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Gender Differences and Determinants of Mathematics Performance in Selected Public Secondary Schools in Morogoro Municipality

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Abstract: Mathematics performance remains a critical determinant of academic and career opportunities, yet gender disparities persist in many secondary schools, prompting an investigation into the factors influencing female students' achievement. This study examined gender differences and determinants of mathematics performance in selected public secondary schools in Morogoro Municipality. The study was guided by behavioural and cognitive learning theories. A mixed-method approach with a sequential explanatory design was employed. Data were collected from a sample of 299 students, 10 mathematics teachers, 10 parents, and 5 school heads. Schools were selected purposively, while convenience and snowball techniques were used to obtain participants. Data collection instruments included questionnaires (both closed - and open-ended), structured interviews, classroom observation, and document review. Quantitative data were analyzed using descriptive statistics with the help of Statistical Package for Social Science (SPSS) Version 26, while qualitative data were analyzed thematically. The findings revealed significant variations in mathematics achievement, with a girls-only school consistently achieving 100% pass rates, while other schools showed persistent gender disparities and low overall performance. Teacher support, personal motivation, peer collaboration, parental encouragement, and a positive learning environment emerged as key determinants of female students' success, whereas weak feedback, limited problem-solving practice, and minimal self-directed learning constrained performance in lower-performing schools. The study emphasizes scaling best practices through gender-responsive pedagogy, structured classroom strategies, and parental engagement.

Keyword : Gender disparities, Mathematics performance, Teacher support, Parental involvement, Secondary education. Tanzania

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INTRODUCTION

Mathematics has long been recognised as a cornerstone of formal education and a key driver of scientific and technological advancement. Historically, it has been viewed not only as a subject of numbers and calculations but as a discipline that shapes logical reasoning, analytical thinking and intellectual growth. Its role in supporting understanding in science-related fields and enhancing problem-solving skills has made it indispensable within modern curricula (Uwezo, 2011; Njiku, 2014; Tella, 2008; Muhawenimana P and Mutarutinya V, 2023; Aminus, 1990). Despite its

significance, mathematics continues to be perceived by many learners as difficult and intimidating, leading to persistent failure and low achievement, particularly among female students (Mzomwe, Y. M. et al., 2020).

The notion of gender in education is understood as the socially and culturally constructed roles and expectations that influence how males and females experience learning opportunities and academic engagement (Fennel and Arnot, 2008; Akena and Amos, 2020). Within this framework, gender disparities in mathematics performance are not interpreted as a result of inherent intellectual differences but rather as outcomes shaped by socialisation, classroom interactions, teacher expectations, cultural beliefs and institutional practices. Several studies have shown that male students generally outperform female students in mathematics at secondary and higher levels, while females often demonstrate lower confidence, reduced participation and negative perceptions towards the subject (Majids., Nasoro M, 2017; Msekwa J., Komba D, 2016; Owiti, 2011). These patterns reflect long-standing global trends in which mathematics has been culturally constructed as a male-oriented domain.

Over time, international assessment reports such as PISA 2019 and studies by Hyde and Mertz (2009) have demonstrated that performance differences between boys and girls are closely linked to social and cultural influences, including stereotypes and bias, rather than biological limitations. Similar patterns have been observed in countries such as Spain, where women remain underrepresented in science and engineering-related fields due to weaker performance and participation in mathematics (MEFP, 2019; WEF, 2020). Research in Kenya and Nigeria further highlights that female students show lower confidence and achievement in mathematics compared to their male counterparts (Nginyi and Ogollah, 2017; Buseri and Ibeawuchi, 2016). These findings reveal that gender differences in mathematics performance remain a persistent global challenge.

