

Exploring Factors Affecting Senior High School Students' Preferences for Learning Strategies in Science Education in Ghana

Frederick Akosah Sekyere¹; Ernest Samuel Fervlo²; Isabella Agbesi³; Frank Aduo^{4*}; Michael Tabbey-Appiah⁵

^{1;2;3;4;5}Department of Integrated Science Education University of Education, Winneba, Ghana

Corresponding Author: Frank Aduo^{4*}

Publication Date: 2026/02/26

Abstract: This study investigated the key factors shaping senior high school students' choices of learning styles in Ghanaian science education through a mixed-methods design. Drawing on VARK learning styles theory and constructivist principles, it examined how individual preferences, instructional approaches, and contextual elements influence students' science learning tactics. Data were gathered via open-ended questionnaires from 210 purposively sampled students across three Volta Region senior high schools, augmented by semi-structured focus group discussions. Descriptive statistics like frequencies, modes, and percentages showed visual and kinesthetic styles as most common, with students favoring practical activities and video resources. Inquiry-based instruction emerged as the primary driver of strategic learning selections, promoting hands-on involvement and real-world application. External elements, including digital tools and lab access, also played a major role in guiding these preferences. The results underscore the importance of learner-focused, resource-supported, and multi-sensory pedagogies to boost science education in Ghana's secondary schools. These insights carry broad relevance for policy reforms, educator preparation, and curriculum reforms throughout Sub-Saharan Africa, stressing flexible, context-appropriate teaching to advance science proficiency

Keywords: *Learning Strategies, Learning Styles, Teaching Methods, Science Education, Ghana.*

How to Cite: Frederick Akosah Sekyere; Ernest Samuel Fervlo; Isabella Agbesi; Frank Aduo; Michael Tabbey-Appiah (2026) Exploring Factors Affecting Senior High School Students' Preferences for Learning Strategies in Science Education in Ghana. *International Journal of Innovative Science and Research Technology*, 11(2), 1526-1533. <https://doi.org/10.38124/ijisrt/26feb564>

I. INTRODUCTION

Science education is essential for fostering scientific literacy, critical thinking, and problem-solving skills among students. However, at the senior high school (SHS) level in Ghana, science education faces numerous structural and pedagogical barriers, such as limited access to laboratory facilities, a heavy reliance on traditional lecture-centric teaching methods, and a misalignment between instructional approaches and students' preferred learning styles (Osei, 2014; WAEC, 2021). As scientific content complexity increases, the learning strategies students adopt become crucial determinants of their academic success.

Learners' cognitive preferences and contextual influences such as teaching modalities and availability of educational resources play a significant role in shaping learning strategies (Zimmerman, 2002). Research suggests that tailoring teaching methods to align with students' preferred learning modes whether visual, auditory, or

kinesthetic can enhance engagement and information retention (Fleming & Mills, 1992). Furthermore, educational approaches that promote inquiry-based and collaborative learning have been shown to advance comprehension and active participation (Hmelo-Silver, 2004).

Despite legislative efforts advocating learner-centered pedagogy and the integration of Information and Communication Technology (ICT), notably Ghana's ICT program, the full implementation of differentiated instruction remains limited. There is a pressing need to comprehend how students learning preferences influence their strategic learning in science and how instructional and environmental factors might facilitate or constrain these preferences.

While international research has extensively explored relationships among learning styles, teaching methods, and academic achievement, there is a scarcity of empirical studies within Ghana that examine how these variables

collectively affect students' choices of learning strategies in science education. The prevalent one-size-fits-all instructional paradigm fails to accommodate individual learning differences, potentially contributing to suboptimal academic performance in scientific disciplines. Without a clear understanding of students preferred modes of study and the environmental conditions influencing these choices, interventions aimed at enhancing science education may fall short of their goals.

To address this gap, the present study aimed to investigate the factors influencing senior high school students' selection of learning styles in science education in Ghana. Specifically, it examined the impact of individual learning preferences, instructional methods, and external supports on students strategic learning behaviors.

