

Gender and mathematics anxiety among senior high school students

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ABSTRACT: A multitude of researchers have consistently emphasized that Mathematics Anxiety holds a substantial role as a predictive factor for academic achievement. Although the factors shaping students' anxiety levels have been extensively explored, the existing literature indicates a notable gap in understanding the gender-based implications on students' Mathematics Anxiety Levels, specifically within the context of the Sagnarigu Municipality. Consequently, this study seeks to investigate whether gender disparities exist in the extent of Mathematics Anxiety among senior high school students. Employing a quantitative approach with an analytical cross-sectional design, the study engaged 385 students selected through simple random sampling. An extensive literature review complemented primary data collection utilizing a dedicated questionnaire, the Mathematics Anxiety Scale. The gathered data underwent thorough analysis utilizing descriptive and inferential statistics. Frequencies and percentages facilitated the categorization of students' Mathematics Anxiety Levels, while the comparison of mean Mathematics Anxiety scores between genders utilized the Mann-Whitney U Test. The study's findings unveiled that Mathematics Anxiety levels among students in the Sagnarigu Municipality, located in the Northern Region of Ghana, were notably high, and gender exerted a significant influence. Specifically, females exhibited higher levels of Mathematical Anxiety compared to their male counterparts. As a recommendation, the study underscores the importance for mathematics educators in Sagnarigu Municipal Senior High Schools to allocate focused attention to female students, aiming to alleviate their apprehensions around mathematics and consequently enhance their academic performance.

Keywords: Gender, level of anxiety, mathematics, male students, female students.

INTRODUCTION

Mathematics holds a pivotal role as one of the cornerstones of education worldwide. Serving as the bedrock for comprehending science and technology, its significance resonates deeply within various domains of human endeavour. Beyond its academic context, mathematics wields a profound influence on the daily lives of countless individuals, permeating tasks ranging from budgeting and decision-making to problem-solving and

critical thinking. Moreover, the socio-economic progress of nations hinges on a solid foundation in mathematics, as it underpins advancements in fields such as engineering, medicine, finance, and information technology. Consequently, fostering a robust mathematical education not only empowers individuals to navigate an increasingly complex world but also cultivates the intellectual and practical skills necessary to drive innovation, shape

economies, and contribute to the broader welfare and advancement of societies on a global scale (Fokuo *et al.*, 2022). A strong command of mathematics skills is universally acknowledged as integral to achieving success in education and navigating everyday tasks with efficiency. Proficiency in mathematics is not only pivotal for academic accomplishments but also extends its importance to numerous aspects of human existence. The mastery of mathematics equips individuals with the ability to approach challenges with adept reasoning, enabling the analytical assessment of situations as they arise and the subsequent formulation of effective solutions. In essence, acquiring mathematical competence enhances one's capacity to engage in critical thinking, enabling them to tackle the complexities of daily life, make informed decisions, and address problems across a spectrum of contexts, thus fostering personal growth and resilience in the face of life's myriad challenges (Udil *et al.*, 2017). Salahot (2022) even believed the transformative potential of mathematics extends beyond its academic boundaries, as it holds the capability to serve as a catalyst for lifting individuals out of poverty and counteracting social decline. Notably, developed nations like China and India have harnessed the power of mathematics to drive their progress and economic prosperity. Mathematics, as a tool for problem-solving and innovation, offers avenues for generating practical solutions that can address societal challenges. Its application in various sectors, from technology to infrastructure, enables nations to optimize processes, enhance productivity, and foster sustainable development. Salahot's perspective underscores the notion that mathematics plays a pivotal role in shaping not only personal opportunities but also the trajectory of societies, serving as a means to foster empowerment, drive economic advancement, and facilitate positive social change. Despite the overarching significance of mathematics in enhancing cognitive and problem-solving abilities, the persistently observed issue of low performance in this subject remains a cause for concern. While mathematics is widely recognized as a valuable discipline that equips individuals with the skills to navigate life's complexities, the prevalence of subpar performance highlights challenges in translating this theoretical importance into practical academic outcomes. The disconnect between the acknowledged value of mathematics and the actual performance of individuals underscores the need to address factors such as teaching methodologies, curriculum design, and individual learning styles that might hinder effective comprehension and application of mathematical concepts. Resolving the issue of low mathematics performance requires a comprehensive approach that bridges the gap between the recognized potential of mathematics and its effective implementation in educational contexts, ultimately enabling individuals to fully harness its cognitive benefits for personal and societal advancement (Fokuo *et al.*,