In Tanzania, mathematics occupies a compulsory position in the curriculum and serves as a gateway subject for advancement in science, technology, engineering and mathematics (STEM). However, national examination results consistently show unsatisfactory performance, with female students recording lower pass rates than males, particularly in Basic Mathematics (ESDP, 2010; UNESCO, 2015; Masanja, 2010; Zilimu, 2014; Shelley Jones, 2016). Several factors have been associated with this situation, including inadequate teaching and learning resources, overcrowded classrooms, limited feedback practices, weak content mastery by teachers and negative learner attitudes towards mathematics (Mazana et al., 2019; Ajai and Imoko, 2015; Kyaruzi et al., 2019; O'Rourke and Prendergast, 2021). Although Tanzania is a signatory to international agreements promoting gender equality such as CEDAW, CRC, the Beijing Declaration and the SDGs, performance disparities in mathematics continue to persist (Jones S, 2016; Novatus Shayo, 2020).

Within Morogoro Municipality, this problem reflects the broader national situation. Public secondary schools record generally low achievement in mathematics, with female students particularly affected. Socio-cultural challenges such as domestic workload, limited parental involvement, traditional practices and negative attitudes towards the subject further compound the problem (Festus N., 2022; Mussa H., 2017). Data from NECTA and BEST reports show that female students consistently perform below their male counterparts in Basic Mathematics and other science subjects, reinforcing the visibility of gender imbalance in academic outcomes in the region.

Despite numerous national and NGO-led initiatives such as scholarships for girls, improved science laboratories, gender-sensitive STEM campaigns, and teacher professional development, gender disparities in mathematics performance remain evident in Tanzania. Although previous studies have explored general causes of these disparities, little is known about why some public secondary schools achieve higher mathematics performance among female students. The specific factors and strategies enabling girls to excel in these contexts remain underexplored.

This study therefore seeks to examine gender differences and the determinants of mathematics performance in selected public secondary schools in Morogoro Municipality. It aims to identify and compare trends in mathematics performance between male and female students and to explore the factors contributing to high mathematics achievement among female students in some of the selected schools. By focusing on both disparity and success, the study intends to provide insights that can inform policies and practices geared towards improving mathematics performance and promoting gender equity in secondary education.

Research objective

The specific objectives of this study were;

1. To identify and compare trends in mathematics performance between male and female students in selected public secondary schools in Morogoro Municipality.
2. To explore factors contributing to high mathematics performance among female students in some of the selected schools.

Literature review

1. Theoretical Literature Review

This study was guided by Behavioural Learning Theory by B. F. Skinner (1953) and Cognitive Learning Theory by L. Vygotsky (1978). Behavioural Learning Theory emphasizes how students acquire knowledge and skills through interactions with their environment, highlighting the role of reinforcement in shaping behaviour. Positive reinforcement, such as praise or rewards, increases the likelihood of repeating desired behaviours, while negative reinforcement or punishment decreases undesirable behaviours. In the context of this study, the theory helps to explore how

teachers, parents, and peers may reinforce or discourage mathematics learning differently for male and female students. The theory provides a structured approach to classroom management, motivation, and performance evaluation, suggesting that reinforcement schedules can influence student engagement and achievement. However, its limitations include an overemphasis on external motivation, neglect of cognitive processes, and insufficient consideration of individual differences in learning styles, which are critical in mathematics education (Eccles et al., 2011).

Cognitive Learning Theory, also known as socio-cultural theory, focuses on the role of social interactions, cultural influences, and the Zone of Proximal Development (ZPD) in learning. According to Vygotsky (1978), students achieve higher levels of understanding when supported by a more knowledgeable other, such as a teacher, parent, or peer. Scaffolding, derived from ZPD, involves guiding learners step by step to expand their knowledge, providing regular feedback, and encouraging problem-solving skills. In mathematics education, this theory highlights how structured support, collaborative learning, and targeted guidance can enhance students' understanding, confidence, and performance. Its limitations include difficulty in precisely measuring ZPD, dependence on teacher skill, and variability in social support across classrooms. Nevertheless, it is valuable for this study in examining how teacher support and collaborative learning environments contribute to mathematics achievement and help address gender disparities in performance.

