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Assessment of Factors Influencing Geometry Achievement in Senior High Schools in Ghana

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Abstract

Geometry is a fundamental aspect of mathematics, essential for problem-solving, critical thinking, and spatial reasoning. Despite its importance, geometry achievement among Senior High School (SHS) students in Ghana remains low, hindering their future academic and professional prospects in STEM fields. This study investigated the determinants of geometry achievement among selected SHS students in the Central Region of Ghana, focusing on teacher, student, curriculum and assessment factors. The study employed a descriptive-correlational research design. The population consisted of all students in public Senior High Schools in the two local government areas of Agona in the Central Region of Ghana. A sample of 248 final-year students was selected using stratified random sampling techniques. Data collection involved a self-developed survey questionnaire and a standardized geometry achievement test, analyzed using descriptive statistics, Pearson's r correlation, and multiple regression analysis. The findings showed a moderate level of geometry achievement (mean score = 53.3%), with students generally having positive perceptions of the factors under study. Correlation analysis revealed significant positive relationships between all predictor variables and geometry achievement, with students' study habits exhibiting the strongest correlation *($r=0.52$, $p<0.01$)*. Multiple regression analysis confirmed that all four factors significantly influenced geometry achievement with students' study habits *($\beta=3.12$, $Beta=0.38$, $P=0.000<0.01$)* being the most influential predictor, followed by curriculum implementation *($\beta=2.85$, $Beta=0.34$, $P=0.000<0.01$),* teachers' pedagogical strategies *($\beta=2.32$, $Beta=0.31$, $P=0.000<0.01$),* and assessment practices *($\beta=2.25$, $Beta=0.28$, $P=0.000<0.01$).* The overall regression model was statistically significant *($F(4, 295)=26.38$, $p<0.01$),* explaining 38.8% of the variance in students' geometry achievement. Based on these findings, the study recommends the development of targeted interventions aimed at enhancing teacher pedagogy, promoting effective study habits, regularly reviewing and updating the curriculum, and incorporating more formative assessments to provide ongoing feedback. These strategies are expected to foster better educational outcomes in geometry and contribute to overall academic success.

Keywords: Geometry achievement, teacher pedagogy, study habits, curriculum implementation, assessment practices, Senior High Technical School, Ghana.
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1. Introduction

Geometry is a foundational subject in the mathematics curriculum of Senior High Schools (SHSs), developing students' spatial reasoning, logical thinking, and problem-solving abilities, as highlighted in the Ministry of Education's 2010 curriculum framework. The significance of geometry lies in its application across various fields such as architecture, engineering, physics, and even art, where spatial understanding and visualizing objects are crucial (Russel, 2018). The Ghanaian mathematics curriculum places great importance on the study of geometry at the pre-tertiary level of education. The curriculum aims to develop students' geometric reasoning, spatial visualization, and problem-solving skills, which are essential for their overall mathematical proficiency and their ability to tackle real-world problems (Ministry of Education, Ghana [MoE], 2019). This importance is shown in the chronological order in which geometry content is taught from the basic school level through senior high school level. According to the National Pre-Tertiary Education Curriculum Framework, geometry is integrated into the mathematics curriculum from the basic to the Senior High School levels, with increasing complexity and depth as students' progress (MoE, 2019). In the Ghanaian mathematics curriculum, geometry constitutes a significant proportion of the content taught in Senior High Schools. At the Senior High School level, geometry topics include Euclidean geometry, coordinate geometry, and trigonometry, which together account for

approximately 25-30% of the mathematics curriculum (MoE, 2010).

The importance placed on geometry content learned at the pre-tertiary level is also seen in many international assessments. For instance, Trends in International Mathematics and Science Study (TIMSS) emphasized the importance of geometry in developing critical thinking skills. The TIMSS 2019 report noted that Students who perform well in geometry tend to exhibit stronger overall mathematical proficiency and problem-solving skills (Mullis et al., 2020). Despite the many importance geometry plays in the school curriculum, many students struggle with geometric concepts, leading to poor performance in both internal and external assessments (Mensah & Nabie, 2021). In Ghana, this issue is highlighted in the West African Senior High School Certificate Examination (WASSCE) Chief Examiner's report, which consistently indicate students' difficulties with geometric problems and concepts. For instance, the 2023 Chief Examiner's report for WASSCE noted, "Many candidates displayed a lack of understanding of basic geometric principles and often could not apply theorems correctly to solve problems" (WAEC, 2023; p.15). Understanding the factors that influence students' achievement in geometry is crucial for educators, policymakers, and researchers seeking to improve educational outcomes in this subject (NCTM, 2000).

