

# The Extent and Effectiveness of the use of Problem Solving Approach in Teaching and Learning of Mathematics in Senior High Schools: A Case Study of Sefwi Wiawso Municipality in Ghana

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**Abstract:-** Globally mathematics is seen to be one of the most crucial subjects of the school curriculum. As it is known to help improve students' cognitive skills. Even though it is an important subject that cannot be separated from human life, most students worldwide find it challenging. This situation is not different in Sub-Saharan Africa and in Ghana, where there is a reflection in an increasing rate of student failure in Mathematics. The teaching method used in teaching and learning mathematics is predominantly teacher-centred rather than student-centred. However, research had proved that using the problem-solving approach in teaching and learning mathematics would help improve student performance. This study, therefore, sought to determine the extent of use of the problem-solving approach and its effectiveness in teaching and learning mathematics in Sefwi Wiawso Municipality.

**Method:** The study employed a cross-sectional quantitative survey design with the use of a questionnaire, checklist and achievement test as a multiple data collection instrument. A total of 380 first-year students and 13 teachers from 4 selected schools in the municipality were sampled to participate in the study. To select the participant for the study a multi-stage sampling design was used. Four schools from the municipality were purposively selected. Secondly, random sampling was used to select three classes from each school except St Joseph Senior High School where four classes were used. Finally, 13 classes with their respective teachers were used for the study. The data collected were entered into SPSS and analyzed using SEM.

**Result:** The result shows that the use of the problem-solving approach in teaching and learning mathematics was observed to be significant in student performance and it was also observed that other factors contribute to the performance of students in mathematics

**Conclusion:** In regard to these findings, the extent of the use of a problem-solving strategy for teaching and studying mathematics was effective. There was a positive correlation between the usage of problem-solving strategies and their effectiveness in students' achievement and this correlation is statistically significant at a p-value of less than 0.05%.

Students' use of problem solving approaches and mathematics performance does not depend on their age. Even though it had a positive effect on problem solving approach it was insignificant. With respect to the findings, it can be concluded that if both genders receive the necessary training and had the same chances, gender will not have any effect on problem-solving and mathematics performance.

The researcher also concluded that even though the problem-solving approach is very effective in students' performance, other factors also contribute to their performance in mathematics.

**Keywords:-** A problem solving approach; mathematics; students; teachers.

## I. INTRODUCTION

Mathematics is a science that is concerned with the logic of shape, quantity, and arrangement (Davis & Simmt, 2006). It increases students' logical reasoning and helps them to think analytically. The ability of students to think and make a decision is enhanced by the knowledge of mathematics (Monrat et al., 2022). Due to the significance of mathematics in human life and its ability to prepare students for a brighter future, mathematics is considered as a major subject that is required at the secondary school level in almost every country throughout the world. (Etsey, 2006). Educating students in Mathematics is very important and it serves as a tool that helps one to perform daily activities. Globally, mathematics is regarded as one of the core academic subjects. Even though it is an important subject that cannot be taken away from human life, the majority of students in the world find it difficult.

Approximately, Seventy-five per cent of Americans quit their studies in mathematics and avoid occupations that are related to it (Gafoor & Kurukkan, 2015a). Also in Sub-Saharan Africa, the situation of mathematics education is precarious, according to a significant body of evidence (Bethell, 2016b). According to a survey conducted that involved asking students to specify the most difficult subjects of their study, most of these students mentioned Mathematics as the most difficult subject (Gafoor & Kurukkan, 2015b) Failure in mathematics is one of the greatest challenges faced by most governments and other stakeholders in the world (Chand et al., 2021). In Ghana, Mathematics is seen as a subject that is only for the smartest students. Many students who have passed the subject frequently describe it as one that was scary and challenging to pass (Bosson-Amedenu, 2017).