2. Empirical Review

Mathematics is a critical subject underpinning higher education and careers in fields such as medicine, ICT, and engineering, making it essential for students' future opportunities (Laurent, 2024). Despite its importance, gender disparities in mathematics performance persist globally, regionally, and locally, with female students often underperforming relative to their male peers. While international assessments indicate a narrowing of the gender gap in some countries at the primary level, disparities remain pronounced at the secondary school level, particularly in public schools where socio-cultural and school-related factors influence performance (UNESCO, 2022). Studies in East Africa have also highlighted similar patterns. For example, research by Musimenta and Sekiwu (2020) in Uganda challenged the assumption that gender determines mathematics ability, showing that performance variations were not inherently gender-based, while Kyaruzi (2023) found that in Tanzania male students consistently outperformed female students, partly due to perceptions of mathematics as a masculine subject and unequal domestic responsibilities. National statistics confirm these disparities: BEST (2022) reports that female students' average pass rate in the Certificate of Secondary Education Examination (CSEE) remains significantly lower than that of male students (14.8% versus 23.1%), though localized success stories exist where female students achieve

exceptional results. These observations highlight the need for school-level, context-specific investigations that can uncover practical strategies for improving female students' mathematics performance in specific settings such as Morogoro Municipality.

Research has also explored factors that contribute to female students' high achievement in mathematics. Evidence from studies in Tanzania, Kenya, and other countries indicates that a supportive learning environment, positive teacher attitudes, parental encouragement, peer support, and access to mentorship and role models play a significant role in fostering success (Kadriye et al., 2005; Mwangi, 2018; Mbelwa and Ismail, 2019). Targeted interventions such as remedial classes, gender-sensitive teaching materials, integrated gender in science and technology with gender responsive pedagogy, STEM clubs, mixed-gender classroom participation, and active parental involvement have been shown to enhance confidence, motivation, and engagement among female students (Kadzamira, 2006; Kimaro and Machumu, 2015; Osaki, KM 2005; UNICEF, 2020; Danielsen et al., 2010; Eccles and Roeser, 2011). These findings underscore the importance of examining specific school-based practices that enable female students to excel, particularly in environments where gender stereotypes and socio-cultural barriers persist. By focusing on high-performing schools in Morogoro Municipality, the present study seeks to identify and document the strategies, structures, and support systems that contribute to female students' success in mathematics, providing actionable insights for reducing gender disparities and improving overall student outcomes.

METHODOLOGY

This study employed a mixed-methods approach with a sequential explanatory design to investigate gender disparities in mathematics performance and factors contributing to female students' high achievement in selected public secondary schools in Morogoro Municipality. Five schools with varied performance levels were purposively selected**,** and participants were chosen using convenience and snowball sampling to ensure representativeness. The total sample size comprised 299 students, 10 parents, 10 mathematics teachers, and 5 school heads**.** Quantitative data were collected from NECTA statistics and questionnaires to analyze performance trends and students' attitudes toward Mathematics subject, while qualitative data were obtained through structured interviews, classroom observations, and document reviews to explore effective teaching strategies and school practices that enhance female students' success in mathematics. The instruments were piloted to ensure validity and reliabilit**y**, and data were analyzed using descriptive statistics for quantitative findings and thematic analysis for qualitative insights. Ethical considerations, including informed consent, confidentiality**,** anonymity, and respect for participants' rights**,** were strictly observed throughout the study.

