

# FUNCTIONAL PEDAGOGICAL STRATEGIES AND STUDENTS' MASTERY OF ALGEBRAIC CONCEPTS IN PUBLIC SECONDARY SCHOOLS IN AKWA IBOM STATE, NIGERIA.

BY

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## ABSTRACT

The study investigated the influence of functional pedagogical strategies on students' mastery of algebraic concepts in public secondary schools in Akwa Ibom State, Nigeria. To achieve this purpose, three research objectives and hypotheses were raised and formulated to guide the study. Correlational research design was adopted for the study. The population comprises of all the entire teachers for 2025/2026 academic session. Out of which, 45 teachers and 1974 students were selected through multi-stage and simple random sampling technique as sample size. A researcher-developed instruments namely: Functional Pedagogical Strategies Questionnaire (FPSQ) and Students' Test in Algebraic Concepts (STAC) were used. The instruments were duly validated using faced validity and Cronbach Alpha was used in obtaining the reliability coefficient of the instruments which stood at .73 and .74 for FPSQ and STAC respectively. The research questions and hypotheses were answered using Simple Linear Regression to answer and test the null hypotheses at 0.05 levels of significance. Based on the findings of the study, it was revealed that experiential learning activities, contextual instruction and reflective learning activities significantly influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State. It was concluded that improving students' outcomes in mathematics necessitates a pedagogical transformation toward more participatory, experiential and reflective teaching practices. Recommendations were made among others that teachers should design algebra lessons around real-life situations, local examples, and community-based projects to help students relate abstract concepts to their daily experiences.

**Key Words:** Experiential Learning Activities, Contextual Instruction, Reflective Learning Activities, and Algebraic

## Introduction/Literature Review

The mastery of algebraic concepts among secondary school students remains a pivotal factor influencing their overall achievement in mathematics and related fields. Algebra holds a foundational position within secondary school mathematics, serving both as a gateway to advanced mathematical thinking and as a filter for future participation in science, technology, engineering, and mathematics (STEM) disciplines. However, despite its central importance, many students continue to exhibit persistent difficulties in grasping key algebraic ideas such as symbolic manipulation, equation solving, and the interpretation of algebraic structures. These challenges often lead to low performance on national and international assessments and limited engagement in STEM pathways. A major cause of this struggle lies in the abstract nature of algebraic symbols, operations, and problem-solving processes. Consequently, instructional practices that make algebraic structures explicit, use representations effectively, and develop conceptual understanding alongside procedural fluency are increasingly essential in today's classrooms.

The continuing gaps in algebra learning have prompted a shift toward instructional approaches that extend beyond the mere acquisition of procedural skills to deliberately connect symbolic algebra with meaningful contexts, representations, and student reasoning. In this study, the term functional pedagogical strategies refer to instructional designs and practices that structure learning so that algebra becomes usable, meaningful, and transferable across diverse contexts. Such strategies include staged representational progression (Concrete–Pictorial–Abstract), activity-based learning tasks that situate symbols within real-world contexts, mastery-oriented sequencing that ensures foundational competence before introducing new concepts and explicit metacognitive instruction that trains students to plan, monitor and evaluate their problem-solving processes. Collectively, these approaches emphasize conceptual understanding, representational fluency and deep learning, moving students beyond rote memorization toward meaningful engagement with algebraic reasoning.

Functional pedagogical strategies refer to instructional approaches that foster active, meaningful and applied learning experiences, enabling students to connect classroom knowledge with practical, real-world situations. As noted by Kolawole (2023), a pedagogical strategy is deemed functional when it supports not only the acquisition of knowledge but also its application, analysis and synthesis in solving authentic mathematical problems. These strategies such as contextual instruction, experiential learning, reflective learning, collaborative learning, problem-based learning, and inquiry-based approaches which encourage higher-order thinking, learner engagement, and self-regulated learning.

In mathematics classrooms, functional pedagogy redefines algebraic learning by shifting focus from the abstract manipulation of symbols to the meaningful exploration of patterns, relationships and problem contexts (Norton & Zhang, 2024). It equips students to discover

and internalize algebraic principles through guided experiences, inquiry projects, and reflective exercises, thereby deepening conceptual mastery.

