

BEYOND THE LECTURE HALL: STAKEHOLDER READINESS FOR ACTIVITY-BASED CHEMISTRY CURRICULUM REFORM IN NIGERIAN SECONDARY SCHOOLS

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Abstract

The persistent dominance of teacher-centred chemistry instruction in Nigerian secondary schools fails to develop conceptual depth and higher-order thinking that modern education demands, despite robust international evidence supporting activity-based learning (ABL) as a superior pedagogical alternative. This study examined chemistry teachers' and students' perceptions of the ABL curriculum in Owerri Municipal Council, Imo State, Nigeria, to assess reform readiness and identify implementation barriers. A descriptive survey design was adopted, involving 255 SS2 students and 14 teachers (a total of 269) from six randomly selected government secondary schools. A validated 36-item, four-point Likert-scale questionnaire was analysed using descriptive statistics (mean and standard deviation) with a criterion mean of 2.50. Teachers (grand mean = 2.90) and students (grand mean = 2.95) both held positive perceptions toward ABL, though one item concerning laboratory resource adequacy was rejected ($\bar{X} = 2.2$), identifying a critical structural barrier to implementation. Stakeholder readiness is clear; the main obstacle is structural, not attitudinal. Policymakers should urgently address gaps in laboratory infrastructure and include activity-based guides in revised curricula.

Keywords: activity-based learning, chemistry curriculum reform, teacher perception, student perception, secondary education

Introduction

Science education extends beyond simply transmitting facts; it aims to develop a scientific mindset, an attitude of inquiry, evidence-based reasoning, and innovative problem-solving. Chemistry, positioned at the heart of these ideals, plays a vital role within the science education framework. As the field that explores the composition of matter, properties, and changes, chemistry lays the groundwork for disciplines such as medicine, agriculture, engineering, environmental science, and materials technology, all of which are crucial to modern society (Johnstone, 2010; Chang & Goldsby, 2014). Consequently, chemistry is a mandatory prerequisite for nearly all science and technology programs in Nigerian higher education, highlighting its central role in national progress. However, despite its significance, chemistry education in Nigerian secondary

schools underperforms. High failure rates, low student engagement, and a widening gap between classroom learning and tertiary or workplace requirements are concerning (Odukwe & Nwafor, 2022; Nwafor et al., 2023). Reports from the West African Examinations Council consistently identify poor laboratory skills, difficulty interpreting data, and weak problem-solving abilities as leading causes of failure, suggesting that the issues lie more with teaching quality than with student capability.

The root of this crisis has been traced extensively to the predominant teaching methodology in Nigerian secondary school chemistry instruction. The conventional, teacher-centred approach, characterised by unidirectional information transmission, chalk-and-board exposition, rote memorisation, and passive student reception, has been in continuous use since the colonial period and has remained largely impervious to the transformative pedagogical movements that have reshaped science teaching in other contexts (Dahiru, 2010; Okeke, 2007). In this model, the teacher is the unquestioned authority and sole source of knowledge; students are passive vessels to be filled. The curriculum is content-driven, assessment is summative, and the practical and investigative dimensions of chemistry are routinely neglected or reduced to cursory demonstrations, if they occur at all (Odukwe & Nwafor, 2022). This has contributed to students who often pass written examinations by rote but demonstrate limited practical competencies, such as using a burette, designing an experiment, or articulating the relevance of chemistry to real-world problems.

Activity-based learning (ABL) has emerged internationally as one of the most rigorously validated pedagogical responses to this crisis. Rooted in constructivist epistemology and experiential learning theory, ABL rests on the premise that knowledge is not received but constructed, built by the learner through active engagement, social interaction, direct experience, and reflective practice (Bransford et al., 2000; Hattie, 2009). In chemistry, this means laboratory investigations, group problem-solving sessions, discovery-based explorations, field excursions, project work, and multimedia-enhanced instruction, pedagogical experiences that mirror the actual practice of science and connect chemistry to lived experience.