RESULTS AND DISCUSSIONS

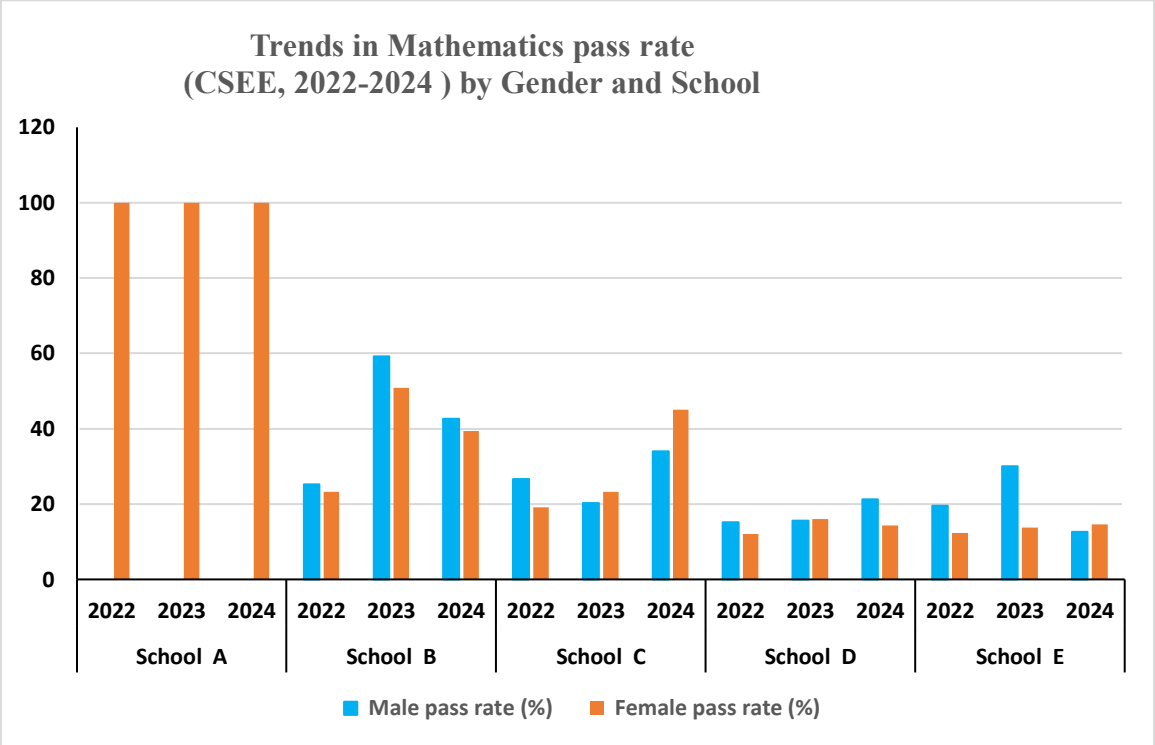
Trends in Mathematics Performance in Selected Secondary Schools in Morogoro unicipality

The first objective of this study was to identify and compare trends in mathematics performance in schools where female students excelled and where they lagged behind. This section presents and compares the performance trends of female students in mathematics from five selected public secondary schools over three consecutive years (CSEE, 2022 – 2024). The trends in mathematics performance were shown in the Table 1 and Figure 1 below.

Table 1. Trends in Mathematics Performance in Selected Secondary Schools (CSEE 2022-2024) in Morogoro Municipality.

School	Year	Number of Candidates			Candidate Average Pass					Grade
		Male	Female	Total	Male	%	Female	%	Total	
School A	2022	0	87	87	0	0	87	100	87	B
	2023	0	112	112	0	0	112	100	112	B
	2024	0	113	113	0	0	113	100	113	B
School B	2022	159	180	339	40	25.2	42	23.3	82	F
	2023	169	153	322	100	59.2	78	50.9	178	D
	2024	188	198	386	80	42.6	78	39.4	158	D
School C	2022	112	136	248	30	26.7	26	19.1	56	F
	2023	173	203	376	35	20.2	47	23.2	82	F
	2024	88	82	170	30	34	37	45.1	67	F
School D	2022	66	83	149	10	15.2	10	12	20	F
	2023	90	106	196	14	15.6	17	16	31	F
	2024	165	161	326	35	21.2	23	14.3	58	F
School E	2022	113	153	266	22	19.5	19	12.4	41	F
	2023	160	153	313	48	30	21	13.7	69	F
	2024	111	137	248	14	12.6	20	14.6	34	F

