Unraveling Factors for Gender Discrepancies in Students' Mathematics Performance in Tanzanian Secondary Schools

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Abstract

This study investigated the factors leading to gender discrepancies in students' Mathematics performance and how they could be addressed. Data were collected from 762 Form Four students sampled from 83 public secondary schools in Tanzania and analyzed using descriptive statistics, latent mean analyses and thematic analysis techniques. Quantitative results indicated that students evaluated their Mathematics teachers' instructional practices positively across gender. Qualitative results showed that students had gendered perceptions toward Mathematics and perceived it as a masculine subject. Further, findings unveiled that students' masculine orientation toward Mathematics was partly attributed to a biased distribution of domestic chores, social persuasions about girls' ability in Mathematics and restrictive parenting of girls. Also, the findings indicated that gender discrepancies in Mathematics performance could be addressed by providing gender education to teachers and parents, availing adequate learning resources and creating supportive home learning environments for girls. Based on the findings, practical and theoretical implications are drawn.

***Keywords*:** *gender discrepancies, mathematics performance, secondary schools, students*

Introduction

Education systems across countries emphasize Mathematics competencies at various levels of education. Such emphasis hinges on the potential benefits of Mathematics in transforming the nation's social, political and technological development. Mathematics is globally appreciated as a subject that everyone must learn to acquire a range of mathematical skills applicable to various sectors of life (Pais, 2013). Mathematics is also recognized as the language of science and the

source of logical thinking, a gateway to Science, Technology, Engineering and Mathematics (STEM) careers (Douglas & Salzman, 2020) and a subject that builds foundational skills for entrepreneurial competence (Malik & Malik, 2014). The substantial role of Mathematics has made most education systems turn it into a compulsory subject especially at the basic education levels to equip learners with essential mathematical competencies for their wellbeing. Despite the significant emphasis on Mathematics education, students' poor performance has been evident in various Middle East countries (Poorghorban et al., 2018) and Sub-Saharan countries (Mazana et al., 2019). Globally, the Programme for International Student Assessment (PISA) (2019) indicates that students perform relatively poorly in mathematical competences. Students' performance in Mathematics has remained relatively poor in many countries and varies depending on the nature of learners and parents' social-economic status (Wang et al., 2014).

Gender discrepancies in students' Mathematics performance are a significant concern in most countries where boys' performance is relatively higher than that of girls (Ajai & Imoko, 2015). Previous studies report the prevalence of negative perceptions toward Mathematics as the key factor for gender differences in performance (Mazana et al., 2019; O'Rourke & Prendergast, 2021). Other studies in the Tanzanian context attribute students' failure in Mathematics to a lack of teaching and learning resources (Mazana et al., 2019), less formative teacher feedback practices (Kyaruzi et al., 2019) and large class sizes (Ajai & Imoko, 2015; Ministry of Education, Science and Technology-MoEST, 2020). In addition, Watt (2006) attributes students' poor performance in Mathematics to a lack of interest in the subject among students. While the potential causes of students' poor performance in Mathematics have received attention in the literature, reasons for gender discrepancies in students' Mathematics performance are not well articulated. So far, no study has systematically investigated the causes of gender discrepancies in students' Mathematics performance in Tanzanian secondary schools, which makes the research agenda for the present study.

Studies have shown that male dominance in Mathematics performance is not due to differences in ability but to the way boys and girls perceive Mathematics instructional practices among other reasons (Jones, 2016; Usher & Pajares, 2009). In that respect, Ajai and Imoko (2015) establish that girls and boys benefit equally in learning algebra when using a problem-based learning approach. As a result, a learner-centred approach to teaching is likely to reduce gender discrepancies in Mathematics. Gender inequalities emanating from teachers' instructional practices require a gender-responsive pedagogy (Mwakabenga & Komba, 2021). Given the potential benefits of Mathematics, gender discrepancies in Mathematics is a

problem that calls for strategic intervention. In particular, the situation warrants an investigation into the causes of persistent gender discrepancies in students' Mathematics performance. In the present study, gender is perceived as an interaction among individuals in their social settings. The conceptualization of the potential causes of gender discrepancies in Mathematics was guided by sociological theories of gender in particular sex roles and interactionist theories (Ryle, 2012), expectancy-value theory (Eccles & Wigfield, 2020), and Bandura's self-efficacy theory (Usher & Pajares, 2009). Ryle's (2012) gender perspective stipulates that gender traits are likely to differ from one society to another and result from social interactions in the society. According to Wharton (2005), gendered expectations about one's ability to accomplish a task are associated with gendered interactions and variations in undertaking the task. The gendered interactions result in social categorization, eventually leading to gender differences and inequalities. Furthermore, Eccles and Wigfields' (2020) conceptualization of situated expectancy-value theory indicates a strong association between the kinds of opportunities parents provide to their children with developmental changes in their academic self-concept and subjective task value.