In this study, functional pedagogical strategies describe classroom practices that deliberately make algebra meaningful, usable, and learnable by linking abstract symbols to concrete experiences, contextual applications and reflective thinking processes. Practically, this involves experiential learning, where students uncover algebraic relationships through hands-on and investigative tasks; contextual instruction, which situates algebraic problems within real or locally relevant situations so symbols reflect meaningful quantities; and reflective learning activities, such as metacognitive journaling and guided reflection, which help learners monitor, evaluate, and refine their problem-solving processes. Together, these elements aim to cultivate deep conceptual understanding, flexible transfer of knowledge and lasting mastery, moving students beyond procedural repetition toward critical reasoning and functional competence in algebra.

One of the major significances of functional pedagogical strategies lies in their ability to deepen students' conceptual understanding of algebra. Traditional teaching methods often emphasize procedural skills such as solving equations and simplifying expressions without adequate attention to conceptual foundations. In contrast, functional pedagogical strategies emphasize understanding the why and how behind algebraic rules and relationships. For example, experiential learning engages students in hands-on exploration of algebraic ideas, while contextual instruction connects algebraic formulas to familiar real-life contexts such as commerce, budgeting, and construction. Empirical findings by Adebayo and Odetunde (2024) and Mahmuti (2025) show that students taught with functional, activity-based approaches significantly outperform those taught through lecture-based methods in algebra tests and problem-solving tasks.

Experiential learning activities are instructional practices that promote learning through doing, that is, by allowing students to engage directly in meaningful experiences, reflect on them and apply their insights to new situations. This approach emphasizes active participation, reflection and real-world application of knowledge rather than passive reception of information. Beard and Wilson (2023) described experiential learning as planned educational encounters in which learners interact with tasks, environments, or people to acquire knowledge, skills and attitudes through reflection and feedback. In essence, experiential learning involves a continuous cycle of acting, observing, reflecting, and conceptualizing for deeper understanding and long-term retention.

In the context of mathematics education, experiential learning refers to instructional designs that position students as active participants engaging in exploration, manipulation, modeling and testing of mathematical ideas through hands-on tasks, investigations, simulations, or problem-based projects rather than merely following teacher-directed procedures (a practice

consistent with Kolb's experiential learning model adapted for mathematics). In algebra classrooms, such activities often include connecting concrete or visual representations (e.g., manipulatives, dynamic geometry software, and simulations) with symbolic expressions, constructing and testing algebraic models based on real-world data, and refining solutions through iterative feedback. These practices help bridge the gap between procedural fluency and conceptual understanding, enabling learners to form, test, and refine mental models of variables, functions, and equations (Žakelj, 2024; Tshering, 2024).

Recent research supports the effectiveness of experiential learning in improving students' academic performance and understanding. McCarthy, Nwankwo and Patel (2025) found that experiential learning activities significantly improved high school students' mastery of algebraic concepts and promoted long-term retention. Similarly, Yusoff and Hassan (2023) reported that project-based experiential tasks enhanced students' mathematical reasoning and motivation in Malaysian secondary schools. Again, Adebayo and Odetunde (2024) revealed that experiential learning improved Nigerian students' engagement, creativity, and problem-solving abilities in mathematics. Also, Lee and Tan (2024) demonstrated that integrating real-world mathematical experiences increased students' interest and reduced mathematics anxiety.

Mechanisms through which experiential activities support algebraic mastery include (a) reducing the abstraction gap by anchoring symbols in manipulable or visual referents (concrete-to-representational pathways); (b) allowing repeated cycles of conjecture, test, and revision that build robust mental models; (c) promoting representational transfer (students learn to move between tables, graphs, and symbolic forms); and (d) increasing motivation and perceived relevance, which supports time-on-task and deeper processing. Dynamic mathematics tools (like GeoGebra) and simulation environments provide particularly strong affordances for experiential algebra teaching by making structural relations visible and instantly testable, and several recent classroom studies report improved algebra performance when such tools supplement hands-on tasks (Adesina & Sosanwo, 2025).

