

## Gender and Other Significant Factors Causing Disparities in Senior High School Students' Mathematics Performance

Emmanuel Kojo Amoah

University of Education, Winneba, Department of Mathematics Education, Ghana  
ekamoah@uew.edu.gh

**Abstract:** In the context of ongoing debates surrounding the influence of gender and various student-related, teacher-related, and school-related factors on students' performance in mathematics, this study seeks to contribute nuanced insights. The recent trend of suboptimal performance in mathematics, as evidenced in both district and national performance statistics within the Assin North District, necessitates a comprehensive examination of the underlying causes. This research specifically investigates the gender factor, along with other significant determinants, that may be contributing to disparities in mathematics performance among high school students. Utilizing a mathematics achievement test and carefully designed questionnaires, data were gathered from a stratified sample of 500 final-year students across three public senior high schools in the Assin North District, Ghana. The data were subjected to rigorous analysis, employing both descriptive statistics and quantitative methods, including independent t-tests and probit regression. The findings reveal that male students outperformed their female counterparts in the mathematics achievement test, with the differences being statistically significant at the .05 significance level. Beyond gender, the study identifies self-assurance and self-regard as pivotal student-related factors influencing mathematics performance. Additionally, teacher subject matter expertise, instructional methodologies, and teacher-student interactions were found to be significant teacher-related factors impacting performance. School-related factors, such as teacher motivation and the overall school environment, were also recognized as influential. While other factors, such as students' socioeconomic background and available teaching resources, were observed to affect performance, they did not reach statistical significance in this study. In light of these findings, the study advocates for the implementation of gender-responsive pedagogies by senior high school mathematics teachers. Furthermore, the formation of professional learning communities at the school level is recommended to facilitate ongoing improvement in teachers' knowledge, motivation, and instructional styles. This approach aligns with the broader goal of enhancing mathematics education and performance within the Assin North District and potentially offers insights applicable to other educational contexts.

**Keywords:** Gender Disparities, Mathematics Performance Factors, diabetes, Senior High School Students

### 1. Introduction

Gender has consistently emerged as a pivotal factor influencing academic performance in mathematics, with disparities in this area becoming a significant global concern. Research has consistently demonstrated that male students tend to outperform female students in mathematics (Adeyemo, Aina, & Akinbobola, 2013). This pattern is particularly pronounced in Ghana, where a substantial gender gap in mathematics achievement has been observed (Meyer, 2016), with female students consistently trailing their male counterparts (Ofori-Attah, 2018). This trend is further corroborated by the West African Senior School Certificate Examination (WASSCE) results, where female students' performance in mathematics consistently lags behind that of males (Baiden & Ahiakpor, 2017), leading to enrollment disparities in mathematics-related courses. For instance, Akyeampong et al. (2007) reported that only 32% of girls, compared to 50% of boys in Ghana, are enrolled in mathematics courses at the senior high school level. The literature exploring the factors contributing to gender disparities in mathematics performance is expansive. Nyarko and Asare (2018) pinpointed societal attitudes, cultural beliefs, and stereotypes as underlying causes of the gender gap in mathematics achievement. Specific factors include cultural and societal constraints that limit girls' engagement in mathematics-related activities (Ofori-Attah, 2018), gender stereotypes framing mathematics as a male-dominated subject, and the scarcity of female role models in mathematics-related fields (Baiden & Ahiakpor, 2017; Mohammed & Kpakpo, 2021).

These disparities have profound implications for Ghana's developmental trajectory. The underrepresentation of females in mathematics-related fields restricts their access to employment opportunities in science and technology sectors, which are vital for national development. Moreover, this lack of diversity stifles innovation and creativity, hindering Ghana's capacity to address complex challenges and foster economic growth. Mohammed and Kpakpo (2021) emphasized the necessity for gender-sensitive teaching practices in mathematics classrooms to mitigate this gap. Such practices involve the adoption of teaching strategies that cater to the diverse learning styles and needs of both genders. The issue of gender disparity in education, particularly in subjects like mathematics, is a longstanding challenge in many countries, including Ghana (Akyeampong & Stephens, 2011; Oduro et al., 2018). Despite concerted efforts to narrow this gap through the implementation of gender-sensitive policies and programs, the disparity persists (UNESCO, 2017). The Assin North District in the Central Region of Ghana exemplifies this issue, where the gender gap in mathematics achievement is notably significant.