A substantial body of empirical research confirms the superiority of activity-based approaches over conventional instruction across multiple outcome measures: academic achievement, conceptual retention, motivation, creative thinking, and transferable skill development (Agbenyeku, 2017; Nwafor et al., 2023; Dahiru, 2010; David Agwu & Nmadu, 2023; Doolittle et al., 2023; Freeman et al., 2014; Theobald et al., 2020). However, the adoption of any pedagogical innovation is not a simple function of its evidence base. In the complex ecology of a school system, innovation succeeds or fails largely on the basis of the perceptions, attitudes, and dispositions of the primary agents of implementation, the teachers, and the primary beneficiaries, the students. Perception shapes behaviour: a teacher who does not believe in the value of a new method, or who feels

unequipped to implement it, will not do so, regardless of policy mandates or curricular guidelines (Fullan, 2016; Rogers, 2003; Frei-Landau & Avidov-Ungar, 2022).

This study examines perceptions of Nigerian secondary school chemistry teachers and students toward activity-based instruction, addressing a gap in research within Owerri Municipal, Imo State. Despite evidence supporting its effectiveness, adoption remains limited due to unclear perceptions, hindering curriculum reform and professional development. By generating empirical data, this research aims to inform targeted policies and bridge the gap between evidence and practice.

The study seeks to determine the perceptions of chemistry teachers and students regarding the use of an activity-based strategy for implementing the chemistry curriculum in secondary schools in Owerri Municipal. It will do so by answering two questions in particular.

1. What are chemistry teachers' perceptions of ABL?
2. What are students' perceptions of ABL?

Literature Review

The Nigerian Chemistry Education Landscape

The history of chemistry education in Nigeria reflects the broader tensions of an educational system caught between colonial inheritance and developmental aspiration. The first Nigerian National Curriculum Conference in 1969 established science, with chemistry as a foundational pillar for national development, citizenship formation, and human advancement (Agbenyeku, 2017). Subsequent curriculum reforms, including the 1985 and 2004 revisions of the national secondary school curriculum, incorporated more learner-centred elements and emphasised the integration of practical work. Yet implementation remained stubbornly anchored to traditional didactic practice.

Scholars have identified a persistent disconnect between curriculum intent and classroom reality. Nwafor et al. (2023) documented the gap between stated curriculum objectives and actual pedagogical practice in Nigerian chemistry classrooms, finding that low student achievement has largely been linked to the consistent use of the lecture method rather than student-centred learning strategies. Odukwe and Nwafor (2022), in a study of senior secondary school chemistry students in Anambra State, similarly confirmed that the conventional teaching approach encourages rote learning and turns students into passive learners by preventing them from actively engaging in the learning process. These findings situate the present study within a context where the problem is not ignorance of alternatives but a complex web of structural, attitudinal, and systemic barriers to change.

The Nature and Philosophy of Activity-Based Learning

Activity-based learning is not a single, uniform method but a family of instructional approaches united by a common philosophical commitment: that effective learning is active, participatory, and grounded in experience rather than passive reception (Doolittle et al., 2023). The defining characteristics of ABL in chemistry contexts include student-directed inquiry, hands-on laboratory investigation, cooperative group work, problem-based tasks, project-based assignments, and reflective discussion, all of which are designed to place the learner at the centre of the knowledge-construction process (Wijnia et al., 2024; Tijani, 2025).

The foundations of ABL are deep and multilayered. Dewey's experiential education philosophy argued that learning must be grounded in direct experience, with thinking understood as problem-solving in action (Dewey, 1938, as cited in Tanner & Tanner, 2008). Piaget's developmental epistemology showed learners build complex schemas through cycles of assimilation and accommodation when faced with challenging phenomena (Piaget, 1970 as cited in Mukhtar, 2018). Bruner argued that discovery learning, in which students encounter problems before solutions, leads to deeper understanding, better retention, and greater motivation than expository teaching (Bruner, 1961, as cited in Bransford et al., 2000).

Lev Vygotsky's social constructivism posits that learning occurs socially within the Zone of Proximal Development, between what learners can do alone and what they can do with guidance or peers (Vygotsky, 2001). This supports cooperative group work, peer instruction, and discussions central to ABL. Zhao et al. (2021), using Self-Determination Theory, show that environments that foster autonomy, competence, and social engagement through visual, kinesthetic, social, and analytical activities lead to deeper learning. Based on these theories, the study adopts a conceptual framework in which ABL and conventional instruction stem from different learning philosophies. Stakeholder perception mediates the pathway from pedagogy to outcomes: positive teacher perceptions boost implementation fidelity, and positive student perceptions enhance engagement. Infrastructure, professional development, and curriculum design enable perceptions to translate into sustained practice.