Also, contextual instruction (often discussed as Contextual Teaching and Learning, CTL) complements experiential tasks by placing algebraic problems in meaningful real-world frames for example, financial, geometric, or vocational scenarios familiar to students. Contextual instruction is a learner-centered teaching approach that helps students connect academic content to real-life situations, making learning meaningful, practical, and transferable. It emphasizes that students learn best when they can relate what they are studying to their own experiences, environment and future applications. Contextualisation reduces the cognitive distance between symbol and meaning, making it easier for students to interpret algebraic expressions as models of real situations rather than as arbitrary manipulations (Mahmuti, 2025).

According to Johnson (2023), contextual instruction is a process of teaching and learning that helps students relate subject matter content to real-world situations and motivates them to make connections between knowledge and its applications in life roles. Similarly, Wahyudi and Hidayat (2024) describe it as an instructional model where teachers link academic concepts to students' daily contexts to promote deeper understanding and retention. In other words, contextual instruction bridges theory and practice, turning abstract content (such as algebraic formulas) into meaningful, life-related experiences.

Contextual instruction embeds mathematical ideas in realistic, culturally relevant, or vocational situations so that symbols and procedures correspond directly to meaningful problems. In algebra, this involves designing tasks where variables, expressions, and equations model real-world phenomena such as financial planning, measurement, motion, or business transactions encouraging students to construct, interpret, and manipulate symbolic models as tools for reasoning about tangible contexts. As a teaching strategy, contextual instruction allows learners to build understanding through the interaction of prior knowledge and new experiences, emphasizing active inquiry, collaboration, and problem-solving rather than isolated drills. By presenting algebraic concepts within authentic scenarios, contextual teaching helps students form meaningful conceptual connections among symbols, relationships, and applications, thereby reducing rote memorization and enhancing transfer of learning. According to Tsafe (2024), using real-life problems involving money, rates, and scaling such as linear modelling which enables students to consistently link symbolic work to practical contexts in every lesson.

In addition, functional pedagogical strategies highlight active participation and reflection, which are crucial for developing mastery of abstract concepts like algebra. Through reflective learning activities such as journals, self-assessments, and metacognitive discussions students critically analyze their thought processes, identify misconceptions, and reconstruct understanding. Ijeoma and Olayinka (2023) found that reflective activities in algebra improved students' retention and problem-solving accuracy by fostering self-awareness and persistence. Likewise, contextual and inquiry-based instruction enables learners to connect their real-world experiences with algebraic representations, enhancing motivation, engagement, and deep learning.

Reflective learning activities are structured classroom practices that prompt students to think critically about their learning, assess their understanding and determine strategies for improvement. In essence, reflective learning involves learning from experience—students not only complete tasks but also pause to evaluate how and why they learned, what challenges they encountered and how to apply their insights in future situations. According to Moon (2023), reflective learning is a structured process that helps learners examine what they are learning, how they are learning it and how this knowledge can be transferred to new contexts. Similarly, Boud and Keogh (2024) described reflection as a deliberate cognitive

process that transforms experience into learning through the evaluation of actions, outcomes, and insights. In educational settings, particularly in mathematics, science, and teacher education which is reflective practices promote metacognition, self-assessment, and conceptual understanding.

Reflective tasks enable students to detect misconceptions, select appropriate representations, and move beyond procedural steps toward coherent conceptual understanding—outcomes that rote practice alone rarely achieves (Okumuş & Öztürk, 2024). These tasks often take the form of think-aloud sessions, error analyses, math journals, self-explanation prompts, reflective checklists, and post-task reflections that require students to justify their choices, identify assumptions, and plan improvements (Thi-Nga, 2024). Norton and Zhang (2024) reported that students who engaged in structured reflection during algebra lessons demonstrated stronger retention and problem-solving accuracy than those relying on rote methods. Similarly, Ijeoma and Olayinka (2023) found that incorporating reflective journals into mathematics instruction significantly improved Nigerian secondary school students' metacognitive awareness and attitudes toward learning algebra.

