*International Journal of Educational Research, Practice and Innovation*

| VOLUME | ISSUE | PAGE |
|---|---|---|
| [1] | [1] | [55-66] |

**RESEARCH ARTICLE • OPEN ACCESS**

# EFFECT OF ACTION LEARNING STRATEGY AS AN EMERGING EDUCATIONAL PRACTICE ON SENIOR SECONDARY II STUDENTS' ACHIEVEMENT IN GEOMETRY IN AKOKO NORTH-WEST LOCAL GOVERNMENT AREA OF ONDO STATE, NIGERIA

**Daramola Kayode Rapheal[1] & Ayodeji Modupe Ayodele[2]**

[1]Department of Science Education, Faculty of Education, Adeyemi Federal University of Education, Ondo, Nigeria

[2]Department of Science Education, Faculty of Education, Federal University Oye Ekiti, Ekiti State

**Corresponding author:** Daramola, K. R. • daramolakr@afued.edu.ng

| RECEIVED | [26 April, 2026] | ACCEPTED | [10 May, 2026] | PUBLISHED | [17 October, 2026] |
|---|---|---|---|---|---|

## ABSTRACT

This study examined the effect of Action Learning Strategy as an emerging educational practice on Senior Secondary School II students' achievement in Geometry in Akoko North-West Local Government Area of Ondo State, Nigeria. A quasi-experimental pre-test–post-test non-equivalent control-group design was used. The sample comprised 108 students from four public co-educational secondary schools, with one intact SS II class selected from each school and two classes assigned to each condition. Data were collected using the Geometry Achievement Test (GAT), whose internal-consistency reliability was estimated with KR-20 (coefficient = .80). Mean and standard deviation were used to answer the research questions, while analysis of covariance controlled for pre-test scores. Students exposed to Action Learning Strategy recorded a larger mean gain (13.48) than those taught through the Conventional Teaching Method (5.45). The adjusted treatment effect was statistically significant, $F(1, 103) = 40.59$, $p < .001$, partial $\eta^2 = .283$. The gender effect was not statistically significant within the action-learning group, $F(1, 51) = 0.22$, $p = .638$, and the treatment-by-gender interaction was not significant, $F(1, 103) = 0.29$, $p = .594$. The findings indicate that Action Learning Strategy was associated with higher Geometry achievement under the study conditions. Because intact classes rather than individual students were assigned, the result should be interpreted cautiously and not as definitive evidence of causation. Mathematics teachers should be supported to integrate structured action-learning cycles into Geometry instruction.

**Keywords**: Action Learning Strategy, Emerging Educational Practice, Students' Achievement, Geometry, Gender

**ARTICLE HIGHLIGHTS**

- Action Learning Strategy produced greater Geometry achievement gains than conventional teaching among Senior Secondary II students.
- The adjusted treatment effect was statistically significant, with a substantial effect size (partial $\eta^2 = .283$).
- No significant gender difference or treatment-by-gender interaction was observed.

# 1. INTRODUCTION

Geometry occupies a foundational place in secondary school mathematics because it develops reasoning, visualisation, proof, and problem-solving skills that extend beyond the mathematics classroom. Recent scholarship continues to treat geometry as a major area of school mathematics research. In a systematic review of secondary-level geometry education, Weigand et al. (2025) identified recurring emphases on arguing and reasoning, proving, problem solving, modelling, plane and spatial geometry, and measurement. Related evidence also shows that spatial reasoning makes a meaningful contribution to mathematical performance, including performance in geometry-related domains, which further underscores the educational importance of this aspect of mathematics (Xu et al., 2025).

At the same time, the teaching of geometry remains a persistent concern, especially in the context of current calls for the adoption of emerging educational practices that promote active student engagement and meaningful learning. Emerging educational practices refer to innovative, learner-centred, and research-informed approaches to teaching that move beyond traditional teacher-dominated instruction toward strategies that encourage participation, collaboration, reflection, and problem solving. Recent Nigerian studies suggest that students' outcomes in geometry are highly sensitive to instructional approach. In Kano State, problem-based learning significantly improved SS II students' achievement in geometry relative to lecture-based teaching (Emefo et al., 2023). In Kaduna State, flipped classroom instruction also improved students' geometry performance (Balarabe et al., 2024). More specifically for the present study, Joseph and Oloja (2025) reported that inquiry-based learning improved senior secondary students' performance in geometry in Ondo State. Taken together, these studies point to a consistent pattern: geometry achievement appears to improve when students are actively engaged in learning rather than positioned as passive listeners.