Teachers believe problem-solving is time-consuming and it would take much of their time during the teaching and learning process. The problem-solving approach in education can be seen as a method that offers a setting that is innately favourable to teaching and learning, according to Polya (1945). So, incorporating a problem-solving approach into the instruction and learning of mathematics is essential (Nyala et al., 2016a). However, routine skill practices dominate mathematics instruction in Ghanaian classrooms, at the expense of problem-solving. This circumstance might be one of the factors why people perform poorly in math. (Nyala et al., 2016b). A review of the trends in students' performance in mathematics in the WASSCE from 2013 to 2016 by (Abreh et al., 2018) in Ghana shows some fluctuations. In 2013, 2014, 2015, and 2016 show that students who had D7 to F9 were 63.6%, 71.7%, 76.1% and 64.7% respectively. This shows the low performance of the students in mathematics from 2013 to 2016 in Ghana. How mathematics is taught in schools is one of the reasons why most students dislike the subject leading to their poor performance (Fatade et al., 2013a). Students memorize formulas and are not able to relate the subject to the real world. Poor performance is likely to occur when students are unable to learn mathematics and use it in both familiar and unfamiliar circumstances. However, there is enough evidence to show that the effective use of problem-solving approaches in teaching and learning mathematics could help improve students' performance. National Council of Teachers of Mathematics (NCTM), in the United State, as mathematical activities that may present intellectual challenges to enhance students' mathematical comprehension and performance (Stramel, 2021a).

NCTM further explains that the use of a problem-solving approach in teaching and learning mathematics is crucial and must be taken into consideration (Stramel, 2021b).

In teaching and learning mathematics, the application of the problem-solving approach will make learners participate in the lesson and will help them to search for their information, analyze them and come out with solutions (Stramel, 2021b). Teaching and Learning Mathematics must be child or student-centred and not teacher-centred (Zain et al., 2012). Teaching activities that focus more on

student activities help students to be active learners (Khatimah & Sugiman, 2019). Problem-solving is a process or an ongoing activity in which we use our previous knowledge to discover that before we start learning, there is an issue that needs to be solved and this problem is given in a way that requires the students to gain new information before they can provide an answer (Pallavi, n.d.-a) (Garrett, 2008). It will also help improve students' self-concepts toward problem-solving, make the students active, motivate them to learn more, broaden students knowledge and also increase their understanding of the subject and problem-solving (Abramovich, 2019). It will make the students independent and long life-learners. Students become active learners, and problem solvers and participate fully in the lesson. It will improve their ability to retain and recall information and will be able to transfer their skills acquired to other fields and effectively relate them to their real-life situations (Ghulam Behlol et al., 2018a).

Effective utilization of PSA in teaching and learning mathematics will help improve their achievement in the subject area under consideration (Ghulam Behlol et al., 2018b).

Students who use problem-solving skills develop their ideas and improve logical reasoning. Due to the importance of the skills developed, teaching mathematics through problem-solving should be encouraged and emphasized by educators and all stakeholders (Das & Das, 2013).

Research confirms that students taught using the problem-solving approach, perform very well when they are motivated to search for their knowledge in the environment in which they live (Ardeleanu, 2019). Due to how the subject is being taught in secondary schools, most students perceived the subject to be very difficult and they turn to dislike the subject (Gafoor & Kurukkan, 2015b). Every four years since 1995, Trends in International Mathematics and Scientific Study (TIMSS) has been monitoring the development of math and science performance in the fourth and eighth grades all around the world (Mullis & Martin, 2021). Ghana has participated 3 times in the years 2003, 2007 and 2011. Ghana was ranked 44th out of 45 participatory countries call in 8th-grade Mathematics with an average score of 276. Also in 2007, Ghana was still placed last but one in TIMSS with a total score of 309 placings Ghana at the 47th position out of 48 participants (Mereku1 & D. K. and Anumel2, 2011) The result from TIMSS-2003 shows Ghana's poor performance in Mathematics. These show how poorly Ghanaian students perform in mathematics. Singapore is one of the topped ranks countries in TIMSS since joining in 1995 and continuously topped from 2015 and 2019 in both Science and Mathematics. Singapore was ranked 1st and 2nd in Programme for International Student Assessment (PISA) in 2015 and 2018 respectively (Jr, n.d.-b).

Owing to Singapore's strong performance in the PISA, it has been ranked among the world's high-performing education systems (HPES), along with Ontario, Canada, Shanghai, China, Hong Kong, South Korea, and Finland (Jr, n.d.-a). Since the inception of TIMSS, their main objective

has been to use a problem-solving approach when teaching and learning mathematics (Anderson, 2009a). According to research on the pedagogy of countries whose children excel in math, such as Singapore and Japan, using diagrams in the process of learning provides a bridge between early advanced learning stages and develops their problem-solving abilities (Dawn, 2020).

