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Exploring Student and Teacher Factors Influencing Students' Performance in Mathematics

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Abstract: Research on academic performance in mathematics has used different factors to assess how well students do in the subject. This study specifically looked at the gender differentials performance in mathematics at Senior High Schools. Data were gathered from 500 students in their final year of school and 15 mathematics teachers through a survey. Statistical methods like descriptive statistics, inferential statistics, and probit regression were used analyse the data. The results showed that males had an average score of 39.01 on the mathematics Achievement Test, while females had an average score of 31.95. Also, the results of Spearman's correlation indicated a significant relationship [0.63($p=0.002$) and -0.58 ($p=0.000$)] between student gender and mathematics performance. There was a statistically significant difference ($t(486), =-1.44, p=0.005$) in the mean scores between gender. Finally, probit regression analysis showed that student self-confidence and self-esteem significantly affected their performance at 5%. Similarly, school-related factors like the learning atmosphere and teaching methods have a significant impact on students' academic performance, just as teacher-related

factors including expertise in the subject matter and experience also play a crucial role in influencing performance. It was therefore recommended that teachers develop positive strategies to bridge this yawning gender gap in mathematics.

Keywords: Contemporary, gender, mathematics performance, predictive factors, probit analysis.

Introduction

Mathematics remains a valuable subject in human knowledge, continually gaining attention as scientific advancements become increasingly complex (d'Entremont & Voillot, 2021). This is why it is one of the compulsory entry requirements for all higher education. The abstract and logical thinking necessary for daily life, problem-solving, and scholastic advancement was instilled along with mathematics literacy (Owan et al., 2019; Tetteh et al., 2018). The knowledge and aptitude for mathematics are indispensable tools in the society (Abreh et al., 2018). It is a tool that can be used in everyday life in order to solve important scientific and technological problems, helping to move towards the sustainable world (Petersen 2018; Rézio et al., 2022). Due to this, one of the most essential core subjects considered is mathematics in a school curriculum. It is widely argued that more mathematics lessons can be taught in colleges and schools worldwide than in any other subject (Suratman et al., 2022).

Recent studies on students' academic performance have utilized a comprehensive range of variables in order to analyse and measure trends and levels of performance across different educational stages. These variables include leadership styles, perceived teacher support, students' attitudes, education policies, teachers' pedagogical communicative practices, school location and concept mapping, teachers' self-efficacy, classroom management strategies, test administration modes, and birth variables. By incorporating these diverse factors into their analyses, researchers aim to gain a more nuanced understanding of the complex interplay of influences on students' academic success (Arhin & Offoe, 2015; Azila-Gbettor & Abiemo, 2021). Despite having comparable abilities, some academic research indicates that learning experiences for females in Science, Technology, Engineering, and Mathematics fields are influenced by a socialisation style that frequently differs from that of males (Ntibi et al., 2020; Ng'ang'a et al., 2018; Uwineza et al., 2018).

In Ghana, the efforts to assess trends in students' science and mathematics performance have been geared towards perceived factors contributing to performance disparities across the country (Abreh et al., 2018; Lassong et al., 2021). According to Abreh et al. (2018), contributing factors, for instance, the inability of teachers to accomplish fifty and seventy-five percent of the academic endeavours, inadequate duration to endorse and accomplish the programme, deficiency of adequate competent facilitators in some localities, and utilisation of inappropriate pedagogies give rise to the downward trajectory in performance of these subjects. According to Mireku et al. (2015) and Zhang et al. (2019), the inherent negative persona demoralises aptitude in the learning of mathematics in Ghanaian High Schools. This development, according to Marginson (2019), has led to a distasteful performance in mathematics and limitations to human capital among female and male students.

Research Problem

Numerous factors contribute to the gender inequalities in mathematics and attitude (Armah et al., 2021). In this study, we perceive six primary characteristics that have been shown to influence students' attitudes toward mathematics these include teacher attitudes and beliefs (Owan et al., 2019; Poku, 2021), teaching style and behaviour, teaching techniques (Azila-Gbettor & Abiemo, 2021; Gyimah, 2020) achievement (Abreh et al., 2018; Nsalamba & Alex, 2019), parent attitudes and beliefs (Nsalamba & Alex, 2019; Owan et al., 2019), and students classroom experiences (Breda & Napp, 2019; Nsalamba & Alex,

2019; Spaul & Makaluza, 2019), as having a significant impact, influencing the extent to which females believe they are not as capable in math as males. Findings from studies exploring classroom environments have shown that teachers' behaviours play a crucial role in shaping students' attitudes towards mathematics (Ghasemi & Burley, 2019).