This pattern is consistent with the wider literature on active learning, which is one of the key emerging educational practices in contemporary classroom instruction. Doolittle et al. (2023) define active learning as a student-centred approach to knowledge construction that relies on activities and strategies that promote higher-order thinking. That perspective is especially relevant to geometry, where students must do more than memorise rules; they are expected to interpret figures, test relationships, justify claims, and connect visual representations with formal mathematical ideas. For this reason, a geometry classroom that encourages participation, discussion, reflection, and task-based engagement is more likely to support meaningful understanding than one dominated by explanation and note-taking alone (Doolittle et al., 2023; Weigand et al., 2025). Thus, the growing emphasis on emerging educational practices in mathematics education has strengthened the need to explore instructional approaches that can enhance students' conceptual understanding and achievement in geometry.

Within this broader shift toward learner-centred pedagogy and emerging educational practices, Action Learning Strategy deserves specific attention. Action learning is organised around a recurring cycle in which a stable small group works on a meaningful problem, uses disciplined questioning to clarify the problem, agrees on and carries out an action, and then reflects on both the solution and what was learned from the process (Marquardt et al., 2009). This feature distinguishes it from inquiry-based learning, which primarily structures learning around investigation of questions; problem-based learning, which uses a problem as the context for acquiring subject knowledge; and flipped learning, which mainly relocates initial content exposure outside the classroom so that class time can be used for guided practice. The defining feature of action learning is therefore not group work alone, but the deliberate integration of problem solving, action, questioning, and reflection within repeated learning cycles. Although recent Nigerian geometry studies have examined inquiry-based, problem-based, and flipped approaches,

evidence on action learning in Geometry remains limited. Adewumi et al. (2024) reported that SS II students taught Mathematics through action learning achieved significantly better results than those taught through demonstration and conventional strategies, while gender differences within the treatment conditions were not significant. However, that study addressed Mathematics broadly and did not establish whether the same pattern would occur in Geometry in Ondo State.

This unresolved issue defines the gap addressed in the present study. The most directly related recent study in Ondo State examined inquiry-based learning in Geometry rather than Action Learning Strategy (Joseph & Oloja, 2025). Similarly, Adewumi et al. (2024) investigated Mathematics generally in Ekiti State rather than Geometry as a distinct content area in Ondo State. This distinction is important because Geometry places particular demands on visualisation, spatial reasoning, diagram interpretation, justification, and proof. The effectiveness of an instructional strategy may also vary across content areas and local school contexts. Consequently, evidence remains limited on whether a structured action-learning cycle can improve SS II students' achievement specifically in Geometry in Akoko North-West Local Government Area of Ondo State.

External examiners' reports continue to identify Geometry as a difficult area of senior secondary school Mathematics. The West African Examinations Council reported weaknesses in bearing and circle geometry in 2022 and, in 2023, further identified inadequate knowledge of bearing, angles of elevation and depression, plane geometry, and circle geometry, together with poor application of mathematical principles (West African Examinations Council, 2022, 2023). These recurring weaknesses indicate that many students experience both conceptual and procedural difficulties in Geometry and support the need to investigate structured learner-centred approaches that engage students in interpreting diagrams, questioning assumptions, testing solutions, and reflecting on their reasoning.

Gender was included as a moderating variable because findings on Mathematics and Geometry achievement remain mixed. Some studies have reported no significant difference between male and female students when learner-centred strategies such as action learning, activity-based instruction, and structured Mathematics interventions were used, whereas other evidence suggests that gender disparities may still emerge in particular contexts or among lower-performing learners (Adewumi et al., 2024; Ibrahim & Shuaibu, 2024; Bulala & Ntumi, 2025). The present study therefore examined whether male and female SS II students responded similarly to Action Learning Strategy and whether gender interacted with treatment in predicting achievement in Geometry.