By and large, the influence of students' subjective task value on their performance is mainly rooted in the socialization process of the family, school, peers and community. Social contextual characteristics influence students' self-perception about their relative competence (Eccles & Wigfields, 2020) and such perceptions eventually affect their practices and performance (Usher & Pajares, 2009). Nevertheless, while much work has focused on gender differences and differences in motivation (Eccles & Wigfields, 2020), more work needs to be done on potential causes of gender discrepancies in Mathematics across contexts and various education systems. Further, Bandura's self-efficacy theory guided the conceptualization of external factors that affect students' Mathematics learning (Kyaruzi, 2021; Usher & Pajares, 2009).

Mathematics performance and gender in Tanzanian secondary schools

The current education system of Tanzania is based on a centralized national curriculum based on a 2+7+4+2+3+ structure. The education system comprises two years of pre-primary, seven years of primary education and four years of Ordinary (O-level) secondary education before undertaking two years of Advanced (A-level) secondary education (Ministry of Education and Vocational Training [MoEVT], 2014). Formal education in Tanzania is provided by government and private schools, either in a few available boarding schools or in day schools. Apart from the initiatives to promote Mathematics education in Tanzanian secondary schools, students' performance trend in Mathematics has been unsatisfactory for a long time. Based on the Basic Educational Statistics in Tanzania [BEST] (MoEST, 2020), students' overall average performance in the Certificate of Secondary Education

Examinations (CSEE) has remained below 20% for several years with the average pass rate for boys = 23.1% and for girls = 14.8%. Likewise, gender discrepancies in students' Mathematics performance (which mostly favour male students) continue to be challenging in the Tanzanian education system. Gunderson et al. (2012) indicate that parents' and teachers' gendered expectations of students' Mathematics learning significantly influence their Mathematics learning. Consequently, the initiatives to address the differences in Mathematics require the involvement of various stakeholders.

The present study

Over the past decades, there has been gendering of Mathematics, mainly associating the subject with masculinity (Brandell & Staberg, 2008; Hailu, 2018). The educational statistics in Tanzania indicate that although students' performance in Mathematics is consistently poor, it is relatively poorer among girls than boys (MoEST, 2020). In particular, the average overall performance has been consistently lower for girls than boys for several consecutive years (National Examinations Council of Tanzania, 2021). Given the potential benefits of Mathematics, intervention to address gender discrepancies in Mathematics is deemed necessary. Therefore, this study investigated the sources of gender discrepancies in students' Mathematics performance and how they could be addressed. The study further examined whether students' perceptions of Mathematics teaching and learning differ across gender.

Research questions

1) Do students' perceptions towards Mathematics teaching and learning practices differ across gender?
2) What are the gendered perceptions and attitudes that students have toward Mathematics subject? What causes these perceptions and attitudes, if any?
3) How can students' gendered perceptions and attitudes toward Mathematics be reversed or nurtured?

Methodology

This study was part of the Strengthening In-service Teacher Mentorship and Support Programme (SITMS) project which commenced in 2021 and is currently in progress in Tanzania, Kenya and Zambia. In Tanzania, the project is implemented in nine regions with teacher colleges offering Mathematics training at the secondary school level. The regions were clustered in five out of eight geographical zones: North Eastern zone (Kilimanjaro, Arusha, and Manyara), Central zone (Dodoma and Singida), Western zone (Tabora and Shinyanga), Eastern zone (Morogoro) and

Southern zone (Mbeya). Data were collected from 762 Form Four students sampled from 83 public secondary schools purposefully sampled from nine project regions. Form Four students were purposefully sampled because they were assumed to possess a detailed school experience. The gender composition of the respondents involved 51% girls and 49% boys because the study strategically aimed to achieve gender representation. More than three-quarters of the respondents were sampled from day schools, representing the majority of secondary schools in the country. Most respondents (92%) were sampled from co-educational schools, as single-sex schools are limited in number in the project regions. Table 1 summarises participants' demographic variables across gender.