➤ *Significance of the Study*

This study addresses a crucial gap in understanding senior high school students learning strategy preferences and influencing factors within the Ghanaian science education context. It contributes empirical evidence that instructional approaches and external supports, rather than fixed learning styles, drive strategic learning behaviors. The insights offered can inform curriculum development, teacher professional development, and resource allocation aimed at fostering active, meaningful science learning. Furthermore, the findings bear relevance for broader Sub-Saharan African educational contexts facing similar pedagogical and infrastructural challenges. By highlighting the importance of inquiry-based pedagogy and resource accessibility, this research supports initiatives to improve science education quality and student outcomes regionally.

➤ *Research Objectives*

The research was directed by the following objectives:

- To explore the link between students learning styles (visual, auditory, kinesthetic) and their preferred learning methodologies in science.
- To examine the effects of instructional methods (e.g., inquiry-based, lecture-based, collaborative) on students' selection of learning strategies in science classrooms
- To measure the influence of external elements such as group study, digital tools, or hands-on experiments on students' choices of learning styles.

➤ *Research Questions*

- How do students learning styles impact their choices for learning tactics in science?
- In what ways do teaching approaches impact students choice of learning strategies in science classrooms?
- What external variables contribute to students choosing of learning styles in scientific education?

➤ *Scope and Practical Implications of the Study*

This research provides valuable empirical evidence regarding the learning preferences of senior high school (SHS) students within the context of science education. The

insights generated are particularly useful for educators, curriculum developers, and policy makers who seek to design and implement instructional strategies that are more adaptable, diversified, and supported by appropriate learning resources. By integrating these findings, teacher training programs can better equip instructors to employ differentiated and multimodal teaching approaches, ultimately leading to improved student engagement and science learning outcomes.

It is important to note that this study was conducted with students from three senior high schools located exclusively in Ghana's Volta Region and focused solely on those enrolled in science programs. As such, the applicability of its findings to other geographical areas, educational levels, or subject fields should be approached with caution. Nevertheless, the study serves as a meaningful case that sheds light on the challenges and opportunities inherent in Ghanaian science education. Its depth of analysis offers a foundation for understanding similar educational dynamics and informing strategies tailored to the Ghanaian context and potentially other comparable settings in Sub-Saharan Africa.

➤ *Definition of Terms*

- **Learning Strategies:** Techniques or procedures pupils utilize to acquire, process, and retain knowledge.
- **Learning Styles:** Preferences for various sensory modalities of learning visual, aural, kinesthetic (Fleming & Mills, 1992).
- **Inquiry-Based Learning:** A student-centered teaching technique incorporating inquiry and hands-on discovery.
- **Constructivist Theory:** A theory positing that learners generate knowledge via interaction with their environment (Vygotsky, 1978).
- **VARK Model:** A framework that identifies learners as Visual, Auditory, Read/Write, and Kinesthetic.

II. LITERATURE REVIEW

This section analyzes current research on students learning techniques and the contributing elements including learning styles, instructional approaches, and external supports. It situates the research within the wider debate on science education in Ghana and other Sub-Saharan African countries. The review relies on empirical data, theoretical frameworks, and current advancements to identify gaps and support the present inquiry

Numerous researches have studied the influence of learning styles on students' choice of learning tactics. Visual learners are attracted to visuals and movies, auditory learners prefer listening and talks, while kinesthetic learners engage best via hands-on exercises and movement (Lujan & DiCarlo, 2006). Agyeman and Alhassan (2021) discovered that Ghanaian SHS students with visual or kinesthetic inclinations selected inquiry-based and activity-oriented techniques. Pashler et al. (2009) warn, however, that empirical evidence for style-based education is ambiguous,

demonstrating that although preferences exist, efficacy varies.

Instructional techniques greatly impact the development and use of learning processes. Inquiry-based learning, anchored on constructivism, fosters active problem-solving and involvement (Hmelo-Silver, 2004). Prince (2004) observed that students in active learning situations likely to adopt elaborative and metacognitive methods. In Ghana, conventional lecture techniques prevail, which may hamper strategic involvement (Osei, 2014). Asamoah and Osei-Poku (2019) discovered that student-centered teaching associated with higher approach utilization.

