest Inventory (CII) were analyzed using appropriate descriptive and inferential statistical techniques. Mean and standard deviation were used to answer the research

questions by describing the academic achievement and interest scores of students taught Chemistry using experiential learning strategy and those taught using the traditional teaching method. The mean scores provided information on the average performance and interest levels of students, while the standard deviations indicated the degree of variability in students' scores. To test the null hypotheses formulated for the study, independent samples t-test was employed at the 0.05 level of significance.

Results

Research Question One: What is the difference in the mean academic achievement of students taught Chemistry using experiential learning strategy and those taught with traditional teaching method?

Table 1: Mean and Standard Deviation of Pre-test and Post-test Achievement Scores of Students Taught Chemistry Using Experiential Learning Strategy and Traditional Teaching Method

Teaching Method	N	Pre-test Mean ($\bar{X}$)	SD	Post-test Mean ($\bar{X}$)	SD	Mean Gain
Experiential Learning Strategy	118	52.11	8.87	66.08	8.24	13.97
Traditional Teaching Method	122	51.94	9.01	55.02	8.03	3.08

Table 1 shows that the experimental group had a pre-test mean score of 52.11 (SD = 8.87), while the control group recorded a comparable pre-test mean score of 51.94 (SD = 9.01). This indicates that both groups were relatively equivalent in academic achievement before the treatment.

However, after the treatment, students taught using experiential learning strategy recorded a higher post-test mean score of 66.08 (SD = 8.24) compared to 55.02 (SD = 8.03) recorded by students taught using the traditional teaching method. The mean gain of 13.97 for the experimental group was substantially higher than the mean gain of 3.08 for the control group. The difference in the post-test mean achievement scores indicates that students taught using experiential learning strategy performed better academically in Chemistry than those taught using the traditional teaching method. This suggests that experiential learning strategy had a more positive effect on students' academic achievement in Chemistry. However, to determine whether the observed difference is statistically significant, a null hypothesis was tested using independent samples t-test, as presented in Table 5.

Research Question Two: What is the difference in the mean interest in Chemistry of students taught using experiential learning strategy and those taught with traditional teaching method?

Table 2: Mean Rank and Sum of Ranks of Students' Interest in Chemistry by Teaching Method

Teaching Method	N	Mean Rank	Sum of Ranks
Experiential Learning Strategy	118	178.64	21079.50
Traditional Teaching Method	122	64.23	7836.50

Table 2 presents the mean rank and sum of ranks of students' interest in Chemistry based on the teaching method used. The results show that students taught using the experiential learning strategy obtained a higher mean rank (178.64) and a larger sum of ranks (21079.50), whereas students taught using the traditional teaching method recorded a lower mean rank (64.23) and a smaller sum of ranks (7836.50). This clear difference in ranking suggests that students exposed to the experiential learning strategy demonstrated a higher level of interest in Chemistry compared to their counterparts taught through the traditional method. The higher concentration of ranks within the experimental group indicates that experiential learning more effectively stimulated students' curiosity, engagement, and positive disposition toward the subject.

HO_1: There is no significant difference in the mean achievement scores of students taught Chemistry using experiential learning strategy and those taught using the traditional teaching method.

Table 3: Z-test Analysis of Students' Achievement Scores by Teaching Method

Teaching Method	N	Mean	SD	Z	P-value	Remark
Experiential Learning Strategy	118	66.08	8.24	9.34	0.000	Rejected
Traditional Teaching Method	122	55.02	8.03			

Table 3 presents the Z-test analysis of students' achievement scores based on the teaching method. The results show that students taught using the experiential learning strategy obtained a higher mean score (66.08, SD = 8.24) compared to those taught using the traditional teaching method (Mean = 55.02, SD = 8.03). The calculated Z-value of 9.34 with a corresponding p-value of **0.000** is less than the 0.05 level of significance. This indicates that the difference in achievement scores between the two groups is statistically significant. Therefore, the null hypothesis is rejected, and it implies that the experiential learning strategy significantly improved students' academic achievement in Chemistry more than the traditional teaching method.

HO_2: There is no significant difference in the interest scores of students taught Chemistry using experiential learning strategy and those taught using the traditional teaching method.