## II. STATEMENT OF THE PROBLEM

Despite the indication that a problem-solving approach in teaching and learning mathematics will help improve students' performance in the subject, there is a limited study on the extent of use of problem-solving methods in teaching and learning mathematics in Ghana.

This study therefore seeks to find out the extent and effectiveness of the use of a problem-solving approach in teaching and learning mathematics in 4 Senior High Schools in the Sefwi Wiawso Municipality.

### A. Objectives

- To determine the relationship between the extent of use of the problem solving approach and its effectiveness in terms of student achievement.
- To examine the demographic factors such as gender, age and socioeconomic status on the extent of use of method and its effectiveness
- To investigate the environmental factors such as the level of human and material resources in the school that affect the extent of use of the method and its effectiveness.

### B. Theory

Theoretical review: The study was founded on the experiential learning theory, constructivism, and social constructivism learning theory.

#### ➤ *Experiential learning theory*

Experiential learning theory by David Kolb emphasizes that learning is a natural outcome of continual engagement and interactions with the environment around us. It takes into account the influence that our feelings, intellect and environment have on our learning. According to experiential learning theory, deep learning is preferred to surface learning.

Deep learning involves learning about something through different approaches, experimenting, and role-playing. All these strategies or approaches encourage students to apply the skills acquired rather than memorizing them and this allows them to have a deeper understanding of what they are learning (Local et al., 2021a).

The best way to learn is by having experience and these experiences however stick in the mind and help one to retain information and remember them. Knowledge results from the combination of grasping and transforming experience. Grasping experience can be obtained through concrete experience (CE) and Abstract conceptualization (AC) and transforming experience can be done by reflective observation (RO) and Active Experimentation (Introduction & Styles, 1984) The term concrete experience refers to

either learning something new or experiencing something familiar in a way (Local et al., 2021b).

Concrete experience is followed by Reflective Observation where the learner spends some time observing what others are doing and reflects on what happened and also reflect on their experiences (Introduction & Styles, 1984)

In abstract conceptualization, the learner makes sense of their experiences and reflections after they have reflected on their concrete experience and this may lead them to consider their next steps toward improvement, devise a plan of action, or confide in literature or an expert. This enables the individuals to generate new thoughts or change old abstract ideas to take action.

#### ➤ *Constructivism :*

Constructivism is a learning theory by Jean Piaget, used to explain how students construct knowledge through experience. It is a learning theory that emphasizes the active role of the learner in constructing knowledge and meaning from their experiences. PSA is a constructivist teaching paradigm that assumes learning is the result of cognitive and social interactions that begin in a problem-solving context (Hinojosa, 2015). This theoretical philosophy is based on John Dewey and discovery learning (Mutange, 2020a). PSA is an educational method in which students are exposed to acquiring the capacity for critical analysis and problem-solving, as well as a comprehension of key concepts, through analyzing real-life problems (Mutange, 2020b). Constructivism points out that individuals construct their knowledge. The learner is seen as an active participant where they create their knowledge.

#### ➤ *Social constructivism*

Social constructivism by Lev Vygotsky plays an emphasis on the importance of culture. It is a learning theory that emphasizes the importance of social interactions and cultural contexts in the construction of knowledge and meaning. Learning at this stage is students centred. Collaborative learning is mainly used in social constructivism.

Collaboration is a skill that talks a lot about a person's capacity to work effectively with a varied group of people (Stanaway et al., 2018). Students learn by participating in group activities and generating shared meaning.

In a social constructivist classroom, the teacher's responsibility is to provide students with the opportunity to do their own research, formulate their personal questions, and analyze the veracity of their theories (Alzahrani & Woollard, n.d.). He develops the concept of learning called the Zone of proximal development which is defined as the difference between what a learner can do without any guidance and what a learner can do with the guidance of an adult or a skilled person (Kusmaryono et al., 2021). Lev Vygotsky believes that when a learner is guided by a skilled person, he understands the concepts very well (Fani & Ghaemi, 2011), cited Lev Vygotsky's definition of ZPD as "the distance between the actual developmental level as determined by independent problem solving and the level of

potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers.” This explains that learning is more effective when students collaborate and work in groups.

### III. MATERIAL AND METHODS

#### A. Research design

A research design is referred to as the plan of action for the research project. A cross-sectional descriptive survey design was used by the researcher. This study's design was ideal because it allowed for the collection of data from a wide range of subjects at once. It is also faster and more inexpensive to conduct as compared to others. The main objective of this study is to determine the extent of use of problem-solving approach and its effectiveness in teaching and learning mathematics in the Sefwi Wiawso Municipality.

