

PERCEIVED INFLUENCE OF ACTIVITY-BASED CHEMISTRY INSTRUCTION ON ACADEMIC PERFORMANCE OF SCIENCE STUDENTS IN SENIOR SECONDARY SCHOOL MINNA, NIGER STATE

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ABSTRACT

The study investigated the perceived influence of activity-based chemistry instruction on the academic performance of science students in senior secondary schools in Bosso Local Government Area, Minna, Niger State. Two research objectives, two research questions and one null hypothesis were formulated and tested at the 0.05 level of significance. A descriptive survey research design was adopted for the study. The study population comprised all SS2 science students in a selected Secondary School, Minna, Niger State, from which a sample of 49 respondents was selected using convenience sampling technique. Data were collected using a structured, validated questionnaire containing items related to the research objectives. The reliability of the instrument was established using Cronbach Alpha formula with 0.74 coefficient. Data collected were analysed using mean, standard deviation, and independent t-test statistics. The findings revealed that students in the selected Secondary School agreed that activity-based chemistry instruction influences their academic performance and significantly enhances their understanding of atomic structure. No significant difference was found between the mean responses of male and female students regarding their perceived influence of activity-based chemistry instruction with $p = 0.68$, which shows that the approach is equally perceived to be effective across the gender. The study concluded that to improve student performance in chemistry, regardless of gender, chemistry teachers must support their teaching with other strategies like activity-based instruction. The study recommended that provision of adequate laboratory resources to enhance the uses of activity-based chemistry instruction by the teachers.

KEYWORD: Academic Performance, Science Students, Activity-based Chemistry Instruction

I. INTRODUCTION

In light of changing in national development needs, as well as demands from labor-market for science, technology, engineering, and mathematics (STEM) skills. There is an increased emphasis on chemistry instruction approaches that enhance conceptual understanding alongside practical skills, problem-solving, and scientific reasoning. Chemistry plays a crucial role in secondary education as a foundational science linked to other essential disciplines that support modern economies. Furthermore, chemistry instruction remains predominantly teacher-centered, relying on rote memorization rather than activity-based learning. Ideally, chemistry education should integrate conceptual explanations with practical activities, enabling students to apply knowledge in experimental contexts and engage in scientific reasoning. Activity-based chemistry instruction, where students engage directly in tasks and inquiries, is argued to support the learning of complex scientific concepts more effectively than traditional lectures (Adeyemi & Adetunji, 2022).

Activity-based chemistry instruction includes instructional practices that engage students in hands-on investigations, collaborative exploration of chemical phenomena, and application of concepts to real-world problems. This often involves structured inquiries, problem-based learning, cooperative tasks, and the use of models and simulations to represent chemical processes (Mohammed, 2020). It emphasizes deeper cognitive engagement, integration of different representations of chemistry, and opportunities for feedback (Muijs, 2022). Research indicates that active learning strategies improve test performance and reduce failure rates (Theobald et al., 2020). Given this concern, this research investigated how adopting activity-based chemistry instruction influences the academic performance of science students in Minna.

Studies have investigated the effect of Activity-Based Learning on Students Academic Performance in various study areas. For instance, in Osun State Nigeria, Oyelami (2023) investigated the effect of Activity-Based Learning and Students Academic Performance in Chemistry. The study adopted a quasi-experimental design and found a statistically significant improvement in academic performance of students exposed to activity-based learning compared to those taught without. Adeyemi and Adetunji (2022) in their study, conducted in Southwestern Nigeria employed a pre-test post-test control group design. The findings revealed that activity-based teaching significantly enhanced students' academic performance in atomic structure, outperforming both inquiry-based and traditional methods. Similarly, Eze and Nwankwo (2021) examined the activity-Oriented Instruction and Students Performance in Chemistry. Their Study was conducted in Enugu State and found a marked improvement in the experimental group's performance scores, suggesting that activity-oriented instruction significantly boosts performance in chemistry. Furthermore, evidence from selected Lagos Secondary Schools on Activity-Based Instruction and Academic Performance in Chemistry revealed higher performance in the activity-based group, with recommendations to integrate such methods into school curricula (Akintunde et al., 2021). In Anambra state, Chukwuma and Igwe (2022) investigated Activity-Based Strategies and Conceptual Understanding in Chemistry particularly on Atomic Structure. The study adopted a mixed-methods design, and found a significant improvement in students' understanding of atomic structure concepts, with activity-based methods facilitating deeper cognitive engagement. Ojo and Lawal (2021) in a similar study in Ibadan Oyo State indicated that activity-based learning significantly enhanced students' grasp of atomic theory, with the experimental group outperforming the control. Also, Adebayo and Sanni (2023) explored Activity-Based Pedagogy and Conceptual Gains in Chemistry: An Empirical Study among Senior Secondary Students in Ekiti State. They revealed that students exposed to activity-based pedagogy exhibited significantly greater conceptual gains compared to those taught conventionally. Obi, and Ogu, (2022) in a similar study adopted a quasi-experimental design and the results showed a marked improvement in conceptual understanding among students taught through activity-based instruction.