In addition to this trend, poor teaching methods, the lack of encouragement, and poor attitude towards mathematics among others prompted the Secondary Education Improvement Project implementation (Suratman et al., 2022). Despite some efforts tailored by scholars to assess male-female mathematics performance in Ghana, the nexus of the gender differentials in mathematics performance has not been well established in the Northern Region of Ghana. Given the recent developments and the underperformance in the Northern Region, it is imperative to conduct a thorough evaluation to determine the gender disparities in mathematics achievement. It is conceivable that female students' subpar mathematics performance contributes to the continuation of gender wage differences since low mathematics achievement may deter women from pursuing careers in high-paying occupational specialties like engineering. Therefore, this study sought to investigate the gender differentials among students in the learning of mathematics.

Research Focus

This research focused on students' performance in mathematics. Students' performance was generally lower in the rural areas of the country. As, in the Ministry of Education's sector performance report for 2018, the percentage of students attaining A1 to C6 in core mathematics subjects by region indicates a very low performance score of 11.8% for the Northern Region as compared to 17.7% and 19.5% for the Upper East and West Regions, respectively. Whereas the Northern Region recorded this underwhelming performance score in the core mathematics for this period, other regions like Bono, Western, and Ashanti Regions recorded outstanding performance scores of 78.2%, 53.6%, and 50.8%, respectively (Ministry of Education, 2018). On the contrary, the gender parity score in the basic school by region for the same period (2017/18), indicates a parity between males and females score for core mathematics for the Schools in the Northern Region. Niepel et al. (2019) opine that gender is directly related to mathematics achievement.

Research Aim and Research Questions

The following questions were used to examine the gender differentials of male and female students:

1. How do students and teachers influence mathematics performance?
2. How do MAT scores and sampled WASSCE from 2016-2021 relate to gender performance in mathematics?
3. How can student and teacher factors determine gender differentials?

Materials and Methods

The Municipality in Ghana's Northern Region was carved from the Tamale Metropolis. According to the Ghana Statistical Service (<https://www.statsghana.gov.gh/>), the boundaries were shared with Savelugu Municipality, Nanton District, Tamale Metropolitan City, Tolon Municipality, and Kumbungu District. The municipality has 148,099 residents. In the Municipality, males made up 50.6% (74,886) of the population, while females made up 49.4% (73,213). Rural residents made up 75.2% of the population, while urban residents made up 24.8% (Ghana Statistical Service, 2012). The young population made up 48.8% of the population and ranged in age from 0 to 19. Just 4.1% of the population was over 65 years old, or the elderly. The proportion of seniors (those 65 and over) in the Municipality is just 4.1%. The highest number (14%) belonged to the age group 0 to 4 years, while the lowest percentage (0.1%) belonged to people over 95.

Research Approach

The researchers adopted the survey approach. In this approach, the researchers generated patterns of students' performance in Mathematics. This was followed by another generation of attitudinal scales, behaviours, and opinions regarding their performance in mathematics. Hence, part of the research was based on the function of researchers' impressions and insights. Generally, the techniques of projective techniques, specific observation of students' mathematics performance, generalisation and conclusion on gender differentials in Mathematics performance, and depth interviews were used (Kabir, 2016).

Research Design

The researchers explored the cross-sectional design. So, gender and its mathematics performance were described. The survey research followed Kabir (2016) where an item of a population or information was studied in detail with an understanding to generalise the outcomes on the population. In this context, the participants were randomly sampled, data were collected and analysed in order to generalise the population. This descriptive survey was used to broaden the scope of knowledge on the gender disparity effect on mathematics performance. Also, the hypothesis-testing research study was used to test the hypotheses of causal relationships between gender and mathematics performance. Such studies require procedures that will not only increase reliability and reduce bias but will allow drawing inferences about causality (Kabir, 2016; Taber, 2018).