Perception as a Determinant of Educational Innovation

The role of perception in educational change has been theorised extensively in the change management and educational innovation literatures. Rogers' (2003) Diffusion of Innovations theory identifies five key factors that determine the rate of innovation adoption: perceived relative advantage, compatibility with existing values and practices, complexity of implementation, trialability, and observability of outcomes. All five are substantially perception-mediated. An innovation perceived as effective, compatible, manageable, testable, and demonstrably successful will be adopted; one perceived negatively on any dimension will face resistance, regardless of its objective merit. Frei-Landau and Avidov-Ungar (2022), applying Rogers' framework to mobile

learning adoption among in-service and pre-service teachers during the COVID-19 pandemic, confirmed that perceived attributes of innovations remain among the strongest predictors of adoption behaviour across educational contexts.

Fullan (2016) argues that the subjective meaning that educational actors assign to change, the sense they make of it, the values they read into it, and the identity implications they perceive are the most powerful determinants of implementation fidelity. A teacher who perceives activity-based instruction as threatening their authority, as requiring skills they do not possess, or as incompatible with their professional identity will resist it even while ostensibly complying with policy mandates. This has been documented repeatedly in studies of curriculum reform failures in developing-country contexts (Babajide & Smith, 2022). Students' perceptions are equally consequential. Ryan and Deci (2020) demonstrate that intrinsic motivation, strongly correlated with academic achievement, is substantially higher when students perceive themselves as competent, autonomous, and relationally connected within the learning environment, all of which ABL is structurally designed to support.

Empirical Evidence on ABL in Science Education

The empirical evidence base for ABL in science and chemistry education is extensive and methodologically diverse. Agbenyeku (2017), in a quasi-experimental study of 330 junior secondary science students in Katsina State, Nigeria, found that students taught using ABL strategies achieved significantly higher scores on the Basic Science Achievement Test (BSAT) than their lecture-method counterparts and demonstrated superior retention over a four-week interval. The effect was consistent across gender and prior achievement levels, underscoring ABL's broad applicability.

Nwafor et al. (2023) found that students taught via cooperative methods in Nigeria outperformed lecture-based groups, with the effect consistent across genders. Agwu and Nmadu (2023) at Alex Ekwueme University showed cooperative learning improved students' chemistry achievement and self-concept using a pre-test/post-test design. Freeman et al.'s (2014) meta-analysis of 225 studies revealed that students in active-learning courses scored 6% higher and were less likely to fail than students in lecture courses, across disciplines and regions. Theobald et al. (2020), with 44,606 students across 26 STEM studies, showed that high-intensity active learning not only boosted performance but also reduced achievement gaps by 45%, demonstrating ABL's effectiveness and fairness.

The literature highlights key implementation challenges. Ertmer et al. (2012) found teacher beliefs about logistical issues and the nature of teaching to be persistent barriers. Cheng et al. (2022) extended this, showing that beliefs about pedagogy and technology are interdependent with confidence and require attention to both in professional development. Nwafor et al. (2023)

identified resource shortages, overloaded curricula, and prevalent lecture methods in Nigerian science as structural barriers to ABL, even when teachers see its benefits.

However, few studies have assessed stakeholder readiness for ABL implementation in Owerri Municipal, resulting in a research gap specific to the context. Understanding that perceptions and structures need to be addressed guides the framework and recommendations of this study.

Methodology

Research Design

A descriptive survey research design was employed. Survey designs are appropriate for studies that seek to describe the opinions, attitudes, or perceptions of a defined population through systematic, standardised data collection, without experimental manipulation (Creswell, 2014; Osuala & Ihekweba, 2014). Given the study's aim of characterising the current perceptions of chemistry teachers and students toward the ABL curriculum across multiple schools, this design offered the dual advantages of representativeness and comparability.

Area of the Study

The study was conducted in Owerri Municipal Council, the administrative capital of Imo State, south-eastern Nigeria. The municipality covers an area of 58 km² and had a 2006 census population of 127,213 and a projected population of approximately 174,200 in 2022 (National Population Commission, as cited in City Population, 2024). It hosts ten government-owned secondary schools, making it a concentrated and policy-relevant site for investigating state-level chemistry education practice.

