impact International Journals and Publications

© IIJP 2026 | Volume 2, Issue 4, pp. 509-518 | ISSN: 2636-4484

EFFECT OF THINK-PAIR-SHARE TEACHING STRATEGY ON SENIOR SECONDARY STUDENTS' MOTIVATION IN ECOLOGY IN GINDIRI, MANGU LOCAL GOVERNMENT AREA OF PLATEAU STATE

Lambuna Villeng Shaibu
Federal College of Forestry Jos, Plateau State
lambunavillengshaibu@gmail.com

ARTICLE INFO
Article No.: 0662
Accepted Date: 10/08/2026
Published Date: 30/10/2026
Type: Research

ABSTRACT
This study investigated the effect of the Think-Pair-Share (TPS) teaching strategy on senior secondary school students' academic motivation in ecology in Gindiri District, Mangu Local Government Area of Plateau State. Adopting a non-equivalent control group pre-test and post-test quasi-experimental design, the study targeted a population of 186 Senior Secondary II biology students across five co-educational public schools. A purposive sample of two schools comprising 81 students. Data were collected using a validated instrument titled the Students Ecology Motivation Questionnaire (SEMQ), which yielded a Cronbach's alpha reliability coefficient of 0.78. Research questions were answered using descriptive statistics (mean and standard deviation), while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at a 0.05 level of significance, controlling for initial baseline differences. The empirical findings revealed a statistically significant difference in post-test motivation mean scores between students in the experimental and control groups ($F(1,78)=79.54, p<.001$, partial $\eta 2=.505$), with the experimental group achieving a higher adjusted post-test mean (51.72) than the control group (40.40). Furthermore, a significant gender difference was observed within the experimental group ($F(1,43)=10.31, p=.003$, partial $\eta 2=.193$), in favor of female students (adjusted mean = 54.45) over male students (adjusted mean = 46.70).. Based on these findings, it is recommended that educational stakeholders, curriculum planners, and science teachers actively integrate cooperative learning strategies like Think-Pair-Share into secondary school instructional practices and teacher training curricula.

Keywords: Think-Pair-Share strategy, academic motivation, ecology, gender differences, senior secondary biology

© IIJP 2026 | Volume 2, Issue 4, pp. 509-518 | ISSN: 2636-4484

Introduction

The term "biology," which is derived from the Greek terms "bios" and "logos," means "the study of living things." The study of living organisms in the environment is the focus of the science subject of biology. Discussing the living environment and the interactions between biological creatures and their surroundings is essential to studying biology. Students who study biology not only gain a lot of fundamental knowledge about the environment, but they also develop positive attitudes about it. For students to acquire favorable attitudes toward the environment, biology is essential. Every society has benefited from the growth, development, and advancement of biology as an area of study. According to this perspective, biology is the lifeblood of any community because it plays a role in practically every aspect of human activity, such as medicine, agriculture, waste management, and recycling. Similarly, there is no denying biology's significance to civilization. This significance is particularly apparent in the fields of industry, agriculture, and medicine, among many others (Ibe et al., 2016).

The environment is made up of both living and nonliving objects that interact harmoniously to support the ecosystem's efficacy. Youth at the secondary school level typically have a foundation of knowledge to build upon at the tertiary level of learning due to the effectiveness and appreciation of these relationships. According to the Nigerian Educational Research and Development Council [NERDC] (2013), as stated in the National Policy on Education, the two main objectives of education in Nigeria are to educate students for higher education and for productive lives in society. These goals are in tandem with the objectives of senior secondary school biology, which are: to prepare students to acquire adequate field skills in biology; meaningful and relevant knowledge in biology; the ability to apply scientific knowledge to everyday life matters of personal and community health and agriculture; and a reasonable and functional scientific attitude (NERDC, 2019).

Despite the significant contribution biology is expected to make to the national growth in the fields of industry, agriculture, medicine, and environmental studies, West African Examinations Council (WAEC) annual reports and empirical studies indicate that student failure rates and low credit pass performances in senior secondary school biology remain persistently high (WAEC, 2023; Cimer, 2012). Teachers can mitigate this problem by leveraging their professional expertise to control instructional variables and direct them toward improving students' engagement, motivation, and drive in the subject (Cimer, 2012).