2022). Salahot (2022) assertion underscores a common and widespread concern: the performance in mathematics education has consistently fallen short of expectations on a global scale. Regardless of geographical location or economic status, nations universally grapple with the challenge of insufficient mathematics performance. This observation reflects a broader trend where many individuals, across diverse educational systems, struggle to achieve desired proficiency in mathematics. The widespread nature of this issue suggests that it is not confined to any specific context, but rather a complex challenge that transcends borders. Salahot's observation resonates with the collective acknowledgment that, despite recognizing mathematics as a vital skill with multifaceted benefits, achieving satisfactory performance in this subject remains an ongoing challenge that requires targeted interventions, innovative pedagogical approaches, and a concerted effort to bridge the gap between the theoretical importance of mathematics and its practical implementation in education.

A recurring pattern across many African nations is subpar performance in both elementary and secondary school mathematics, leading to a diminished pool of exceptional individuals who might otherwise pursue higher education in the field. This widespread underperformance has far-reaching consequences, serving as a significant hindrance to the cultivation of a skilled workforce and the realization of individuals' academic potential. It stands as a formidable obstacle, contributing to a phenomenon where a considerable number of individuals halt their educational journey after completing secondary school. The challenges in mastering mathematics at the foundational levels create a ripple effect that impacts not only higher education opportunities but also the overall capacity of these nations to nurture innovation, technological advancement, and economic development. Addressing this issue requires a comprehensive approach that enhances mathematics education at all levels, from elementary to secondary school, and empowers individuals to excel academically, thereby unlocking a pathway to further education and contributing to the broader progress of African societies (Brezavšek *et al.*, 2020). The achievement of senior high school graduates in mathematics at the West African Senior School Certificate Examination (WASSCE) which served as a standard measure of performance at the senior high school level is characterized by an elevated percentage of candidates receiving a grade F9 (fail), and this percentage has been relatively constant throughout the years when compared to other grades with a general indefinite trend of performance (Abreh *et al.*, 2018).

The educational landscape in Ghana reflects an ongoing issue where recent reports from the chief examiner, such as the WASSCE 2021 results, consistently reveal a troubling decline in mathematics performance, echoing a persistent trend observed in previous years. The subject of

core mathematics has transformed into a formidable barrier for a significant portion of senior high school graduates, thwarting their progression to the subsequent educational level. This recurring pattern of subpar mathematics performance, particularly in the national tests conducted by the West African Examination Council (WAEC), evokes deep concern and unease among key stakeholders including the government, parents, and the broader community. Furthermore, this concern is compounded by a gender disparity in performance, where females exhibit lower achievement compared to their male counterparts. The evident gender gap in mathematics achievement raises additional concern, as it emphasizes the need for targeted efforts to address not only the overall mathematics performance but also the specific challenges faced by female students. The cumulative impact of poor mathematics performance, coupled with gender-based discrepancies, underscores the urgency of implementing comprehensive educational reforms and interventions that ensure equitable access to quality mathematics education for all students and thereby contribute to the nation's educational progress and socioeconomic development (Ampofo, 2018). Bornaa *et al.* (2022) stated that a significant concern emerges from the annual WASSCE examination outcomes, revealing that approximately one-third of candidates face admission denials at post-secondary institutions due to inadequate mathematics performance. This widespread and persistent challenge underscores the pivotal role of mathematics as a deciding factor in students' educational trajectories. Importantly, the gender disparity in this issue is particularly concerning, with females disproportionately impacted by the consequences of poor mathematics performance. The implications of this problem extend beyond mere academic outcomes, as it not only hinders individual progress but also reflects a systemic barrier to equitable educational access and opportunities. Addressing this issue necessitates targeted interventions that address the root causes of low mathematics performance while also striving to mitigate the gender-based disparities, ultimately fostering a more inclusive and supportive educational environment where all students, irrespective of gender, can thrive and access post-secondary education to contribute positively to society. Focusing on the Sagnarigu Municipality, the local educational landscape appears to echo the broader national trend of declining mathematics achievements among senior high school students, as indicated by a report from the Municipal Education Directorate. This distressing pattern of deteriorating performance in the WASSCE examinations spanning nearly a decade highlights the persistent nature of the issue within the region. Moreover, this situation is notably exacerbated when considering gender dynamics, with female students disproportionately bearing the brunt of the deteriorating mathematical achievements. The gender disparity underscores the urgency of addressing this