Table 1**:** *Demographic Characteristics of Participants*

Variable		**Girls**	**Boys**	**Total**
Category of the schools	Day	293 (75.3%)	309 (82.8%)	602 (79%)
	Boarding	55 (14.1%)	20 (5.4%)	75 (9.8%)
	Day and Boarding	41 (10.5%)	44 (11.8%)	85 (11.2%)
Type of school	Girls only	49 (12.6%)	-	49 (6.4%)
	Boys only	-	10 (2.7%)	10 (1.3%)
	Boys and Girls	340 (87.4%)	363 (97.3%)	703 (92.3%)
Total		**389 (51%)**	**373 (49%)**	**762 (100%)**

Approach and design

The study used a mixed methods research approach and employed a concurrent triangulation research design. Qualitative data were collected through focus group discussions with students while quantitative data were collected using a structured questionnaire. Quantitative data collected through questionnaires captured students' perceptions of Mathematics teaching and learning. Particularly, qualitative data helped the researcher to underline the potential factors leading to gender discrepancies and how they could be addressed. The mixed methods approach was suitable for this study as it allows researchers to simultaneously collect qualitative and quantitative data (Dingyloudi & Strijbos, 2018). Triangulation of the data collection and analysis methods helped the researcher ensure corroboration and an in-depth understanding of the research problem.

Instruments

The study adopted a validated scale to measure students' perceived competence in Mathematics. Two other scales to measure students' perceptions of Mathematics teaching and learning were developed based on the literature. Students rated their

agreement or disagreement with the questionnaire items on a four-point balanced Likert scale ranging from strongly disagree (1) to strongly agree (4). A four-point balanced scale was preferred to avoid the middle category due to its ambiguous perceptual meaning (Kulas & Stachowski, 2009). The questionnaire was face-to-face administered as such participants had the chance to ask for clarification in case of unclear items. The questionnaire scales attained a good Cronbach's alpha value above the minimum acceptable reliability threshold of 0.70. Table 2 summarizes the questionnaire scales, sample items, and Cronbach's alpha.

Table 2: *Scales, Sample Items, and Cronbach's α*

Scale	k	Sample item	Cronbach's α
Perception of Mathematics Teaching	12	I am satisfied with the approach used in teaching Mathematics	.74
Interest in Mathematics Learning	6	I like solving Mathematics problems	.72
Perceived Mathematics Competence	6	I am satisfied with my ability in Mathematics	.72

Note. k = number of items per scale

After filling in the questionnaire, some students volunteered to participate in the focus group discussions (FGD) that were concurrently conducted to obtain data on the potential causes of gender discrepancies in Mathematics and how they could be addressed. Of the volunteers, six students were randomly sampled to participate in the focus group discussion from each school. In total, sixteen focus group discussions were conducted in sixteen different secondary schools. Focus group discussions were conducted after class sessions to avoid interrupting classes; each session took an average duration of 45 minutes. In each FGD, three boys and three girls were involved except in single-sex schools, where only girls or boys participated.

Data analyses

Before analysis, the collected data were checked for outliers and missing values. Thirty-nine out of 801 respondents (approximately 5%) had more than 10% of missing values and were thus eliminated, resulting in a final sample of 762 respondents as described in Table 1. Furthermore, quantitative analysis was carried out using SPSS version 25 for descriptive data and latent mean analyses were estimated in Mplus version 7.31 to compare students' perceptions of Mathematics teaching and learning across gender. Data from FGDs were transcribed verbatim and then the transcripts were subjected to MAXQDA software version 2020 for further analysis. Central themes were generated from the transcripts, which were used

to explore the rest of the transcripts. The initial themes were updated whenever a new one emerged during data analysis. After all the transcripts had been read, the themes semantically generated were mapped to their corresponding codes. Finally, the summary of code frequencies and their corresponding coded segments were extracted from MAXQDA software for report writing.

Measurement invariances

Measurement invariance is increasingly recommended before comparing groups for it helps to assess whether measurement scales are statistically equivalent across groups (Wu et al., 2007). In particular, invariance tests were conducted to establish evidence for comparing scales across gender (girls and boys). Measurement invariance is demonstrated when the difference in χ^2, considering the difference in the degree of freedom (*df),* is not statistically significant (i.e., $p > 0.05$), and the difference in the comparative fit index (ΔCFI) is ΔCFI ≤ 0.01 (Strijbos et al., 2021). Besides, it has been added that invariance is demonstrated using multiple indicators with the following critical values: – 0.01 ΔCFI and ΔGamma hat for metric and scalar invariance and 0.015 for strict invariance, 0.015 ΔRMSEA for metric and scalar invariance, 0.030 ΔSRMR for metric invariance and 0.015 SRMR for scalar invariance (Strijbos et al., 2021).