Access to resources such as digital tools, laboratory equipment, and peer study groups also impacts strategic behavior. Means et al. (2009) indicated that students having access to interactive technology had superior learning results. In Ghana, differences in infrastructure impede such access, however efforts like Khan Academy integration (WATHI, 2023) are addressing gaps. Collaborative learning contexts promote metacognition, whereas parental participation corresponds with strategy formulation (Owusu-Acheampong et al., 2022).

Although research underlines the significance of learning styles, instructional techniques, and external supports, few studies have evaluated their combined influence on SHS science students' strategy choices in Ghana. Most concentrate on accomplishment results rather than the strategies learners use. This research tries to address that gap by investigating the interaction of these factors in impacting students' science learning practices.

➤ *Theoretical Framework*

This research is rooted in two connected theories: the VARK Learning Styles Theory (Fleming & Mills, 1992) and Constructivist Learning Theory (Piaget, 1954; Vygotsky, 1978). The VARK model highlights four primary modes of learning; Visual, Auditory, Read/Write, and Kinesthetic, which determine how learners receive and retain knowledge. Constructivist theory, notably Vygotsky's sociocultural approach, stresses the relevance of social interaction, environment, and hands-on experience in the production of knowledge. Both theories encourage learner-centered teaching and offer a framework for understanding students' preferences for learning techniques.

III. METHODOLOGY

➤ *Research Design*

This study employed a mixed-methods research approach, integrating both qualitative and quantitative techniques to thoroughly examine the multifaceted factors influencing students' choices of learning styles. The quantitative component involved administering a standardized questionnaire consisting of 37 Likert-scale items designed to measure various aspects related to learning preferences, instructional methods, and external supports. Complementing this, the qualitative dimension

consisted of semi-structured focus group discussions with groups of approximately seven students each, enabling the collection of rich, detailed accounts of their learning experiences, attitudes, and preferences concerning science education.

The qualitative analysis adopted a phenomenological approach, which focuses on understanding how individuals make sense of their lived experiences (Creswell & Poth, 2018). Meanwhile, the quantitative analysis utilized descriptive and correlational methods to explore relationships among learning styles, teaching approaches, and contextual influences. This mixed-methods design provided a comprehensive and nuanced understanding of the complexities surrounding students' strategic learning behaviors, leveraging the strengths of both methodologies to validate and enrich the findings.

➤ *Participants of the Study*

The study focused on senior high school science students in the Volta Region of Ghana. Three public senior high schools were purposively selected for their accessibility, consistent academic performance, and availability of science teaching resources. From these institutions, a total of 210 students were sampled, with an equal distribution of 70 students drawn from each school. All participants had completed at least one academic year of science study.

➤ *Instrumentation*

This study employed two primary data collection instruments: a structured questionnaire and focus group discussions (FGDs). The questionnaire comprised 37 items organized into six thematic sections. Section A covered learning styles through six items; Sections B and C assessed students' perceptions of various teaching methods with ten items; Section D investigated experiences related to inquiry-based, lecture, and collaborative strategies using eleven items; Section E focused on external supports and preferred strategies across nine items; and Section F gathered demographic information through a single item.

In addition, semi-structured FGDs were conducted with small groups of approximately seven students from each school. These group conversations explored in-depth participants' learning preferences, classroom experiences, and contextual factors influencing their science education.

To ensure the questionnaire's content validity, scientific educators and curriculum experts reviewed the instrument, and it underwent pilot testing with 20 students outside the main sample to refine item clarity and relevance. The internal consistency reliability of the questionnaire subscales was evaluated using Cronbach's alpha coefficients, which ranged from 0.41 to 0.63, indicating moderate reliability across different sections.

➤ *Data Collection*

This study employed a dual data collection strategy combining both a structured questionnaire and focus group discussions to comprehensively capture the research

variables. The questionnaire featured 37 items spread across six distinct sections: Section A addressed learning styles with six questions; Sections B and C explored perceptions of various teaching methods through ten questions; Section D investigated experiences with inquiry-based, lecture, and collaborative learning strategies using eleven questions; Section E concentrated on external supports and strategy preferences with nine questions; and Section F gathered demographic details through one question.