Population

The study targeted a population consisting of senior high school students and mathematics teachers within a specific municipality. The target population in Tamale Senior High School was 995 final-year students and 28 mathematics teachers and Islamic Senior High School was 729 final-year students and 12 mathematics teachers. However, because of time and cost implications, the sample was limited to only public Schools in the Municipality and the final year students.

Sample and Sampling Technique(s)

A stratified random sampling method was utilised to account for the diverse characteristics of the sampling population, which included high schools, students, and teachers. This multi-stage sampling technique was employed due to the heterogeneity of the participants, ensuring the generalisability of the study findings. Based on this technique, a simple random sampling was used to select two senior high schools in the municipal area. This was followed by the cluster sampling technique to represent the different areas, and then the quota sampling technique to represent the population sizes of the schools.

Sample Size Determination

A sample size was taken from the target population using recommended statistical approaches. To ensure the population is truly represented by the sample, the researchers desire a higher 95% level of confidence and a lower 5% level of significance (Taherdoost, 2017). Therefore, the desired sample size as $n = \frac{z^2 pq}{e^2}$, for the sample size n was applied. So, 30.2% and a final sample size of 500 were obtained to increase the reliability and validity and reduce sampling errors (Cochran, 1977; Taber, 2018).

Sampling Procedure

The sampling procedure was in two stages. In Stage I, two educational circuits were zoned into 2 clusters of Senior High Schools that is eastern cluster and the western cluster. Out of the two clusters, two (2) Senior High Schools were sampled using the technique of simple random sampling. The two Senior High Schools were therefore randomly selected through the paper fold (Hanif et al., 2018) out of

the four (4) Senior High Schools in the two clusters. Based on this, two independent individuals were tasked to pick the fold of papers for the schools that were included in the study from each cluster. The four schools in the two clusters were Kalpohini, Tamale Islamic, Northern School of Business, and Tamale. In effect, Tamale, Islamic Senior High School was picked for the Eastern zone whereas Tamale Senior School was also picked for the Western cluster (Sedgwick, 2015).

In Stage 2, the quota sampling technique helped to distribute the sample size among the sampled schools to represent the schools using a proxy. The quotas were then written on paper and folded for each individual to pick for the school he represents. Thus, the quota was randomly assigned to each school. Based on this, 230 and 270 students were selected from Tamale and Tamale Islamic Senior High Schools respectively. Additionally, six schools were selected from the sampled schools through a random 'Yes' or 'No' selection method. Thus, those who picked "Yes" were sampled and those who picked "No" were excluded. Table 3.1 below presents the sampled schools and the quota sampled.

Table 1

Sampled Schools and Quotas

Sampled School	Sampled Students
Tamale Senior High	230
Tamale Islamic Senior High	270
Total	500

In Stage 3, the simple random sampling technique (Hanif et al., 2018) was used to select the respondents who mainly were final-year students and their mathematics teachers in the carefully chosen schools. At this stage, the final-year classes in each of these selected schools were randomly selected through paper folds. All 7 classes were selected out of 15 final year classes from the two schools which are 4 classes from Tamale Islamic Senior High and 3 classes from Tamale Senior High. It is important to note that the classes were picked from the schools based on the researcher's intuition. That is, taking into account the distribution of respondents sampled from each school as determined by the quota sampling process.

The class register was used to draw the students out of the class to participate in this study. The names were then called out by the researchers who did not have any previous knowledge about the academic backgrounds of the students. Thus, in obtaining the 500 participants, the students in the study schools were given numbers. A table of random numbers was generated from the computer. If any two last digits resembled the student's number, he/she was selected. This ensured that every student had an equal opportunity to be selected.