Although experiential learning, contextual instruction, and reflective activities each have strong empirical backing when examined independently, relatively few studies have explored their combined impact as an integrated functional pedagogical framework for teaching algebra. Moreover, existing research remains fragmented and inconsistent definitions vary across studies, implementation fidelity often differs, and many interventions report short-term improvements without addressing long-term retention, transfer to unfamiliar problems, or scalability in resource-limited classrooms (Akinpelu, Salman, Akinpelu and Ameen, 2024). Nevertheless, current findings provide encouraging evidence that mastery-oriented and experiential approaches, when adapted to local contexts, can yield meaningful and sustained improvements in secondary school mathematics performance. This underscores the need for rigorous classroom-based investigations of integrated, contextually responsive functional strategies.

In light of the central importance of algebra and the promising yet inconclusive evidence on individual pedagogical elements, the present study seeks to examine the impact of an integrated instructional model that combines experiential learning tasks, contextualized problem-solving, and structured reflective activities on secondary school students' mastery of algebraic concepts. The study measures multiple dimensions of mastery including conceptual understanding, procedural fluency, representational flexibility, and metacognitive regulation, while also documenting key implementation factors such as teacher preparation, instructional resources, and classroom climate. By doing so, this research aims to provide practical insights for teachers and policy-relevant evidence for curriculum developers committed to improving algebra learning outcomes in secondary schools.

### **Theoretical Framework**

This study is based on Constructivist Learning Theory by Piaget (1972) and Experiential Learning Theory by Kolb (1984). Constructivism posits that learners actively construct their own understanding based on prior knowledge, experiences, and interaction with their environment. In mathematics education, this means students build algebraic understanding by manipulating symbols, exploring patterns, and making sense of relationships through guided discovery and discussion. Relevance to the study, the functional pedagogical strategies are rooted in constructivist ideals that experiential learning allows students to manipulate algebraic problems using real-life analogies; contextual instruction situates abstract algebraic principles within meaningful contexts; and reflective learning activities encourage learners to evaluate their reasoning and identify conceptual links. In the Akwa Ibom State context—where traditional rote learning still dominates—constructivism provides a powerful lens for understanding how interactive, learner-centred strategies enhance conceptual mastery in algebra.

Also, Kolb conceptualized learning as a cyclical process involving four stages, which are concrete experience (engaging directly in an activity, e.g., exploring algebraic patterns using manipulatives or technology tools); reflective observation (thinking critically about the experience, noting errors or insights); abstract conceptualization (forming general rules or algebraic principles from observed patterns); and active experimentation (applying new algebraic ideas in varied contexts). The relevance of Kolb's model to the study aligns directly with experiential and reflective pedagogical strategies, which supports the idea that students develop mastery in algebra by doing, reflecting, and applying—rather than memorizing procedures. In classrooms using functional pedagogy, teachers guide learners through each stage of the cycle, thus promoting deeper understanding of algebraic concepts.

### **Empirical Framework**

A study by Anugwo, Onyebuchi, Ugama, Egbe, Okpube, Ngwu and Ikporo (2024) examined the influence of an experiential instructional approach on senior secondary two (SS II) students' achievement in algebra within the Abakaliki Education Zone of Ebonyi State, Nigeria. The study employed a quasi-experimental pre-test, post-test non-equivalent control group design, using intact classes. The experimental group received instruction through experiential strategies such as hands-on activities, manipulatives and real-life problem contexts, while the control group was taught using conventional methods. Findings indicated that students in the experiential group significantly outperformed their counterparts in the control group on post-test algebra achievement. Although male students in the experimental group recorded slightly higher mean scores than females, the difference was not statistically significant, and there was no interaction effect between gender and instructional method on achievement.

Similarly, Nwigboji and Nwoke (2025) explored the effects of simulation-based experiential learning tools on students' algebra performance. Using a quasi-experimental pre-test, post-

test non-equivalent control group design, the study sampled 205 SS II mathematics students (121 experimental, 84 control). The experimental group was taught using GeoGebra software and collaborative simulation-based tasks over four weeks, while the control group received traditional lectures. Instruments included an Algebraic Achievement Test ( $KR-20 = 0.86$ ) and an Algebraic Interest Scale ( $\alpha = 0.84$ ). Results showed that the experimental group achieved significantly higher algebra scores than the control group ( $F(1,200) = 110.239, p < .001$ , partial  $\eta^2 = .355$ ), and demonstrated greater interest in algebra ( $F(1,200) = 47.655, p < .001$ , partial  $\eta^2 = .192$ ). No significant gender or interaction effects were found, indicating both male and female students benefited equally from the intervention.