Table 4: Mann–Whitney U Test Analysis of Students' Interest Scores by Teaching Method

Teaching Method	N	Mean Rank	U	Z	p-value	Remark
Experiential Learning Strategy	118	178.64	1423.50	-10.84	0.000	Rejected
Traditional Teaching Method	122	64.23				

Table 4 shows the Mann–Whitney U test comparison of students' interest scores by teaching method. The calculated U value of 1423.50 with a corresponding p-value of 0.000 is less than the 0.05 level of significance. Since the p-value (0.000) is less than 0.05, the null hypothesis is rejected. This implies that there is a statistically significant difference in the interest of students taught Chemistry using an experiential learning strategy and those taught using the traditional teaching method, in favor of the experiential learning strategy.

Discussion of Results

Findings from this study revealed that the use of an experiential learning strategy in teaching Chemistry significantly improved students' academic achievement and interest when compared with the traditional teaching method. Results from the tested hypotheses further showed that experiential learning strategy did not only enhance students' performance but also promoted positive learning dispositions toward Chemistry. Gender was found not to be a significant factor influencing students' achievement and interest, indicating the inclusive nature of the experiential learning strategy.

The findings of this study revealed a significant difference in the mean academic achievement scores of students taught Chemistry using an experiential learning strategy and those taught using the traditional teaching method, in favour of experiential learning strategy. This result strongly emphasizes the effectiveness of experiential learning strategy as a learner-centred instructional approach that enhances understanding and mastery of Chemistry concepts.

The superior performance of students exposed to experiential learning strategy can be attributed to its hands-on, activity-based, and reflective nature, which actively engages students in the learning process. Through experimentation, observation, and real-life applications, students were able to construct meaningful knowledge, leading to improved comprehension and retention of Chemistry concepts. Unlike the traditional lecture method, experiential learning allows students to learn by doing, which deepens conceptual understanding.

This finding aligns with earlier studies such as Eze and Ogunleye (2023) and Usman (2025), who reported that experiential and activity-based instructional strategies significantly improved students' academic achievement in Chemistry and other science subjects. However, this finding contrasts with Johnson et al. (2019), who found no statistically significant difference in achievement between experiential and traditional instructional methods, suggesting that contextual factors and implementation fidelity may influence outcomes.

The findings of this study further revealed a significant difference in the mean interest scores of students taught Chemistry using experiential learning strategy and those taught using the traditional teaching method. Students exposed to experiential learning strategy demonstrated higher levels of interest, enthusiasm, and engagement in Chemistry lessons. This outcome suggests that experiential learning strategy makes Chemistry learning more interactive and enjoyable. The involvement of students in experiments, group activities, and real-world problem-solving increased their curiosity and motivation, thereby fostering a positive attitude toward the subject. Experiential learning reduces the abstraction often associated with Chemistry and transforms learning into an engaging experience.

This finding supports the studies of Alabi et al. (2022) and Yusuf and Bello (2023), who found that activity-based and learner-centred instructional approaches significantly enhanced students' interest and motivation in science subjects. However, Chen et al. (2017) reported mixed results, noting that interest improvement may vary depending on students' engagement levels and instructional delivery.

Overall, the findings of this study highlight the effectiveness of experiential learning strategy in enhancing students' academic achievement and interest in Chemistry. The strategy promotes

inclusive learning, minimizes gender disparities, and aligns with modern educational practices that emphasize active, student-centred learning. While some contrasting findings exist in the literature, the results of this study provide strong empirical support for the integration of experiential learning strategy into Chemistry instruction.

Conclusion

Based on the findings of this study, it can be concluded that experiential learning strategy is an effective instructional approach for improving students' academic achievement and interest in Chemistry. The strategy promotes active participation, hands-on learning, and meaningful engagement with instructional content, which leads to better understanding and retention of Chemistry concepts. The study further concludes that experiential learning strategy creates an inclusive learning environment where both male and female students benefit equally. Gender differences in achievement and interest were found to be insignificant, suggesting that effective teaching strategies play a more critical role in students' learning outcomes than gender. Overall, the study demonstrates that replacing or complementing traditional lecture-based teaching methods with experiential learning strategy can significantly enhance students' learning experiences and outcomes in Chemistry.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are made:

1. Chemistry teachers should adopt experiential learning strategy in the teaching of Chemistry concepts, as it promotes active participation, enhances understanding, and significantly improves students' academic achievement and interest in the subject.
2. Educational authorities and school administrators should provide adequate laboratory facilities, instructional materials, and continuous teacher training to support the effective implementation of experiential learning strategy in secondary schools.