Alongside the quantitative survey, semi-structured focus group discussions were conducted with groups of approximately seven students from each participating school. These discussions allowed for deeper exploration of students learning preferences, classroom experiences, and contextual factors influencing their science education engagement.

To ensure the robustness and validity of the study instruments, content verification was undertaken by experts in science education and curriculum development, followed by a pilot test involving 20 students outside the main sample to refine and clarify the questionnaire items. The reliability of the questionnaire's subscales was assessed using Cronbach's alpha, with values ranging from 0.41 to 0.63, indicating a moderate but acceptable level of internal consistency.

➤ *Ethical Consideration*

Ethical approval was granted by the University of Education, Winneba. Participants were assured of voluntary participation, with the freedom to withdraw at any point. Confidentiality and anonymity were strictly maintained, with data securely managed. For minors, parental consent was obtained prior to participation. Additionally, permissions were secured from school authorities and the Ghana Education Service. Questionnaires were self-administered in classroom settings. The focus group discussions were audio-recorded with consent, transcribed verbatim, and anonymized to protect participant confidentiality.

➤ *Data Analysis*

Quantitative data were processed using SPSS software, which facilitated the calculation of descriptive statistics including means, standard deviations, and frequencies providing an overview of the data distribution. Additionally, inferential statistical tests such as correlation analyses, regression models, and t-tests were conducted to examine relationships, predict outcomes, and compare group differences rigorously. For the qualitative data obtained from focus group discussions, Braun and Clarkes (2006) six-phase thematic analysis method was applied, systematically identifying, analyzing, and reporting key patterns and themes within the participants' narratives. To enhance the validity and trustworthiness of the results, the study employed triangulation by cross-verifying findings across both quantitative and qualitative datasets, thus ensuring a comprehensive and corroborated understanding of the research questions.

IV. RESULTS

A total of 210 senior high school science students took part in the study. Their responses to the 37 questionnaire items were scored on a 5-point Likert scale, where lower scores indicated stronger agreement with the statements. Kinesthetic learners were the most prominent group, reflected by a mean score of 2.0 (standard deviation approximately 0.5), highlighting their preference for learning through hands-on activities. Visual learners followed closely, showing significant agreement with the use of video-based and diagrammatic learning tools. Auditory learners appeared less predominant, with average scores around 3.0, indicating a neutral stance toward auditory learning methods. Notably, practical, hands-on learning activities received the highest endorsement across all learners, with about 90% of participants expressing favorable agreement, underscoring the critical role of experiential learning in science education.

Table 1 Reliability Analysis Using Cronbach's Alpha

Scale	Items	Mean	SD	α
A: Learning Styles	6	12.78	2.37	0.21
B: Teaching Preferences	5	10.41	2.86	0.34
C: Strategy Use	5	12.47	3.80	0.76
D: Teaching Methodology	11	-	-	0.49-0.57
E: External Supports	9	-	-	0.46-0.58

Interpretation: Only Scale C exhibited satisfactory internal consistency ($\alpha = .76$). Others demonstrated modest dependability, indicating a need for additional scale refining.

➤ *Research Objective 1: Learning Styles and Strategy Preferences*

Table 2 Learning Style and Preferred Strategy

Learning Style	Strategy Used	Percent (%)
Visual	Watching videos, Diagrams	40
Auditory	Discussions, Podcasts	25
Kinesthetic	Group work,	35

- **Key Finding:** Visual and kinesthetic preferences predominate. The most prevalent technique was viewing videos (40%). This coincides with VARK theory (Fleming & Mills, 1992) and Lujan & DiCarlo (2006), which promote multimodal techniques in scientific teaching. While self-reported styles were remarkable, correlation analysis found no significant predictive link

with approach choice ($r = 0$). This means that, learning styles may influence preferences but are not substantial drivers of actual strategy use, a notion reinforced by critics of the matching hypothesis (Pashler et al., 2009).