Source: NECTA (CSEE, 2022-2024)



Source: Researcher (2025)

Figure 1.
Mathematics Pass Rate (CSEE, 2022-2024) by Gender and School

The analysis of Table 1 and Figure 1 highlights significant variations in mathematics performance between male and female students across the selected public secondary schools in Morogoro Municipality. School A, a girls-only institution, consistently demonstrated outstanding performance, with 100% of candidates passing mathematics from 2022 to 2024 and achieving an average grade of B. Interviews with mathematics teachers and the school head revealed that this success was supported by targeted teaching strategies, remedial classes, mentorship programs, and a culture of high expectations for female students. Classroom observations confirmed active student engagement, frequent formative feedback, and collaborative learning practices that reinforced understanding. Document reviews of lesson plans and student exercise books showed structured curriculum coverage and systematic assessment, which together created a supportive academic environment conducive to female students' mastery of mathematics.

In contrast, School B recorded moderate performance with persistent gender disparities. Female pass rates increased from 23.3% in 2022 to 39.4% in 2024, while male pass rates ranged from 25.2% to 42.6%. Interviews with teachers indicated that female students faced challenges including low confidence, limited parental support, and socio-cultural expectations, although some students received targeted encouragement. Classroom observations noted that while teaching was generally interactive, female participation remained lower than males, particularly in problem-

solving activities. Document reviews revealed uneven coverage of the syllabus and gaps in remedial support, which partially explains the continued gender gap despite improvements. School C presented a positive trend where female students progressively closed the gender gap and even surpassed male students in 2024, with pass rates of 45.1% compared to 34.0% for males. Observations and interviews indicated that targeted academic support, peer collaboration, and teacher scaffolding contributed to this improvement.

Schools D and E consistently recorded low mathematics performance across both genders, with female students lagging behind males. Interviews highlighted challenges such as inadequate teaching resources, high student-teacher ratios, and limited encouragement for female learners. Classroom observations confirmed minimal student participation, with teachers relying heavily on lecture methods and little formative feedback. Document reviews further revealed incomplete lesson coverage and insufficient assessment practices. Overall, these findings suggest that female students' success in mathematics is highly context-dependent, influenced not only by quantitative outcomes but also by qualitative factors such as teaching strategies, classroom engagement, school leadership, and learning resources. The exceptional performance in School A demonstrates that with targeted interventions, supportive environments, and gender-sensitive teaching, female students can achieve equal or higher performance than male students. Policy implications include scaling up best practices from high-performing schools to weaker schools, promoting parental involvement, mentorship, and teacher training in gender-sensitive pedagogy to reduce disparities and enhance STEM participation among female students.

Factors contributing to High Mathematics Performance by Students

Student respondents were asked to indicate the extent to which various factors contributed to their performance in mathematics including teachers 'supports ,parental encouragement, access to learning resources, peer support and personal motivation. Both multiple responses and Likert scale questions from students' questionnaire guide were used. The multiple responses question asked what factors you think influence female students' performance in mathematics (Table 2).

Table 2. Influential Factors Frequencies

Influential factors' Frequencies

		Responses		
		N	**Percent**	**Percent of Cases**
Influential– factors	Teacher support influence on female students' mathematics performance	152	31.0%	50.8%
	Patents' encouragement influence on female students' mathematics performance	108	22.0%	36.1%
	Peer support influence on female students mathematics performance	61	12.4%	20.4%
	Personal interest (efficacy) influence on female students mathematics performance	143	29.1%	47.8%
	Others.	27	5.5%	9.0%
Total		491	100.0%	164.2%

Source: Researcher (2025)

The findings revealed that teacher support emerged as the most frequently mentioned factor contributing to female students' mathematics performance, cited by 31.0% of respondents, followed closely by personal interest (29.1%) and parental encouragement (22.0%). Peer support accounted for 12.4%, while other factors such as being hardworking were noted by 5.5% of respondents. These results underscore the pivotal role of teachers in shaping academic outcomes, particularly for female students, while also highlighting the importance of intrinsic motivation and self-efficacy, which according to Bandura (1997), are critical predictors of achievement in mathematics. The data suggest that improving female students' performance requires a multifaceted approach that strengthens teacher effectiveness, fosters parental involvement, and nurtures students' internal drive and confidence.