Recent trends in mathematics performance at the school, district, and national levels have raised serious concerns (Assin North Education Directorate Statistics, 2022), especially among female students. Various

interventions, including initiatives by Non-Governmental Organizations, the District Assembly, and Member of Parliament scholarships for high-performing female students, have been implemented to bridge this gap. However, the effectiveness of these efforts remains unclear, and persistent contributing factors to the gender gap in mathematics achievement have yet to be fully understood.

This study, therefore, aims to explore the intricate relationship between gender and academic performance in mathematics among senior high school students in the Assin North District of the Central Region of Ghana. Specifically, it seeks to establish the connection between gender groups and academic achievement, contributing to the gender gap in mathematics, and to furnish evidence-based recommendations to redress this disparity.

## 2. Some other related factors affecting performance in mathematics

While focusing on the issue of gender, research has acknowledged that other factors including student socioeconomic status, self-assurance and self-regard may contribute positive or negatively to students performance in mathematics. Farooq et al. (2011) found socioeconomic status have a significant effect on students' overall academic achievement as well as achievement in the subjects of Mathematics. They identified that educational levels of parents and family in general had influence on the efforts of their wards in school (Ozcan, 2021). Socioeconomic status has been consistently linked to mathematics achievement, with students from higher backgrounds performing better than those from lower backgrounds (Sirin, 2005). This may be due to various factors, such as access to resources, parental involvement, and educational opportunities.

Zhao et al. (2021) studied the relationship between self-regard and adolescent performance in school. It was revealed that self-regard positively affected academic performance of adolescents. In recent study, Akbari and Sahibzada (2020) concluded that students' self-assurance effected students' academic performances as students with high self-assurance develop interest in mathematics lessons more that those with low self-assurance. Ashad et al. (2015) also assessed the relationship between self-regard and academic performance, and found that there was a strong positive relationship between self-regard and academic performance. Despite these findings, other studies found contrasting evidences. Kariuki et al. (2017) for example found no relationship between self-regard and academic performance. They concluded that self-regard does not influence students' academic performance. In view of the discrepancies in the conclusions, it is significant to examine if the recent trend of poor performance in mathematics among senior high school students in the Assin North District could be attributed to students' self-assurance.

Aside student related factors, research acknowledges the contribution of the mathematics teacher towards the performance of students at the senior high school level. For example, Siachifuwe (2017) examined the influence of teacher related factors on pupils' academic performance. It was revealed that the unsatisfactory academic performance of learners was due to some of the teacher lack of motivation, inadequate teacher preparedness, teacher lack of punctuality, non-availability of teaching resources and non-marking of learners' exercises. Teachers' understanding of mathematical concepts and their ability to effectively communicate mathematical knowledge to students is critical for student success (Hill et al., 2008). Teachers who demonstrated strong social relationship with students creates tension-free classroom environment serving as a motivation factor for students to learn (Ozcan, 2021). This helps reduce mathematics anxiety and as a result serve as a positive motivation to achieve well in mathematics. Positive teacher-student interaction also improves students' attitude towards school and learning. Yunus et al. (2011) found student motivation and teacher-student relationship as the major determinant of academic achievement. This very vital to the success of learning so much attention should be paid to it. Also, Kimani et al. (2013) suggests that teacher-based factors do have an influence on academic achievement. They mention teacher's workload and teaching methods as factors that affect mathematics achievement. On the contrary, they found that, teachers' qualification and experience do not significantly affect achievement. This review of literature suggests that not all teacher related factors significantly affect students' mathematics performance.

