

# **Female Students' Mathematics Performance In Senior High Schools In The Shai-Osudoku District Of Greater Accra Region**

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## **Abstract**

**Aim:** The overall goal of this thesis work was to examine gender as a factor influencing math achievement, with a focus on secondary schools in the Shai-Osudoku District of the Greater Accra Region. In that the following were the study's objectives: To

1. Assess the gender-based disparities in mathematics performance of Senior High School students in the Shai-Osudoku district.
2. Ascertain the impact of societal factors on gender-based disparities in the mathematics performance of Senior High School students of Shai-Osudoku district?

**Method:** The study used quantitative research approach which aims to investigate the influence of gender on math performance among secondary school students in the Shai-Osudoku District of the Greater Accra Region with a sample of 347 students randomly selected from the population using systematic random sampling technique. The primary data was collected using questionnaire and a forty-five-minute multiple choice items mathematics achievement test on statistics and probability. The data collected was analyzed using, the regression tool.

**Results:** The *t*-test value of -1.02 with 82 degrees of freedom and a *p*-value of 0.312 indicates that the difference between the means of male and female responses is not statistically significant at a conventional significance level (e.g.,  $p < 0.05$ ). This implies that the observed difference between male and female responses in this study could likely have occurred by chance. The study therefore found no significant relationship between the independent variable gender and the dependent variable academic performance among senior high school students in Shai-Osudoku district signifying that students' performance in mathematics do not largely depends on gender.

With regards to objective two, the finding aligns with existing research that highlights the disparities in educational resources and opportunities linked to income status. This suggests an acknowledgment of the role that economic background plays in determining the educational opportunities available to students

**Conclusion:** For research question 1, the mean scores for males (Mean = 2.32, SD = 1.17) and females (Mean = 2.58, SD = 1.11) indicate that both genders recognize factors affecting gender-related disparities in mathematics achievement, with females showing a slightly higher mean response. However, the difference between these means was not substantial. Based on the findings that emanated from the data analyzed, the study concluded that gender has no significant relationship with students' academic performance in mathematics among senior high school students in Shai-Osudoku district of greater Accra region.

**Recommendation:** There should be a development and implementation of a gender-inclusive mathematics curriculum that showcases diverse role models and examples, highlighting the contributions of both male and female mathematicians and scientists. This can help challenge gender stereotypes and create a more inclusive learning environment for all students.

Also encourage teachers to use gender equality and social inclusion (GESI) teaching strategies that cater for diverse learning styles and abilities. Employ innovative and interactive teaching methods that engage students and make mathematics more relatable and enjoyable for everyone.

**Keywords:** students' performance, probability, gender equality and social inclusion (GESI).

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## **I. Introduction**

According to Legewie & DiPrete (2012), by middle school, many more boys than girls have the ambition and subsequently the enthusiasm to pursue professions in analysis or engineering. This low patronage of females in mathematics-related disciplines begins very early. The gaps are more pronounced in high school subjects like mathematics, physics, and engineering (Cunningham et al., 2015). For instance, in American high schools, women account for nearly 50% of the Statistics students. However, they are only little more than 25% represented in physics and computer science. In college, the differences become much more pronounced, with significantly more boys than girls expressing a desire to excel in subjects linked to science, mathematics, and engineering.

Mathematics has shown to be a struggle for students in general, not just female students, in several of these fields, including computers, medicine, and engineering where there seems to be a high record of gender disparity. However, women seem to have greater trouble studying mathematics, which explains the poor enrollment in mathematics-related programs in African universities and colleges. In general, and particularly in math-related topics, guys have traditionally been perceived to do better academically than girls. Benbow et al. (2000) theorized that this is due to men's greater levels of intrinsic spatial ability. Similar studies have shown that females often do better in language learning because they have stronger verbal and analytical skills than boys (Naidoo & Sibanda, 2020). According to Eriksson & Sandberg (2012), this is because young females are encouraged to utilize more expressive gestures for communication. In comparison to males of the same age, both newborn and toddler girls create more words. In fact, this supports the argument made by Watt et al. (2017) that there are gender differences in academic ability and career goals, particularly in the domains of science and mathematics. According to a plethora of study data, Ghana has the same poor accomplishment in mathematics both males and girls, but more so among females. Male participation in elective mathematics was 50.5%, whereas female participation was 27.2%, according to Baah-korang (2015), demonstrating that female elective mathematics participation was lower than male elective mathematics engagement.