Equally, few studies were identified on activity-based instruction and students' performance in chemistry in Northern parts of Nigeria. For instance, Egbunu (2020) conducted a study titled Enhancing Students' Conceptual Understanding of Chemistry through Activity-Based Approaches: Insights from Kogi State. The study demonstrated a substantial improvement in understanding among those taught via activity-based method. Mohammed (2020) also examined the effect of Practical Activities on Senior Secondary Students Performance in Chemistry in Kano State, Nigeria. Using a quasi-experimental design, Findings indicated a significant increase in performance scores for the experimental group, establishing practical activities as crucial for effective chemistry learning. Overall, the literature establishes that activity-based chemistry instruction represents a powerful lever for improving academic performance and conceptual

understanding in Nigerian Senior Secondary Schools. However, based on studies reviewed, little or no were known about activity-based instruction and students' performance in Niger state. Therefore, this study fills such gap to investigates the perceived influence of chemistry students on the activity-based instruction and on their performance in atomic structure in a selected secondary school in Bosso Local Government Area Minna, Niger state.

II. METHODOLOGY

The study adopted a descriptive survey research design to investigate the perceived influence of activity-based chemistry instruction on the academic performance of students in a selected Secondary School, Minna, Niger State. The population of this study consists of Senior Secondary School II (SS2) students enrolled for the 2024/2025 academic session. The instrument for this study was a structured questionnaire, which was carefully organised to correspond directly with the research objectives, thereby ensuring that each item included is purposeful and aligned with the aim of the study. The instrument has three sections, Section A was designed to capture essential demographic data, including gender and class. Section B contains items specifically constructed to elicit responses regarding the perceived effect of activity-based chemistry instruction on students' academic performance in atom. While, section C features items intended to capture the extent at which activity-based chemistry instruction was perceived to enhances students' conceptual understanding of atomic structure. Modified Four Liker Scale of Strongly agreed to strongly disagreed was used. The respondents were selected using convenience sampling techniques since they were available and responded to the instrument. The research instrument was validated by experts from the department of Science Education at Federal University of Technology, Minna Niger State and yield reliability coefficient index of 0.74 using Cronbach Alpha. The data was collected through physical means, with hardcopy questionnaires personally distributed to the SS2 science students at the selected Secondary School. The data collected were analysed using SPSS to calculate the mean and standard deviation for all variables, providing a clear summary of the central tendencies and variability within student responses regarding their perceived activity-based chemistry instruction strategy. Additionally, independent samples t-tests were conducted to test the study's null hypotheses at a 95% confidence level ($\alpha = 0.05$), enabling the comparison of differences in academic performance and conceptual understanding between demographic groups such as gender.

III. RESULTS AND DISCUSSION

The results obtained in this study are presented in Tables 1 to Table 4. Table 1 showed the mean and standard deviation of the respondents on their perceived influence of activity chemistry instruction on the academic performance in atomic structure. The grand mean of 3.26 indicate strong agreement that students perceived activity-based chemistry instruction enhances their academics performance in the atomic structure. The result presented in Table 1 revealed that activity-based chemistry instruction has a perceived influence on academic performance in atomic structure. This finding shows that students experience improved performance when exposed to hands-on learning approaches. The effects include improve in their performance due to activity-based methods and better ability to tackle challenging questions after practical sessions suggesting that active engagement significantly enhances learning outcomes. This finding agrees with Oyelami's (2023) observations about the effectiveness of perceived influence of activity-based learning on students' academic performance in chemistry, where significant improvements in test scores were recorded. Similarly, this results support. Adeyemi and Adetunji's (2022)

findings that activity-based chemistry instruction significantly enhanced students' academic performance in atomic structure, outperformed traditional methods.

Table 1: Mean and Standard Deviation of Perceived Influence of Activity-Based Chemistry Instruction

S/N	ITEM	MEAN	STD. DEVIATION
1	Activity-based chemistry instruction helps me score higher in chemistry tests on atomic structure	3.21	1.105
2	I find it easier to answer exam questions after participating in hands-on chemistry activities.	3.41	.637
3	Group experiments in chemistry improve my understanding and grades in atomic structure.	3.51	.683
4	Using models and practical tasks helps me remember key concepts for assessments.	3.38	.633
5	My performance in chemistry has improved since we started using activity-based methods.	3.1	.852
6	Activity-based lessons motivate me to participate more in class, leading to better test results.	3.28	.887
7	I am able to solve more challenging questions in atomic structure after practical sessions.	3.05	.826
8	Activity-based tasks make it easier for me to understand and answer past examination questions.	3.38	.782
9	I perform better in continuous assessment when activity-based chemistry instruction is used.	3.28	.857
10	My overall academic performance in chemistry has increased due to activity-based chemistry instruction.	3.13	.978
	GRAND MEAN	3.26	