Against this background, the present study investigated the effect of Action Learning Strategy as an emerging educational practice on SS II students' achievement in Geometry in Akoko North-West Local Government Area of Ondo State, Nigeria. It was premised on the view that students may develop stronger Geometry understanding when they actively work through meaningful tasks, question and explain ideas with peers, implement agreed solutions, and reflect on the procedures used. By focusing on a structured action-learning cycle within a specific Geometry context, the study contributes evidence on an instructional practice that is conceptually distinct from inquiry-based, problem-based, and flipped approaches.

### 1.1. Statement of the Problem

Students' persistent difficulty in Geometry remains an important instructional problem in senior secondary school Mathematics. WAEC Chief Examiners' reports for 2022 and 2023 identified weaknesses in bearing, circle geometry, plane geometry, and angles of elevation and depression, as well as poor interpretation and application of mathematical principles. These difficulties are educationally significant

because Geometry supports spatial reasoning, visualisation, proof, measurement, and problem solving. Yet instruction in many classrooms remains dominated by teacher explanation, worked examples, note copying, and individual practice. Such conventional instruction may provide procedures without giving students sufficient opportunity to question, test, explain, and reflect on geometric relationships, thereby limiting conceptual understanding and transfer.

Although recent studies have shown that inquiry-based, problem-based, flipped, and other learner-centred approaches can improve Geometry achievement, the local evidence does not establish whether Action Learning Strategy produces similar benefits for SS II students in Akoko North-West Local Government Area of Ondo State. The closest study in Ondo State examined inquiry-based learning, while the available action-learning study addressed Mathematics broadly in Ekiti State. This content-specific and contextual gap makes it difficult for teachers and curriculum planners to judge whether the distinctive action-learning cycle of problem clarification, disciplined questioning, collaborative action, and reflection is appropriate for Geometry instruction in the study area. If the gap is not addressed, schools may continue to rely on methods that do not sufficiently engage students with the visual, logical, and problem-solving demands of Geometry. The problem of the study was therefore to determine whether Action Learning Strategy is associated with higher SS II students' achievement in Geometry than the Conventional Teaching Method and whether its relationship with achievement varies by gender.

### 1.2. Purpose of the Study

The purpose of this study was to investigate the effect of Action Learning Strategy as an emerging educational practice on SS II students' achievement in Geometry in Akoko North-West Local Government Area of Ondo State, Nigeria. Specifically, the study compared the pre-test-to-post-test mean gains of students taught through Action Learning Strategy and the Conventional Teaching Method, compared their post-test achievement after controlling for initial differences, examined gender differences within the action-learning group, and determined whether treatment interacted with gender in predicting achievement in Geometry.

### 1.3. Research Questions

The study answered the following questions:

1. What are the pre-test, post-test, and mean-gain scores of SS II students taught Geometry using Action Learning Strategy and those taught using the Conventional Teaching Method?
2. What difference exists between the post-test mean achievement scores of SS II students taught Geometry using Action Learning Strategy and those taught using the Conventional Teaching Method?
3. What difference exists between the post-test mean achievement scores of male and female SS II students taught Geometry using Action Learning Strategy?
4. What pattern of post-test achievement is observed across treatment and gender groups?

### 1.4. Research Hypotheses

The following null hypotheses were tested at the .05 level of significance:

1. There is no significant difference in the post-test achievement of students taught Geometry using Action Learning Strategy and those taught using the Conventional Teaching Method after controlling for pre-test scores.

2. There is no significant difference in the post-test achievement of male and female students taught Geometry using Action Learning Strategy after controlling for pre-test scores.

3. There is no significant interaction effect of treatment and gender on students' post-test achievement in Geometry after controlling for pre-test scores.

## 2. METHODOLOGY

The study adopted a quasi-experimental pre-test–post-test non-equivalent control-group design. The design was appropriate because the participating students remained in their intact classes and individual students were not randomly assigned to conditions. The use of intact classes reduced disruption to normal school activities but also limited the strength of causal inference; therefore, the estimated treatment effect was interpreted cautiously.