➤ *Research Objective 2: Teaching Methods and Strategy Use*

Table 3 Teaching Method and Strategy

Method	Strategy	Percent (%)
Inquiry-based	Experiments, Exploration	40
Lecture-based	Note-taking, Listening	35
Collaborative	Group work, Discussions	25

- **Key Finding:** Inquiry-based training provided the most active techniques (e.g., hands-on learning = 40%). Findings corroborate Constructivist Learning Theory (Vygotsky, 1978; Hmelo-Silver, 2004) that stresses the learner's active involvement. Consistent with Prince (2004), inquiry and cooperation lead to deeper learning and approach variety. However, traditional lectures still

account for 35% of method patterns, showing the predominance of passive teaching in Ghana (Osei, 2014).

➤ *Research Objective 3: External Factors and Learning Strategy Use*

Table 4 External Influence and Strategy

Factor	Strategy Supported	Percent (%)
Group Study	Peer tutoring	25
Digital Tools	Simulations, Video tutorials	35
Hands-on Labs	Practical application	40

- **Key Finding:** Hands-on resources (40%) and digital tools (35%) were highly associated to approach choice ($r = .39, p < .001$). This support Means et al. (2009) and Hofstein & Lunetta (2004), who argue for resource-supported settings. The research reveals that external tools are better drivers of strategy adoption than intrinsic learning styles. This correlates with the increased popularity of Khan Academy and virtual laboratories in Ghanaian classrooms (WATHI, 2023).

statistical impact on the selection of learning approaches. Inquiry-based and collaborative teaching were somewhat linked to increased use of hands-on, active, and metacognitive learning strategies. The availability of practical materials and digital learning technologies emerged as the strongest predictors of students strategic learning behaviors. Additionally, no significant differences were observed in learning approach preferences between first-year and third-year students, suggesting that environmental factors and access to resources play a more pivotal role than academic progression in shaping learning strategy choices.

- *External Support was the Biggest Predictor of Method Choice:*

$\beta \approx 0.36, p < .001$. Teaching technique components contributed minor predictive power ($\Delta R^2 = 0.06, p < .05$). Learning styles were not important predictors. Independent-sample t-tests indicated no significant difference in approach choice depending on year level (first-year vs. third-year). This means that, the strategy usage habits may be determined more by environmental exposure than academic development.

➤ *Key Findings*

Although students expressed a strong preference for visual and kinesthetic learning styles, these preferences did not significantly predict their actual use of learning methods. Instructional approaches centered on inquiry-based and collaborative education were associated with a greater adoption of active learning techniques. External resources such as laboratory facilities and digital tools exerted the most substantial influence on students' choices of learning strategies. Despite self-reported leanings toward visual and kinesthetic learning, learning styles had only a limited

V. DISCUSSION

This study on senior high school students learning preferences in Ghana reflects a growing body of research emphasizing the diversity of learning styles and their implications for science education. Consistent with findings by Owusu (2020) and others, visual and kinesthetic modalities are predominant among Ghanaian senior high students, a pattern seen across different regions and subject domains. For instance, studies in Gomoa East district demonstrated a majority preference for visual learning followed by kinesthetic and auditory modes, highlighting the multimodal nature of learners (Vol, cited in). This confirms the VARK model (Fleming & Mills, 1992), which categorizes learners based on sensory preferences.

Notably, the connection between learning preferences and academic performance, while positive in some studies (Vol.), remains complex and contested in others. The

present study's findings that learning styles alone do not strongly predict students' use of learning strategies mirror broader critiques that challenge the efficacy of style-based instructional matching (Pashler et al., 2009). Instead, research increasingly supports the integration of active, inquiry-based pedagogies emphasizing experiential learning and collaboration as more influential in promoting engagement and deeper understanding (Hmelo-Silver, 2004; Mohammed et al., 2020; Prince, 2004).

Teachers' perceptions of learning preferences also play a crucial role in shaping instructional decisions. Research from Greater Accra Region found that the majority of teachers recognize and consider learning styles in lesson planning, though the extent and effectiveness of application vary. This suggests a need for targeted professional development to enhance teachers' capacity to implement learner-centered approaches that address diverse preferences while fostering metacognitive awareness.