There also school related factors which are noted to have effect on students' mathematics performance. In Ghana, senior high schools are categories into low and high performing schools based on the overall performance of candidates in the national examinations as well as school environment. Students' performance in Mathematics is key in the categorization. In the Assin North District, all three senior high schools are categorized as category C indicating average performing schools with poor teaching and learning resources. Availability of adequate resources, such as textbooks, technology, and learning materials, are essential for supporting effective mathematics instruction. Limited resources can hinder student learning and widen achievement gaps (Baker, Sciarra, & Farrie, 2018). A positive school environment, characterized by high expectations and supportive relationships, can contribute to improved mathematics performance (Thapa, Cohen, Guffey, & Higgins-D'Alessandro, 2013). Conversely, a negative school climate can undermine student engagement and achievement.

In the literature reviewed, it appears that the issues of gender, self-regard, self-assurance, teacher knowledge, teacher methods, teaching resources and school environment may be significant factors affecting students' performance in mathematics. With the recent trend of poor performance in mathematics recorded in both district and national performance statistics in the Assin North District, this present study examined the gender factor and other significant factors causing disparities in mathematics performance among high school students.

### 3. Methodology

The study utilized a cross-sectional survey design to investigate gender and other influential factors contributing to disparities in mathematics performance among high school students in the Assin North District of Ghana. The initial target population of 526 final-year students was refined to 500 after excluding 26 students with inconsistent attendance records, based on data obtained with appropriate approvals. Data were collected through a 50-item Mathematics Achievement Test and a 27-item questionnaire, capturing information on student-related, teacher-related, and school-related factors, as well as demographics. Both instruments underwent rigorous validation, with content validity aligned to conceptual definitions, criterion validity assessed through multi-collinearity, and reliability confirmed with a Cronbach's alpha coefficient of 0.679. The data analysis encompassed descriptive statistics to outline demographics and test score distribution, an independent samples t-test to determine gender differences in mathematics performance, and binary Probit regression analysis to evaluate factors affecting students' success or failure in mathematics. This comprehensive methodology aimed to provide an in-depth understanding of gender disparities and multifactorial influences on mathematics performance within the specific context of the Assin North District.

### 4. Study Findings

The study examined the gender differences in senior high school students' performance as well as the factors significantly affecting their mathematics performance. Table 1 shows the distribution of gender and age ranges of students in the study.

**Table.1.** Demographic characteristics of the students

| Variable         | Frequency | %     |
|------------------|-----------|-------|
| <b>Gender</b>    |           |       |
| • Male           | 248       | 49.6  |
| • Female         | 252       | 50.4  |
| <b>Age range</b> |           |       |
| • 13 – 15 years  | 59        | 11.8  |
| • 16 years above | 441       | 88.2  |
| Total            | 500       | 100.0 |

Table 1 shows that 49.6% of the students were males while 50.4% were female students. This means that the males and females in the study are relatively comparable. Furthermore, a large proportion of the students (88.2%) were 16 years and above with a few (11.8%) within the age of 13 and 15 years.

#### Gender difference in mathematics performance

The achievement test in Mathematics was conducted on a sample of 500 students. The test was scored out of 100. The means and standard deviations of the students by gender are displayed in Table 2.

**Table.2.** Distributions of Descriptive statistics of test scores of students by gender

| Gender | N   | Mean | Std. deviation |
|--------|-----|------|----------------|
| Male   | 248 | 39.0 | 10.5           |
| Female | 252 | 32.0 | 8.3            |
| Total  | 500 | 35.5 | 12.1           |

Table 2 shows that, out of total possible score of 50, the overall mean score for the students was of 35.5 with a rather wide standard deviation of 12.1. This indicates that the students performed averagely well although there is a widespread variability. In terms of gender, the mean score of male students (39.0) was higher than that of female students (32.0). In particular, the mean score difference of 7.0 was found between the males and females. In terms of performance variability, the standard deviation of the males (10.5) was quite wider than that of the females (8.3). This means that while the variations in the scores of the males were widespread, the scores of the females were relatedly clustered around 32.0 score. To determine any statistically significant difference between the mean score of the males and females, an independent-samples t-test was conducted on the achievement test scores of the students. Prior to the analysis, the Levene's Test for Equality of Variance was examined to check the key assumption that the variances of the two groups were equal. The result yielded an F-value of 3.51 corresponding to a p-value of .006 which indicated that the assumption of equal variances was not supported. Hence, as an alternative, the interpretation of the t-test result was based on equal variance not assumed as shown in Table 3