In-depth information on attitudes toward mathematics, perceptions of the problem-solving approach, student mathematics performance and the extent to which the problem-solving method is used in teaching and learning mathematics were gathered. The data was collected from the respondents using multiple tools which involves the use of a questionnaire, a checklist and an achievement test. The data was collected from four selected schools in the municipality. All students in the Senior High School within the municipality were the target population of the study.

#### B. Study population

The targeted population for this research was students, teachers and administrators in public Senior High schools in the Sefwi Wiawso Municipality. The focus was on the first-year student and their mathematics teachers from the four Senior High schools in the municipality. The first years were selected, since they have additional two years before completing school, and also have enough time to adjust to any new method of teaching and learning mathematics.

#### Sample size determination and sampling technique

Sefwi Wiawso Municipality has four Senior High Schools with 4875 students and 36 mathematics teachers. According to (Bhardwaj, 2019), the sample is a collection of individuals, things or things used for measurement out of a larger population. Out of the total population, a sample of 380 students and 13 teachers was used for the study. The study has 3 categories of respondents, teachers, students and administration. The sample size was calculated using Sloven's formula.

The formula is written as follows:  $n = \frac{N}{1 + Ne^2}$

where  $n$  = sample size

$N$  = population (the total number of students in the four schools).  $e$  = required level of precision (margin of error = 0.05).

#### C. Sampling Techniques:

Sampling is the process of taking a representative sample from a sizable portion of the population to conduct a specific type of research (Bhardwaj, 2019). All four public senior High Schools in the municipal were used for the study and simple random sampling was used in selecting the classes for the research. In this type of sampling, the members were selected randomly and purely by chance. Only first-year classes that were randomly picked were used for the study with their respective teachers. Every class had the chance to be selected in the sample, hence the quality of the sample is not affected thus bias is avoided. The academic heads of the schools were also involved in the collection since they monitor the educational service of the school. In selecting the classes, the names of the classes were placed in a box and an independent person was asked to pick 3 classes from the box without replacements except for St. Joseph Senior High School where four classes were picked. This method was applied in all four schools.

#### D. Data Collection Procedure

With an introductory letter from the University, permission was sought from the various heads of the participating schools to administer the questionnaire to the students. With the assistance of some mathematics teachers from the schools, the questionnaire was distributed to the participating students with their respective mathematics teachers. The instructions on the questionnaire were read and explained to the students in English and their local dialect and within 25 to 30 minutes the questionnaires were completed by both students and teachers. Immediately after the questionnaire, the students were given the achievement test to answer. Due to the way the questionnaires were administered all questionnaires were answered and collected without any difficulty. The researcher assured the participants of their confidentiality.

#### E. Data analysis procedure and process

The data were statistically analyzed using both descriptive and inferential methods. Frequencies and cross-tabulations are the main components of descriptive statistics, which are used to highlight significant characteristics of the respondents. The chi-square test and multivariate statistical analysis were used to perform inferential analysis. The structural Equation Model (SEM) was used to analyze the data.

## IV. RESULT AND DISCUSSION

#### A. Gender of students

Out of three hundred and eighty (380) respondents, two hundred and forty-five (245) representing 64.5% were males and one hundred and thirty-one (135) respondents representing 35.5% were female.

#### B. Age Range of the Respondents

Out of three hundred and eighty (380) respondents, 4 (1.1%) were at the ages of twelve (12) or less while 43 (11.3%) were between the ages of thirteen (13) to fifteen (15) years. The majority, 302 (79.5%) respondents were between the ages of sixteen (16) to eighteen (18) years. Also, the participants aged nineteen (19) to twenty-one (21)

years were seen to be 31 (8.2%) of the respondents. It can also be noticed that about 345(90.8%) of the respondents were teenagers.

### C. Parents Education

Regarding the education level of the parents of the respondents, 276(44.6%) completed basic school of which 153(48.3%) were female parents while 123(40.7%) were male parents. Also, 111(35.0%) female parents and 130 (43.0%) male parents completed Senior High School and 13 (4.1%) and 15(5.0%) female and male parents had diploma certificates respectively. Also, 6 (1.9%) and 14(4.6%) female and male parents respectively were degree holders while 1 (0.3%) female parent and 2( 0.7%) male parents had master's degrees. 51 (16.4%) comprising 33(10.4%) female parents and 18 (6.0%) male parents were uneducated. The research reveals that most of the respondents' mothers completed basic school while more of their fathers completed senior high school. This means that male parents are more educated compared to their female counterparts.