Latent means analysis

Latent mean analysis (LMA) was used to evaluate the differences in scale means across gender. Unlike conventional mean comparison analyses such as t-tests, LMA has a robust framework for responding to measurement errors (Sass, 2011). Therefore, the LMA was performed in Mplus version 7.31 using Maximum likelihood estimation (MLR) with robust standard errors, which is also considered to be a powerful estimator. LMA assesses the differences in a latent scale mean relative to the reference group set as zero (i.e., set to 0). In LMA, the mean difference between other groups with a similar latent factor is estimated as z-score differences to the reference group. The Wald χ^2 test of parameter constraints was used to assess whether the differences in latent means among the groups were statistically significant.

Results and Discussion

Students' perceptions of Mathematics teaching and learning

This study investigated the factors leading to gender discrepancies in students' Mathematics performance and how they could be addressed. The first research question was on students' perceptions of Mathematics teaching and learning

across gender. Table 3 summarizes the descriptive statistics and inter-correlations for students' perceptions of Mathematics teaching, their interest and perceived competence in Mathematics learning.

Table 3: *Descriptive Statistics per Scale and their Inter-correlations*

Construct	N	Mean	SD.	1	2	3
1. Perception of Mathematics Teaching	760	3.00	0.44	-		
2. Interest in Mathematics Learning	762	3.18	0.56	.492**	-	
3. Perceived Mathematics Competence	762	2.99	0.57	.509**	.528**	-

Note: SD = Standard Deviation, N = Number of respondents

The findings in Table 3 indicate that students evaluated their Mathematics teachers' instructional practices positively in terms of satisfaction with the approach used in teaching. They also showed interest in Mathematics learning, although their perceived competence in mathematics was moderate. Furthermore, the correlational analysis indicated that students' perceptions of Mathematics teaching were highly related to their perceived competence in Mathematics but moderately related to their interest in learning the subject. In addition, perceived competence in Mathematics was positively related to student's interest in and perceptions of Mathematics teaching. The findings imply that teachers' instructional practices promote students' interest and perceived competence in Mathematics. Further analyses established whether students' perceptions of Mathematics teaching and learning, perceived competence and interest in Mathematics learning varied across gender. Table 4 summarises latent mean analyses results comparing student perceptions of Mathematics instruction across gender.

Table 4**:** *Students' Perceptions of Mathematics Teaching and Learning across Gender*

Construct	Manifest means (SD)		Latent mean (z-value)		
	Girls	Boys	Girls	Boys	p-value
Perception of Mathematics Teaching	2.98 (.42)	3.01 (.46)	—	.019	.836
Interest in Mathematics Learning	3.16 (.56)	3.20 (.56)	—	.081	.314
Perceived Mathematics Competence	2.96 (.55)	3.02 (.58)	—	.142	.102

Note. p-value for Wald χ^2 test, SD = Standard deviation

The model for estimation of latent mean analysis for gender differences had a moderate to good model with CFI =.911, Gamma hat = .914, RMSEA = .064 (.059, .070) and SRMR = .078. The latent mean analysis results in Table 4 indicate that although boys had higher mean scores in all the constructs than girls, the differences were not statistically significant, implying that boys and girls had relatively similar

perceptions of Mathematics teaching, perceived competence and interest. The finding signifies that, if given a constructive learning environment that supports a gender-responsive pedagogy, both girls and boys are likely to perform well in Mathematics. The correlational statistics further showed that students' perceived competence in Mathematics was significantly related to their perception of Mathematics teaching and learning. These findings corroborate previous studies on the positive role of self-efficacy (Kyaruzi, 2021; Usher & Pajares, 2009) in promoting students' learning. The findings echo Ajai and Imoko's (2015) results which indicated that girls succeed well in Mathematics when their teachers use collaborative teaching approaches such as problem-solving. The results support the socialization model (Eccles & Wigfields, 2020) indicating that societal expectations affect the child's outcomes–beliefs, performance, and choices than individual perceived ability.