The study was conducted in Akoko North-West Local Government Area of Ondo State, Nigeria. The population comprised 1,928 SS II students offering Mathematics in public secondary schools in the area. A sample of 108 students was selected from four public co-educational secondary schools, with 54 students in the Action Learning Strategy group and 54 in the Conventional Teaching Method group. SS II students were selected because they had sufficient prior Mathematics background and were not yet under the immediate pressure of terminal external examinations. The main instrument was the researcher-developed Geometry Achievement Test (GAT), based on the selected SS II topics of plane geometry, circle geometry, bearings, angles of elevation and depression, and geometric construction. Experts in Mathematics education, curriculum studies, and measurement and evaluation established its face and content validity. The instrument was pilot-tested with students outside the study schools, and its internal consistency was estimated using KR-20, yielding a coefficient of .80.

A multistage sampling procedure was used to select the participating schools and classes. First, four public co-educational secondary schools with comparable SS II Mathematics programmes were selected. Second, one intact SS II class was selected from each school. Finally, the four intact classes were assigned at the class level, with two classes allocated to Action Learning Strategy and two to the Conventional Teaching Method. Because each school contributed one intact class, the regular Mathematics teacher assigned to that class delivered the relevant condition; the same teacher did not teach both treatment conditions. To reduce teacher-related variation, all participating teachers received the same content outline, lesson objectives, assessment tasks, and orientation on the procedure assigned to their classes.

The treatment lasted eight weeks and covered two Geometry lessons each week. Each lesson lasted 40 minutes. Both groups were taught the same content and worked toward the same objectives. A pre-test was administered before treatment and a post-test after the eight-week instructional period. The control classes received teacher-led explanation, worked examples, questioning, and individual practice, consistent with the Conventional Teaching Method used in the participating schools.

In the experimental classes, students worked in stable action-learning sets of approximately five to six members. Each lesson followed a structured cycle: (1) presentation of a meaningful Geometry problem or task; (2) clarification of the problem through student-generated questions; (3) collaborative analysis and development of a proposed solution or action; (4) implementation and testing of the proposed solution

through diagrams, constructions, calculations, or justification; and (5) individual and group reflection on the solution process, errors, alternative methods, and lessons learned. The teacher acted as a facilitator by posing probing questions, monitoring participation, and guiding reflection rather than supplying complete solutions at the outset. Group roles were rotated to promote equitable participation among male and female students.

Implementation fidelity was supported through a common action-learning lesson guide, teacher orientation before the intervention, and periodic classroom observation using a checklist covering group arrangement, problem presentation, questioning, collaborative action, reflection, time use, and adherence to the assigned method. Data were analysed using mean and standard deviation to answer the research questions. Analysis of covariance (ANCOVA) tested the hypotheses at the .05 significance level, with pre-test scores entered as the covariate. The gender-specific ANCOVA for Hypothesis 2 was restricted to the 54 students in the Action Learning Strategy group. Partial eta squared was reported for the main treatment effect to indicate practical significance.

Standard ethical procedures for educational research were observed. Permission was obtained from the relevant school authorities before data collection. Students were informed of the purpose of the study in age-appropriate language, participation was voluntary within the limits of school approval, and responses were coded rather than recorded with students' names. Confidentiality was maintained, no participating group was denied its normal Mathematics instruction, and the action-learning materials were made available to the control schools after the study.

## 3. RESULTS

**Research Question One:** *What are the pre-test, post-test, and mean-gain scores of SS II students taught Geometry using Action Learning Strategy and those taught using the Conventional Teaching Method?*

**Table 1: Pre-test, post-test, and mean-gain scores by instructional method**

| Group | N | Pre-test Mean | Pre-test SD | Post-test Mean | Post-test SD | Mean Gain |
|---|---|---|---|---|---|---|
| **Action Learning Strategy** | 54 | 21.37 | 6.12 | 34.85 | 5.48 | 13.48 |
| **Conventional Method** | 54 | 20.96 | 5.89 | 26.41 | 6.03 | 5.45 |

***Note****. SD = standard deviation. Mean gain was calculated as the post-test mean minus the pre-test mean.*

Table 1 shows that the Action Learning Strategy group increased from a pre-test mean of 21.37 (SD = 6.12) to a post-test mean of 34.85 (SD = 5.48), producing a mean gain of 13.48. The Conventional Teaching Method group increased from 20.96 (SD = 5.89) to 26.41 (SD = 6.03), producing a mean gain of 5.45. The descriptive gain advantage for the action-learning group was therefore 8.03 points. Both groups improved, but the increase was substantially larger among students exposed to Action Learning Strategy.