Research Instruments and Procedures

Three different research instruments were used to gather the data. The research instrument employed to collect the primary data includes the following; Mathematics Achievement Test (MAT), Factors affecting students' attitude towards learning of Mathematics questionnaire, Factors affecting Teachers' attitude towards teaching it, and Mathematics WASSCE results for the year 2016 – 2021. This was a self-constructed assessment tool by the researcher. It comprised 50 objective test questions from the past mathematics questions between 2016 and 2021. The questions were randomly selected from each year to make up the 50 questions. The questions were given to the respondents and collected after the allotted 2-hour time for the test had passed. Prior to distributing the questions to the students, the

mathematics teachers at each selected school reviewed the content validity of the questions. The questionnaire was self-constructed and comprised seven (7) variables with various scale items to assess learning and performance (Krosnick, 2018).

The research instrument comprised two sections. The first section outlined information about the students. The second section was based on information on the personal disposition of the students towards learning Mathematics, which includes, self-confidence, self-esteem, social and economic background, student-teacher relation, learning environment, learning materials, and learning methods. The instrument was self-constructed by the researcher. It was focused on the personal disposition of the mathematics teacher toward teaching and learning and their students. It comprised 12 items.

The data was gathered by an interview guide and a structured mathematics objectives test. A total of 500 students were sampled and were given 50 objective test items to which respondents responded by ticking the correct option. In all, 488 administered achievement tests were received from respondents and marked out of 100. The remaining 12 were not received as a result of data mortality. Standard deviation and mean were used to describe the results of the MAT conducted. The questionnaires were administered to both SHS students and their mathematics teachers and also examined students in the objectives test. The questionnaire was designed using a Likert scale constructed to elicit the responses of the respondents. The questionnaire was designed to measure respondents' demographic variables and personal predisposition factors that affect respondents' attitudes. The structured questionnaire was used to collect data from students and mathematics teachers in the Municipality.

Ethical Consideration

In the study, permission and access were granted by the Northern Regional and Municipal Directors of Ghana Education Service for the research to be conducted in the two SHSs. The permission letters were sent to the school administrators for their approval. The respondents were asked for their consent and given the option to either accept or decline participation. Also, respondents were assured anonymity and confidentiality of the information they provided. In effect, both heads of the two schools selected were granted permission to conduct the research (Arifin & Roshaidal, 2018).

Data Analysis

Primary data gathered from the survey were processed using SPSS and Microsoft Excel. Frequencies and percentages were used to describe the demographic data and to analyse the test score of students in the objective test and the sampled WASSCE results in mathematics for male and female students. Also, we used the means and standard deviations to describe respondents' mathematics performance in the objectives test for objective one. The study utilised Spearman's correlation coefficients to examine the association between gender and performance in mathematics, as well as gender and scores on the MAT test, at a statistically significant level of 5%.

Also, the independent t-test analysis was used to test the statistical significance between female and male students. This t-test was considered because it tells us how significant the differences between group means are (male and female mean scores). The basis for using the independent t-test is that it allows the comparison of the mean scores of two diverse groups or subjects. The independent samples t-test was deemed more appropriate instead of the Analysis of Variance because the latter is applicable when comparing three or more means (Breda & Napp, 2019; Shrestha, 2020). Finally, we used the binary Probit regression to establish the effect of other predisposing factors on students' performance in mathematics (Laerd Statistics, n.d.).

Results

Demographic Characteristics of Students

Gender and Age of Student Respondents

Gender	Number	Percentage (%)
Male	237	49
Female	251	51
Total	488	100
Age	Male	Female
13 - 15 years	28 (6%)	20 (4%)
16 years above	209 (43)	231 (47%)
Total	209 (49%)	251 (51%)

Demographic Characteristics of Teachers

The study showed that out of the 12 mathematics tutors sampled, 8(70%) of them were males whilst 15 of them representing 30% were females (Table 3). This shows that the majority of mathematics teachers in the Municipality at the SHS level are males hence there is a need to encourage female teachers who are interested in teaching mathematics at the SHS level to take up mathematics courses. This will inspire high school students when female teachers instruct them in mathematics. Salifu et al. (2017) argued that specific attitudes of gender towards competition may cause mathematics test scores to provide a predisposed picture of true gender differences in skills of mathematics, even if the content of the tests is not predisposed against girls.