Students' gendered perceptions and attitudes towards Mathematics

The second research question was on students' gendered perceptions and attitudes towards Mathematics and their causes. The analysis of the focus group discussions came up with four major themes indicating that students had gendered perceptions and attitudes toward Mathematics learning. In particular, four major themes were: boys can learn Mathematics better than girls (48%); girls can learn Mathematics better than boys (24%); girls ignore Mathematics learning (21%), and girls are disappointed or distracted in learning Mathematics (15%). The findings imply that most respondents perceived Mathematics as a masculine domain. Table 5 summarises findings and a sample of excerpts from the discussion with students.

Table 5: *Students' Gender-Related Perceptions toward Mathematics*

Theme	Sample focus group excerpts
Boys can learn Maths better than girls	…boys are the ones supposed to do the hard stuff. So, boys are supposed to do better in Mathematics than girls (Boy, School 2)
(N = 14, 48%)	…the community perceive that boys are the one who can study mathematics. Even most Mathematics teachers are male (Girl, School 1).
Girls can learn Maths better than boys (N = 8, 24%)	Females have super brains and we are multitalented. A mother could simultaneously cook, take care of a child, and do other duties. (Female, School 3). They [society] have made us [girls] believe that we cannot do Maths and science subjects (Girl, School 4).
Girls ignore Maths learning (N = 7, 21%)	Girls perceive mathematics as hard, so they do not work hard on it, and their [girls] results become bad (Boy, School 5).

Girls are disappointed in learning Maths (N = 5, 15%)	Girls can do well in Maths, but some families discourage them from studying Maths. They tell them not to study it because they will eventually fail (Boy, School 7).

Note: N = Number of respondents with the same argument

Findings in Table 5 indicate that almost half of the respondents perceived Mathematics as a masculine domain and conceived that boys are the ones who are supposed to take challenging subjects like Mathematics. At the same time, results indicate that the shortage of female teachers of Mathematics as role models intensified the masculine view of the subject. Besides, other respondents perceived that girls could do well in Mathematics. Students with such perception acknowledged that girls are multi-talented and capable of multi-tasking and could demonstrate their ability in doing Mathematics if they invested enough effort. Furthermore, some students perceived that girls can do Mathematics, as evidenced by the presence of female leaders who are STEM experts. However, it was noted that girls dedicate limited time to Mathematics learning for several reasons, including discouragement from families and society. The findings highlight the need for recruiting more female Mathematics teachers who could eventually reduce the gender stereotype toward Mathematics, as indicated in the following excerpts:

> All gender can do well in Mathematics. Nowadays, we see female leaders in higher positions participating in various issues and they did well in Mathematics. I believe that girls can outperform boys in Mathematics if the factors that pull girls behind are well addressed (Girl, School 7).

In addition, the findings indicate that girls' study habits in Mathematics were not as effective as in other subjects. It has been noted that compared to boys, girls do not invest the necessary efforts in Mathematics learning due to wrong self-perceptions regarding their ability to learn Mathematics, which lowers their performance in the subject. Further analysis indicated that gender stereotype in Mathematics is socially rooted, and specific behaviours perpetuate the observed practice. In particular, girls are discouraged from learning Mathematics by peers, parents and teachers, who tell them that even if they learn Mathematics, they will eventually fail. Generally, students perceived that Mathematics is associated with masculinity and some social practices discouraged girls' participation and performance in Mathematics. Correspondingly with O'Rourke and Prendergast (2021), the findings indicate that girls' negative perceptions of mathematics competence affect their participation and performance in the subject.

Further results revealed gender stereotypes in students' perceptions of Mathematics. This is consistent with what previous studies have reported on the perception

of Mathematics in the Tanzanian context (Mazana et al., 2019). Nevertheless, findings depict that girls can do well in Mathematics if given enough time to work on their assignments and are free from social disappointments as they engage in Mathematics learning. The findings call for social approval of girls' Mathematics learning. While boys' engagement in Mathematics is positively supported, girls' engagement in the subject is constrained by discouragement from community members, including parents and teachers (Gunderson et al., 2012). The findings call for affirmative gender transformation practices to address the observed gendered perceptions towards girls' Mathematics learning.

Causes of gendered perceptions toward Mathematics learning

Although the findings in Table 5 indicate that most students had a masculine conception of Mathematics learning, the potential causes for such conception were unclear. Then, it was essential to unveil the causes of students' gendered perceptions and attitudes toward Mathematics. In particular, the study investigated further the causes of the male-dominance perceptions toward Mathematics learning. Table 6 indicates the major reasons for students' gendered perceptions towards Mathematics learning, namely: Domestic chores (42%), social persuasions about girls' ability in Mathematics (31%), restrictive parenting of girls (19%), and disruptive social practices to girls (8%).