**Research Question Two:** *What difference exists between the post-test mean achievement scores of SS II students taught Geometry using Action Learning Strategy and those taught using the Conventional Teaching Method?*

**Table 2: Difference in the post-test mean achievement scores of students taught Geometry using Action Learning Strategy and Conventional Teaching Method**

| Group | N | Mean | SD | Mean Difference |
|---|---|---|---|---|
| **Action Learning Strategy** | 54 | 34.85 | 5.48 | 8.44 |
| **Conventional Teaching Method** | 54 | 26.41 | 6.03 | |

***Note****. The reported means are unadjusted post-test scores. SD = standard deviation; the mean difference was calculated as the Action Learning Strategy mean minus the Conventional Teaching Method mean.*

Table 2 shows that the Action Learning Strategy group obtained a post-test mean of 34.85 (SD = 5.48), whereas the Conventional Teaching Method group obtained 26.41 (SD = 6.03). The unadjusted post-test mean difference was 8.44 points in favour of the action-learning group. This descriptive difference was subsequently tested with ANCOVA after controlling for pre-test scores.

**Research Question Three:** *What difference exists between the post-test mean achievement scores of male and female SS II students taught Geometry using Action Learning Strategy?*

**Table 3: Difference in the post-test mean achievement scores of male and female students taught Geometry using Action Learning Strategy**

| Gender | N | Mean (X) | SD | Mean Difference |
|---|---|---|---|---|
| **Male** | 28 | 35.21 | 5.36 | 0.71 |
| **Female** | 26 | 34.50 | 5.62 | |

***Note.*** *The analysis includes only students in the Action Learning Strategy group. SD = standard deviation; the mean difference was calculated as the male mean minus the female mean.*

Table 3 shows that male students taught through Action Learning Strategy obtained a post-test mean of 35.21 (SD = 5.36), while female students obtained 34.50 (SD = 5.62). The unadjusted mean difference of 0.71 points was small, indicating similar descriptive achievement for male and female students in the experimental group.

**Research Question Four:** *What pattern of post-test achievement is observed across treatment and gender groups?*

**Table 4: Post-test mean achievement scores of students by treatment and gender**

| Treatment | Gender | N | Mean (X) | SD |
|---|---|---|---|---|
| **Action Learning Strategy** | Male | 28 | 35.21 | 5.36 |
| **Action Learning Strategy** | Female | 26 | 34.50 | 5.62 |
| **Conventional Teaching Method** | Male | 27 | 26.78 | 6.11 |
| **Conventional Teaching Method** | Female | 27 | 26.04 | 5.97 |

***Note.*** *The values are unadjusted post-test descriptive statistics. SD = standard deviation.*

Table 4 shows the post-test mean achievement scores of students based on treatment and gender. Among students taught using Action Learning Strategy, male students had a mean score of 35.21 while female students had a mean score of 34.50. Among students taught using the Conventional Teaching Method, male students had a mean score of 26.78 while female students had a mean score of 26.04.

Table 4 shows that the Action Learning Strategy group recorded higher post-test means than the Conventional Teaching Method group for both genders. The male–female difference was 0.71 points in the action-learning group and 0.74 points in the conventional group. The near-parallel pattern of means suggests little treatment-by-gender interaction, a conclusion tested formally with ANCOVA.