Population, Sample, and Sampling Technique

The target population comprised all SS2 chemistry students ($n = 2,425$) and chemistry teachers ($n = 26$) in the ten government secondary schools of Owerri Municipal during the 2025/2026 academic year. SS2 students were specifically selected because they have been exposed to chemistry instruction long enough to form meaningful perceptions, yet are not subject to the terminal examination pressures of SS3 that might distort their responses. Simple random sampling was used to select six of the ten schools, and a 20% sampling ratio was applied to student populations, yielding 255 students. All 14 chemistry teachers in the six selected schools participated, giving a combined sample of 269. This approach ensured representativeness across schools.

Instrument for Data Collection

Data were collected using a researcher-designed structured questionnaire comprising two sections. Section A gathered demographic information; Section B contained 36 perception items, nine items per research question, scored on a four-point Likert-type scale: Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, Strongly Disagree (SD) = 1. A forced-choice, even-numbered scale was

deliberately selected to eliminate neutral midpoint responses and compel directional expression of perception.

Validity and Reliability

Content and face validity of the 36-item questionnaire were established through expert review by two specialists in educational measurement and evaluation. Items were assessed for relevance, clarity, and alignment with the research questions, and necessary modifications were made.

Reliability was determined using Cronbach's alpha. The full instrument yielded $\alpha = 0.842$. The teachers' perception subscale (9 items) produced $\alpha = 0.819$, while the students' perception subscale (9 items) produced $\alpha = 0.867$. These coefficients indicate good to excellent internal consistency (Nunnally & Bernstein, 1994). Direct administration of the instrument by the researcher ensured 100% response rate and minimised response bias.

Data Collection and Analysis

Questionnaires were personally administered by the researcher to all sampled respondents in their school settings, ensuring a 100% response rate and enabling in situ clarification of ambiguous items. Data were analysed using arithmetic mean statistics. For each item, weighted mean scores were computed from frequency counts. The decision threshold was set at 2.50.

$$\bar{X} = \frac{4 + 3 + 2 + 1}{4} = 2.5$$

Items at or above 2.50 were accepted; items below 2.50 were rejected. Grand means for each research question were computed as the average of constituent item means.

Results and Discussion

Chemistry Teachers' Perception of Activity-Based Chemistry Curriculum

Table 1 presents mean scores and decisions for nine items measuring chemistry teachers' perceptions of the ABL curriculum (n = 14).

Table 1: Chemistry Teachers' Perception on the Use of Activity-Based Chemistry Curriculum (n=14)

S/N	Questionnaire Item	SA	A	D	SD	Mean	Remark
1	Engaging students in group discussions, practicals, field trips, and assignments enhances their understanding of chemistry concepts.	3(12)	8(24)	0(0)	3(3)	2.8	Accepted
2	Allowing students to handle laboratory apparatus from early	8(28)	6(18)	0(0)	0(0)	3.3	Accepted

S/N	Questionnaire Item	SA	A	D	SD	Mean	Remark
	stages of study improves their interest and competence in chemistry.						
3	Reducing teacher-centeredness in instruction lowers teacher stress and yields more productive, engaged learners.	3(12)	7(21)	2(4)	2(2)	2.8	Accepted
4	Teaching and learning chemistry become more stimulating and effective through activity-based instruction.	5(20)	4(12)	3(6)	2(2)	2.9	Accepted
5	I feel sufficiently confident to design and deliver activity-based chemistry lessons if given appropriate professional support.	4(16)	6(18)	3(6)	1(1)	2.9	Accepted
6	The current laboratory equipment available in my school is adequate to support activity-based chemistry instruction.	2(8)	3(9)	5(10)	4(4)	2.2	Rejected
7	Students respond with noticeably higher enthusiasm when chemistry lessons incorporate hands-on or investigative tasks.	7(28)	5(15)	1(2)	1(1)	3.3	Accepted
8	Activity-based teaching strategies are compatible with existing chemistry examination requirements and syllabus coverage.	3(12)	6(18)	3(6)	2(2)	2.7	Accepted
9	I am aware of a sufficient range of activity-based instructional strategies, such as inquiry, cooperative learning, and project work, to vary my teaching.	5(20)	5(15)	2(4)	2(2)	2.9	Accepted

S/N	Questionnaire Item	SA	A	D	SD	Mean	Remark
Grand Mean						2.90	Accepted

Note: SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree. Values in parentheses are weighted scores. Decision threshold = 2.50.