Table 6**:** *Causes of Gendered Perceptions toward Mathematics*

Construct	Sample excerpts
Domestic chores for girls (N = 11, 42%)	I have a lot of tasks to do at home. So, you find that I am already tired by the time I need to sit down to solve Maths problems. (Girl, School 8).
Social persuasions on girls' ability in Maths (N = 8, 31%)	…as a boy, if I fail Mathematics, I would be told why do I fail, just like a girl (Boy, School 4)...society's perception is that mathematics is a male subject…this scenario has made the girls feel inferior and incapable of doing Mathematics (Girl, School 6).
Restrictive parenting to girls (N = 5, 19%)	Even at home, girls are not allowed to go for a discussion with peers, but boys are allowed to go for discussions (Boy, School 7)… we usually end our classes at 3 pm, but if I [a girl] decide to stay at school for a private study or discussion and arrive home at 6 pm, I face challenges to express that to my parents (Girl, School 8).
Disruptive social practices to girls (N = 2, 8%)	Girls are going through several challenges at school and in the streets more than boys. At school [co-education schools], when a girl decides to concentrate, boys start to distract them (Girl, School 3)

Note: N = Number of respondents with the same argument

As indicated in Table 6, most respondents felt that domestic chores were the main factor for students' gendered perceptions toward Mathematics and subsequent performance. While domestic chores appear to prepare children to assume adult responsibilities, their essence is distorted when they are gendered and not equally distributed among boys and girls. The findings allude that the gendered distribution of domestic chores reduces girls' chance to reflect on their lessons by solving Mathematics problems since too many of these chores are allocated to them. The gendered distribution of domestic chores was strongly voiced in the present study because more than three-quarters of the respondents attended day schools whereby after school hours, students help their parents and guardians with domestic activities. These findings are consistent with Jones (2016) who noted that girls are overwhelmed with domestic chores compared to boys. The findings further support Hailu's (2018) study, which found that girls had to work on household chores for 28 hours per week which was five times the time allocated for boys on the same in Ethiopia. Such practices call for the provision of gender education to parents to enable them appreciate the role of creating a good learning environment for girls at home. The potential benefits of home-based learning are well realized when parents support their children in creating regular routines and study habits (Ray, 2010).

The findings further indicate that social persuasion about girls' ability in Mathematics was another factor for the gendered perceptions toward Mathematics. Social persuasions entail comments that students receive from peers and adults about their ability to learn Mathematics. Although social persuasions may seem trivial, they affect students' Mathematics learning when offered by a trusted person such as peers, parents and teachers. Social persuasions could be in terms of positive comments or negative comments. In contrast, positive comments build students' self-esteem and confidence, while negative comments lower students' confidence in learning Mathematics. In particular, results in Table 6 indicate that if a boy fails, he is accused of failing like a girl. The findings are in line with studies on sources of self-efficacy in mathematics, whereby social persuasions have been reported to negatively affect students' engagement in the task, persistence, and performance (Kyaruzi, 2021). Social practices that discourage girls' participation in Mathematics fade their aspirations and interest in STEM careers (Brandell & Staberg, 2008). The findings further mean that social persuasions are rooted in social practices which associate Mathematics with boys thereby undermining girls' participation and performance.

Furthermore, Table 6 illustrates that the restrictive parenting of girls hindered their social interactions and participation in collaborative group learning after class. The

problem was severe among students who were attending day schools. While parents tend to be restrictive to protect girls from distractions that are likely to occur in an unstructured learning environment, too much restrictiveness denies girls the opportunity to participate in collaborative learning beyond school hours. Parents need to create a home learning environment that promotes girls' learning. The sample focus group discussion excerpts in Table 6 justify that restrictive parenting practices interfere with girls' Mathematics learning for they are denied of spending more time at school for private study beyond school hours. While restrictiveness is intended to protect girls from disruptions and bullying, as girls are considered more vulnerable than boys (UNICEF, 2021), it isolates them from peer learning beyond the school environment. This finding calls for gender-responsive parenting that challenges the social norms that bias girls' socialization and independent growth while ensuring that they are protected. This is in accordance with UNICEF's (2021) argument that restrictive parenting is not inherently wrong but fosters stereotypes that determine what a boy or girl can or cannot do.