Further insights emerged from students' responses on classroom dynamics, which explored mechanisms contributing to high mathematics performance. The majority of students reported that classroom activities strongly influenced their knowledge acquisition and motivation to learn mathematics, with 81.3% indicating these factors impacted them "much" or "very much." Peer discussion in small groups also received strong support, with 68.8% positive responses, while female students' participation was positively rated by 56.3% of respondents. Classroom observations in School A and, to a lesser extent, School C confirmed these findings, showing that female students actively engaged in lessons, asked questions, and collaborated confidently in problem-solving activities. Structured group discussions and

supportive interactions, consistent with Vygotsky's socio-cultural theory, were observed to scaffold learning and build confidence among female learners.

However, some areas limited student attainment. Problem-solving skills were reported as insufficiently developed (31.3% positive), constructive feedback was weak (18.8% positive), and opportunities for self-directed learning were minimal (6.3% positive). Classroom observations and document reviews revealed that in low-performing schools, such as School D and School E, exercise books were rarely marked, lesson plans were inconsistently implemented, and students lacked practice with non-routine problems. Addressing these gaps through formative assessment, structured peer learning, problem-solving pedagogy, and goal-setting routines could enhance mastery and confidence in mathematics for female students.

Students also highlighted the broader school environment and home support as influential. Nearly all respondents (100%) agreed that both male and female students receive equal learning opportunities, and 87.6% confirmed that their school environment supports academic success, reflecting progress toward gender equality. Approximately 87.6% believed female students could perform equally well as male students, while 75.5% reported that teachers encourage both genders. Despite this progress, a small proportion of students still held neutral or negative views regarding gender and mathematical ability, and only 29.4% reported receiving adequate home support, indicating that lack of parental involvement remains a barrier. Parental questionnaires further reinforced this point: 70% of parents reported providing encouragement and motivation, 60% offered learning facilities, and 60% helped with homework and nurtured interest in mathematics. Nonetheless, only 40% regularly attended parent-teacher meetings, suggesting gaps in home-school collaboration, especially in lower-performing schools.

Collectively, these findings highlight that female students' success in mathematics is influenced by a combination of teacher support, classroom practices, peer interaction, personal motivation, and parental involvement. Qualitative observations and document reviews confirm that schools providing structured teaching, scaffolding, and equitable learning environments achieve stronger outcomes for female students. To sustain and scale these gains, policy and practice interventions should focus on strengthening teacher training, promoting gender-responsive pedagogy, formalizing peer-learning strategies, enhancing feedback mechanisms, and increasing parental engagement to create conditions where female students can excel in mathematics across all schools.

Discussion of the Findings

The analysis of mathematics performance trends across selected secondary schools in Morogoro Municipality revealed significant variations both between schools and between genders. School A, a girls-only institution, consistently achieved

a 100% pass rate over the three-year period, demonstrating that female students can excel in mathematics when provided with a supportive learning environment. These findings are consistent with the Behavioural Learning Theory (Skinner, 1953), which emphasizes the role of reinforcement in shaping student behaviour. Interviews and classroom observations confirmed that School A employed positive reinforcement strategies, including praise, rewards, remedial classes, mentorship, and structured feedback, which reinforced students' engagement and mastery of mathematical concepts. Similarly, Cognitive Learning Theory (Vygotsky, 1978) explains how scaffolding, peer collaboration, and guided problem-solving observed in School A facilitated deeper learning, particularly for female students, allowing them to achieve performance outcomes equal to or surpassing male students in coeducational settings.