In another study, Olatunji and Nwosu (2023) found that contextualized algebra instruction significantly enhanced students' conceptual understanding, retention, and real-world application of algebraic concepts among secondary school students in Oyo State, Nigeria. Employing a quasi-experimental design, they discovered that learners exposed to contextual examples—such as market and transport scenarios—performed better on algebraic word problems than those taught conventionally. Similarly, Ismail and Rahman (2024) in Malaysia reported that contextual teaching improved students' problem-solving ability and motivation in algebra through community-based projects and collaborative learning, which connected algebraic principles to students' daily experiences, thereby promoting deeper comprehension and long-term retention. In the same vein, Etuk and Akpan (2025) revealed that the integration of contextual instructional strategies including situational storytelling, use of local examples, and practical applications significantly enhanced both male and female students' algebra achievement in Akwa Ibom State. Their findings showed that contextualized learning tasks increased cognitive engagement, making algebra more interactive and less intimidating. Collectively, these studies affirm that contextual instruction fosters active learning, critical thinking, and knowledge transfer, which are crucial for mastering algebraic concepts.

Finally, Chinelo (2025) investigated the impact of a reflective instructional strategy on secondary school students' mathematics achievement in the Nnewi Education Zone of Anambra State. The study adopted a quasi-experimental pre-test/post-test non-equivalent control group design, using intact classes. The experimental group engaged in structured reflective activities such as end-of-lesson reflections, learning journals, guided error analyses, and teacher-led debrief sessions over several weeks, while the control group received traditional instruction. Results revealed that students exposed to the reflective strategy achieved significantly higher post-test scores than those in the control group, after adjusting for pre-test differences. The treatment effect was consistent across gender, and no significant interaction occurred between gender and instructional method. Classroom observations and student interviews indicated heightened metacognitive awareness, more detailed verbal explanations of problem-solving steps, and reduced anxiety or fatalism toward challenging mathematics problems.

### **Statement of the Problem**

Algebra serves as the foundation of advanced mathematics and a vital link to higher learning in science, technology, and engineering. However, consistent evidence from national and international assessments indicates that Nigerian secondary school students particularly those in Akwa Ibom State struggle with mastering algebraic concepts. Reports from WAEC (2023) and NECO (2024) highlight persistent low performance in algebra-related tasks, reflecting conceptual weaknesses rather than mere computational errors, as students often find it difficult to translate word problems, apply correct operations, and interpret algebraic symbols accurately.

Scholars attribute these challenges largely to the dominance of traditional, teacher-centered instructional approaches that emphasize rote learning and procedural memorization, with limited use of functional, activity-based pedagogies that encourage understanding and application. Although the Nigerian mathematics curriculum advocates learner-centered and problem-solving methods, many teachers in Akwa Ibom State still rely on lecture delivery and note-taking, giving students few opportunities to explore or apply algebra in real-life contexts. Consequently, learners perceive algebra as abstract, irrelevant, and difficult.

Emerging evidence identifies experiential learning, contextual instruction and reflective learning activities as effective strategies for enhancing engagement and deep cognitive processing in mathematics. These methods connect abstract algebraic principles to real-world experiences, promote contextual understanding and encourage self-evaluation of problem-solving processes. Nonetheless, there is limited empirical research on how mathematics teachers in Akwa Ibom State implement these strategies and their effectiveness in strengthening students' mastery of algebraic concepts.

Therefore, this study addresses the persistent low achievement in algebra among secondary school students in Akwa Ibom State, which appears linked to the insufficient application of functional pedagogical strategies. The study seeks to examine how experiential, contextual and reflective learning approaches are utilized in mathematics classrooms and the extent to which they influence students' conceptual understanding and achievement in algebra.

### **Purpose of the Study**

This study seeks to explore the extent to which functional pedagogical strategies influence students' mastery of algebraic concepts in public secondary schools in Akwa Ibom State. Specifically, the study seeks to:

- I. determine the extent to which experiential learning activities influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State.
- ii. determine the extent to which contextual instruction influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State.
- iii. determine the extent to which reflective learning activities influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State.