Conventionally, didactic lecture methods are predominantly used by teachers to transmit knowledge, wherein the instructor talks to students rather than encouraging active interaction, inquiry, or deep conceptual understanding. Moreover, teaching methods work effectively only when they suit learners' needs, given that every learner interprets and responds to stimuli in a unique way. Traditional instruction relies more on theoretical memorization than practical application, failing to support activity-based learning that teaches students how to solve real-world problems. As a result, student motivation and comprehension are diminished, leading to subpar academic performance.

The interplay between the situation and the individual is a primary driver of academic motivation, serving as a psychological force that energizes, directs, and sustains goal-oriented actions in educational settings (Pintrich, 2003). Motivation acts as the mechanism through which teachers inspire and engage pupils across various classroom activities. One prominent active learning strategy within cooperative learning frameworks is the Think-Pair-Share (TPS) technique, in which students collaborate to solve problems or answer queries regarding specific subject matter (Lyman, 1981). This method requires students to first contemplate a topic

independently; subsequent discussions with a peer increase active involvement, concentrate attention, and deepen subject comprehension (Lightner & Tomaswick, 2017). Through this instructional model, students maximize learning potential by forming interactive dyads that stimulate effective communication, foster team spirit, and build intrinsic motivation (Karura et al., 2021).

Motivation and learning behavior are two critical determinants of academic outcomes. Students who are motivated to learn maintain interest and attention, invest the necessary time and effort, remain focused under demanding circumstances, and persist until tasks are completed (Chan & Norlizah, 2017). Conversely, traditional secondary school instructional methods are frequently perceived by students as dull, monotonous, and uninteresting, which allows academic failure and apathy to persist unchecked (Cimer, 2012). To improve student achievement, educational researchers advocate for a transition toward instructional styles that foster long-lasting comprehension through active interaction (Amrai et al., 2011).

Cooperative learning approaches, which stand in direct contrast to traditional teacher-centered lectures, embody this active framework. The Think-Pair-Share (TPS) strategy provides students with structured time and clear focus to develop independent ideas before presenting them to peers. Originally introduced by Lyman (1981), the TPS approach proceeds in three stages: students first reflect and construct ideas independently, discuss their responses in pairs, and finally share their consolidated perspectives with the wider class (Lightner & Tomaswick, 2017).

By encouraging direct engagement between students and teachers, this technique fosters a vibrant, active learning environment (Razak, 2016). Furthermore, it stimulates participation among reticent learners and sustains class-wide interest. Active student engagement encompassing both mental and physical participation is essential for developing lasting interest, conceptual understanding, and long-term knowledge retention (Raba, 2017; as cited in Ogunyebi, 2018). Active learning lessons encourage higher levels of student independence, engage specific cognitive skills for analyzing and comparing information, and connect new concepts to prior knowledge and critical judgment. Consequently, the Think-Pair-Share strategy holds a distinct advantage over traditional teaching methods in fostering cognitive growth, social skills, and academic motivation (Loh, 2019).

Conceptual framework and review of related literature

For enhancing cognition, social skills, and academic motivation, the Think-Pair-Share (TPS) learning strategy has a clear edge over conventional teaching methods (Loh, 2019). Students who are driven to study understand their academic performance better and consistently work to improve. According to expectation-value theory, students' motivation to learn is more strongly affected by tasks they value (Loh, 2019).

Active teaching methods greatly increase student engagement and academic motivation, according to empirical research on cooperative learning tactics in Nigeria. For example, Ogunyebi (2018) found that TPS and other cooperative tactics significantly increase student engagement and performance in scientific instruction in Nigerian classrooms. In a similar vein, Karura et al. (2021) found that structured peer interaction models increase intrinsic motivation, decrease science anxiety, and promote positive attitudes in secondary school students. Despite these established advantages, there is still a dearth of empirical studies assessing the precise effect of the Think-Pair-Share approach on senior secondary students' ecological motivation in Plateau State's Mangu Local Government Area.

Theoretical framework

This study is anchored on Vygotsky's Social Development Theory (1978), which posits that cognitive development and learning are fundamentally social processes. According to Vygotsky, learners construct knowledge through social interaction and collaboration with more knowledgeable peers within their Zone of Proximal Development (ZPD). The Think-Pair-Share strategy directly operationalizes this theory by engaging students in structured peer dialogues, collaborative problem-solving, and social communication, thereby boosting academic confidence, engagement, and motivation.