Research has shown that several factors contribute to students' success or failure in geometry, including teachers' pedagogical strategies, students' study habits, curriculum implementation, assessment practices, among others. According to Hattie (2015) pedagogical strategies refer to the various methods and techniques that teachers employ to deliver content and engage students in the learning process. Effective pedagogical strategies can make abstract geometric concepts more tangible and understandable, thus improving students' achievement (Van de Walle, et al., 2018). The Ghanaian mathematics curriculum emphasizes learner-centered approaches, however, the Chief Examiner's reports for WASSCE indicate that many mathematics teachers still rely heavily on traditional lecture methods, which may not effectively engage students in understanding geometric concepts (WAEC, 2023). For example, the Chief Examiner's report for 2023 specifically admonished mathematics teachers to adopt more interactive teaching methods to help students grasp geometric concepts better, as traditional lecturing has proven inadequate (WAEC, 2023). Additionally, students' study habits, such as their consistency in practicing geometric problems and their participation in class, and motivation to learn geometry, play a significant role in their overall performance (Mensah, et al., 2022; Zimmerman & Schunk, 2011).

Curriculum implementation and assessment practices are also critical determinants of students' achievement in geometry. A well-structured curriculum that is effectively implemented ensures that students receive a comprehensive and coherent education in geometry, building their knowledge and skills progressively (Stein, et al, 2007). The Ghanaian pre-tertiary mathematics curriculum aims to develop students' geometric reasoning and problem-solving skills, but challenges such as inadequate resources and insufficient teacher training can hinder effective implementation (Ministry of Education, 2019). Furthermore, assessment practices, including formative and summative assessments, provide valuable feedback and measure students' understanding and mastery of geometric concepts (Rehmani, 2016). There is the need for more effective and continuous formative assessments and timely feedback to help identify students' weaknesses and address them promptly to improve their performance in geometry (WAEC, 2023). This study investigates the combined influence of these factors on SH/TS students' achievement in geometry, providing insights that can inform educational practices and policies in Ghana.

1.1 Statement of the Problem

Geometry, a crucial component of the mathematics curriculum, has consistently posed challenges for students in Ghanaian SH/TSs. Despite its importance in developing spatial reasoning and critical thinking skills, students' achievement in geometry remains suboptimal in Ghanaian s, as evidenced by the West African Senior School Certificate Examination (WASSCE) results Several factors have been identified as potential determinants of geometry achievement, including teachers' pedagogical strategies, students' study habits, curriculum implementation, and assessment practices. Research indicates that effective teaching methods are pivotal in enhancing students' understanding of geometric concepts (Mensah & Nabie, 2021; Mensah et al., 2022; Van de Walle et al., 2016). However, there is a noticeable gap in the adoption of interactive and learner-centered teaching strategies in many Ghanaian classrooms (Ampadu, 2012).

Students' study habits also play a significant role in their academic performance. Zimmerman and Schunk (2011) highlight the importance of self-regulated learning and effective study practices in achieving academic success. Yet, many students struggle to develop and maintain productive study routines, which adversely affects their performance in geometry (Pintrich, 2004). Curriculum implementation is another critical factor. The structure and delivery of the mathematics curriculum significantly impact students' learning outcomes (Stein, et al., 2007).

In Ghana, inconsistencies in curriculum implementation and a lack of continuous professional development for teachers often undermine the effectiveness of the curriculum (Akyeampong et al., 2013). Assessment practices, including formative assessments, are essential for providing feedback and guiding student learning (Rehmani, 2016; Stiggins, 2013). However, many teachers in Ghana rely heavily on summative assessments, which may not provide the necessary feedback to support students' learning and improvement in geometry (WAEC, 2023).

Given these challenges, and limited research studies in this area, it is imperative to investigate the specific factors that influence geometry achievement among SH/TS students in Ghana. This study aims to identify and analyze these determinants, providing insights that could inform strategies to improve geometry education and student performance in Ghana.