### **Significance of the Study**

The relevance of functional pedagogical strategies including experiential learning, contextual instruction, and reflective learning activities on students' mastery of algebraic concepts in secondary schools is extensive and globally significant. For teachers, these strategies promote a shift from traditional, teacher-centered instruction to learner-focused and inquiry-oriented methods, thereby enhancing professional competence, instructional innovation, and alignment with international standards of effective mathematics education. For students, functional strategies foster deeper conceptual understanding of algebra by connecting abstract ideas to real-world experiences, cultivating critical thinking, problem-solving, and metacognitive skills essential for achievement in mathematics and other STEM disciplines.

For curriculum developers, these findings provide valuable insights for designing and revising competency-based and inquiry-driven curricula that prioritize conceptual comprehension over rote learning. Likewise, for school administrators, the adoption of such strategies underscores the importance of ongoing teacher professional development, adequate instructional resources, and supportive learning environments that sustain teaching excellence. On a global scale, functional pedagogical strategies resonate with contemporary educational objectives that emphasize conceptual mastery, lifelong learning, and STEM readiness, equipping students with the creativity, adaptability, and analytical capacities necessary to thrive and innovate in an increasingly complex, knowledge-driven world.

### **Research Questions**

To guide the researcher to achieve the earlier stated research objectives, the following research questions were posed.

- I. To what extent does experiential learning activities influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State?
- ii. What is the extent to which contextual instruction influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State?
- iii. What is the extent to which reflective learning activities influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State?

### **Research Hypotheses**

The following hypotheses were formulated to guide the study

- i. Experiential learning activities does not significantly influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State.
- ii. Contextual instruction does not significantly influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State.
- iii. Reflective learning activities does not significantly influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State.

## Research Methods

The study employed a correlational research design, utilizing a questionnaire for data collection. This approach involves examining a group of participants by gathering and analyzing data from individuals who are representative of the entire population, describing specific characteristics of the sample at the time of the study (Nwankwo, 2016). The research was conducted within the Akwa Ibom State of Nigeria, comprising 31 Local Government Areas.

The population of the study comprises of all the entire students for 2025/2026 academic session. Out of which, 45 teachers and 1974 students were selected through multi-stage and simple random sampling technique as sample size. A researcher-developed instrument namely Functional Pedagogical Strategies Questionnaire (FPSQ) and Students' Test in Algebraic Concepts (STAC) were used. The FPSQ and STAC had face and content validity from three lecturers. Cronbach Alpha formula was used to determine the internal consistency reliability where the reliability coefficient stood at .73 and .74 respectively via trial test. The data collected was analysed using Simple Linear Regression to answer the research questions and to test the null hypotheses at the 0.05 level of significance.

## Data Analysis and Results

Research questions are answered alongside testing of hypotheses

### Hypothesis 1

Experiential learning activities does not significantly influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State.

**Table 1:** Result of Simple Linear Regression Analysis for the influence of experiential learning activities on students' mastery of algebraic concepts.

| Variables  | Sum of Squares | Df   | Mean Square | F-cal | F-crit | Sig.              |
|------------|----------------|------|-------------|-------|--------|-------------------|
| Regression | 2698.993       | 1    | 2698.993    | 30.91 | 3.84   | .000 <sup>b</sup> |
| Residual   | 172182.803     | 1972 | 87.314      |       |        |                   |
| Total      | 174881.796     | 1973 |             |       |        |                   |

\*= significant at  $P < .05$  alpha level;  $N = 1974$ ;  $R = .624^a$ ;  $R^2 = .389$ ; adj.  $R^2 = .388$

Analysis in Table 1 reveals the R value of 0.624 indicating a strong positive relationship between experiential learning activities and students' mastery of algebraic concepts. Again, the  $R^2$  of 0.389 means that only 38.9% of the variation in students' mastery of algebraic concepts is accounted for by the variation in experiential learning activities. Also, the calculated F-value of 30.91 is greater than the critical F-value of 3.84 at .05 alpha level of significance with 1 and 1972 degrees of freedom. Also, the p-value of .000 is less than the alpha level of 0.05. This confirms that the result is statistically significant and the null

hypothesis that speculates that experiential learning activities does not significantly influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State is rejected, confirming that experiential learning activities play a crucial role in enhancing students' understanding and performance in algebra.