Statement of the problem

Equipping pupils with useful scientific knowledge, useful field skills, and favorable environmental attitudes is the main goal of secondary school biology instruction (NERDC, 2019). Nonetheless, biology students still have high failure rates and little academic motivation, especially when it comes to abstract ecological ideas (Cimer, 2012; WAEC, 2023). Rote memorization and passive listening are the mainstays of traditional, teacher-centered teaching approaches, which do not actively involve students or promote deep conceptual comprehension.

The specific effectiveness of cooperative learning approaches, such as Think-Pair-Share, on student motivation in ecology within Plateau State has not been sufficiently established, despite the fact that they provide a workable answer by encouraging active engagement. The current empirical study is required due to this methodological gap.

Aim and objectives of the study

The aim of this study is to determine the effect of the Think-Pair-Share teaching strategy on senior secondary two students' motivation in ecology in Gindiri, Mangu Local Government Area of Plateau State. The study intends to specifically achieve the following objectives:

i. To find out the difference in the post-test motivation mean score of students in the control and Think-Pair-Share group.
ii. To ascertain the difference between the post-test motivation mean scores of the male and female students in the Think-Pair-Share group.

Research questions

i. What is the difference in the post-test motivation mean scores of students in the control and Think-Pair-Share group?
ii. What is the difference between the post-test motivation mean scores of the male and female students in the Think-Pair-Share group?

Hypotheses

i. There is no significant difference in the post-test motivation mean score of students in the control and Think-Pair-Share groups.
ii. There is no significant difference between the post-test motivation mean scores of male and female students in the Think-Pair-Share.

Scope of the study

This study is geographically restricted to public co-educational secondary schools in Gindiri District, Mangu Local Government Area of Plateau State. Content-wise, the study focuses exclusively on Senior Secondary II (SS II) biology curriculum content relating to *Ecology* (specifically ecosystem interactions, energy flow, and environmental relationships).).

Methodology

The study adopted a quasi-experimental research design, specifically a non-equivalent control group pre-test and post-test design. This design was considered appropriate because intact classes were used to avoid disrupting normal school administrative and instructional

schedules. The two groups were not composed through random assignment; instead, intact groups were utilized, assigning one school as the experimental group and the other as the control group. To establish baseline equivalence prior to the intervention, a pre-test was administered to both groups, confirming that there were no statistically significant initial differences in motivation scores between the experimental and control groups ($p>.05$).

The target population for this study comprised all 5 co-educational public secondary schools in Gindiri District, Mangu Local Government Area of Plateau State, with a total population of one hundred and eighty-six (186) Senior Secondary II (SS II) biology students. The study focused exclusively on SS II biology students who had offered biology as a subject since SS I, ensuring adequate foundational knowledge for the study's instructional content.

A sample of two (2) co-educational Senior Secondary II schools was selected from the five public schools using a purposive sampling technique. The factors considered in choosing the participating schools included: school composition (co-educational status), presence of an SS II student population, availability of qualified biology teachers holding at least a B.Sc. (Ed), B.Sc./PGDE, or M.Ed. in Biology with a minimum of three years of teaching experience, and a consistent history of presenting candidates for WAEC and NECO biology examinations for at least three consecutive years. The total sample comprised eighty-one (81) students (forty-five females and thirty-six males). Specifically, the experimental group consisted of 46 students taught using the Think-Pair-Share (TPS) strategy, while the control group consisted of 35 students taught using traditional lecture methods.

The treatment was administered over a six-week period during regular biology class periods by the regular classroom teachers, who were trained by the researcher prior to the intervention. The experimental group were taught ecology concepts (specifically ecosystem interactions, energy flow, and nutrient cycling) using the Think-Pair-Share instructional strategy. Instruction followed three structured phases: (1) *Thinking phase*, where students independently reflected on teacher-posed ecological questions; (2) *Pairing phase*, where students discussed their thoughts in assigned dyads; and (3) *Sharing phase*, where pairs presented their consolidated solutions to the wider class. While the control group were taught the exact same ecology curriculum content over the same six-week duration using traditional, teacher-centered lecture methods without structured peer collaboration or interactive cooperative learning tasks.