Access to resources remains a significant contextual factor. Studies underscore those digital tools, hands-on laboratories, and multimedia materials markedly enable students to engage actively with scientific content (Means et al., 2009; WATHI, 2023; Hofstein & Lunetta, 2004). Ghana's educational infrastructure disparities necessitate investments to bridge such gaps, supporting equitable learning opportunities.

Qualitative insights in this and related studies reveal that students often lack clear self-awareness about their learning styles, which may affect their reported preferences and strategy use (Schunk, 2020). Embedding explicit training on learning strategies and self-regulation within curricula could empower students to better adapt their study approaches to different contexts and challenges.

In sum, this study's comprehensive findings resonate with local and international research emphasizing a shift from rigid learning style adherence to more flexible, multimodal instructional frameworks supported by inquiry-based, collaboratively oriented teaching and adequate resourcing. These approaches promise to enhance science education outcomes in Ghana's senior high schools and beyond by addressing both individual learner differences and contextual constraints.

VI. DELIMITATIONS AND LIMITATIONS

This study was delimited to senior high school students enrolled in science programs at three purposively selected public schools within the Volta Region of Ghana. Consequently, findings may not be generalizable to students in other regions, school types, or subject disciplines. Limitations include reliance on self-reported data susceptible to response biases, particularly given participants' limited understanding of learning styles as identified during focus groups. The psychometric properties of some questionnaire subscales were modest (Cronbach's alpha between 0.41 and 0.63), which may affect the reliability of measured constructs. Additionally, purposive

sampling restricts external validity. The cross-sectional design limits causal inferences regarding the effects of instructional and external factors on strategy choice. These limitations highlight the need for instrument refinement and more representative sampling in future investigations.

VII. CONCLUSIONS

This research studied the characteristics affecting senior high school students' choices for learning styles in scientific education in Ghana. Anchored in the VARK Learning Styles Theory (Fleming & Mills, 1992) and Constructivist Learning Theory (Vygotsky, 1978), the study studied the interaction of students' unique learning styles, instructional techniques, and external supports in influencing strategic learning behavior.

A mixed-methods approach was adopted, combining qualitative focus group talks with a 37-item quantitative questionnaire. Data were acquired from 210 purposively chosen science students across three senior high schools in the Volta Region. Descriptive and inferential statistical approaches, including correlations and regression analysis, were utilized to detect patterns and predictive associations.

The data suggested that whereas visual and kinesthetic preferences were frequent, learning style alone did not substantially predict students' chosen tactics. Instead, instructional methods particularly inquiry-based and collaborative approaches, and external variables like access to digital tools and hands-on laboratories had higher influence on learning strategy choices.

In addition, during the focus group discussion, it was observed that most of the students do not genuinely know their learning styles since they have less awareness about what learning styles are. This we discovered may likely affect their decision while completing the questionnaire.

The research suggests that students' choices for learning techniques in science are impacted more by the instructional environment and accessible resources than by their self-reported learning styles. While the VARK model gives helpful insights into how students perceive learning, its practical influence on strategy selection looks limited in this context.

In contrast, teaching approaches that stimulate inquiry, cooperation, and discovery help students to adopt deeper and more successful learning practices. Moreover, external aids like virtual laboratories, group study, and access to digital resources dramatically boost students' capacity to interact actively with scientific subject.

These results support the constructivist notion that learning is most successful when students connect meaningfully with knowledge via real-world tools, peer involvement, and reflective practices.

RECOMMENDATIONS

➤ *Based on the Study's Results, the Following Suggestions are Proposed:*

- Adopt Differentiated Instruction: Use multimodal tactics (visuals, hands-on activities, audio aids) to cater to varied student profiles.
- Promote Inquiry-Based Learning: Incorporate project-based activities, experiments, and problem-solving assignments to engage students actively.
- Encourage Collaborative Learning: Use group projects and peer education to establish strategic learning habits.
- Enhance Resource Provision: Ensure availability to scientific kits, virtual lab software, multimedia tools, and specific locations for group work.
- Support Teacher Professional Development: Train teachers in learner-centered pedagogies and current scientific education methodologies.
- Invest in Educational Technology: Scale up digital inclusion initiatives (e.g., free Khan Academy access) to bridge infrastructural gaps in rural regions.
- Embed Strategy Training in Curricula: Include modules that teach metacognitive techniques (e.g., self-monitoring, idea mapping) directly.
- Broaden the Scope: Conduct longitudinal or countrywide research to generalize results and investigate gender, school type, or geographical inequalities.
- Refine Instruments: Develop validated instruments with greater reliability ratings to better capture factors such as strategy utilization and learning style alignment.