### D. Occupation

Finally, 28 (8.8%) female parents and thirty- eight 38 (12.6%) male parents were professionals workers which comprises of teachers, nurses, Doctors, administrators, etc while 240(75.7%) and 230 (76.2%) female and male parents respectively were Non-professional workers which are made up of petty traders, farmers, drivers, etc. Also thirteen (4.1%) and nineteen (6.3%) were labourers and messengers. 30(9.5%) of female parents and 4(1.3%) male parents were unemployed. The study also shows that 6 (1.9%) and 11(3.6%) female and male parents were in other specifications.

## V. DISCUSSION

The findings from the current study illustrate that the majority of the respondents were male students 245 (64.5%) while the largest age group ranging from 16 to 18, constitute 302 (79.5%) of the respondents. The education level of the majority of participants' parents was at the basic level, 153 (48.3%), and 123 (40.7%) making up female and male parents respectively. This shows that the literacy rate of the male was more than that of the female parents. More males 161(53.1%) than females 131 (41.3%) attends higher level of education in this study. This is in confirmation with the 2010 census conducted in the Western North Region which states that there are comparatively more females (42.5%) than males (30.9%) with their highest education level being JSS/JHS. In addition, there is also an indication that the reverse is true at the SSS/SHS level where more males (14.1%) have SSS/SHS as their highest level of education than females (9.6%). Also the majority of the parents of the students 75.7% and 76.2% female and male were non-professional workers respectively.

### A. Gender of the teacher's Respondents

As seen in Table 5 above, 11(84.6%) of the teacher participants were men, while 2 (15.4%) were women. This demonstrates that there are far more male mathematics teachers than females in this study.

### B. Age Range of teacher's Respondents

The age range of the teachers was between the ages of twenty-seven to forty - six. While the majority 11(84.6%) fall between the ages of 33 to 41, the youngest 1 (7.7%), and the oldest 1(7.7%), were between the ages of 27 to 31 and 42 - 46 years respectively. Also, findings from this study show that more of the teachers who took part in the study were in their Middle Ages.

A study conducted by Alufohai and Ibhafidon (2015) in Edo State, Nigeria concluded that teachers between the ages of 36-48 old were more effective in assisting students to achieve higher scores than younger and older teachers.

### C. Teaching Experience

In relation to the teacher's teaching experience, the findings of the research show that one (1) representing 7.7% of teachers have 2 or less experience in teaching mathematics, and 3 (23.1%) respondents have teaching experience ranging from three (3) to six (6) years. Five (5) respondents representing 38.5% have teaching experience from seven (7) to ten (10) years. Three (23.1%) respondent have teaching experience ranging from eleven (11) to fourteen (14) years and one (1) respondent which constitutes 7.7% have teaching experience ranging from fifteen (15) to eighteen (18) years. The study shows that about 68.3% of teachers have more working experience ranging from seven (7) to eighteen (18) years. This may mean that with accumulated experience, they are more likely to impact their knowledge on the students than those with less working experience. Effective classroom management due to experience is likely to improve students' performance. According to (Rahida Aini et al., 2018) (Ünal & Ünal, 2012) teachers with more years of teaching experience exhibit a positive attitude toward classroom management. They normally have good interaction with students and teach them to their understanding than teachers with fewer years of teaching experience. Likewise (Sadik & Akbulut, 2015) also concluded in their study that teachers with more experience are more effective in teaching and also have good classroom management skills.

### D. Level of Education

Out of thirteen (13) respondents, 3 (23.1%) have attained a Diploma level of education, 6 (46.2%) had a first degree, while 3 ( 23.1%) and 1 (7.7%) have their Master's Degree and other certificates respectively. The results depict that more teachers 10 (77%) have a first degree or more in education which means that they may have vast knowledge in the subject area under consideration. Many research findings indicated a direct connection between teachers' higher education and learners' achievement. Structural equation model.