Table 2. showed the mean and standard deviation of respondents on the perceived activity chemistry instruction and conceptual understanding of atomic structure. The grand mean of 3.27 indicates that students perceived activity-based chemistry instruction and enhances their conceptual understanding of atomic structure. The results in Table 2 demonstrate that perceived influence of activity-based chemistry instruction enhances students conceptual understanding of atomic structure. Students particularly agreed that experiments and demonstrations improved their understanding of atomic models and that using models deepened their understanding of atomic theory. This shows that practical engagement facilitates deeper comprehension of abstract concepts of the students. This finding is consistent with Chukwuma and Igwe's (2022) research on activity-based strategies and conceptual understanding in chemistry, which revealed significant improvements in students' understanding of atomic structure concepts through hands-on activities. The strong agreement observed in this study reflects the effectiveness of activity-based methods in promoting meaningful learning experiences.

Table 2. Mean and Standard Deviation of Perceived Influence of Activity-Based Chemistry Instruction on their Conceptual Understanding of Atomic Structure.

S/N	ITEM	MEAN	STD. DEVIATION
1	Activity-based chemistry instruction helps me understand the arrangement of subatomic particles.	3.29	.768
2	Practical activities make it easier to grasp the concept of electron configuration.	3.15	.709
3	Using models and experiments deepens my understanding of atomic theory.	3.18	.885
4	Activity-based lessons help me explain atomic structure in my own words.	3.41	.595
5	Group work during activity-based classes clarifies difficult concepts about atoms.	3.26	.751
6	I can relate atomic structure to real-life examples through practical tasks.	3.23	.667
7	Hands-on activities help me distinguish between protons, neutrons, and electrons.	3.31	.832
8	Activity-based chemistry instruction enables me to solve conceptual questions about atoms.	3.21	.833
9	My understanding of atomic models has improved through experiments and demonstrations.	3.23	.842
10	I am able to apply atomic structure concepts to other chemistry topics after activity-based learning.	3.36	.707
Grand mean		3.27	

Table 3 shows the Mean response of male and female students on their perceived influence of the activity-based chemistry instruction and their academic performance. The table revealed t-value of 2.885 and p-value 0.06 >0.05 indicates no significant difference between the mean response of male and female students on the perceived influenced of activity-based chemistry instruction and academic performance.

Table 3: Summary of t-test analysis of Mean response of male and female students on the perceived Influence of the Activity-Based Chemistry Instruction on the Academic Performance

	Gender	Mean	Std. Deviation	t	Df	p-value
Activity base chemistry instruction	Male	3.4579	.35950	2.885	37	.06
	Female	3.1000	.41167			

Not significant at $p > 0.05$

Table 4 show the difference between the mean response of male and female students of perceived activity-based chemistry instruction on their conceptual understanding, there is no significant difference between the mean response of male and female students on their perceived activity-based chemistry instruction on their conceptual understanding of science students in the selected topic. Hence the Null hypothesis was retained.

Table 4: Summary of t-test analysis of Mean response of male and female students on the perceived activity-based chemistry instruction enhance student conceptual understanding of atomic structure

	Gender	Mean	Std. Deviation	t	df	p-value
Conceptual understanding	Male	3.3737	.30884	1.882	37	.068
	Female	3.1550	.40714			

Not significant at $p > 0.05$

The hypothesis testing results revealed no significant difference between male and female students regarding the perceived influence of activity-based chemistry instruction on academic performance. This finding confirms that the effectiveness of the perceived influence of activity-based chemistry instruction methods is consistent across gender groups within the same educational environment. This result agrees with Eze and Nwankwo's (2021) study on activity-oriented instruction, which found consistent positive effects across different student demographics. The lack of significant difference observed in this study demonstrates that activity-based chemistry instruction methods are equally effective for both male and female students, supporting the universal application of these approaches in enhancing chemistry education at the selected Secondary School, in Minna, Niger State.

IV. CONCLUSION

Based on the findings and discussions, it can be inferred that perceived influence of activity-based chemistry instruction significantly influences academic performance and conceptual understanding of chemistry students in senior secondary school Minna, Niger State. Students recognize the benefits like enhanced academic performance, improved conceptual understanding, better problem-solving capabilities, and increased engagement with chemistry concepts, particularly in the topic of atomic structure. The absence of gender difference confirms that activity-based chemistry instruction is equally effective for both male and female students. Therefore activity-based chemistry instruction be adopted by the teachers to improve the students' performance. It was recommended that adequate laboratory resources should be provided to enhance the uses of activity-based chemistry instruction by the teachers.

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