1.2 Purpose of the Study

The main purpose of this study is to investigate the complex interplay of factors that influence geometry achievement among SHS students in the Ghana, to identify areas for improvement and provide recommendations for stakeholders. Specifically, the study aimed to:

1. Investigate the impact of teachers' pedagogical strategies including teaching methods and resources, on students' achievement in geometry.
2. Examine the role students' study habits, including learning behaviours, motivation, and self-efficacy, in influencing their geometry achievement.
3. Assess the quality of curriculum implementation, including alignment with instructional practices, and its impact on students' geometry achievement.
4. Evaluate the effectiveness of assessment practices, including types and frequency of assessments, in measuring students' geometry knowledge and skills.
5. Identify the most significant predictors of students' success in geometry among the factors studied.

1.3 Research Questions

The study addresses the following research questions:

1. How do teachers' pedagogical strategies influence SHS students' geometry achievement?
2. What are the relationships between SHS students' study habits and their geometry achievement?
3. What is the impact of curriculum implementation on SHS students' geometry achievement?
4. How do assessment practices influence SHS students' geometry achievement?
5. Which factors among teachers' pedagogical strategies, students' study habits, curriculum implementation is the most significant predictor of students' achievement in Geometry?

2. Literature Review

2.1 Teachers' Pedagogical Strategies

Teachers' pedagogical strategies play a crucial role in shaping students' understanding and achievement in geometry. Effective teaching methods can transform abstract geometric concepts into tangible learning experiences, fostering better comprehension and retention (Van de Walle, et al, 2018). Research studies, both old and new, indicates that interactive teaching approaches, such as the use of manipulatives, technology, dynamic geometry software, and inquiry-based learning, significantly enhance students' geometric reasoning and problem-solving skills (Mensah & Nabie, 2021; Kogan & Laursen, 2014; Norton & McRobbie, 2000). For instance, as far back as the year 2000, a study by Norton and McRobbie demonstrated that students who were engaged in hands-on activities and used dynamic geometry software showed marked improvement in their understanding of geometric concepts compared to those who received traditional lecture-based instruction. This finding suggests technology integration in teaching concepts in mathematics, as a pedagogical strategy, has been one of the effective instructional strategies since time immemorial.

Similarly, a recent study by Mensah and Nabie (2021) in the Gomoa West District of the central region of Ghana, found significant difference in academic achievement between SH/TS students taught in a technologically-enhanced classroom and those taught using traditional strategy. The study, using a sample size of 80 randomly selected from two s, employed quasi-experimental methodology and mixed methods as means of enquiry. The authors employed PowerPoint presentation as an instructional strategy in teaching geometry in the experimental class and traditional approach in teaching the control group. The study, among other things, found that the experimental group significantly outperformed the control group in terms of academic achievement and interest in mathematics (Mensah & Nabie, 2021). This finding suggests that technology integrated instructional strategies are able to improve students' learning outcomes in geometry.

Inquiry-based learning (IBL) is another pedagogical strategy found to have positive impact on students' learning outcomes. IBL emphasizes student-centered approaches such as student-led investigation and discovery, which promotes deep understanding and critical thinking skills of students. Kogan and Laursen (2014**)** examined the impact of IBL and non-IBL, in teaching three different courses, on 3,212 college undergraduate students from two institutions in the United States of America. The results show that students in IBL classes' performance was equal or better than their colleagues in the non-IBL classes, with higher gains in attitudes towards mathematics (Kogan & Laursen, 2014).

In Ghana, despite the curriculum's emphasis on learner-centered pedagogies, many teachers continue to rely heavily on didactic methods due to constraints such as large class sizes, limited resources, and insufficient professional development (Osei, 2016). The West African Senior School Certificate Examination (WASSCE) Chief Examiner's reports consistently highlight the inadequacy of traditional lecture methods in effectively teaching geometry, recommending a shift towards more interactive and student-centered approaches (WAEC, 2017; WAEC, 2018; WAEC, 2019; WAEC, 2023). For example, in light of improving students' learning outcomes, the 2023 report recommended that mathematics teachers should incorporate more hands-on activities and technology in their instructional deliveries to make geometric concepts more accessible and engaging for students. The current study investigates the factors that determine SH/TS students' achievement in geometry, including mathematics teachers' pedagogical practices.