In 1995, 4.1% of female students in Ghana chose to study mathematics. In comparison, the national rate for boys rose from 14% in 1995 to 34.8% in 1999, a difference of just 13.9%. This graphic illustrates how, up until 1995, females' interest in mathematics in senior secondary schools was far lower than that of boys (Baah-korang (2015) as mentioned in Eshun, 2000). Girls participated less in mathematics in Ghana's former secondary school system's forms four and five than males did, according to Sun (2019). However, the results above do not conclusively show that the low involvement of females in mathematics in Ghana is due to a gender gap in arithmetic ability or a lack of opportunity for girls. Despite this, there is a widespread belief that women's engagement and success in mathematics are poor due to their gender, notably in the Shai-Osudoku District of Greater Accra.

Therefore, the purpose of this study is to establish whether or not gender genuinely influences or determines arithmetic success. It was intended to learn the teaching methods and/or philosophies of secondary school math instructors and, in the end, to ascertain students' views on how gender-related aspects impact arithmetic performance. Mathematics continues to be at the core of existence. It is commonly believed that without mathematics, life would practically be impossible since it gets firmly ingrained in all academic subjects. Simply said, it is difficult to buy, sell, communicate, travel, eat, wear, or even sleep without employing numerical (mathematical) notions. Science and technology have always been valued highly in our planet.

Mathematics has evolved into an essential instrument for creating a logical human personality in the present day (Kavkler, Babuder & Magajna, 2014). In other words, having a strong foundation in mathematics aids individuals in developing their critical thinking abilities, particularly for crucial personal and professional choices. Ghana's designation of mathematics as a core subject for both the basic and second cycles of education has been significantly affected by the importance of mathematics. In Ghana, it is a requirement for admission to secondary school and prominent postsecondary programs at universities, polytechnics, colleges of education, etc., according to Anamuah-Mensah, Asabere-Ameyaw, and Dennis (2005) as referenced in (Poku & Ampadu, 2020).

## **II. Statement Of The Problem**

In Ghana and in particular Shai-Osudoku district available literature indicate that female students in secondary school shy away from studying mathematics related programs in schools. As such, very few students get admitted into mathematics and science bias programs. This phenomenon persistently continues to widen the inequality gap between boys and girls mathematics education.

Data from the office of the district education directorate of Shai-Osudoku shows that even though 63% of the secondary school student population is made up of females, on 8% of girls student population accept

mathematics related courses in secondary schools as against 56% of boys accepting and doing mathematics and science related programs.

Also, West Africa Senior Secondary School Certificate Examinations results shows that forty percent of boys had a grade C+ whilst only 19% of girls got a grade of C+ and that the performance of girls in mathematics is on the consistent decline every year. The report continues to add that in all, only 27% of girls obtained grades ranging from A1 to E8 whilst 47.5% of boys obtained grades A1 to E8 over the years.

This, among other research findings elsewhere has consequently resulted in the wide spread notion and perception that being a boy or girl determines one's strength in mathematics achievement and so, gender is a determinant in mathematics achievement in secondary schools in Shai-Osudoku District.

During the researcher's informal conversations with some teachers, students and other stakeholders in the Shai-Osudoku District: he quizzed "could it not be that low performance of girls in mathematics is a result of lack of opportunities or attitude towards mathematics learning or even teaching method?". Certainly, there could be any other factors accounting for the gender difference in mathematics achievement in the Shai-Osudoku district of the greater Accra region which can only be determined by research. Hence, this study seeks to investigate some of the challenges accounting for the seemingly poor performance of girls and lack of interest in mathematics in secondary schools in Shai-Osudoku district in order to confirm or otherwise the wide spread perception that one's achievement in mathematics actually depends on gender.

### **Gender-Based Differences in Mathematics Achievement**

Gender-based differences in mathematics achievement have been a subject of ongoing research and debate. While considerable progress has been made in promoting gender equity in education, disparities in mathematics performance between males and females continue to be observed in various contexts. This literature review examines recent studies and findings on this topic, shedding light on the multifaceted factors contributing to these differences. Historically, there has been a belief that gender differences in mathematics performance might be attributed to innate biological and cognitive differences between males and females. However, contemporary research challenges this assumption. Hyde et al., (2019) conducted a meta-analysis and found no substantial gender differences in mathematical abilities. Their study suggests that cognitive factors do not significantly contribute to disparities in mathematics achievement.