Official administrative approval and ethical clearance were obtained from the principals of the participating secondary schools. Furthermore, informed consent was secured from all participating students and their parents or legal guardians prior to data collection, ensuring voluntary participation, anonymity, and data confidentiality.

Data was collected using a researcher-developed instrument titled the Students Ecology Motivation Questionnaire (SEMQ). The instrument contained 20 items structured on a 4-point Likert scale ranging from Strongly Agree (4) to Strongly Disagree (1). The SEMQ was subjected to face, content, and construct validation by four expert judges: one from Tests and Measurement (Department of Educational Foundations), one from the Department of Psychology, and two from the Department of Science and Technology Education, Faculty of Education, University of Jos. Their inputs led to the refinement of item clarity and relevance. To determine the internal consistency reliability, a pilot test was conducted using 20 SS II biology students from a co-educational public school outside the study area but sharing identical characteristics. Cronbach's alpha reliability coefficient yielded an index of $r=0.78$, confirming that the instrument was highly reliable.

Data collected from pre-test and post-test administrations were analyzed using descriptive statistics (mean and standard deviation) to answer the research questions. Inferential statistics, specifically Analysis of Covariance (ANCOVA), were utilized to test the null hypotheses at a 0.05 level of significance, controlling for initial pre-test differences. The decision rule dictated that if the computed p-value was less than the alpha level (0.05), the null hypothesis was rejected; otherwise, it was retained.

Results

Research Question One: What is the difference in post-test motivation mean scores of students in the control and experimental groups?

Table 1

Comparison of Pre-Test, Post-Test Means, Standard Deviations, and Adjusted Post-Test Means for SEMQ of Experimental and Control Groups

Group	*N*	Pre-Test Mean	Post-Test Mean	Std. Deviation	Adjusted Mean	Mean Difference
Experimental	46	39.12	51.59	7.882	51.72	11.02
Control	35	39.45	40.57	4.913	40.40	

As shown in Table 1, the experimental group recorded a pre-test mean of 39.12 and a post-test mean of 51.59 (*SD*=7.882, adjusted mean = 51.72), whereas the control group recorded a pre-test mean of 39.45 and a post-test mean of 40.57 (*SD*=4.913, adjusted mean = 40.40). The mean score difference of 11.02 points in post-test scores was in favor of the experimental group.

Research Question Two: What is the difference between the post-test motivation mean scores of male and female students in the experimental group after exposure to the Think-Pair-Share strategy?

Table 2

Comparison of Pre-Test, Post-Test Means, Standard Deviations, and Adjusted Post-Test Means for SEMQ in the Experimental Group by Gender

Gender	*N*	Pre-Test Mean	Post-Test Mean	Std. Deviation	Adjusted Mean	Mean Difference
Male	17	38.90	46.53	11.029	46.70	8.02
Female	29	39.25	54.55	8.842	54.45	

Table 2 reveals that male students in the experimental group obtained a pre-test mean of 38.90 and a post-test mean of 46.53 (*SD*=11.029, adjusted mean = 46.70), while female students obtained a pre-test mean of 39.25 and a post-test mean of 54.55 (*SD*=8.842, adjusted mean = 54.45). The mean score difference of 8.02 was in favor of female students.

Testing of hypotheses

Hypothesis One: There is no significant difference between the post-test motivation mean scores of students in the control and experimental groups.

To test hypothesis one, students' post-test scores were subjected to Analysis of Covariance (ANCOVA) using pre-test scores as the covariate. The summary of the analysis is presented in Table 3.

© IIJP 2026 | Volume 2, Issue 4, pp. 509-518 | ISSN: 2636-4484

Table 3
ANCOVA Analysis of Post-Test Mean Scores for SEMQ of Experimental and Control Groups

Source	Type III Sum of Squares	df	Mean Square	*F*	*Sig.*	Partial $\eta 2$
Corrected Model	3739.330*a*	2	1869.665	40.360	.001	.509
Intercept	11542.074	1	11542.074	249.159	.001	.762
Pre-Test (Covariate)	2.610	1	2.610	0.056	.813	.001
Group (Treatment)	3684.774	1	3684.774	79.543	.001	.505
Error	3613.287	78	46.324			
Total	196771.000	81				
Corrected Total	7352.617	80				

Note. R^2=.509 (Adjusted R^2=.496).