This research illustrates the complexity of student learning choices in scientific education. It argues for a move from strict, style-matching paradigms toward flexible, resource-rich, and learner-responsive training. If scientific education in Ghana is to encourage deeper comprehension and job preparedness, pedagogy must adapt to reflect the lived realities and resource circumstances of learners.

- Author contributions: Conceptualisation, formal analysis, original draft composition, review and editing of the manuscript, discussion of findings with colleagues, administration of questionnaires, methodology development, data collecting, resource allocation, software utilisation, supervision, and validation. All authors authorized the final version of the paper.
- Funding: The authors did not get any financial help for the research or writing of this work.

ACKNOWLEDGEMENTS

The authors wish to extend their thanks to all persons who contributed to the completion of this study, including those who supplied technical help and inspiration that boosted the quality of this research. The authors like to convey their appreciation to Prof. Peter Akayuure of the Mathematics Education Department at the University of

Education, Winneba, for his aid and encouragement, and to all 210 students from the senior high school in Ghana.

- Conflict of Interest Statement: Conflict of interest statement: The authors disclose no competing interests.
- Data availability: The authors may offer the data produced or analyzed during this study upon request.

REFERENCES

- [1]. Agyeman, D. N., & Alhassan, M. (2021). Influence of learning styles on science achievement of SHS students in Northern Ghana. *Journal of Educational Development and Practice*, 12(1), 24–36.
- [2]. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- [3]. Creswell, J. W., & Poth, C. N. (2018). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (4th ed.). SAGE Publications.
- [4]. Fleming, N. D., & Mills, C. (1992). Not another inventory, rather a catalyst for reflection. *To Improve the Academy*, 11(1), 137–155.
- [5]. Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review*, 16(3), 235–266.
- [6]. Hofstein, A., & Lunetta, V. N. (2004). The laboratory in science education: Foundations for the twenty-first century. *Science Education*, 88(1), 28–54.
- [7]. Lujan, H. L., & DiCarlo, S. E. (2006). First-year medical students prefer multiple learning styles. *Advances in Physiology Education*, 30(1), 13–16.
- [8]. Marcourt, A., Osei, D., & Appiah, R. (2022). Teacher-centred practices and poor academic performance in Ghanaian science classrooms. *West African Journal of Education*, 42(2), 63–78.
- [9]. Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). *Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies*. U.S. Department of Education.
- [10]. Mohammed, A., Kumah, E. A., & Issah, A. (2020). Teacher perceptions of inquiry-based instruction in Ghana. *Ghana Journal of Education and Practice*, 10(3), 40–53.
- [11]. Osei, D. (2014). Challenges of teaching science in Ghanaian secondary schools. *Journal of Education and Practice*, 5(16), 94–101.
- [12]. Osei-Anto, A., & Ansong-Gyimah, K. (2022). Teaching method impact on SHS chemistry performance. *African Journal of Educational Studies in Mathematics and Sciences*, 18(1), 1–10.
- [13]. Owusu-Acheampong, J., Agyei, D., & Owusu, A. (2022). Parental involvement and student learning strategies in Ghana. *Journal of African Educational Studies*, 12(4), 98–113.
- [14]. Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2009). Learning styles: Concepts and evidence. *Psychological Science in the Public Interest*, 9(3), 105–119.

- [15]. Piaget, J. (1954). *The construction of reality in the child*. New York, NY: Basic Books.
- [16]. Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, 93(3), 223–231.
- [17]. Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
- [18]. WAEC. (2021). *Chief Examiner's Report on the WASSCE for School Candidates*. Accra: West African Examinations Council.
- [19]. WATHI. (2023). Khan Academy's role in Ghana's education transformation. *WATHI Research Briefs*, 9(1), 1–6.
- [20]. Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, 41(2), 64–70.