Recent research emphasizes the role of socio-cultural factors in shaping gender disparities in mathematics. Stereotype threat, a phenomenon in which individuals underperform due to anxiety about confirming negative stereotypes about their group, has been shown to affect females more than males in mathematics (S. J. Spencer et al., 2016). This suggests that societal stereotypes about gender and math can create a self-fulfilling prophecy, impacting girls' performance in the subject. Efforts to narrow the gender gap in mathematics achievement have focused on educational strategies. Dweck, (2017) emphasizes the importance of promoting a growth mindset in both males and females. A growth mindset emphasizes effort and perseverance over innate talent, and it has been shown to be effective in reducing gender disparities in mathematics performance. Encouraging students to believe in their ability to improve through effort can foster more positive attitudes towards mathematics. Gender-based differences in mathematics achievement can vary depending on cultural, societal, and educational contexts.

A study by (Else-Quest & Hyde, (2017) investigated these variations across 67 countries. They found that while gender differences existed, they were not consistent across all countries. In some countries, girls outperformed boys in mathematics, highlighting the significant influence of contextual factors. The teacher and classroom environment also play pivotal roles in shaping gender-based differences in mathematics achievement. Research by Riegler Crumb et al., (2017) shows that teachers' attitudes and expectations can inadvertently perpetuate gender stereotypes. Encouraging teachers to provide equitable opportunities and support for both male and female students is essential in promoting gender equity in mathematics education. Gender-based differences in mathematics achievement are influenced by a combination of biological, cognitive, socio-cultural, and educational factors. While earlier beliefs in innate gender differences have been debunked by recent research, the impact of societal stereotypes and stereotype threat on female students cannot be underestimated. Promoting a growth mindset and addressing stereotype threat are essential strategies to reduce these disparities. Context and cultural factors surrounding mathematics education contribute to variations in gender differences. Teachers and classroom environments play pivotal roles in either perpetuating or mitigating gender stereotypes. As we move forward, it is crucial to consider these multifaceted factors in efforts to promote gender equity in mathematics education. Further research is needed to explore the effectiveness of various interventions and strategies aimed at narrowing the gender gap in mathematics achievement in diverse educational settings.

### **Impact of Cultural and Societal Factors on Gender Differences in Mathematics Performance Among Senior High School Students**

Cultural norms, societal expectations, and parental influences are integral elements that contribute significantly to gender differences in mathematics performance among Senior High School students. This literature review explores recent studies and findings regarding how these factors shape disparities in math achievement. Cultural norms and gender stereotypes often reinforce traditional gender roles, impacting the choices and attitudes of high school students towards mathematics. Many cultures perpetuate the idea that certain subjects, including mathematics, are more suitable for one gender over the other. This stereotype can discourage students from pursuing math if it is not aligned with societal expectations for their gender (Eccles, 2020).

Cultural norms can contribute to math anxiety, especially for females, who might feel the pressure to conform to perceived gender norms Foley et al., (2017). Stereotype threat can lead to lower math performance when students feel their abilities are being judged based on their gender. Societal expectations can significantly impact students' self-efficacy and confidence in mathematics. Societal expectations often influence career choices. Girls may be discouraged from pursuing STEM careers due to the perception that these fields are male-dominated and require advanced math skills (Moote et al., 2020).

The lack of female role models in STEM fields can contribute to the underrepresentation of women in these areas. Students may struggle to envision themselves pursuing mathematics-related careers without visible role models (Stoet & Geary, 2020). Parental influences are crucial in shaping students' attitudes and performance in mathematics. Parents' expectations for their children's math performance can significantly impact students. High parental expectations can motivate students to excel in mathematics, while low expectations can discourage them (Ng et al., 2019). Parents may unintentionally reinforce gender biases at home by encouraging different activities or expectations for their children based on their gender. For example, they may provide more math-related resources or encouragement to male children (Tenenbaum & Leaper, 2018). It is important to note that the impact of cultural and societal factors can vary significantly across different cultural contexts.

Cultural norms and expectations may differ from one region or community to another, resulting in diverse experiences for high school students. Cultural norms, societal expectations, and parental influences are powerful forces that shape gender differences in mathematics performance among Senior High School students. These factors can either motivate or discourage students from pursuing mathematics, impacting their self-efficacy, career aspirations, and overall performance.

Efforts to reduce gender disparities in mathematics achievement must consider these cultural and societal influences. Promoting gender-neutral educational environments and challenging stereotypes can encourage all students to engage with mathematics regardless of their gender. Additionally, involving parents and caregivers in promoting gender equity in education is essential.

### **Students' Attitude Towards Mathematics**

Attitude towards mathematics holds significant importance in the teaching and learning process, as it directly impacts students' math achievement (Duku et al., 2021). Various factors, including the teaching method, school structure, family support, and students' own attitudes towards school, can influence attitudes towards mathematics. Unfortunately, the way mathematics is presented and perceived in classrooms often alienates students, leading to negative attitudes towards the subject (Duku et al., 2021).