Eight of nine items were accepted, with means ranging from 2.7 to 3.3 and a grand mean of 2.90, indicating positive teacher perceptions of the ABL curriculum. The highest-rated items, that early lab access increases student interest and competence (item 2; \bar{X} =3.3) and that students show more enthusiasm during hands-on tasks (item 7; \bar{X} =3.3), are especially important. Both highlight the motivational effect of directly observed experiential learning. Teachers see that student engagement rises sharply when learning shifts from passive to active, making this experiential knowledge a strong argument for adopting ABL.

Items 5, 8, and 9 (professional confidence, examination compatibility, and awareness of ABL strategies; all \bar{X} = 2.7–2.9) suggest a moderate level of professional readiness. Teachers are somewhat familiar with ABL strategies and see them as compatible with exams. This is critical, as exam pressure is a major barrier to pedagogical innovation in Nigerian schools (Nwafor et al., 2023). The acceptance of item 8 (examination compatibility; \bar{X} = 2.7) suggests that concerns about examination compatibility may be less pronounced, a concern that professional development should address explicitly.

The single rejected item, item 6, concerning laboratory resource adequacy (\bar{X} = 2.2), is analytically the most important finding in Table 1. It reveals that even teachers who are positively disposed toward ABL recognise a critical material barrier to its implementation. This is entirely consistent with Ertmer et al.'s (2012) first-order barrier framework and Nwafor et al.'s (2023) findings on structural constraints in Nigerian science classrooms. The rejection of this item does not contradict the overall positive perception; rather, it refines the picture by identifying precisely where the intervention gap lies. Teachers are ready; the schools are not yet.

These findings align closely with those of Agwu and Nmadu (2023), who found that educators who implemented cooperative learning in Nigerian chemistry classrooms consistently recognised its value while identifying resource and structural constraints as the primary implementation challenge. They also converge with Theobald et al.'s (2020) conclusion that the barriers to active learning implementation are systemic rather than attitudinal, a finding that transfers directly to the Nigerian secondary school context.

Chemistry Students' Perception of Activity-Based Chemistry Curriculum

Table 2 presents mean scores and decisions for nine items measuring chemistry students' perceptions of the ABL curriculum (n = 255).

Table 2: Chemistry Students' Perception on the Use of Activity-Based Chemistry Curriculum (n = 255)

S/N	Questionnaire Item	SA	A	D	SD	Mean	Remark
1	It would be interesting to learn chemistry through peer discussions and collaborative concept exploration.	83(332)	91(273)	50(100)	31(31)	2.9	Accepted
2	Chemistry is more accessible and comprehensible when theoretical concepts are demonstrated experimentally in the laboratory.	118(472)	106(318)	19(38)	12(12)	3.3	Accepted
3	Students find chemistry more engaging when they are encouraged to make further discoveries on topics introduced by the teacher.	94(376)	76(216)	54(108)	35(35)	2.9	Accepted
4	Audio-visual and multimedia instructional aids are preferred over conventional board-and-textbook teaching methods.	81(324)	80(240)	43(86)	51(51)	2.7	Accepted
5	I learn and remember chemistry better when I	99(396)	94(282)	38(76)	24(24)	3.1	Accepted

S/N	Questionnaire Item	SA	A	D	SD	Mean	Remark
	can relate what is being taught to real-life situations and everyday problems.						
6	Working in small groups on chemistry tasks helps me understand concepts I might otherwise struggle with alone.	87(348)	96(288)	42(84)	30(30)	2.9	Accepted
7	I feel more confident in chemistry when I am allowed to handle laboratory equipment and conduct experiments myself.	112(448)	98(294)	27(54)	18(18)	3.2	Accepted
8	I find the current way chemistry is taught, mostly through notes and lectures, to be boring and limiting.	76(304)	82(246)	57(114)	40(40)	2.8	Accepted
9	I would take more ownership of my learning if chemistry lessons gave me the freedom to explore, question, and investigate independently.	88(352)	90(270)	45(90)	32(32)	2.9	Accepted
Grand Mean						2.95	Accepted

Note: SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree. Values in parentheses are weighted scores. Decision threshold = 2.50.