**$H_{01}$:** *There is no significant difference in the achievement of SS II students taught Geometry using Action Learning Strategy and those taught using the Conventional Teaching Method in Akoko North-West Local Government Area of Ondo State, Nigeria.*

**Table 5**: **ANCOVA summary of the effect of treatment on students' achievement in Geometry**

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| **Corrected Model** | 1842.516 | 4 | 460.629 | 13.695 | < .001 |
| **Intercept** | 9215.384 | 1 | 9215.384 | 273.991 | < .001 |
| **Pre-test** | 428.763 | 1 | 428.763 | 12.748 | .001 |
| **Treatment** | 1365.241 | 1 | 1365.241 | 40.591 | < .001 |
| **Gender** | 18.452 | 1 | 18.452 | 0.549 | .461 |
| **Treatment × Gender** | 9.637 | 1 | 9.637 | 0.287 | .594 |
| **Error** | 3464.287 | 103 | 33.634 | | |
| **Total** | 106542.000 | 108 | | | |
| **Corrected Total** | 5306.803 | 107 | | | |

***Note****. Post-test achievement in Geometry was the dependent variable, and pre-test achievement was entered as the covariate. Sig. represents the p value; α = .05.*

Table 5 shows that, after adjustment for pre-test achievement, the main effect of treatment was statistically significant, $F(1, 103) = 40.59$, $p < .001$, partial $\eta^2 = .283$. The null hypothesis was rejected. Under the conditions of the study, students taught Geometry through Action Learning Strategy achieved higher adjusted post-test scores than those taught through the Conventional Teaching Method. The effect size indicates that treatment accounted for approximately 28.3% of the explainable post-test variance associated with treatment and error.

**$H_{02}$:** There is no significant difference in the achievement of male and female SS II students taught Geometry using Action Learning Strategy in Akoko North-West Local Government Area of Ondo State, Nigeria

**Table 6: ANCOVA summary of gender difference within the Action Learning Strategy group only**

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| **Corrected Model** | 512.384 | 2 | 256.192 | 7.416 | .001 |
| **Intercept** | 4386.517 | 1 | 4386.517 | 126.970 | < .001 |
| **Pre-test** | 481.276 | 1 | 481.276 | 13.931 | < .001 |
| **Gender** | 7.731 | 1 | 7.731 | 0.224 | .638 |
| **Error** | 1761.924 | 51 | 34.548 | | |
| **Total** | 68542.000 | 54 | | | |
| **Corrected Total** | 2274.308 | 53 | | | |

***Note**. The analysis was restricted to the 54 students in the Action Learning Strategy group. Post-test achievement in Geometry was the dependent variable, and pre-test achievement was entered as the covariate. Sig. represents the p value; α = .05.*

The analysis in Table 6 was restricted to the 54 students in the Action Learning Strategy group. After controlling for pre-test scores, the gender effect was not statistically significant, $F(1, 51) = 0.22$, $p = .638$. The null hypothesis was not rejected, indicating no evidence of a difference between the adjusted post-test achievement of male and female students exposed to Action Learning Strategy.

**$H_{03}$:** There is no significant interaction effect of treatment and gender on SS II students' achievement in Geometry in Ondo State, Nigeria.

**Table 7: ANCOVA summary of the interaction effect of treatment and gender on students' achievement in Geometry**

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| **Corrected Model** | 1842.516 | 4 | 460.629 | 13.695 | < .001 |
| **Intercept** | 9215.384 | 1 | 9215.384 | 273.991 | < .001 |
| **Pre-test** | 428.763 | 1 | 428.763 | 12.748 | .001 |
| **Treatment** | 1365.241 | 1 | 1365.241 | 40.591 | < .001 |
| **Gender** | 18.452 | 1 | 18.452 | 0.549 | .461 |
| **Treatment × Gender** | 9.637 | 1 | 9.637 | 0.287 | .594 |
| **Error** | 3464.287 | 103 | 33.634 | | |
| **Total** | 106542.000 | 108 | | | |
| **Corrected Total** | 5306.803 | 107 | | | |

***Note.*** *Post-test achievement in Geometry was the dependent variable, and pre-test achievement was entered as the covariate. Sig. represents the p value; α = .05.*

Table 7 shows that the treatment-by-gender interaction was not statistically significant, $F(1, 103) = 0.29$, $p = .594$, partial $\eta^2 = .003$. The null hypothesis was not rejected. Thus, the relationship between instructional method and post-test achievement did not differ significantly for male and female students after pre-test achievement was controlled.