Research has shown that a positive attitude towards mathematics is closely linked to academic success in the subject. However, gender disparities in math achievement persist, with girls often facing discouragement from pursuing math careers during their early years. Consequently, they tend to develop negative attitudes towards math in secondary school and are more likely to drop the subject at higher grade levels, resulting in fewer women in math-related professions (Kwarteng et al., 2018).

Although the gap between male and female math students' achievement scores is narrowing, research still indicates disparities in some complex mathematical areas (Abreh et al., 2018). Attitudes are shaped by values, beliefs, and factual knowledge, but the influence of other factors on math achievement makes it difficult to draw definitive conclusions about gender differences in mathematics (Abreh et al., 2018).

Girls' reduced engagement and success in mathematics have often been attributed to their negative attitudes towards the subject. The perception that mathematics aligns with a male self-image and clashes with a female self-image contributes to this negative self-image, often influenced by peer pressure (Enu, 2021). Various studies have shown that girls' perceptions of their gender roles negatively impact their participation in mathematics lessons (Duku et al., 2021). In some countries, lacking mathematical skills has led to exclusion from numerous professions for women.

It is crucial to assess attitudes and achievements in mathematics based on gender in the age of science and technology to develop initiatives and plans for increasing female involvement in the subject (Anayitime et al., 2020). Women tend to take mathematics at higher levels less frequently than men, resulting in men dominating professions requiring high math proficiency.

Attitude and achievement in any academic discipline are directly related; thus, students' attitudes towards mathematics undeniably impact their math performance (Emerson Peteros, 2020). It is essential for students to have positive attitudes towards math, as it reflects their values, self-confidence, enjoyment, motivation, and anxiety levels regarding the subject (Emerson, 2020). Behavioural differences towards mathematics have been suggested as a contributing factor to performance disparities in the subject (Enu, 2021). Students' attitudes towards mathematics have a greater influence on their academic achievement, emphasizing the importance of teachers fostering and boosting students' self-confidence in the subject through active involvement in class discussions and interactions (Emerson, 2020).

Several factors, such as students' aptitude, instructional, and social psychological environmental factors, influence their liking or disliking of mathematics (Mazana et al., 2020). Teachers' positive attitudes towards mathematics have a significant impact on students' interest and attitude towards the subject ( Mensah et al., 2013).

### **Students Attitude and Performance in Mathematics**

Students expressed either a fondness for or a disdain for mathematics depending on the manner in which the content was given to them. They developed a natural attitude toward the topic, which was ultimately the determining factor in whether or not they did well in that class. Students were motivated to learn, stimulated, and their attention was awakened to grasp the information that was being given to them by the instructor when they positively regarded the subject to be learned as engaging, entertaining, significant, and relevant.

Additionally, the instructor's attention was awakened to ensure that the students were able to comprehend the information that was being given to them. According to (Wills & Sherris, 2010), having a positive attitude about a subject was associated with improved performance. Research that was carried out in Ghana by a number of significant figures in the secondary education system (Nui & Wahome, 2006) found that repeated failure in mathematics and science may be connected to the attitudes that students and instructors have towards the respective subjects. According to the findings of this research, attitude is one of the most important factors that determines performance. In line with this idea, (Manoah et al., 2011) discovered that students' attitudes had an effect on how well they performed in their research. Students who went into the exam with a positive attitude had a far better chance of doing well, which suggested that this was an essential component of the mathematics curriculum.

According to the findings of these research, attitude is a crucial factor that plays a role in deciding how efficiently a curriculum is implemented in learning institutions, particularly in the area of mathematics. This is especially true when it comes to the subject of algebra.

### **The Attitude of Teachers Towards Mathematics and Their Performance in the Subject**

According to the findings of study that Nyabuto and Njoroge (2014) performed on the methodologies used in secondary school classrooms, the teaching of science and mathematics has been a contentious topic for quite some time. The focus of the conversation was on the instructional approach and methodology, with an emphasis on attitude as one of the primary factors that determine how well a program is delivered.

They note that traditional or teacher-centered teaching methods are one approach that leads to students having a negative attitude toward the subject matter being taught, which in turn leads to students not enjoying their classes and missing out on the benefits of learning what they already know on their own. As a direct consequence of this, the student's performance on the test was subpar. According to Kwame & Samuel, (2020), teachers provided their students with carefully crafted claims that the pupils were required to memorize and recite whenever the instructor deemed it necessary.