The largest portion (58.33%) of high school mathematics teachers fall within the age range of 42 to 50+ years (Table 3). Also, 33.33% of SHS mathematics teachers in the Municipal are within the age cohort of 31 - 41 years and few (8.33%) of the SHS mathematics teachers are within the age cohort of 20 - 30%(Table 5). The above finding implies that SHS mathematics teachers based on their ages are considered mature enough to handle diverse characters of students in the mathematics lessons. Additionally, teachers of varying ages can provide valuable guidance and support to students who struggle to cooperate and exhibit disruptive behaviour in both the classroom and school environment.

Five out of 10 (50%) of SHS mathematics teachers had a first degree in a STEM-related area (Table 3). Also, 33.33% of teachers had master's degrees in STEM areas and just 16.66% of the teachers have HND qualifications in STEM-related areas (Table 6). The finding of this study implied that all the teachers who teach mathematics in SHS had the requisite qualifications in mathematics to effectively deliver in the learning and teaching of mathematics.

Table 3

Demographic Characteristics of Teachers

Gender	Number	Percentage (%)
Male	8	70
Female	4	30
Total	12	100
Age	Frequency	Percent (%)
20-30	1	8.33
31-41	4	33.33
42-50+	7	58.33

Total	12	100
Academic qualification	Frequency	Percent (%)
HND	2	16.66
First Degree	6	50
Master Degree	4	33.33
Total	12	100

Results of Mathematics Achievement Test (MAT)

In total, 488 achievement tests were collected from participants and scored on a scale of 0-100. 12 tests were not included due to missing data. The results of the MAT were analysed using measures of central tendency and variation. Similarly, Anokye-Poku and Ampadu (2020) revealed that both male and female students held attitudes that were positive towards mathematics and showed no significant difference. However, the established results were significantly different.

Results of MAT Scores and Sampled WASSCE from 2016-2021

Tables 4 and 5 below present the MAT score of students and the WASSCE results in mathematics. The means and standard deviations included in them were used to describe the results obtained by the students. The results of the descriptive statistics indicate a mean score of 39.01 for male students and 31.95 for female students.

Table 4

Descriptive Statistics of MAT Score of Students

Gender	Mean	N	Std. deviation
Male	39.01	237	10.49
Female	31.95	251	8.34
Total	35.38	488	32.09

In Table 4, the analysis indicates the mean scores of 39.01 for male students and 31.95 for female students. However, the overall mean score for both males and females was 35.38 and the standard deviation score of 32.03. Also, the standard deviation score for male students in the sampled results was 10.49 whereas that of female students was 8.34. It was noticed that male students tended to achieve higher scores than female students, but there was a wider range of scores among male students. Based on the data, there are not enough evidences to definitively say that male students outperformed their female counterparts.

Table 5

Descriptive Statistics of Sample WASSCE Results in Mathematics

Gender	Mean	N	Std. deviation
Male	7.99	1068	1.84
Female	7.20	574	1.56

Total	7.47	1642	1.79
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Source: Sampled WASSCE Mathematics Results (2016-2021).

In Table 5, the WASSCE results showed that male students performed better than female participants. Even though the standard deviation for male participants was greater than female participants there was still strong evidence to conclude that male students performed better than female students. However, it is difficult to establish the statistically significant differences between the two genders from Table 6, and this requires a comparison t-test analysis.

Table 6

Spearman's Correlation Analysis of Gender and Mathematics Performance

Student Gender	Mathematics Performance
Male	0.632 (0.002)
Female	-0.582 (0.000)
Mathematics performance	1.000

In Table 6, while male students have a positive correlation with mathematics performance (0.632), female students have a negative correlation with mathematics (-0.582). The performance of male students in mathematics is on the rise, whereas female students are experiencing a decline in their performance. Both genders showed statistically significant relationships, but the correlation for female students was notably strong (p-value = 0.000). These divergent relationships require further robust statistical tests to establish any differences in their performance.

Table 7

Results of independent-sample t-test statistics

Levene's Test for Equality	t-test for Equality of Means							
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	St. Error Difference	95% CI Lower Upper
Equal variance assumed	3.51	0.006	-1.44	486	0.005	7.06	.097	-0.18 1.87
Equal variance not assumed				474.35	0.008	7.06	.096	-0.16 1.85

In Table 7, the results show a statistically significant difference in scores for males (M = 39.01, std. deviation = 10.49) and females (M = 31.95, std. deviation = 8.34); t (486) = -1.436, p = 0.005 (2-tailed). However, the eta squared of 0.00 showed that the differences were very marginal.