References

Adedoyin, B. A., & Ugwueze, E. E. (2024). Enhancing scientific reasoning through experiential approaches in secondary schools. *International Review of Science Education, 16*(2), 112–129.

Adeyemi, K. J., & Olatoye, B. A. (2024). Students' persistent difficulties in Chemistry concepts: Causes and remedies. *African Journal of Chemical Education, 7*(3), 55–71.

Aluko, J. F., & Adebisi, M. O. (2024). Interest as a predictor of students' engagement in science classrooms. *West African Journal of Education, 18*(2), 76–90.

Badmus, M. H., & Ajani, S. O. (2024). Hands-on Chemistry and cognitive gains among senior secondary students. *Chemistry Education Research Forum, 11*(1), 23–36.

Carlone, H., & Johnson, A. (2023). Science literacy and national development: A contemporary view. *Journal of Global Science Policy, 5*(1), 1–15.

Chikendu, R. E., & Ejesi, N. S. (2021). Causes of ineffective learning of chemistry in private Secondary Schools in Enugu State. *African Journal of Educational Management, Teaching and Entrepreneurship Studies*, *2*(1), 157-171.

Eboh, U. C., & Mohammed, A. A. (2024). Influence of activity-based strategies on academic achievement in physical sciences. *Nigerian Journal of STEM Studies, 14*(1), 66–80.

Eze, C. A., & Achufusi, C. C. (2023). Persistent misconceptions in secondary school Chemistry: A review. *African Journal of Science Teaching, 12*(4), 98–113.

Hassan, S. M., & Bello, D. Y. (2024). 21st-century learning skills and the future of science education. *International Journal of STEM Pedagogy, 7*(2), 50–71.

Johnson, O. E., & Adamu, H. (2022). Teacher-centered pedagogies and surface learning in senior secondary school science classrooms in Nigeria. *Journal of Education and Pedagogical Inquiry, 4*(1), 88–101.

Kalu, R. N., & Ahmed, L. (2023). Retention of chemical concepts through hands-on experimentation. *Journal of Classroom Science Research, 6*(3), 41–54.

Kasso, P. K., & Wanjohi, P. M. (2023). Experiential learning and its impact on learners' conceptual mastery in science. *East African Journal of Educational Studies, 9*(1), 122–138.

Kasso, S. M., & Wanjohi, J. M. (2023). Activity-based learning and its influence on students' science performance: A review of recent findings. *International Journal of Science Pedagogy*, 6(4), 55–68.

Ngugi, L., & Kimani, G. (2023). Students' active engagement through experiential learning models. *Journal of Transformative Teaching, 15*(1), 18–33.

Nsa, F. K., Johnson, J. E., & Akpan, M. O. (2023). Challenges of teaching Chemistry in developing countries. *Journal of Science Instruction, 13*(2), 101–118.

Obafemi, M. A., & Musa, S. U. (2023). Teacher-centered instruction and declining performance in secondary school Chemistry. *West African Journal of Teacher Education, 5*(1), 33–49.

Okeke, P. C., & Nnaji, H. C. (2023). Enhancing interest in physical sciences through learner-centered strategies. *Nigerian Journal of Educational Innovations, 19*(3), 67–81.

Oladejo, O. (2023). Concept difficulty in secondary school Chemistry: An interplay of gender, school location and school type. *Journal of Technology and Science Education*.

Onu, D. O., & Ogbodo, C. M. (2023). Students' declining interest in secondary school Chemistry: Trends and instructional implications. *Journal of Contemporary Science Education*, 7(1), 88–97.

Talanquer, V. (2022). Why Chemistry matters: Understanding the world through molecular interactions. *Chemistry Education Today, 4*(2), 1–13.

Usman, R. (2025). Effect of experiential learning approach on retention and academic performance in chemistry among senior secondary school students in Kaduna Metropolis. *Journal of Educational Studies Trends and Practice*, *10*(8). https://doi.org/10.70382/sjestp.v10i8.065

Yusuf, A. M., & Ibrahim, S. S. (2023). Real-life Chemistry activities and students' motivation. *Journal of Applied Science Teaching, 6*(1), 54–68.