**Table.3.** Summary of independent-samples t-test statistics

| Levene's Test for Equality of Variance |             | t-test for Equality of Means |      |       |      |      |
|--|-------------|------------------------------|------|-------|------|------|
| Equal variance                         |             | F                            | Sig. | df    | T    | Sig. |
|  | Assumed     | 3.516                        | .006 | 4847  | 1.44 | .006 |
| Achievement Test in Mathematics Score  | Not assumed |                              |      | 4.329 | 1.34 | .004 |

The t-test for equality of means resulted in a t-value of 1.44 with a p-value of .006. This shows that there is a statistically significant difference between the mean scores of male and female students. The mean difference between the two groups was 7.06, indicating that on the average, female students scored slightly lower on the test than male students.

**Significant Factors Affecting Performance in Mathematics**

A probit regression analysis was performed to test any statistically significant effect of student related factors, teacher related factors and school related factors on mathematics performance of the students.

The result of the analysis is presented in Table 4.

**Table.4.** Regression analysis of effect of factors on students' performance in Mathematics

| Factors                            | Coefficients | Std. error | z-score | p-value |
|------------------------------------|--------------|------------|---------|---------|
| Constant                           | 2.60         | 1.39       | 1.88    | .061    |
| <i>Student related factors</i>     |              |            |         |         |
| • Self-assurance                   | .27          | .11        | 2.40    | .016*   |
| • Self-regard                      | -.23         | .08        | -2.92   | .003*   |
| • Socioeconomic background         | .06          | .03        | .642    | .104    |
| <i>School related factors</i>      |              |            |         |         |
| • School environment               | -.44         | .10        | -2.70   | .004*   |
| • Teacher motivation               | 1.24         | .67        | 1.67    | .003**  |
| • Teaching resources               | .06          | .02        | .675    | .078    |
| <i>Teacher related factors</i>     |              |            |         |         |
| • Teacher subject matter knowledge | .32          | .20        | 1.65    | .006*   |
| • Teaching methods                 | -.78         | .36        | -2.60   | .003*   |
| • Teacher-pupil interaction        | -.70         | .24        | -2.62   | .004    |

Significant level of .05 \*\*Significant level .001

As shown in Table 4, at .05 level of significance, student self-assurance ( $p=.016<.05$ ) and self-regard ( $p=.003<.05$ ) affect mathematics performance of senior high school students in the Assin North District. Students' socioeconomic background ( $p=.104>.05$ ) however did not significantly affect performances in mathematics. In terms of school related factors, school environment ( $p=.004<.05$ ) and teacher motivations ( $p=.003<.05$ ) had significant effect on students' mathematics performance. However, though teaching resources ( $p=.078>.05$ ) contributed to students performance in mathematics, they effect was not significant at .05 significance level. With regards teacher related factors affecting performance, the results shows that teacher subject matter knowledge ( $p=.006<.05$ ), teacher methods of teaching ( $p=.003<.05$ ) and teacher-pupil interaction ( $p=.004<.05$ ) significantly affect students' performance in mathematics.