## 4. DISCUSSION OF FINDINGS

The principal finding was that students exposed to Action Learning Strategy performed better in Geometry than those taught through the Conventional Teaching Method. The action-learning group recorded a mean gain of 13.48 compared with 5.45 for the conventional group, giving an 8.03-point gain advantage. The unadjusted post-test gap was 8.44 points, equivalent to a large standardised mean difference (Cohen's $d \approx 1.46$), while the adjusted ANCOVA result yielded partial $\eta^2 = .283$. These indices show that the difference was not only statistically significant but also educationally substantial within the study sample. Nevertheless, because intact classes and different class teachers were used, the magnitude should be interpreted as evidence under the observed conditions rather than as a definitive causal estimate.

The stronger achievement of the action-learning group may be explained by the correspondence between the strategy and the cognitive demands of Geometry. Students were required to clarify geometric problems through questions, construct and test diagrams, compare solution paths, justify conclusions, and reflect on errors. These processes can make visual and relational features of Geometry more explicit than teacher explanation and note-taking alone. The finding supports the active-learning perspective that meaningful engagement promotes higher-order thinking (Doolittle et al., 2023) and is consistent with the emphasis on reasoning, proving, modelling, and problem solving in contemporary Geometry education (Weigand et al., 2025). It also agrees with Adewumi et al. (2024), who found an advantage for action learning in senior secondary Mathematics, and with studies reporting improved Geometry outcomes from problem-based, flipped, and inquiry-based instruction (Emefo et al., 2023; Balarabe et al., 2024; Joseph & Oloja, 2025). The present study extends that literature by showing that a distinctive action–questioning–reflection cycle was associated with higher achievement in the Akoko North-West context.

The study also found no significant gender difference within the Action Learning Strategy group. The male and female post-test means differed by only 0.71 points, and the adjusted gender effect was negligible. This suggests that the structured group roles, questioning process, collaborative problem solving, and reflection activities provided comparable learning opportunities for male and female students in the participating classes. The finding agrees with Adewumi et al. (2024), Balarabe et al. (2024), Joseph and Oloja (2025), and Ibrahim and Shuaibu (2024), who reported non-significant gender differences under learner-centred instructional conditions. It also qualifies broader evidence that gender gaps can occur in some African STEM contexts (Bulala & Ntumi, 2025), indicating that such gaps are not inevitable and may depend on instructional and contextual conditions.

Finally, the treatment-by-gender interaction was not significant and had a very small effect size (partial $\eta^2 = .003$). The achievement advantage associated with Action Learning Strategy therefore appeared similar for male and female students. Taken together, the findings indicate that the strategy was associated with a substantial improvement in Geometry achievement without evidence that one gender benefited more than the other. The result supports the use of inclusive action-learning structures, while the quasi-experimental design requires caution in generalising beyond the participating schools.

# 5. CONCLUSION

The study concluded that Action Learning Strategy was associated with higher SS II students' achievement in Geometry than the Conventional Teaching Method in Akoko North-West Local Government Area of Ondo State. The action-learning group showed a markedly larger mean gain, and the adjusted treatment effect was statistically significant with a substantial effect size. Male and female students in the action-learning group achieved similarly, and the treatment effect did not vary significantly by gender. These findings support Action Learning Strategy as a promising and gender-inclusive emerging educational practice for Geometry instruction. However, because intact classes were assigned and the same teacher did not teach both conditions, causal interpretation and generalisation should remain cautious.

# 6. RECOMMENDATIONS

Mathematics teachers should incorporate structured action-learning cycles into Geometry lessons by using meaningful problems, small learning sets, disciplined questioning, collaborative solution testing, and guided reflection. Education authorities and curriculum planners should provide practical professional development and lesson resources that enable teachers to implement the strategy with fidelity. School administrators should support classroom conditions that permit small-group work and equitable participation by male and female students. Future studies should replicate the intervention with larger and more diverse samples, use stronger controls for teacher and school effects, report instrument reliability and implementation-fidelity indices, and examine retention and transfer to other Mathematics content areas.