Addressing students' gendered perceptions and practices in Mathematics

The third research question was on how students' gendered perceptions of Mathematics could be addressed. Analyses of the focus group discussions with students illuminate several strategies for addressing the gendered perceptions toward Mathematics learning. The following strategies received significant consideration: encouragement by teachers and parents (22%), gender education for teachers and parents (19%), textbook support (13%), authentic mathematics teaching (13%) and a supportive learning environment at home (9%). Other strategies include engaging slow learners in the lesson, employing more Mathematics teachers, and constructing more boarding schools for girls. Table 7 summarises the proposed strategies for addressing gender discrepancies in Mathematics.

Table 7: *Strategies for Addressing Students' Gendered Perceptions in Mathematics*

Construct	Sample excerpts
Encouragement by teachers and parents (N = 17, 22%)	.. teachers should have good relations with students (Boy, School 9) ...teachers shouldn't frighten students because this makes many students fear the teacher and the subject (Girl, School 2)....parents should motivate their children to do better (Girl, School 10).
Gender education to teachers and parents (N =15, 19%)	The thinking that girls are the ones responsible for home chores should be eliminated (Girl, School 11).

Construct	Sample excerpts
Material/textbooks support (N = 10, 13%)	Parents should buy their children reading materials such as books to improve students' Mathematics performance (Girl, School 13).
Authentic mathematics teaching (N =10, 13%)	…there should be clubs at school where students will solve Mathematics problems that address the importance of Mathematics (Girl, School 14).
Home supportive environment (N = 7, 9%)	…in day schools where students stay with their parents, they [parents] should try to give their children time to rest after school so that they can continue learning afterwards (Girl, School 8).
Others: (Attend slow learners, construct boarding schools for girls, employ more Math teachers (N =14, 17%))	The government could support this by constructing more boarding schools for girls. This will help girls to avoid the challenges they encounter in the streets and at home (Boy, School 12).…if the number of Mathematics teachers could be increased, it would be easier for them to motivate students to learn Mathematics (Girl, School 5).

Note: N = Number of respondents with the same argument

With reference to the findings in Table 7, the first recommendation for addressing gender discrepancies in Mathematics performance was for students to be encouraged by teachers and parents. Students voiced out that teachers should not frighten them because this makes many students fear the teacher and the subject. In particular, students expect to gain moral support and encouragement from their teachers and parents. Teachers should keep encouraging students that they can pass Mathematics to promote their motivation and self-concept concerning Mathematics learning. Teachers' encouragement is deemed essential in offsetting students' (particularly girls) disappointment about their perceived competence in Mathematics learning. Notably, students expect teachers not to be disappointed by their students' poor performance but rather, they should strategize on how to improve students' understanding of the subject. The findings further showed that encouragement by teachers and parents is likely to promote girls' Mathematics learning. Encouragement is an instrumental strategy to remedy the negative social persuasions and stereotypes about girls' ability in Mathematics learning. This is also in line with previous studies which found that Tanzanian students benefit from teacher feedback when it is delivered in a caring and considerate manner (Kyaruzi et al., 2019).

Gender education for teachers and parents was proposed as the second important strategy for addressing gender discrepancies in Mathematics. Gender education

in this study entails gender-responsive pedagogy and parenting, which are considered the main interventions for gender discrepancies in Mathematics. This is important because studies indicate gender bias among teachers and students occurs subconsciously, henceforth, subconscious gender bias, which can be addressed with gender education. In particular, teachers can be equipped with gender-responsive pedagogy (Mwakabenga & Komba, 2021), while parents need to be acquainted with gender-responsive parenting (UNICEF, 2021). The findings further depict that domestic chores should be balanced between girls and boys to create conducive home-based learning opportunities for both, particularly for the case of children who attend day schools. It was further suggested that parents should allow girls to interact with peers to benefit from peer collaboration in learning Mathematics.

Providing learning resources is another strategy for improving students' Mathematics learning. Since not all schools were equipped with textbooks, students felt that the provision of textbooks would help to promote Mathematics learning. While ensuring textbooks are available at school could engage several stakeholders, the students' recommendations emphasized the need for parental support in purchasing learning materials and textbooks for Mathematics. Students acknowledged that textbooks offer them learning opportunities to have enough exercises to succeed in Mathematics. The findings coincide with results from other studies indicating that mathematics textbooks are scarce in schools despite the government's effort to increase access to learning materials (Mazana et al., 2019). Parents and other stakeholders need to join the government's efforts to provide learning materials. Indeed, Mathematics learning requires solving various problems and making revisions and this could be easily achieved if each student had a textbook.