challenge, emphasizing the need for gender-sensitive educational reforms and interventions that not only reverse the declining mathematics performance but also work to empower female students to overcome the barriers that hinder their academic success, thereby fostering a more inclusive and equitable learning environment within the Sagnarigu Municipality. In response to the widespread concern over low mathematical achievement, both globally and specifically in Ghana, researchers have recognized the urgency of investigating the factors underlying this issue. The imperative to delve into these contributing factors stems from the need to engage stakeholders' attention and catalyse measures aimed at curbing, if not eradicating, the pervasive problem. The ramifications of poor mathematics achievement ripple through multiple dimensions of society, encompassing vital areas such as the foundation of life support systems, the advancement of intellect and technology, and the overall trajectory of national growth. Additionally, when considering the gender perspective, the impact of low math achievement extends to influence the equitable participation and empowerment of both male and female students, underscoring the importance of addressing gender-based disparities. Consequently, these efforts to unravel the complex web of factors driving low math achievement and their subsequent remediation hold profound implications for fostering a more robust educational landscape that not only propels individual potential but also fuels societal progress, innovation, and socioeconomic development.

In recent times, the concept of mathematics anxiety has emerged as a significant factor influencing academic performance, particularly in mathematics. Mathematics anxiety refers to the sensation of unease, apprehension, and heightened tension experienced by individuals when faced with mathematical tasks or challenges. This emotional response can hinder their ability to effectively engage with and complete mathematical tasks, ultimately leading to performance deficits. This psychological phenomenon can impact individuals across various age groups and academic levels, often manifesting as a self-perpetuating cycle where the fear of mathematics exacerbates the anxiety, further impairing performance. Recognizing and understanding mathematics anxiety is crucial, as it sheds light on the intricate interplay between emotions and cognitive processes, underscoring the importance of fostering a supportive learning environment that helps alleviate these anxieties, enabling students to unlock their full mathematical potential and excel in their studies (Salakot, 2022).

There has been a concerning decline in the enrolment of pupils in mathematics-related programs, largely attributed to a dwindling number of students who successfully meet the requisite mathematics grade to proceed in their education. This decline can be attributed to a prevalent fear of mathematics, which discourages students from pursuing such programs (Metje *et al.*, 2007). The fear of

mathematics creates a barrier that impedes students' willingness to engage with the subject and attain the necessary proficiency. Consequently, this fear-induced phenomenon contributes to an alarming shortage of individuals entering mathematics-related fields, highlighting the urgent need to address the emotional and psychological factors that hinder students' mathematical progress, fostering a more encouraging learning environment that promotes confidence, competence, and enthusiasm in the pursuit of mathematics education and its associated programs. According to Marshall *et al.* (2017), within the context of higher education in the United States, a noteworthy statistic reveals that a substantial 85% of college students experience math anxiety exceeding moderate levels. This prevalent emotional response to mathematics poses a significant hurdle to their ability to grasp and comprehend mathematical concepts effectively. The deleterious impact of heightened math anxiety on students' learning experiences is striking, as it inhibits their capacity to engage with the subject matter, stifles their confidence, and ultimately undermines their academic progress. This pervasive phenomenon underscores the importance of implementing strategies that address and mitigate math anxiety within educational institutions, ensuring that students are provided with the supportive resources and techniques needed to overcome this psychological barrier, enabling them to access mathematics education more effectively and fostering a more positive and productive learning environment. Al Majali (2020) also found that pervasive math anxiety, in this case, serves as a source of anxiety that dampens students' motivation to engage with mathematics, thereby negatively impacting their capacity to achieve high academic accomplishments in this subject. This aligns with Al Majali's assertion that high anxiety levels hinder motivation and subsequently hinder academic performance.