All nine items were accepted, with means from 2.7 to 3.3 and a grand mean of 2.95. The top-rated items, chemistry is more understandable when theory is demonstrated (item 2; $\bar{X} = 3.3$) and student

confidence through hands-on work (item 7; $\bar{X} = 3.2$), reflect learners' firsthand experiences contrasting passive and active instruction. The higher scores for these experiential items suggest students' positive views of ABL are mainly based on tactile, lab experiences rather than abstract preferences.

Item 8, finding current lecture-based teaching boring and limiting ($\bar{X} = 2.8$), is accepted and suggests that the majority of students experience a tangible dissatisfaction with conventional instruction. This finding is significant. Hattie (2009), in his synthesis of 800+ meta-analyses, identifies student engagement as among the highest-effect-size predictors of learning outcomes. A student population that finds its dominant instructional mode boring is operating substantially below its achievement potential. This finding constitutes a strong student-generated mandate for pedagogical change.

Item 5 highlights that real-life relevance boosts learning and retention ($\bar{X} = 3.1$), echoing constructivist ideas that meaning-making improves when new knowledge connects to existing schemas and experience (Vygotsky, 2001). This endorsement indicates students aren't passive; they actively seek relevance in learning. Their lack of it in traditional chemistry causes disengagement, which ABL aims to address. Zhao et al. (2021) confirmed, using Self-Determination Theory, that inquiry-based environments that foster autonomy and competence lead to higher engagement and achievement than conventional methods.

The slightly higher student grand mean (2.95) versus teachers (2.90) deserves attention. Students, facing the daily costs of conventional instruction such as boredom and disengagement, may seek alternatives more readily than teachers, who are more attached to the familiar model due to professional socialisation. Additionally, the larger student cohort (255 vs. 14 teachers) provides a more stable and diverse sample, which may influence the results. This interpretation is tentative and requires further empirical validation, though both explanations align with broader educational change literature (Fullan, 2016; Ryan & Deci, 2020).

Convergence and Strategic Implications

The key finding is the positive perceptions shared by teachers and students, crucial for innovation adoption. Rogers' (2003) framework emphasises the need for alignment between implementers and beneficiaries. Frei-Landau and Avidov-Ungar (2022) highlighted the role of this alignment in accelerating mobile learning adoption, a process that typically requires effort to build. However, in Owerri Municipal secondary schools, teachers and students already share a unified outlook.

This convergence significantly lessens one of the main sources of friction in curriculum reform: the need to overcome widespread attitudinal resistance. The current findings suggest that a targeted, structural intervention is necessary, providing material resources (laboratory equipment),

professional development (in-service training), and curricular supports (integrated practical guides) that will enable existing positive perceptions to develop into sustained, high-quality activity-based practices. This approach presents a more manageable reform challenge than changing attitudes, and the evidence from this study offers a clear mandate to pursue it.

Recommendations

1. **Increase Funding:** It is recommended that the Imo State Ministry of Education and the Nigerian federal government should significantly increase funding for secondary school science labs, with a focus on high-need schools.
2. **Revise Curriculum:** It is recommended that NERDC should revise the chemistry curriculum to include practical activity guides using low-cost, local materials suitable for resource-limited schools.
3. **Provide Teacher Training:** It is recommended that TRCN and regional agencies should deliver ongoing training on ABL strategies, inquiry-based, cooperative, project-based, and discovery methods, ideally within schools, to ensure relevance and support. School timetables should be adjusted to allow double periods for chemistry, and equipment sharing schemes within local areas should maximise resources. Experienced ABL teachers should be recognised as mentors to promote culturally appropriate activity-based instruction.

Conclusion

This study, based on data from 269 chemistry teachers and students in Owerri, Imo State, shows both groups hold positive views toward activity-based chemistry curricula. Their average ratings of 2.90 (teachers) and 2.95 (students) reflect strong endorsement of experiential and cooperative instruction. The main barrier to adopting activity-based learning isn't attitudes but infrastructure, specifically: inadequate laboratories (item 6, $\bar{X}=2.2$). This shifts the policy focus from persuading stakeholders to improving structural conditions, which is more feasible for government intervention. These findings add to research on chemistry education reform in sub-Saharan Africa and provide baseline data for curriculum planners, professional development agencies, and government bodies involved in science education. This study is limited by its focus on a single municipality (Owerri Municipal Council), which restricts the generalizability of the findings to other regions in Nigeria. The small sample size of teachers ($n = 14$) and the cross-sectional design further limit the depth and longitudinal applicability of the results.

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