In addition, there was a little to nonexistent emphasis placed on understanding. As a consequence of this, pupils were unable of comprehending what was being taught in class, which led to a negative attitude toward the subject matter being discussed. In a study on the factors that influence students' attitudes toward mathematics, Bolaji (2005) found that the teaching style and personality of the teachers were significant factors in the students' positive attitudes toward mathematics. This was discovered in a study on the impact of students' attitudes toward mathematics.

### **Factors Affecting Girls Performance in Mathematics**

Achievement in mathematics, as well as in other subjects, is influenced by several interconnected elements (Owu-Ewie & Eshun, 2015). When evaluating the mathematical ability of girls, irrespective of their age or stage, there are various significant factors that exert effect. The following points are explored below: Societal impact and patterns of socialisation.

Johnston (2016) asserts that any analyses aimed at enhancing mathematics teaching and learning must address the students, parents, teachers, employers, government officials, and also consider the prevailing attitudes, beliefs, and aspirations of individuals in society.

Society consists of individuals, organizations, institutions, and ideas that promote certain values and skills, and provide opportunities and representations that inevitably influence how mathematics is seen, comprehended, and ultimately acquired by individual learners. As an example, in the United Kingdom, an important Committee of 1992 initiated a research to investigate the level of mathematical proficiency among individuals. The findings were significant since they unveiled not just the mathematical proficiency of adults.

The discovery was significant since it not only demonstrated a lack of capacity to do what might be considered basic tasks, but also highlighted the frustrated, unpleasant, and negative feelings experienced by many adults in relation to their mathematics experiences. Assume that the overall recollection of school mathematics by parents and adults is mostly unfavourable.

Under certain circumstances, this memory may be readily sent as a negative representation to the process of generating text, thereby impacting the overall mathematical expectations of their offspring, especially the female ones. This incentivizes females to persist in studying the topic, perhaps impacting their subsequent performance (Donkor & Justice, 2016). Put simply, if a parent has an aversion to mathematics, it is highly probable that the parent cannot see any abnormalities or deficiencies when the kid is underperforming in arithmetic. With this in mind, little assistance can be provided to the youngster in order to address this issue and impact their performance.

In order for a kid to be socially integrated into a social structure, they must be instructed in the customs, principles, and convictions of that specific community. Boakye-Gyasi et al. (2017) found that males tend to have more intensive socialization experiences compared to girls, and they also face higher pressure to conform to gender-specific behaviours, suggesting that differences exist between the two genders. Guys are seen to garner more attention, both positive and negative, and adults tend to exhibit a higher level of curiosity and provocation towards guys compared to girls. All of these factors have consequences for the academic achievement of female students in mathematics. The disparity in educational attainment between males and girls is also prevalent in Ghana. According to Clarkson et al. (2017), in their research on the health issue faced by rural women, they observe that when the family's financial situation is poor, young girls are often required to discontinue their education. This suggests that the importance of girls' education is secondary to most rural parents.

As to the research conducted by Taley & Adusei (2020), it is recommended that women's education should be on par with men's education. This includes fostering love and appreciation for women among men, as well as educating males from a young age to care for women, provide emotional support, and provide a pleasant existence for them. According to him, the necessary education for women and girls mostly revolves on their duties as housewives and mothers. Once these expectations are acknowledged and internalized, decisions are made accordingly. This has significantly impacted females' academic performance since they often see themselves as being excluded from the field of mathematics.

Consequently, they lack a clear understanding of how to effectively use mathematics in relation to their assumed societal function. Toril Brekke asserts that inside educational institutions, females tend to be directed towards disciplines that are seen to have more practical value in the broader society. Typically, girls focus on acquiring skills in painting, home science, and dressmaking, while guys dedicate their time to solving complex mathematical problems and conducting experiments in physics and chemistry labs, as well as working with sawdust in the woodwork department. This perspective is supported by Bran-Gun Brandson, who said that if education is provided for females, it is not intended to elevate them above their conventional role in society.

### **III. Methodology**

The study settled on quantitative method. This quantitative research approach aimed to investigate the influence of gender on math achievement among secondary school students in the Shai-Osudoku District of the Greater Accra Region. The study utilized a combination of standardized tests, surveys, and statistical analysis to examine potential gender differences in math performance and identify factors contributing to these disparities. The test assessed various math skills, such as problem-solving, algebra, and geometry. By using this research method, the study employed quantitative procedures for data collection and interpretation. The use of the quantitative method strategy gave the researcher the chance to make use of statistical instruments that precisely assess the correlations between the variables.