Table 8

Regression Analysis of Factors Affecting Student Mathematics Performance

Student Performance Factors	Coef.	std. Error	z-value	P-value	[95% interval]	conf.
<i>Student predisposing factors affecting performance</i>						
Self-confidence	0.27	0.11	2.40	0.016*	0.05 0.50	
Self-esteem	-0.23	0.08	-2.92	0.003*	-0.39 -0.08	
Social and economic	0.09	0.05	1.832	0.104	0.20-0.02	
<i>School predisposing factors affecting performance</i>						

Teacher-student relation.	0.07	0.03	2.25	0.087**	-0.02	0.16
Learning environment	-0.42	0.15	-2.80	0.005*	-0.71	-0.12
Learning method	0.37	0.21	1.75	0.008*	-0.04	0.78
Learning materials	1.13	0.64	1.77	0.077**	-0.12	2.38
<i>Teacher predisposing factors affecting performance</i>						
Teacher social environment	-0.09	0.08	-1.06	0.288	-0.26	0.08
Subject knowledge	-0.74	0.26	-2.87	0.004*	-1.24	-0.23
Teacher experience	-0.88	0.33	-2.68	0.007*	-1.53	-0.24
Constants	2.60	1.39	1.88	0.061	-0.12	5.32

In Table 8, the three sets of factors were analysed to determine the magnitudes of their effects on students' mathematics performance. On students' factors, the z-values showed that self-confidence and socio-economic were positive while the self-esteem was negative. On school factors, three of the four factors were positive. And on teacher factors, all three factors were negative. So, the strongest influencing factors came from the school and followed by the students. Teachers' factors were negative.

Discussion

The Participants

The age and sex of students was studied. For mathematics teachers, the demographic variables covered age, sex, level of education, and number of years of active teaching in Mathematics. Salifu et al. (2017), reported that the performance of male students is better on average in all the performance indicators of mathematics (knowledge, understanding, and perception). The performance in mathematics across the course of the study was significant (Salifu et al., 2017).

Further, the study of Salifu et al. (2017), showed that there was a significant level of knowledge and understanding of mathematics among students, with no apparent bias in perception based on students' age. Out of the students who took part in this study, 237 (49%) were males and 251 (51%) were females. In principle, females generate the same knowledge as males provided that adequate consistency is assumed in scientific inquiry (Breda & Napp, 2019). Males and females are equal in their approach to science, and inequality in science education and science is caused by educational, political, and social factors external to science. This study underscores the necessity of providing males and females with equitable opportunities and challenges, along with access to high-quality education (Gyimah, 2020). It also reveals that females who lack confidence exhibit impaired causal attribution patterns, view mathematics as a predominantly male domain, and experience heightened levels of anxiety when engaging with the subject (Abrehet al., 2018; Breda & Napp, 2019).

Based on the age category of the students, the study revealed that 48 (10%) of the students were within the age cohort of 13-15 years. This is made up of 28 males and 20 females representing 6% and 4%, respectively. Also, 440(90%) of them comprising 209(43%) males and 231 (47%) were between the ages of 16 years and above (Table 2). This suggests that most of the students at the SHS were at an age where they have reached the formal operational stage, allowing them to grasp abstract mathematical concepts. around the age of 12 or 13, males' proficiency in mathematics began to improve at a quicker rate compared to females', creating a substantial gender gap in performance in high schools, students who were less than the age of 15 years attending publicly funded coeducational and single-sex schools and stated robust differences between the choices of girls from coeducational and single-sex schools.

Factors Affecting Teaching and Learning Mathematics

The probit analysis was employed to test the hypothesis that “There was no statistically significant influence of student predisposing factors, teacher predisposing factors, and school factors on the performance of SHS students in mathematics”.