In this study, the analysis for the research question was performed by using Structural Equation Model (SEM). According to Cohen (1988), the requirement for the alpha value to be used in rejecting or accepting the null hypothesis in most studies is set at 0.5 which this study adopted to test for most of the significance.

➤ *Exploratory Factor Analysis (EFA)*

The EFA estimate was determined by using SPSS (ver. 23). Exploratory Factor Analysis was performed to identify the interrelated factor so that the observable variables were loaded on their corresponding latent variables. This will eliminate or reduce the number of observed variables on the

questionnaire whose loading wasn't at the proper place of the latent variables Surh (2005).

The table presents the results of the Exploratory Factor Analysis (EFA) of the observed variables under their right latent variables.

Table 1: Exploratory Factor Analysis (EFA)

variables	Rotated Component Matrix			
	1	2	3	4
MP1	.785			
MP2	.776			
MP3	.857			
MP4	.863			
MP5	.835			
EF1		.840		
EF2		.888		
EF3		.868		
EF4		.855		
AQ1			.657	
AQ2			.805	
AQ4			.829	
AQ5			.800	
EQ1				.709
EQ2				.598
EQ4				.790

Total Variables Explained	74.138%
Kaiser-Meyer- Olkin Measure of Sampling Adequacy.	.894
Bartertt's Test of Sphericity	Approx Chi-Square 4725.661
	Df 136
	Sig. 0.000
Determinant	3.093E-006

Method of Extraction: Principal Component Analysis.  
 Rotation Method: Varimax With Kaiser Normalization.  
 Rotation converged in 5 iterations.  
 Source: Field Survey (2022)

Again, the number of observed variables loaded under their respective right latent variables is displayed in Table 5 above. The observed variables loading greater than 0.5 and under the right latent variable were further used for the data analysis but observed variables loading less than 0.5 is deleted and cannot be used for further analysis of this study. The number of the observed variables in their correct definiteness for Environmental Factor (EMF) was four (4), Problem-Solving was four (4), Attitude towards Mathematics was three (3), and Mathematics Performance (MAP) was five (5). With a Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) of 0.893, the coefficient of determination was calculated to be 3.093E-006. The KMO briefly explained that there was 89% adequacy supposition among the observed variables loading at their correct dimension on the latent variables. Bartlett's Test of Sphericity reported a significant p-value of 0.000 from a Chi-Square of 4725.661 with a degree of freedom of 210. The Exploratory Factor Analysis (EFA) for the four (4) latent variables gives a cumulative Variance of 74.138%. Finally, the other observed variables which were poor

loading and were not in their rightful place on the rotated component matrix were deleted.

➤ *Confirmatory Factor Analysis (CFA)*

To show how well the data fit the model, confirmatory factor analysis (CFA) was carried out in Amos (ver.23) using maximum likelihood (result presented in Table 7). Based on (Arthur et al., 2022) recommended fit indices criteria, CMIN/DF is supposed to be less than 3, CFI is all expected to be greater than 0.9, and RMSEA and RMR are also to be less than 0.08. P-close is achieved if it is statistically insignificant at 5%, the Average Variance Extracted (AVE) for all the constructs was greater than 0.5 which is recommended by Fornell and Larcker (1981); the composite reliability (CR) and Cronbach's alpha were greater than 0.7 as expected (Bamfo et al., 2018). From table 6, problem-solving, Environmental Factor, Attitude towards Mathematics and Mathematics Performance all had five (5) variables but two (2) variables of Problem Solving and one (1) variable each of Environmental Factor and attitude towards mathematics were omitted because each latent variable's factor loading was poor.

Table 2: Confirmatory Factor Analysis (CFA)