#### **Population, Sample and Sampling Procedure**

The accessible population of the study comprised all final year senior high school students in the selected school at Shai-Osudoku district of greater Accra region of Ghana. A total of 2600 students were present at the time of data collection. Additionally, 53% (1400) of students were female and 47% (1200) were male

made up the accessible population. A total sample size of 347 respondents was therefore determined based using a simplified formula for proportion .

**Data Instruments**

Inferential statistics was used to analyze the quantitative data. The responses from the respondents were compiled and entered using SPSS. The association between the main variable and the outcome variable was determined. Students' Performance in mathematics was measured using Math Achievement Test which was made up of twenty-five (25) multiple-choice questions which focus on statistics and probability chosen from WAEC past questions. Hence the instrument was valid. It actually concentrated on two competencies or skills: Problem-solving skills and computation ability. A questionnaire was used to elicit from the mathematics facilitators, the factors that determine learners' academic achievements in mathematics. The constructed test items which were adopted from (WAEC) was administered on some randomly selected students in the two senior high schools in Shai-Osudoku District so to increase validity and reliability. Thirty third year students were randomly selected for the test. Fifteen learners were picked from each of the purposively sampled schools in the district. Also, two teachers from the two secondary schools who are trained to teach mathematics were randomly selected by the researcher to fill the questionnaire. Respondents who were part of the pilot study were excluded from the actually study.

In order to ensure coherence, participants were given codes to use when responding to the questionnaire After examining the data, a Cronbach's alpha reliability value of 0.798 was discovered. This shows that the instrument was trustworthy and implies an outstanding performance. Expert researchers in the field of the study evaluated and validated the instrument.

**Study Area**

It is located about 34km from Accra thus about 1hour 20minutes drive from Accra. The district is situated at the south eastern part of the region. The population of the district per 2021 Population and Housing Census is 105,610 comprising 53,136 males representing 50.3% and 52,474 females representing 49.7%.

**IV. Results**

*What is the gender-based disparities in mathematics performance of Senior High School students in the Shai-Osudoku district?*

Participants were asked to indicate their agreement on ten (10) questions in order to obtain answers to the first study question about students' views of mathematics. This was done to evaluate their personal qualities and future significance as agents of students' perceptions. The answers are shown in Table 1.

**Table 1: Difference between secondary school boys and girls**

items	N	Mean	SD
Mathematics is a subject where gender differences do not exist.	10	4.1083	.93799
Males are naturally better at mathematics than females.	10	3.9708	.82280
Females receive the same level of encouragement and support in mathematics as males.	10	3.8500	.82960
Gender stereotypes negatively affect females' confidence and performance in mathematics.	10	3.7542	.83816
Female students have the same access to advanced math courses and resources as male students.	10	4.1183	.81837
Gender-based discrimination exists in mathematics classrooms.	10	4.3208	.70316
Female teachers are equally effective as male teachers in teaching mathematics.	10	3.8708	.82510
Girls are as interested in pursuing STEM (Science, Technology, Engineering, and Mathematics) careers as boys.	10	3.8510	.89160
Encouraging female students to participate in math-related extracurricular activities is important.	10	3.7548	.91138
Gender diversity in mathematics education benefits all students.	10	4.0208	.90316

Source: Field survey (2023)

The results presented in Table 1 shed light on the perceptions and attitudes regarding gender-based differences in mathematics achievement among Senior High School students in the Shai-Osudoku District of the Greater region. These findings are based on a survey of 10 teachers and provide insight into the prevailing beliefs and opinions concerning gender disparities in mathematics education.

Table 1 presents attitudes and perceptions regarding gender-based differences in mathematics achievement among Senior High School students. To analyze the data and explore the gender disparities in math performance, it is important to discuss the key findings indicated by the mean values and standard deviations provided in the table.

**Mathematics Gender Disparities:** The table reveals a variation in perceptions regarding gender differences in mathematics. Notably, the mean scores for the statement "Mathematics is a subject where gender differences do not exist" (Mean = 4.1083, SD = 0.93799) and "Female students have the same access to advanced math

courses and resources as male students" (Mean = 4.1183, SD = 0.81837) indicate a high level of agreement among respondents. This suggests a prevailing belief in equality of access and ability in mathematics.

**Gender Stereotypes and Discrimination:** Contrarily, the mean score for "Gender-based discrimination exists in mathematics classrooms" (Mean = 4.3208, SD = 0.70316) suggests a widespread acknowledgment of discrimination in math education. Additionally, the statement "Gender stereotypes negatively affect females' confidence and performance in mathematics" (Mean = 3.7542, SD = 0.83816) indicates a recognition of the impact of societal perceptions on female students' performance.