## 5. Discussion and Conclusion

The study's findings reveal a significant gender difference in mathematics performance among senior high school students in the Assin North District. The mean score of male students was notably higher than that of female students, with a mean difference of 7.0. This result is consistent with previous research that has identified gender disparities in mathematics achievement (Adeyemo, Aina, & Akinbobola, 2013; Meyer, 2016). The statistical significance of this difference, as evidenced by the t-test result (t-value of 1.44, p-value of .006), underscores the importance of addressing gender-related factors in mathematics education. The wider standard deviation among male students suggests a more diverse range of performance within this group, whereas female students' scores were more clustered around the mean. This may indicate underlying factors that constrain female students' performance, such as societal attitudes, cultural beliefs, and stereotypes (Nyarko & Asare, 2018). The regression analysis identified self-assurance and self-regard as significant student-related factors affecting mathematics performance. Positive self-assurance was associated with better performance, while negative self-regard was linked to lower performance. These findings align with the broader literature on the role of self-efficacy and self-concept in academic achievement (Bandura, 1997). Interestingly, students' socioeconomic background did not significantly affect performance, contrary to some previous studies that have found a link between socioeconomic status and academic success (Sirin, 2005). School environment and teacher motivation were found to have a significant effect on students' mathematics performance. A negative school environment and lack of teacher motivation were associated with lower performance. These findings emphasize the importance of fostering a supportive learning environment and motivating teachers, as they play a crucial role in students' academic success (Hattie, 2012). Teaching resources, although contributing to performance, were not significant at the 0.05 level, suggesting that other factors may have a more pronounced impact.

Teacher subject matter knowledge, teaching methods, and teacher-pupil interaction were all found to significantly affect students' performance in mathematics. These results highlight the critical role that teachers play in shaping students' learning experiences and outcomes. Effective teaching methods and positive teacher-pupil interactions can enhance understanding and engagement, leading to better performance (Darling-Hammond, 2000). This study provides valuable insights into the gender disparities in mathematics performance and the multifaceted factors that influence students' achievement in the Assin North District. The findings underscore the need for targeted interventions that address gender differences, enhance students' self-assurance and self-regard, improve school environments, motivate teachers, and promote effective teaching practices. Educational stakeholders, including policymakers, educators, and administrators, should consider these findings in designing and implementing strategies to enhance mathematics education. Future research could further explore the underlying mechanisms that contribute to these observed patterns and evaluate the effectiveness of interventions aimed at reducing gender disparities and improving overall mathematics performance.

## 6. Recommendation

This present study also added to existing evidence that the gender disparity in mathematics achievement in Assin North and in Ghana as a whole requires a collaborative effort from school authorities, teachers and the students themselves. Therefore, the study recommends that:

- School authorities should prioritize gender equity issues and implement policies that promote equal access to quality mathematics education. This may include adopting interventions such as mentorship programs and financial support for girls pursuing studies in mathematics related programs.
- Mathematics teachers should be equipped with the necessary skills and knowledge to teach mathematics effectively using gender responsive pedagogies. This can be achieved through targeted professional development programs and ongoing support for teachers to enhance their teaching practices. Furthermore, teachers should be encouraged to create a supportive community learning environment to promote their confidence and engagement in mathematics for all students.