2.2 Students' Study Habits

Students' study habits, including their consistency in practicing geometric problems, participation in class, and self-regulated learning behaviour, are significant determinants of their academic success in geometry (Zimmerman & Schunk, 2011). Effective study habits enable students to consolidate their understanding, apply geometric concepts to solve problems, and prepare adequately for assessments (Pintrich, 2004). Research by Zimmerman (2002) suggests that students who set specific goals, monitor their progress, and employ effective study strategies tend to perform better academically.

In the context of Ghanaian senior high schools, studies have shown that students' study habits are influenced by factors such as their motivation, learning environment, and the support they receive from teachers and peers (Ampadu, 2012). For example, a study by Ampadu (2012) found that students who participated in study groups and regularly sought help from teachers were more likely to excel in geometry compared to their peers who studied in isolation. The WASSCE Chief Examiner's reports also emphasize the importance of good study habits, noting that students who consistently practiced geometric problems and engaged actively in class discussions performed better in geometry assessments (WAEC, 2023).

2.3 Curriculum Implementation

The implementation of a well-structured and coherent curriculum is vital for ensuring that students receive a comprehensive education in geometry. A curriculum that is effectively aligned with instructional practices provides a clear roadmap for teachers, guiding them in delivering content that builds students' knowledge and skills progressively (Stein et al., 2007). The Ghanaian mathematics curriculum aims to develop students' geometric reasoning and problem-solving abilities through a systematic and integrated approach, covering topics such as Euclidean geometry, coordinate geometry, and trigonometry (MoE, 2019).

However, challenges such as inadequate resources, insufficient teacher training, and disparities in curriculum implementation across schools can hinder the effectiveness of the curriculum (Osei, 2016). Research by Akyeampong et al. (2013) indicates that inconsistencies in curriculum implementation often result in variations in student achievement, with some students receiving a more comprehensive and rigorous education in geometry than others. The WASSCE Chief Examiner's reports have also pointed out the need for continuous professional development for teachers to ensure they are well-equipped to implement the curriculum effectively (WAEC, 2023). The 2023 report stated, "Teachers should receive ongoing training and support to help them deliver the geometry curriculum effectively and address the diverse learning needs of their students" (WAEC, 2023).

2.4 Assessment Practices

Assessment practices, including formative and summative assessments, play a critical role in measuring students' understanding of geometric concepts and providing feedback that can guide instructional decisions (Rehmani, 2016). Effective assessment practices not only evaluate students' knowledge and skills but also identify areas where they need further support and intervention (Stiggins, 2005). Research indicates that formative assessments, such as quizzes, classwork, and peer assessments, are particularly valuable in helping students improve their understanding and performance in geometry (William, 2018, p. 45).

In Ghanaian senior high schools, WASSCE serves as the primary summative assessment for evaluating students' mastery of geometry and other subjects. However, the WASSCE Chief Examiner's reports suggest that more emphasis should be placed on formative assessments to provide ongoing feedback and support for students (WAEC, 2023). For example, the 2023 report recommended, "Teachers should incorporate a variety of formative assessments into their teaching to help students identify and address their weaknesses in geometry before they take the WASSCE" (WAEC, 2023). This approach aligns with research by Kellaghan (2014), who argues that formative assessments are essential for improving students' learning outcomes by providing timely and constructive feedback.

3. Methodology

3.1 Research Design

The study employed a descriptive-correlational design to investigate the determinants of geometry achievement among senior high school students in two administrative districts in the Central Region of Ghana. The descriptive aspect of the design enabled the researchers to provide a detailed account of the factors influencing geometry achievement, while the correlational aspect facilitated the examination of the relationships between these factors and students' geometry achievement in a naturalistic setting without manipulating the study environment. The design is particularly suitable for educational research where the goal is to identify and describe patterns of association between variables as they occur naturally in real-world settings (Creswell & Creswell, 2018). By using this design, the study can provide insights into how the various factors interplay to influence students' academic outcomes, thereby informing targeted interventions.

3.2 Population, Sample and Sampling Procedure

The target population of the study consisted of all final year Senior High/Technical School (SHS) students in the Agona area of the Central Region. The study area comprised two districts: Agona West Municipal Assembly (AWMA) and Agona East District Assembly (AEDA). The area has a total of 13 SHSs, with seven (7) located in AWMA and six (6) in AEDA. A sample of 248 final-year students was drawn from the target population using a multi-stage sampling technique to ensure representativeness.