Students Predisposing Factors Affecting Performance

Self-Confidence. The results indicate that student self-confidence was a significant factor that affected SHS students' performance in mathematics since the p-value of 0.016 was significant at a 5% level of significance (Table 8). The implication is that it can be predicted that student self-confidence is a good determinant of their performance in mathematics. In general, the girls' lack of confidence hindered their ability to attribute causation effectively, they viewed mathematics as a subject primarily for males, and they felt anxious when tackling it (Abrehet et al., 2018; Breda & Napp, 2019; Ntibi et al., 2020).

Self-Esteem. Again, the regression analysis indicated that student self-esteem in the learning and teaching of mathematics was a significant factor influencing their mathematics performance. This indicates a p-value of (0.003) at a 5% significance level (Table 8). Based on this, students' self-esteem in the teaching and learning of mathematics influences their performance in the subject. The attitude is a central part of human identity and always serves as a tool for measuring an individual's expected commitment to an adventure or an activity. Every day people hate, love, like, agree, dislike, argue, favour, oppose, disagree, and persuade among others are evaluative responses to an object which are influenced by self-esteem. Also, drawing on the human-specific factors of students, Capuno et al. (2019), examined the relationship between study habits and students' performance in mathematics. Capuno et al. (2019) showed an insignificant positive correlation between the academic performance and attitudes of the respondents in terms of their motivation, enjoyment, and self-confidence whilst there was a positive weak correlation between the value and their math performance.

Social and Economic Factors. The results indicated that student social and economic condition was not a significant factor that affected SHS students' performance in mathematics since the p-value of 0.104 at a 5% level of significance (Table 8). The implication was that students' social and economic conditions did not affect their performance in mathematics. Mathematics gaps tend to favour males more in socio-economically advantaged districts and school districts with greater gender differences in adult education, income, and occupations (Reardon et al., 2019).

School Predisposing Factors Affecting Performance

Teacher-student relation: the regression analysis indicated that teacher-student relation in class was statistically significant in influencing students' performance in mathematics at a 10% significance level with a p-value of 0.087 (Table 8). This was not significant at the 5% (Table 8). The above findings implied that it was impossible to predict that teacher-student relation in class had a significant influence on students' performance at a 10% significance level.

Learning Environment. Again, the analysis of the regression indicated that the learning environment of students had a significant influence on their academic performance in mathematics with a p-value of (0.005) at a 5% significance level (Table 8). The implication was that the classroom environment and school learning sessions among others had a significant influence on student's mathematics performance. Based on the above findings, it can be predicted that students' learning environment in school has a significant influence on their performance in mathematics subject. The learning environment can greatly affect the academic achievement of learners. A positive learning

environment positively influences the achievement of learners whilst a negative learning environment negatively affects the academic performance of learners.

Learning Method. This analysis of the regression model indicated that the learning methods students adopt in teaching and learning mathematics had a significant effect on their performance in the mathematics subject. This returned a 0.008 p-value at a 5% significance level (Table 8). This implies that the learning methods students adopt such as extra classes, student discussion, and time of learning among others have a significant effect on their overall performance in mathematics. Based on these results it can be predicted that students' learning methods have a significant effect on their performance in mathematics. Alghadari et al. (2020) acknowledge that geometry mastery in mathematics is a must for senior high school students, and this is affected by several factors such as gender, learning approach, level of mathematical self-efficacy, and level of basic geometry competencies among others.

Learning Materials. the regression analysis indicated that the kind of teaching and learning materials students use in the learning and teaching of mathematics had a significant effect on their performance of the subject at a 10% significance level with a p-value of 0.077. The above finding implies that students' access to the right teaching and learning materials in mathematics has a significant effect on their performance in mathematics. Based on the results emanated from the study, it can be predicted that students learning materials in mathematics have a significant effect on their performance at a 10% significance level. Salifu et al. (2017), argue that gender-specific attitudes towards competition may skew mathematics test scores, potentially misrepresenting true gender differences in mathematical abilities. This bias could exist even if the test content itself is not inherently biased against females (Azila-Gbetteor & Abiemo, 2021).