In schools with moderate performance, such as School B and School C, female students exhibited gradual improvement, though gender disparities persisted. The findings from interviews, classroom observations, and document reviews indicate that female students in these schools benefitted from targeted academic support, peer discussions, and teacher scaffolding, which contributed to enhanced motivation and problem-solving confidence. These qualitative insights align with the empirical literature emphasizing the importance of teacher support, parental encouragement, and positive peer influence in fostering female students' mathematics achievement (Kadriye et al., 2005; Mwangi, 2018; Mbelwa & Ismail, 2019). However, persistent gaps in teacher encouragement, constructive feedback, and self-directed learning, particularly in problem-solving, limited female students' attainment. This resonates with the Behavioural Learning Theory's caution that reinforcement must be timely and contextually meaningful to produce consistent improvements in student performance.

Conversely, schools D and E demonstrated persistent low performance across both genders, with female students lagging slightly behind males. Observations revealed limited participation, heavy reliance on teacher-centered methods, minimal peer interaction, and inconsistent assessment practices. Document reviews further indicated incomplete syllabus coverage and lack of structured feedback, reflecting contextual barriers to learning such as inadequate teaching resources, high student-teacher ratios, and socio-cultural factors that constrain female participation in mathematics. These findings reinforce previous research by Kyaruzi (2023) and UNESCO (2022), which highlighted socio-cultural attitudes and resource limitations as key factors underlying gender disparities in mathematics performance. Quantitative data from student and parent questionnaires further confirmed that teacher support, personal interest, and parental encouragement were the primary contributors to high mathematics performance, while classroom practices such as collaborative learning, motivation, and peer discussions were critical enablers, consistent with Cognitive Learning Theory.

The findings suggest that female students' mathematics success is highly context-dependent, influenced by the interaction of school-level support, classroom pedagogy, teacher reinforcement, peer collaboration, personal motivation, and parental involvement. The exceptional performance in School A illustrates that, with structured teaching, gender-sensitive strategies, and a supportive environment, female students can excel in mathematics. Conversely, low-performing schools highlight the need for interventions that address resource gaps, improve formative assessment, promote self-directed learning, and enhance teacher capacity in gender-responsive pedagogy. These results support the conceptual framework guiding this study, which emphasizes the combined influence of school, home, and individual factors on student mathematics achievement (Researcher, 2025). Policy and practice implications include scaling up best practices from high-performing schools, strengthening teacher training programs, formalizing peer-learning strategies, enhancing feedback mechanisms, and fostering greater parental engagement to reduce gender disparities and improve overall STEM participation among female students.

CONCLUSION

Female students' performance in mathematics is significantly shaped by teacher support, classroom practices, peer interactions, personal motivation, and parental involvement. Schools that provide structured teaching, active scaffolding, equitable learning opportunities, and consistent positive reinforcement, such as School A, enable female students to achieve at levels equal to or higher than their male peers. In contrast, schools with limited resources, minimal teacher encouragement, weak formative feedback, and low parental engagement, like Schools D and E, experience persistent low performance and widening gender disparities. These findings indicate that gender differences in mathematics achievement are largely influenced by contextual and environmental factors rather than inherent ability, emphasizing the importance of supportive teaching and learning environments alongside motivated and confident learners.

To improve female students' mathematics performance, a multifaceted approach is essential. Schools should adopt gender-responsive teaching strategies, strengthen formative assessment and feedback, and formalize structured peer-learning activities to encourage participation and build confidence. Teachers require continuous professional development in scaffolding, problem-solving pedagogy, and motivation techniques. Parental engagement should be enhanced through support with homework, encouragement, and involvement in school activities. At the policy level, educational authorities should replicate best practices from high-performing schools, provide targeted resources to low-performing institutions, and implement mentorship programs that promote female students' participation in STEM subjects.

Together, these interventions can reduce gender disparities, foster equitable learning opportunities, and empower female students to achieve excellence in mathematics.

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