First, the researchers stratified the population by the two district assemblies (AWMA and AEDA) and employed simple random sampling technique to select two schools from each of the districts (stratum), ensuring equal inclusion chances for all schools (Larson & Ferber, 2019). The random sampling technique adopted here was the lottery method. Secondly, the purposive sampling technique was applied to select SHS three students from the three levels within SHSs, allowing for deliberate selection based on specific criteria and structured. The systematic sampling technique was then used to select the sample of 248 students from the various academic programmes in the four SHSs. Systematic sampling enabled the researchers to select unbiased samples from an ordered list of students provided to the researchers by the various schools (Larson & Ferber, 2019).

3.3 Data Collection Instruments

Data were collected using two main instruments: a structured survey questionnaire and a standardized geometry achievement test. The Structured Survey Questionnaire (SSQ) was designed to gather information on the four key factors under investigation: teachers' pedagogical strategies, students' study habits, curriculum implementation, and assessment practices. The geometry achievement test assessed students' understanding and mastery of key geometric concepts and principles.

The Structured Survey Questionnaire (SSQ) consisted of four sections, each corresponding to one of the four factors. Items were measured on a 5-point Likert scale, ranging from strongly disagree (1) to strongly agree (5). The questionnaire was pilot-tested to ensure clarity, reliability, and validity. A reliability index of 0.835 for SSQ was obtained after subjecting the research instruments to pilot testing using 20 students from a sister SHS in the study region. The Geometric Achievement Test (GAT) included both multiple-choice and open-ended questions, covering topics such as Euclidean geometry, coordinate geometry, and trigonometry. The multiple-choice test was included in the GAT due to its objectivity in marking and vast flexibility in assessing various types of outcomes, including knowledge goals, application goals, and analysis goals.

The GAT was content-validated using a Table of Specification to construct the test items. Additionally, it was face-validated by three experts from the Mathematics Education Department of SDA College of Education, Asokore-Koforidua, Ghana. The reliability coefficient of the GAT was 0.87, which was estimated using the test-retest reliability method. The expected score for the GAT ranges from 0 to 100, reflecting the minimum and maximum possible scores.

3.4 *Data Collection Procedure*

The data collection process involved administering a combined instrument that pairs the SSQ with the GAT in a single booklet to the selected sample of students. Prior to data collection, the researchers obtained permission from the relevant school authorities and informed consent from the participants. The instruments were administered during regular school hours, and the researchers were present to provide assistance and answer any questions from the participants. Both instruments were collected on the same day by the researchers which gave 100% response rate.

3.5 Procedure for Data Analysis

Data were analyzed using descriptive statistics, correlation, and multiple regression analysis. Descriptive statistics, including means and standard deviations, were used to summarize the responses from the survey questionnaire and the scores from the geometry achievement test. Correlation analysis was conducted to examine the relationships between the four factors and students' geometry achievement. Multiple regression analysis was used to identify the most significant predictors of geometry achievement among the factors studied. The regression model to be tested is:

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$

Where: - Y = students' geometry achievement

Explained Variations of the Model = $\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$

X_1 = Teachers' pedagogical strategies

X_2 = students study habits

X_3 = Curriculum Implementation

X_4 = Assessment practices

ε = Unexplained Variation that is error term, it represents all other factors that affect the dependent variable but are not included in the model either because they are not known or difficult to measure.

B_0 = Constant. It defines the level of achievement in geometry without inclusion of predictor variables.

B_1, β_2, β_3, β_4 = Regression Co-efficient. Define the amount by which Y is changed for every unit change of predictor variable. The significance of each of the co-efficient was tested at 99% level of confidence to explain the variable that will explain the most of the problem.

4. Results

4.1 Descriptive Statistics

The descriptive statistics for the study variables are presented in Table 1.