**Teacher Effectiveness and Encouragement:** The mean scores for "Female teachers are equally effective as male teachers in teaching mathematics" (Mean = 3.8708, SD = 0.82510) and "Females receive the same level of encouragement and support in mathematics as males" (Mean = 3.8500, SD = 0.82960) suggest a somewhat moderate level of agreement among respondents, reflecting a perception of gender-neutral teaching effectiveness and support. The data indicate a relatively moderate level of agreement on the statement "Girls are as interested in pursuing STEM careers as boys" (Mean = 3.8510, SD = 0.89160), implying a perception of similarity in interest but not a strong consensus.

The mean score for "Encouraging female students to participate in math-related extracurricular activities is important" (Mean = 3.7548, SD = 0.91138) suggests a perceived significance in encouraging female participation in extracurricular activities, while "Gender diversity in mathematics education benefits all students" (Mean = 4.0208, SD = 0.90316) reflects a stronger consensus about the benefits of gender diversity in math education. The data reflect a multifaceted understanding of gender-based differences in mathematics education. While there's a prevalent belief in equality of access to resources and ability in mathematics, there's also a recognition of gender-based discrimination and the impact of stereotypes on female students' performance and confidence.

The findings align with recent literature on gender disparities in mathematics. Studies such as Hyde, et al. (2018) emphasize the role of societal stereotypes in shaping students' perceptions of their abilities, impacting their performance in mathematics. Additionally, research by Else-Quest, Hyde, & Linn (2010) highlights that although girls and boys perform similarly in math, cultural and social influences can impact their confidence and pursuit of STEM fields. To bridge the gap, interventions promoting gender diversity, encouraging participation in math-related extracurricular activities, and actively addressing discriminatory practices should be implemented. This resonates with studies advocating for interventions that combat gender biases in educational settings (Stoet & Geary, 2018).

**Research Question 2**

*What is the impact of societal factors on gender-based disparities in the mathematics performance of Senior High School students of Shai-Osudoku district?*

Participants were asked to indicate their agreement on ten (10) questions in order to obtain answers to the first study question about students' views of mathematics. This was done to evaluate their personal qualities and future significance as agents of students' perceptions.

The answers are shown in Table 2.

**Table 2: Strategies to Improve Students' Performance**

Strategies	N	Mean	SD
Cultural expectations influence the career choices of female students in math-related fields.	347	2.6102	1.28125
Societal biases affect the confidence and self-perception of female students in mathematics.	347	2.9746	1.12821
Stereotypes about gender and mathematics persist in society and impact female students' performance.	347	3.2542	1.27559
Cultural and societal norms shape the opportunities available to female students in math education.	347	2.8559	1.08821
Female students often face external pressure and discouragement from pursuing mathematics.	347	3.4492	1.19541
Media representations of mathematicians and scientists predominantly feature males, influencing perceptions.	347	2.6186	1.13920
Female role models in mathematics can inspire and motivate female students to excel in the subject.	347	2.8814	1.30200
Cultural and societal factors contribute significantly to gender-based disparities in mathematics achievement.	347	2.2373	1.14487
Schools and communities should actively challenge cultural and societal barriers to gender equity in mathematics.	347	1.9661	1.06162
Increasing awareness of the impact of cultural and societal factors is essential in addressing gender disparities in mathematics.	347	2.2203	1.28193

Source: Field survey (2023)

Table 2 presents data on the perceptions of Senior High School students in the Shai-Osudoku District regarding the impact of cultural and societal factors on gender-based disparities in mathematics education.



These results shed light on the awareness of students about the role of external influences in shaping gender disparities in math-related fields and the strategies that can be employed to address these disparities.

Firstly, the data indicate that respondents strongly agree that cultural expectations influence the career choices of female students in math-related fields, with a mean score of 2.6102. This reflects an understanding of the influence of cultural norms and expectations on the career decisions of female students, which can lead to disparities in STEM fields.

Similarly, there is a consensus among respondents that societal biases affect the confidence and self-perception of female students in mathematics, as indicated by a mean score of 2.9746. This recognizes the negative impact of societal biases on the mindset and self-esteem of female students in the context of mathematics education. The data also show that stereotypes about gender and mathematics persist in society and impact female students' performance, with a mean score of 3.2542. This suggests an awareness of the detrimental effects of stereotypes on female students' academic performance and self-efficacy (Ambady et al., 2001). Respondents believe that cultural and societal norms shape the opportunities available to female students in math education, as indicated by a mean score of 2.8559. This acknowledges the role of external factors in determining the educational opportunities and pathways for female students in mathematics.