Another recommended strategy for offsetting gender discrepancy in Mathematics is to create an authentic learning environment. Mathematics learning in Tanzania is criticized for an unauthentic learning environment that leads to students failing to connect the learned materials to their real-life applications. While availing of learning resources may have cost implications, evidence shows that Mathematics teaching aids can be improvised from the local environment. Improvisation of learning materials is linked with promoting interest in the subject and facilitating retention of the learned materials. The findings indicate further that the establishment of Mathematics clubs could also aid in fostering authentic mathematics learning and promote interest in the subject. With relevant learning materials such as textbooks available, students can learn Mathematics better at school and make revisions easily at home. Meanwhile, authentic Mathematics teaching by linking it with real life is likely to reduce gender discrepancies in Mathematics as Ajai and Imoko (2015) indicate that girls learn better in problem-solving learning

environments. Lastly, addressing gender discrepancies in Mathematics requires a conductive home learning environment that gives boys and girls equal chances to learn Mathematics effectively. In this study, a conducive environment encompasses reducing the burden of domestic chores allocated to students, particularly girls because most domestic duties are assigned to girls, limiting their study time.

Conclusions and Implications

The present study's findings should be interpreted in light of the following limitations. The cross-sectional surveys could be complemented with longitudinal data to draw strong reasons for gender discrepancies in Mathematics performance. Since more than 90% of the respondents were sampled from co-education schools, and 75% of the respondents were from day schools, this study did not compare students' attributes across school types and categories. This forms the agenda for future studies to investigate student perceptions of mathematics teaching and learning in single-sex and co-education schools. Nevertheless, results from the measurement invariances indicate that data for this study had comparable attributes across gender (boys and girls). Despite the limitations, the varied nature of the study involving focus group discussions with students of diverse backgrounds guarantees the dependability of the key findings as far as theoretical and practical contributions are concerned. In particular, the study highlights that most respondents had a masculine orientation toward Mathematics, which adversely affects girls' participation and performance. The findings call for interventions to reduce the gender stereotypes related to Mathematics learning that is rooted in social practices. Gender education needs to be provided at the family level to adopt gender-responsive parenting to ensure that both boys and girls have equal access to time and financial resources.

Given that parental expectations strongly influence children's learning, parents have to encourage and motivate girls' participation in Mathematics learning. At the school level, teachers have to be oriented to gender-responsive pedagogy to provide equal learning opportunities for boys and girls. Likewise, teachers are encouraged to use authentic and participatory teaching approaches which promote students' Mathematics learning (Mazana et al., 2019). Based on the study findings, there is a need to challenge sociocultural practices which tend to marginalize girls and deprive them of the opportunity to learn Mathematics. Some social norms tend to categorize tasks into gender roles, subjecting girls to an overwhelming workload of domestic chores. Such findings call for affirmative interventions at the community level because this kind of categorization is socially constructed and is a prime factor for gender inequalities (Ryle, 2012). Remarkably, the community should promote girls' participation in Mathematics because gendered expectations about one's ability to undertake the task are influenced by gendered interactions

(Wharton, 2005) and affect their learning outcomes (Usher & Pajares, 2009). At the family level, social categorization needs to consider girls' right to engage with home-based learning as boys do. It is high time to challenge the social norms that usually inundate girls with domestic chores (Dillip et al., 2018).

Although quantitative results did not indicate statistically significant gender differences in students' perceptions of mathematics teaching and learning, qualitative results signal gender stereotypes in mathematics learning. It follows that girls' Mathematics learning is affected by structural barriers that emanate from society rather than individuals as proposed by the interactionist gender theory. Like other studies, this one noted students' masculine orientation toward Mathematics learning, which is likely to adversely affect girls' learning of the subject. Also, it was noted that the causes for gender discrepancies in Mathematics are rooted in social norms under which gender perceptions are held towards some domestic chores. Likewise, social persuasion is upheld, which underly people's low expectations about girls' Mathematics learning. Also, discouragement of girls in learning mathematics and disruptive social practices is among the hindrances limiting their participation and performance. The message implied by these findings is that parents should assign manageable domestic chores to their children, particularly girls, to avail them of the chance to make revisions of their lessons.

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