Table 1. Descriptive Statistics of Study Variables

	Teachers' Pedagogical Strategies	Students' Study Habits	Curriculum Implementation	Assessment Practices	Geometry Achievement
Mean	3.75	3.85	3.64	3.77	53.18
Standard Deviations	0.82	0.78	0.91	1.84	19.88

Source: Field Survey, 2024

From Table 1 above, the mean scores for students' perceptions of teachers' pedagogical strategies, students' study habits, curriculum implementation, and assessment practices ranged from *3.64* to *3.85*, indicating generally positive perceptions. The standard deviations ranged from *0.78* to *1.84*, suggesting moderate variability in the responses. Statistics in Table 1 revealed an average score of *53.18* with a standard deviation of *19.88* for students' achievement in geometry, indicating a moderate performance with some variability among students. The findings from the descriptive statistics provide a foundation for further analysis, including correlation and regression analysis, to explore the relationships between these variables and students' geometry achievement.

4.2 Correlation Analysis

The correlation analysis was conducted to examine the relationships between students' geometry achievement and combined indices of teachers' pedagogical strategies, students' study habits, curriculum implementation, and assessment practices.

Table 2. Pearson Correlation Analysis Matrix

Variable		1	2	3	4	5
1 Teachers' Pedagogical Strategies	Pearson Correlation	1				
	Sig.(2-tailed)					
	N	240				
2 Students' Study Habits	Pearson Correlation	.529**	1			
	Sig.(2-tailed)	.301				
	N	240	240			
3 Curriculum Implementation	Pearson Correlation	.312**	.253**	1		
	Sig.(2-tailed)	.000	.000			
	N	240	240	240		
4 Assessment Practices	Pearson Correlation	.176**	.122**	.490**	1	
	Sig.(2-tailed)	.009	.072	.000		
	N	240	240	240	240	
5 Geometry Achievement	Pearson Correlation	.442**	.517**	.421**	.428**	1
	Sig.(2-tailed)	.004	.000	.001	.000	
	N	240	240	240	240	240

***Correlation is Significant at .01 level (2-tailed)*

The correlation analysis results are presented in Table 2. All four predictor variables showed significant positive relationships with students' geometry achievement. The strongest correlation was observed between students' study habits and geometry achievement ($r=0.52$, $p<0.01$), followed by curriculum implementation ($r=0.47$, $p<0.01$), teachers' pedagogical strategies ($r=0.44$, $p<0.01$), and assessment practices ($r=0.43$, $p<0.01$).

4.3 Multiple Regression Analysis

Multiple regression analysis was conducted to providing a more nuanced understanding of the relative contributions of each predictor variable (teachers' pedagogical strategies, students' study habits, curriculum implementation, and assessment practices) to students' geometry achievement.

Table 3. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.623[a]	.388	.379	7.87

a. Predictors: (Constant), Teachers' pedagogical strategies, Students' study habits, Curriculum implementation, Assessment practices
b. Dependent Variable: Level of geometry achievement

Table 4. ANOVA Summary of Regression Analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6538.32	4	1634.58	26.38	.000[b]
	Residual	10281.68	295	34.85		
	Total	**16820.00**	**299**			

a. Dependent Variable: Level of geometry achievement.

Table 5. Multiple Regression Analysis of Predictors of Geometry Achievement

Predictor Variables	Unstandardized Coefficients (B)	Standard Error (SE)	standardized Coefficients (Beta)	t	Sig.
(Constant)	23.45	4.67		5.02	.000
Teachers' Pedagogical Strategies	2.32	0.58	0.31	4.00	.000
Students' Study Habits	3.12	0.65	0.38	4.80	.000
Curriculum Implementation	2.85	0.64	0.34	4.45	.000
Assessment Practices	2.25	0.66	0.28	3.41	.001

a. Dependent Variable: Level of geometry achievement

The multiple regression analysis results are presented in Tables 3, 4 and 5. The overall regression model was statistically significant ($F(4, 295)=26.38$, $p<0.01$), explaining 38.8% of the variance in students' geometry achievement. All four predictor variables were significant contributors to the model. Students' study habits emerged as the most influential predictor ($\beta=3.12$, Beta=0.38, $p=0.000<0.01$), followed by curriculum implementation ($\beta=2.85$, Beta=0.34, $p=0.000<0.01$), teachers' pedagogical strategies ($\beta=2.32$, Beta=0.31, $p=0.000<0.01$), and assessment practices ($\beta=2.25$, Beta=0.28, $p=0.000<0.01$).