Furthermore, the data highlight that female students often face external pressure and discouragement from pursuing mathematics, with a mean score of 3.4492. This underscores the need to address societal pressures and biases that may deter female students from pursuing math-related fields. Regarding media representation, respondents believe that media predominantly featuring male mathematicians and scientists influences perceptions, with a mean score of 2.6186. This reflects an understanding of the importance of diverse representation in the media to challenge stereotypes and inspire female students (Cheryan et al., 2017). Respondents also acknowledge that female role models in mathematics can inspire and motivate female students to excel in the subject, with a mean score of 2.8814. This underscores the importance of showcasing successful female mathematicians as role models to encourage more female participation in math-related fields. The data indicate that cultural and societal factors contribute significantly to gender-based disparities in mathematics achievement, as shown by a mean score of 2.2373. This recognition of the role of external factors in disparities is essential for developing targeted interventions.

Lastly, respondents believe that schools and communities should actively challenge cultural and societal barriers to gender equity in mathematics, with a mean score of 1.9661. This highlights the importance of educational institutions and communities taking proactive measures to address and mitigate the impact of external factors on gender disparities in mathematics education.

The analysis of participants' responses provides insights into potential strategies that can be adopted to improve students' performance in mathematics in Senior High Schools in the Shai-Osudoku District. The findings align with existing research on the importance of support, innovative teaching methods, professional development, mentorship, real-life applications, resource availability, growth mindset, inclusive environments, collaboration, and problem-solving skills in promoting math achievement (e.g., Landicho, 2021; Boaler, 2013). These strategies can address various challenges and support students' engagement, understanding, and success in mathematics. The variability in participants' responses reflects the diversity of perspectives and experiences within the Shai-Osudoku District. It highlights the importance of tailoring strategies to local contexts and addressing specific needs and challenges.

The analysis of participants' responses to the strategies for improving math performance provides valuable insights into potential approaches to enhance students' achievement in the Shai-Osudoku District. The findings align with existing literature on effective instructional practices and supportive environments.

### **Analysis of Mathematics Achievement Test**

**Table 3: T-test results comparing male and female responses on factors affecting gender-related disparities in Senior High School students' mathematics achievement.**

Gender Level	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>t-cal</i>	<i>Df</i>	<i>P</i>
Male	190	2.32	1.17	- 1.02	345	0.312
Female	157	2.58	1.11			

Source: Field survey (2023)

The researcher used the responses from mathematics achievement test. In answering research question 1, the mean score for males (Mean = 2.32, SD = 1.17) and females (Mean = 2.58, SD = 1.11) suggest that both genders perceive factors affecting gender-related disparities in mathematics achievement, with females expressing a slightly higher mean response compared to males. However, these differences in means are not substantial. The t-test value of -1.02 with 82 degrees of freedom and a p-value of 0.312 indicates that the difference between the means of male and female responses is not statistically significant at a conventional significance level (e.g.,  $p < 0.05$ ). This implies that the observed difference between male and female responses in this study could likely have occurred by chance. The findings from this t-test analysis suggest that while there

is a numerical disparity in the mean scores between male and female responses regarding factors affecting gender-related disparities in mathematics achievement, this difference is not statistically significant. This implies that any observed differences between male and female perceptions might be due to random variability within the sample rather than a true disparity between genders.

Gender disparities in mathematics achievement among high school students often highlights the intricate interplay of socio-cultural, educational, and psychological factors. Studies, such as those by (Landicho, 2021), emphasize implicit biases and societal stereotypes that might affect how individuals perceive their abilities and influence their performance in mathematics. Moreover, studies by Hulleman and Harackiewicz (2009) underscore the importance of motivational factors, emphasizing that both genders' beliefs and values regarding math can significantly impact their achievements. Given the lack of statistical significance between male and female responses in this study, it becomes crucial to delve deeper into the underlying reasons for the observed perceptions and the potential implications on educational policies and interventions. This might involve examining the socio-cultural context, educational environment, and individual experiences that contribute to perceptions of gender disparities in mathematics achievement.

#### **Authors contribution**

Conceptualization, formal analysis – Isaac and Malik  
Data curation – Isaac, Enoch and Issah  
Methodology – Idriss, Malik, Isaac and Enoch  
Writing, review and editing – Idriss, Issah, Enoch and Malik  
Validation – Isaac, Enoch and Malik  
Investigation, visualization – Isaac and Idriss  
Original draft – Idriss and Isaac

#### **Data availability**

Data generated or analysed during this study are available from the authors upon request.

#### **Conflict of Interest**

The authors declare no conflict of interest.

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