	Std. Factor Loading
Model Fit Indices : CMIN =261.303; DF = 106; CMIN/DF = 2.465; CFI = 0.967; TLI = 0.957; RMR = 0.062; RMSEA = 0.0468; PCLOSE = 0.018	
Problem Solving; CA = 0.823; CR = 0.543; AVE = 0.408	
I like solving new challenging questions in mathematics (EQ1)	.582
I relate what am learning in mathematics to my daily activities. (EQ2)	.516
My teacher gives us a group assignment. (EQ3)	∞
I complete challenging exercise that requires more research (EQ4)	.693
I solve more mathematics questions on my own (EQ5)	∞
Environmental Factor; CA = 0.941; CR = 0.740; AVE = 0.732	
Students have access to the library (EF1)	.838
Students have access to the computer laboratory (FE2)	.717
school is in an urban area (EF3)	.923
The school environment is very conducive which helps students to learn mathematics (EF4)	.927
The school is having a well-furnished library with mathematics text (EF5)	∞
Attitude Towards Mathematics; CA = 0.908; CR = 0.737; VE = 0.725	
It is difficult for me to engage in mathematics assignments (AQ1)	.737
Am always excited when the mathematics teacher comes to class (AQ2)	.868
I enjoy learning mathematics (AQ3)	∞
Am always excited when the mathematics teacher comes to class. (AQ4)	.897
I visit the library continuously to make further studies in mathematics (AQ5)	.895
Mathematics Performance; CA = 0.928; CR = 0.830; AVE = 0.867	
My performance in mathematics is far better than in any other subject. (MP1)	.778
I believe I can perform well in mathematics than in any other subject. (MP2)	.826
My performance in mathematics is excellent.	.830
I am more worried about my performance in mathematics than any other subject. (MP4)	.832
Having to learn difficult topics in mathematics does not worry me. (MP5)	.896

The study of this research shows that problem-solving approach statistically influence students' performance positively. This outcome is in line with the research study conducted by Gakinya (2022) which states that teaching and learning mathematics through the use of problem-solving methods improved students' performance. Also, the outcome of research conducted at Kohat University and Science Technology, Pakistan, by Perveen, (2010b) supports the current findings which indicate that there was an improvement in performance of student in mathematics when the problem -solving approach was used. The outcome of the research conducted by Sappaile & Djam'an(2017) also affirms the fact that the method has a positive significance in mathematics performance. Their research concluded that to improve students' performance in mathematics, problem-solving approach should be used in the teaching and learning process. According to the findings from the analysis, using a problem-solving strategy for teaching and studying mathematics benefits student

achievement. A positive correlation between the usage of problem-solving strategies and its effectiveness in students' achievement was identified, and this correlation is statistically significant at a p-value of less than 0.05%. Additionally, the data shows that employing a problem-solving strategy can raise students' mathematics achievement by roughly 23%. This indicates that mathematics teachers who employ a problem-solving technique are likely to notice an improvement in their students' mathematics proficiency. According to the findings, there is a positive relationship between students' mathematics achievement and how frequently problem-solving techniques are used to teach and learn mathematics. In regards to the data, its effectiveness will increase by 23% if problem-solving techniques are used more frequently in teaching and learning mathematics. This means that the more teachers use the problem-solving approach in teaching mathematics, the more likely students are to perform better in mathematics. In terms of the study's objectives, the

outcome is in favour of examining the relationship between the frequency of the use of the approach and its effectiveness. Based on the data, using a problem-solving approach as a teaching strategy can raise students' mathematics proficiency. As a result, the aim of finding the effectiveness of the approach for raising students' mathematics achievement has been accomplished. Overall, these results imply that using a problem-solving technique to teach and learn mathematics is a successful strategy that can aid students in better comprehending and using mathematical ideas.

The findings of this study disagree with the researchers that demonstrated that gender affects mathematics performance. It is however in line with the findings of (Josiah & Olubunmi Adejoke, 2014). Overall, it is intended that if both genders receive the necessary training, chances and orientation, gender won't be a factor in mathematics achievement and problem-solving approaches.

The path analysis shown in Table 10 reveals that environmental factors had a direct influence on student performance in mathematics and was significant on problem-solving approach at p value 0.1 but insignificant at 0.05. This is in line with research conducted in Nigeria by Aliyu et al., (2013) which is of the view that teachers' academic qualifications influenced students' performance. This presumes that there are many other factors than a problem-solving method that influences the performance of students.

## VI. CONCLUSION

The purpose of the study was to determine the extent and effectiveness of use of problem-solving approach in teaching and learning mathematics in terms of students' performance in Senior High Schools in Sefwi Wiawso Municipality. The data shows that employing a problem-solving strategy may enhance students' mathematics achievement by roughly 23%. This indicates that mathematics teachers who employ a problem-solving techniques are likely to notice an improvement in their students mathematics proficiency.

Overall, these results imply that using a problem-solving technique to teach and learn mathematics is a successful strategy that can aid students in better understanding and applying mathematical ideas. It is likely that this strategy will have a positive impact on students' mathematics achievement for teachers who adopt it into their teaching methods.

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