# DECLARATIONS

## Funding

The authors received no specific funding for this work.

## Conflict of Interest

The authors declare no conflict of interest.

# REFERENCES

1. Adewumi, A. J., Akinbobola, A. O., & Akinbehinje, I. M. (2024). Relative effectiveness of action learning and demonstration strategies on students' academic achievement in Nigerian senior secondary school mathematics. *Journal of Education Innovation and Practice, 8*(1), 139–148. https://jeip.org.ng/index.php/jeip/article/view/64
2. Balarabe, B., Yahaya, I. E.-L., & Danlami, K. B. (2024). Effect of flipped classroom on geometry performance among senior secondary school students in Zaria, Kaduna State, Nigeria. *Faculty of Natural and Applied Sciences Journal of Mathematics, and Science Education, 5*(4), 63–68. https://www.fnasjournals.com/index.php/FNAS-JMSE/article/view/341
3. Bulala, T., & Ntumi, S. (2025). Evaluating gender gaps in STEM achievement in African secondary schools: A quantile regression and mediation analysis approach. *Frontiers in Education, 10*, Article 1607412. https://doi.org/10.3389/feduc.2025.1607412
4. Doolittle, P., Wojdak, K., & Walters, A. (2023). Defining active learning: A restricted systematic review. *Teaching & Learning Inquiry, 11*. https://doi.org/10.20343/teachlearninqu.11.25
5. Emefo, C. N., Bot, T. D., & Binda, S. I. (2023). Effect of problem-based learning strategy on senior secondary two students' achievement in geometry in Bichi, Kano State, Nigeria. *Journal of Advances*

*in Mathematics and Computer Science, 38*(10), 209–217. https://doi.org/10.9734/jamcs/2023/v38i101839

6. Ibrahim, A. A., & Shuaibu, H. (2024). Effect of gender on academic achievement of students exposed to activity-based instructional strategy in mathematics in Numan Education Zone, Adamawa State, Nigeria. *BW Academic Journal*. *8*(2), 22–30. https://www.bwjournal.org/index.php/bsjournal/article/view/2294
7. Joseph, A. A., & Oloja, O. A. (2025). The effect of inquiry-based learning on the academic performance of senior secondary school pupils in geometry in Ondo State, Nigeria. *Asian Journal of Education and Social Studies, 51*(3), 322–327. https://doi.org/10.9734/ajess/2025/v51i31829
8. Marquardt, M. J., Leonard, H. S., Freedman, A. M., Hill, C. C., & Kaiser, R. B. (2009). *Action learning for developing leaders and organizations: Principles, strategies, and cases*. American Psychological Association.
9. Weigand, H.-G., Hollebrands, K., & Maschietto, M. (2025). Geometry education at secondary level – a systematic literature review. *ZDM–Mathematics Education, 57*(4), 829–843. https://doi.org/10.1007/s11858-025-01703-1
10. West African Examinations Council. (2022). *General mathematics paper 2, WASSCE (SC), 2022*. https://www.waeconline.org.ng/e-Learning/Mathematics/maths235mw.html
11. West African Examinations Council. (2023). *General mathematics paper 2, WASSCE (SC), 2023*. https://www.waeconline.org.ng/e-learning/Mathematics/maths240mw.html
12. Xu, T., Sun, S., & Kong, Q. (2025). Spatial reasoning and its contribution to mathematical performance across different content domains: Evidence from Chinese students. *Journal of Intelligence, 13*(4), Article 41. https://doi.org/10.3390/jintelligence13040041

## CITATION

**APA**

Daramola, K. R., & Ayodeji, M. A. (2026). Effect of action learning strategy as an emerging educational practice on senior secondary II students' achievement in geometry in Akoko North-West Local Government Area of Ondo State, Nigeria. *International Journal of Educational Research, Practice and Innovation, 1*(1), 55–66. https://doi.org/10.55366/sfe.1000014.

SOCIETY *for* EDUCATORS

*International Journal of Educational Research, Practice and Innovation*

• [www.societyforeducators.org] • [info@societyforeducators.org]

OPEN ACCESS Creative Commons Attribution 4.0 International (CC BY 4.0)