### Hypothesis 2

Contextual instruction does not significantly influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State.

**Table 2 :** Result of Simple Linear Regression Analysis for the influence of contextual instruction on students' mastery of algebraic concepts.

| Variables  | Sum of Squares | Df   | Mean Square | F-cal  | F-crit | Sig.              |
|------------|----------------|------|-------------|--------|--------|-------------------|
| Regression | 1824.799       | 1    | 824.799     | 20.793 | 3.84   | .000 <sup>b</sup> |
| Residual   | 173056.997     | 1972 | 87.757      |        |        |                   |
| Total      | 174881.796     | 1973 |             |        |        |                   |

\*= significant at  $P < .05$  alpha level;  $N=1974$ ;  $R = .469^a$ ;  $R^2 = .219$ ; adj.  $R^2 = .218$

Analysis in Table 2 reveals the  $R$  value of 0.469 the indicating a moderate positive relationship between contextual instruction and students' mastery of algebraic concepts. Again, the  $R^2$  of 0.219 means that only 21.9% of the variation in students' mastery of algebraic concepts is accounted for by the variation in contextual instruction. Also, the calculated  $F$ -value of 20.79 is greater than the critical  $F$ -value of 3.84 at .05 alpha level of significance with 1 and 1972 degrees of freedom. Also, the  $p$ -value of .000 is less than the alpha level of 0.05. This confirms that the result is statistically significant and the null hypothesis that speculates that contextual instruction does not significantly influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State is rejected, confirming that contextual instruction make a significant contribution to improving students' comprehension and achievement in algebra.

**Table 3 :** Result of Simple Linear Regression Analysis for the influence of reflective learning activities on students' mastery of algebraic concepts.

| Variables  | Sum of Squares | Df   | Mean Square | F-cal  | F-crit | Sig.              |
|------------|----------------|------|-------------|--------|--------|-------------------|
| Regression | 1479.529       | 1    | 1479.529    | 16.825 | 3.84   | .001 <sup>b</sup> |
| Residual   | 173402.267     | 1972 | 87.932      |        |        |                   |
| Total      | 174881.796     | 1973 |             |        |        |                   |

\*= significant at  $P < .05$  alpha level;  $N=1974$ ;  $R = .367^a$ ;  $R^2 = .134$ ; adj.  $R^2 = .132$

Analysis in Table 3 reveals the R value of 0.367 the indicating a moderate positive relationship between reflective learning activities and students' mastery of algebraic concepts. Again, the  $R^2$  of 0.134 means that only 13.4% of the variation in students' mastery of algebraic concepts is accounted for by the variation in reflective learning activities. Also, the calculated F-value of 16.83 is greater than the critical F-value of 3.84 at .05 alpha level of significance with 1 and 1972 degrees of freedom. Also, the p-value of .001 is less than the alpha level of 0.05. This confirms that the result is statistically significant and the null hypothesis that speculates that reflective learning activities does not significantly influence students' mastery of algebraic concepts in secondary schools in Akwa Ibom State is rejected, confirming that reflective learning activities make a meaningful contribution to improving students' comprehension and achievement in algebra.

### **Discussion of Findings**

The findings showed that experiential learning activities have a significant impact on students' mastery of algebraic concepts in secondary schools in Akwa Ibom State. This result suggests that students grasp algebra more effectively when they are actively involved in hands-on experiences, practical demonstrations, and real-life problem-solving situations. The result aligns with Kolb's Experiential Learning Theory (1984), which underscores learning as a process grounded in concrete experience and reflective observation. It is also consistent with the findings of Adebayo and Odetunde (2024), who reported that experiential instructional strategies enhance students' engagement, creativity, and problem-solving competence in mathematics. Essentially, engaging students in experiments, modelling activities, and practice-oriented tasks fosters deeper conceptual understanding and lasting mastery of abstract algebraic principles.