## References

- [1]. Adeyemo, S. A., Aina, J. K., & Akinbobola, A. O. (2013). Gender and achievement in mathematics among senior secondary school students in Lagos State, Nigeria. *Gender & Behaviour*, 11(1), 5189-5196.
- [2]. Akbari, O., & Sahibzada, J. (2020). Students' Self-Confidence and Its Impacts on Their Learning Process. *American International Journal of Social Science Research*, 5(1), 1–15. <https://doi.org/10.46281/aijssr.v5i1.462>
- [3]. Akyeampong, K., Amidu, A. R., & Osae, E. K. (2007). Participation in science, mathematics and technical education in Ghana: Analysis of policy and realities. *CREATE*, 1(1), 1-36
- [4]. Akyeampong, K., & Stephens, D. (2011). Access, participation and progression in science and mathematics education in Sub-Saharan Africa: a literature review. *International Journal of Educational Development*, 31(6), 528-536.
- [5]. Arshad, M., Muhammad, S., & Zaidi, I. (2015). Self-Esteem & Academic Performance among University Students. *Journal of Education and Practice*, 6(1).
- [6]. Assin North District Education Directorate (2022) Assin North Education Directorate 2022 Annual Report. GES, AS: Ghana Education Service.
- [7]. Bandura, A. (1997). *Self-Efficacy; The Exercise of Control*, VV. H. Freernan, 8.
- [8]. Baker, B. D., Sciarra, D. G., & Farrie, D. (2018). *Is School Funding Fair? A National Report Card*. Newark, NJ: Education Law Center.
- [9]. Baiden, P., & Ahiakpor, F. (2017). Gender differences in mathematics performance: The case of Ghanaian Senior High Schools. *Journal of Education and Practice*, 8(11), 48-57.
- [10]. Darling-Hammond, L. (2000). Teacher quality and student achievement. *Education policy analysis archives*, 8, 1-1.
- [11]. Farooq, M. S., Chaudhry, A. H., Shafiq, M., & Berhanu, G. (2011). Factors affecting students' quality of academic performance: A case of secondary school level. *Journal of Quality and Technology Management*, 7(2), 1-14.
- [12]. Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. Routledge.
- [13]. Hill, H. C., Blunk, M. L., Charalambous, C. Y., Lewis, J. M., Phelps, G. C., Sleep, L., & Ball, D. L. (2008). Mathematical Knowledge for Teaching and the Mathematical Quality of Instruction: An Exploratory Study. *Cognition and Instruction*, 26(4), 430–511. <https://doi.org/10.1080/07370000802177235>
- [14]. Kimani, G., Kara, A., & Njagi, L. (2013). Teacher factors influencing students' academic achievement in secondary schools in Nyandarua county, kenya. *International Journal of Education and Research*, 1(3).
- [15]. Kariuki, R. N. (2018). *Association between Self-Esteem and Happiness among Tangaza University College Student: A Comparative Study between the Lay and Religious* (Doctoral dissertation, Tangaza University College).
- [16]. Mathematics in Ghana. (n.d.). UNESCO Institute for Statistics. Retrieved from <https://uis.unesco.org/en/country/gh>.
- [17]. Mohammed, Y. A., & Kpakpo, S. B. (2021). Gender gaps in math education: Ghanaian senior high schools as a case study. *International Journal of Research in Education and Science (IJRES)*, 7(2), 523-534.
- [18]. Meyer, H. (2016). Gender disparities in mathematics in Ghana: An analysis of WASSCE results. *Journal of Education and Practice*, 7(12), 71-76.
- [19]. Nyarko, K., & Asare, P. (2018). Attitudes toward mathematics: The gender perspective. *International Journal of Education and Practice*, 6(5), 258-263.
- [20]. Oduro, G. K., Amankwaa, A. A., & Boateng, K. (2018). Gender disparity and student academic performance in Ghanaian tertiary institutions. *Journal of Education and Learning*, 7(3), 91-100.
- [21]. Ofori-Attah, K. (2018). Attitudes of senior high school students towards mathematics: the gender factor. *Africa Education Review*, 15(1), 65-85Z
- [22]. Ozcan, M. (2021). Factors Affecting Students' Academic Achievement according to the Teachers' Opinion. *Education Reform Journal*, 6(1), 1–18. <https://doi.org/10.22596/erj2021.06.01.1.18>
- [23]. Siachifuwe, M. (2017). Teacher Based Factors Influencing Academic Performance among Learners in Open Learning Classes at Twin Palm Secondary School, Lusaka, Zambia. *International Journal of Humanities, Social Sciences and Education*, 4(12). <https://doi.org/10.20431/2349-0381.0412012>
- [24]. Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research*, 75(3), 417-453.
- [25]. Thapa, A., Cohen, J., Guffey, S., & Higgins-D'Alessandro, A. (2013). A review of school climate research. *Review of Educational Research*, 83(3), 357-385.

- [26]. Yunus, M. M., Osman, W. S. W., & Ishak, N. M. (2011). Teacher-student relationship factor affecting motivation and academic achievement in ESL classroom. *Procedia - Social and Behavioral Sciences*, 15(15), 2637–2641. <https://doi.org/10.1016/j.sbspro.2011.04.161>
- [27]. Zhao, Y., Zheng, Z., Pan, C., & Zhou, L. (2021). Self-Esteem and Academic Engagement Among Adolescents: A Moderated Mediation Model. *Frontiers in psychology*, 12, 690828. <https://doi.org/10.3389/fpsyg.2021.690828>