Table 3 indicates an *F*-value of 79.54 with degrees of freedom (1, 78) and a *p*-value of .001 (p<.05). Because the computed *p*-value is less than the alpha level of 0.05, the null hypothesis is rejected. This confirms a statistically significant difference in post-test motivation mean scores between students taught ecology using the Think-Pair-Share strategy and those taught using the conventional lecture method (F(1,78)=79.54,p<.001,partial η2=.505). The treatment had a substantial positive effect on students' academic motivation.

Hypothesis Two: There is no significant difference between the post-test motivation mean scores of male and female students in the experimental group after exposure to the Think-Pair-Share strategy.

To test hypothesis two, post-test motivation scores of male and female students within the experimental group were subjected to ANCOVA, controlling for pre-test baseline differences. The results are summarized in Table 4.

Table 4
ANCOVA Analysis of Post-Test Mean Scores for SEMQ in the Experimental Group by Gender

Source	Type III Sum of Squares	df	Mean Square	*F*	*Sig.*	Partial $\eta 2$
Corrected Model	997.004*a*	2	498.502	5.599	.007	.207
Intercept	3744.358	1	3744.358	42.059	.001	.495
Pre-Test (Covariate)	307.260	1	307.260	3.451	.070	.074
Gender	917.746	1	917.746	10.309	.003	.193
Error	3828.148	43	89.027			
Total	127241.000	46				
Corrected Total	4825.152	45				

Note. *R*2=.207 (Adjusted *R*2=.170).

Table 4 shows an *F*-value of 10.31 with degrees of freedom (1, 43) and a *p*-value of .003 (p<.05). Since p<.05, the null hypothesis regarding gender equity in post-test motivation is rejected. This demonstrates a statistically significant difference in motivation scores between

male and female students exposed to the Think-Pair-Share strategy, in favor of female students (F (1,43)=10.31,p=.003,partial η2=.193).

Discussion of findings

The primary objective of this study was to examine the effect of the Think-Pair-Share (TPS) teaching strategy on senior secondary students' motivation towards ecology in Gindiri, Mangu Local Government Area of Plateau State. The empirical findings are discussed below across the two core dimensions investigated:

The first finding established a statistically significant difference in post-test motivation mean scores between students in the experimental group (taught via TPS) and those in the control group (taught via conventional lecture) (F(1,78)=79.54,p<.001,partial η2=.505). The adjusted post-test mean score of 51.72 for the experimental group was substantially higher than the 40.40 recorded for the control group, demonstrating that the Think-Pair-Share strategy significantly enhances students' academic motivation in ecology. This outcome aligns with the findings of Karura et al. (2021), who affirmed that active, student-centered cooperative learning strategies like TPS significantly boost academic motivation and conceptual acquisition in secondary school science. Skillful deployment of TPS engages students through structured peer interactions, creates a positive classroom climate, and reduces science-related anxiety (Amrai et al., 2011; Karura et al., 2021). Fostering individual reflection followed by dyadic problem-solving allows learners to clarify misconceptions before presenting to the wider class, strengthening self-efficacy and task interest (Lightner & Tomaswick, 2017; Razak, 2016). Furthermore, these results support the core tenets of Vygotsky's Social Development Theory and Expectancy-Value Theory, which posit that social collaboration within the Zone of Proximal Development enhances task value and goal-directed learning behaviors (Loh, 2019; Pintrich, 2003).

The second finding revealed a statistically significant difference in post-test motivation mean scores between male and female students in the experimental group, favoring female students (F (1, 43) =10.31, p=.003, partial η2=.193). Female students achieved an adjusted post-test mean score of 54.45, compared to 46.70 for their male counterparts.

This finding is consistent with Chan and Norlizah (2017), who observed that female students often display higher social responsiveness and collaborative engagement during cooperative learning activities in science contexts. The structured verbal interaction inherent in TPS provides a supportive, low-stakes environment that particularly empowers female students who may remain reticent during whole-class, teacher-led lectures to articulate their ideas and build confidence in biological concepts (Raba, 2017). Active peer communication reduces social evaluation anxiety, allowing female learners to take greater ownership of their learning and demonstrate superior motivation gains (Ogunyebi, 2018).