The findings also revealed that contextual instruction exerts a significant influence on students' mastery of algebraic concepts. This may be because students tend to achieve better results in algebra when teachers present mathematical problems within real-life contexts that are familiar and meaningful to them. Contextual instruction enables learners to perceive algebra as relevant and applicable beyond the classroom environment. This result aligns with Ismail and Rahman (2024), who found that contextualized learning allows students to connect algebraic concepts with their personal experiences, leading to deeper understanding and improved long-term retention. By relating algebraic ideas to everyday experiences such as commerce, measurement, and local industrial activities, teachers make learning more engaging and purposeful. Thus, contextual instruction effectively bridges the gap between abstract mathematical concepts and their practical applications, thereby strengthening students' mastery, confidence, and appreciation of algebra.

The findings further revealed that reflective learning activities have a significant impact on students' mastery of algebraic concepts. This influence may stem from students' engagement in reflective practices such as self-assessment, journaling, peer dialogue, and error analysis,

which help them to monitor and evaluate their own learning progress. When learners are guided to think critically about their learning experiences, identify and analyse errors, and assess the effectiveness of their problem-solving strategies, they develop a deeper and more durable understanding of algebraic ideas. This result aligns with Norton and Zhang (2024), who reported that students who engaged in systematic reflection during algebra instruction exhibited greater retention and problem-solving precision compared to those who relied solely on memorization. Consequently, reflective learning fosters students' ability to internalize mathematical concepts, assess their comprehension, and transfer knowledge effectively to new and varied contexts.

### **Conclusion**

The study concluded that experiential learning, contextual instruction, and reflective learning activities have a significant impact on students' mastery of algebraic concepts in secondary schools in Akwa Ibom State. This indicates that when teachers employ functional and learner-centered instructional approaches that integrate experience, contextual relevance, and reflective thinking, students attain deeper comprehension and improved performance in algebra. The results further reveal that traditional teacher-centered approaches are less effective for fostering conceptual understanding, whereas active, experience-based, and context-driven strategies enhance students' ability to grasp and apply abstract algebraic ideas. Therefore, improving students' outcomes in mathematics necessitates a pedagogical transformation toward more participatory, experiential, and reflective teaching practices.

### **Recommendations**

Based on these findings, the following recommendations were made:

- I. Mathematics teachers should integrate experiential learning activities such as hands-on problem solving, laboratory experiments, and real-life modelling into the teaching of algebra to make learning more practical and engaging.
- ii. Teachers should design algebra lessons around real-life situations, local examples, and community-based projects to help students relate abstract concepts to their daily experiences.
- iii. Schools should encourage reflective learning by incorporating activities such as learning journals, group discussions, self-assessment, and feedback sessions that prompt students to evaluate their understanding and problem-solving methods.
- iv. Educational authorities and curriculum planners should organize regular workshops and in-service training to build teachers' capacity in designing and implementing experiential, contextual, and reflective learning strategies.
- v. The mathematics curriculum at the secondary school level should be revised to emphasize active learning approaches that connect theory with practice and reflection, aligning with 21st-century educational standards.

### **Educational Implications**

The findings have several implications for educational practice and policy:

- I. Teachers need to shift from rote and lecture-based approaches to learner-centered pedagogies that encourage participation, exploration, and reflection. This change will enhance students' critical thinking, creativity, and problem-solving abilities.
- ii. Curriculum planners should embed experiential and contextual elements into mathematics syllabuses, ensuring that learning outcomes emphasize understanding and application rather than memorization.
- iii. Principals and school leaders should support teachers by providing materials, facilities, and flexible timetables that allow for experiential and reflective classroom activities.
- iv. Policy frameworks should promote pedagogical innovation and continuous teacher training as core strategies for improving mathematics performance in Nigerian schools.

### **Contributions to Knowledge**

The study supports the significance of functional pedagogical strategies in mathematics education by offering empirical proof that experiential, contextual, and reflective learning activities greatly improve students' comprehension of algebraic ideas. Additionally, it contributes to a localized knowledge of teaching efficacy by proving that learner-centered pedagogies work in the unique socio-educational environment of Akwa Ibom State, Nigeria. Lastly, it provides a framework for improving instruction, arguing that a comprehensive model for raising learning outcomes in mathematics can be achieved by fusing experiential, contextual, and reflective techniques.

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