Teacher Predisposing Factors Affecting Performance

Teacher Social Environment. The social environment of the teacher as applied in this study had to demonstrate the interaction of the mathematics teacher with other school mathematics teachers. It examined the kind of support mathematics teachers could gain from colleagues to enhance their learning and teaching of the subject. The results of the analysis indicated that the teacher's social environment was significant at both 5 and 10% (Table 8). This means that at both 5% and 10% significance levels, the teacher's social environment was not significant in students' mathematics performance. Based on this, we can conclude that the teacher's social environment does not have any significant effect on student mathematics performance. However, studies described classroom environment as the relationships between students and teacher, and students between students, which included goal types, academic support, instructional materials, teaching methods, teaching practices, and teacher beliefs. In general, peers and teacher support are positively related to academic attitudes, learning motivation, self-efficacy, achievement, and emotions (Anokye-Poku & Ampadu, 2020).

Subject Knowledge. Pedagogical aptitude in teaching mathematics as a subject is assessed through teachers' subject knowledge. The results indicated that teachers' knowledge of mathematics had a significant effect on student's performance in the subject at a 5% significance level with a p-value of 0.004 (Table 8). This means that teachers' lack of knowledge of mathematics negatively impacts students' performance and vice versa. Thus, an improvement in teachers' knowledge of teaching and mathematics learning has a significant effect on the student's performance. Teachers chosen methodologies favoured male learners more which positively influenced male learners' academic performance and negatively influenced female learners' performance (Azila-Gbetteor & Abiemo, 2021).

Teacher Experience. The teacher's level of experience was found to have an impact on students' performance in mathematics. It is expected that as the teachers spend years in the teaching profession, their teaching effectiveness is expected to increase thereby improving students' learning achievements.

The results indicated that teacher experience had a significant impact on students' performance with a p-value of 0.007 at a 5% significance level (Table 8). The implication is that as long as teachers continue to teach the subject, they will develop an effective way through which they can present their thoughts to the students to appreciate much better hence improving their performance.

Mathematics performance largely depends on teaching practices such as being helpful, supportive, and responsive having a good number of teaching years, positive impact on the mathematics grades of students, and having self-competence in Senior High School. Research indicates that teachers' instructional abilities and achievement goals play a significant role in student academic performance. Students demonstrate faster progress when taught by highly skilled teachers. In Senior High School, the experience of teachers has a positive impact on students' mathematics grades and self-competence.

Conclusions and Implications

The math test scores show that male students performed better than female students. This trend was also seen in the WASSCE results from 2016 to 2021, with males consistently outperforming females. There is a strong positive correlation between being male and doing well in math. On the other hand, being female is negatively correlated with math performance. Factors like self-esteem and self-confidence also play a significant role in how well students do in math.

School predisposing factors such as learning materials and teacher-student relationships also have a significant effect on students' mathematics performance. Finally, the study revealed that teacher predisposing factors such as subject knowledge and teaching experience have a significant effect on student performance. The method and environment within which students learn mathematics has a significant effect on their performance in the subject, hence effective learning methods and environment would improve their performance in the subject.

Suggestions for Future Research

This study examined only the gender differentials in performance in mathematics in Senior High Schools with views to examining the gender differentials of male and female students on how students and teachers influence mathematics performance, how MAT scores and sampled WASSCE from 2016-2021 relate to gender performance in mathematics, and how student and teacher factors determine gender differentials.

We have found that students and teachers influence each other in mathematics performance. However, we could not pinpoint the particular levels of students and teachers. Some students are young and others are old enough to decide on teaching methods and techniques they expect their teachers to use. On the other hand, teachers could not select the kinds of students they prefer to use for teaching. The selection of the students has been done by state agencies as they were public school students.

We also found that the teacher-made mathematics assessment scores and the West African Examinations Council scores from 2016 to 2021 were positively related. However, this six-year data was woefully inadequate and not long enough to establish any meaningful long-term trend of performance. A good trend should require 20 to 50 years. Any replication must consider data from at least 1994 to 2024.

Again, we found the gender differentials of students from only three main sources. The students' factors are self-confidence, self-esteem, and social and economic. The teacher predisposing factors are teachers' social environment, subject knowledge, and teacher experience. However, many other factors could have determined gender differentials, including but not limited to cultural diversity, racial orientation, and professional career. Future replication could explore some of these vital areas.

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Conflict of Interest

None.

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