Limitations of the study

To contextualize the findings, the following limitations must be acknowledged:

1. The study was restricted to two public co-educational secondary schools (N=81) within a single district (Gindiri, Mangu LGA), which limits the immediate generalizability of the findings to private schools or other geopolitical regions.
2. The experimental treatment was conducted over a six-week period. A longer intervention period might provide deeper insights into the long-term sustainability of motivation gains.
3. The study focused exclusively on academic motivation in ecology and did not measure direct academic achievement or long-term retention.

© IIJP 2026 | Volume 2, Issue 4, pp. 509-518 | ISSN: 2636-4484

Conclusion

Based on the empirical findings of this study, it is concluded that the Think-Pair-Share teaching strategy is significantly superior to conventional lecture methods in boosting senior secondary students' motivation towards learning ecology in biology. The Think-Pair-Share strategy exhibits gender-differential efficacy, with female students benefiting significantly more than male students in terms of post-treatment motivation gains in ecology.

Recommendations

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

1. Teacher training institutions (Colleges of Education and Faculties of Education) should explicitly incorporate cooperative learning strategies like Think-Pair-Share into their methodology curricula to equip pre-service teachers with student-centered instructional skills.
2. Ministry of Education officials, Post-Primary Schools Management Boards, and science professional bodies (such as STAN) should organize regular capacity-building workshops to train practicing biology teachers on the effective implementation of TPS in secondary classrooms.
3. School administrators should structure classroom physical layouts and time allocations to encourage seamless peer-pairing and collaborative group interactions during science lessons.

References

Amrai, K., Motlagh, S. E., Zalani, H. A., & Parhon, H. (2011). The relationship between academic motivation and academic achievement. *Procedia - Social and Behavioral Sciences*, 15, 15–19. https://doi.org/10.1016/j.sbspro.2011.03.042

Chan, Y. L., & Norlizah, C. H. (2017). Students' motivation towards science learning and students' science achievement. *International Journal of Academic Research in Progressive Education and Development*, 6(4), 174–189. https://doi.org/10.6007/IJARPED/v6-i4/3432

Cimer, A. (2012). What makes biology learning difficult and effective: Students' views. *Educational Research and Reviews*, 7(3), 61–71. https://doi.org/10.5897/ERR11.205

Ibe, E., Nwosu, A. A., Obi, C. N., & Nwoye, M. N. (2016). Gender and levels of attainment of scientific literacy among students under constructivist instructional model. *International Journal of Engineering Sciences & Research Technology*, 5(7), 81–90. https://doi.org/10.5281/zenodo.57218

Karura, J. W., Kimosop, M., & Orora, W. (2021). Influence of cooperative teaching strategies on students' academic motivation in secondary schools in Kenya. *Journal of Education and Practice*, 12(4), 45–52. https://doi.org/10.7176/JEP/12-4-06

Lightner, J., & Tomaswick, L. (2017). *Active learning – Think, Pair, Share*. Kent State University Center for Teaching and Learning. https://www.kent.edu/ctl/think-pair-share

Loh, E. K. (2019). What we know about expectancy-value theory, and how it helps to design a sustained motivating learning environment. *System*, 86, Article 102119. https://doi.org/10.1016/j.system.2019.102119

Lyman, F. (1981). The responsive classroom discussion: The inclusion of all students. In A. S. Anderson (Ed.), *Mainstreaming digest* (pp. 109–113). University of Maryland Press.

Nigerian Educational Research and Development Council. (2013). *National policy on education* (6th ed.). NERDC Press.

Nigerian Educational Research and Development Council. (2019). *Senior secondary school curriculum for biology*. NERDC Press.

Ogunyebi, T. H. (2018). Enhancing science performance through think-pair strategies among College of Education students in integrated science in Ekiti State, Nigeria. *International Journal of Education and Evaluation*, 4(4), 55–66.

Pintrich, P. R. (2003). A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology*, 95(4), 667–686. https://doi.org/10.1037/0022-0663.95.4.667

Raba, A. A. (2017). The influence of Think-Pair-Share (TPS) strategy on improving students' speaking performance in the EFL classroom. *Asian EFL Journal*, 9(2), 23–35.

Razak, F. (2016). The effect of cooperative learning on mathematics learning outcomes viewed from students' learning motivation. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, 1(1), 49–55. https://doi.org/10.23917/jramathedu.v1i1.1782

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

West African Examinations Council. (2023). *West African Senior School Certificate Examination (WASSCE) chief examiners' report (Biology)*. WAEC Press.