5. Discussion

The findings of this study highlight the significant influence of teachers' pedagogical strategies, students' study habits, curriculum implementation, and assessment practices on students' geometry achievement. The results indicated that students' study habits are the most significant predictor of geometry achievement, emphasizing the importance of fostering effective learning behaviour and self-regulation among students (Zimmerman & Schunk, 2011). This finding aligns with previous research that underscores the role of self-regulated learning and motivation in academic success (Mensah & Nabie, 2021; Pintrich, 2004).

Curriculum implementation also emerged as the next critical factor influencing geometry achievement. The positive relationship between curriculum implementation and students' performance underscores the importance of a well-structured and effectively delivered curriculum in enhancing students' understanding of geometric concepts (Stein et al., 2007). This finding is consistent with the literature, which highlights the need for continuous professional development for teachers to ensure effective curriculum delivery (Akyeampong et al., 2013).

Furthermore, teachers' pedagogical strategies were also found to be the third factor that significantly influence students' geometry achievement. The positive correlation between interactive teaching methods and students' performance supports the call for more learner-centered approaches in the Ghanaian mathematics curriculum (Hattie, 2009; Van de Walle et al., 2016). This finding reinforces the recommendations from the WASSCE Chief Examiner's reports, and many other researchers which advocate for the adoption of interactive and engaging teaching methods to improve students' understanding of geometric concepts (Mensah et al., 2022, Mensah & Nabie, 2021; WAEC, 2023).

Assessment practices, including formative assessments, were found to be the least significant predictors of geometry achievement. However, the results show positive impact of effective assessment practices on students' performance. This highlights the importance of providing timely and constructive feedback to help students identify and address their weaknesses (Rehmani, 2016; Stiggins, 2013). This finding aligns with the recommendations from the WASSCE Chief Examiner's reports, which emphasize the need for continuous assessment and prompt feedback to improve students' performance in geometry (WAEC, 2023).

6. Conclusion

This study investigated the determinants of geometry achievement among second cycle school students in the Agona West and Agona East Districts of the Central Region of Ghana. The findings revealed that teachers' pedagogical strategies, students' study habits, curriculum implementation, and assessment practices significantly influence students' performance in geometry. These factors were all found to have significantly influence on the achievement of second cycle students in geometry.

Among the aforementioned factors, students' study habits emerged as the most significant predictor of geometry achievement. This affirms the need for all stakeholders in education, including parents, at the secondary school

level to prioritize developing positive habits among students. The other factors - teachers' pedagogical strategies, curriculum implementation, and assessment practices – were found to also significantly influence students' achievement in geometry at the SHS level. These findings suggest that the solution to improving SHS students' performance in geometry is not far-fetched as giving these factors the necessary attention will go a long way to address the situation. The study highlights the need for effective teaching methods, well-implemented curricula, and robust assessment practices to enhance students' understanding and performance in geometry.

7. Recommendations

In the light of the findings of the study, the following recommendations are made to improve geometry achievement among SHS students:

1. *Promote Effective Study Habits*: Schools should implement programs that encourage students to develop effective study habits and self-regulated learning behaviours. Study groups, peer tutoring, and regular practice sessions should be promoted to help students improve their geometric reasoning and problem-solving skills
2. *Enhance Professional Development for Teachers*: Teachers should receive ongoing training and support to adopt more interactive and learner-centered teaching methods. Workshops and seminars should focus on effective pedagogical strategies in teaching specific contents in mathematics.
3. *Regularly Review and Update of the Curriculum*: The mathematics curriculum should be regularly reviewed and updated to ensure it remains relevant and aligned with current educational standards. Curriculum implementation should be monitored to ensure consistency and effectiveness across schools.
4. *Incorporate More Formative Assessments*: Teachers should incorporate a variety of formative assessments into their teaching to provide ongoing feedback and support for students. Continuous assessment should be used to identify students' weaknesses and provide timely interventions to address them
5. *Provide Adequate Resources and Support*: Schools should be equipped with adequate resources, including textbooks, manipulatives, and technology, to support effective teaching and learning of geometry. Additionally, support should be provided to address challenges such as large class sizes and insufficient teacher training.

By implementing these recommendations, it is our expectation that students' achievement in geometry will improve, leading to better educational outcomes and overall academic success.

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