Generally, variables that influence students' levels of anxiety have been thoroughly studied. For instance, Wahid *et al.* (2014) found that anxiety over mathematics among senior high school students is significantly influenced by emotions, surroundings, and assessments while Aosi *et al.* (2019) identified teaching techniques, negative attitudes, gender, among others as contributing factors. To the best of the researchers' knowledge, little academic consideration has been given to the degree to which gender affects students' anxiety levels within the Sagnarigu Municipality. As a result, further research is needed to figure out if there is a disparity according to gender in the level of mathematics anxiety among senior high students.

Problem statement

Mathematics anxiety has emerged as a significant underlying factor contributing to low performance in

mathematics. This debilitating psychological barrier not only impacts students' academic outcomes but also perpetuates a cycle of avoidance and disengagement from mathematics-related activities (Rozgonjuk *et al.*, 2020). Understanding the origins of one's mathematics anxiety can serve as a powerful strategy for alleviating or even eliminating its negative impact. This principle applies to individuals of all genders. By identifying the specific triggers, experiences, or beliefs that contribute to the development of math anxiety, individuals can gain insight into the root causes of their unease and apprehension towards mathematics. When this self-awareness is coupled with targeted interventions and cognitive strategies, individuals can gradually reframe their perceptions and develop coping mechanisms to counteract the anxiety (Siaw *et al.*, 2020). Gender has emerged as a notable factor contributing to mathematics anxiety, with extensive research exploring its impact on pupils' levels of math anxiety, particularly in industrialized nations. The recognition of gender as a source of mathematics anxiety highlights the complex interplay between sociocultural influences and individual experiences. Studies have sought to uncover how societal expectations, gender stereotypes, and differential treatment may shape students' perceptions of their mathematical abilities. Investigating these dynamics within industrialized nations underscores the need to address gender-related disparities in educational settings. By understanding how gender influences math anxiety, educators and policymakers can implement targeted interventions to foster a more inclusive learning environment that promotes equitable engagement and performance in mathematics, thus mitigating the negative effects of gender-specific anxiety and enhancing overall educational outcomes for instance, Pirrone *et al.* (2022) studied 405 Italian high school students (222 females and 183 males) and the outcome indicated that gender has an influence over the level of anxiety.

The Northern region, and specifically the Sagnarigu Municipality, has been relatively underrepresented in efforts to address the issue of mathematics anxiety. The scarcity of research and interventions in this geographical context has created a gap in understanding and addressing the specific challenges faced by students in this region. Recognizing this gap, the current investigation aimed to fill this void by shedding light on the prevalence and impact of mathematics anxiety among senior high school students in the Sagnarigu Municipality. The study aimed to contribute valuable insights and data to this underexplored area, thereby striving to bridge the gap in research and knowledge, inform educational practices, and offer targeted solutions that can improve students' mathematical experiences and outcomes in a region that has received comparatively limited attention in the realm of mathematics anxiety research. The Sagnarigu Municipal is grappled with persistent poor mathematics

performance among students for nearly a decade, as highlighted by the Municipal Education Directorate's 2020 report. This study serves as a valuable addition to the academic discourse surrounding mathematics performance within Sagnarigu senior high schools. Notably, many researchers have identified mathematics anxiety as a prominent factor influencing math achievement. In this context, the study contributes by investigating the role of mathematics anxiety in shaping students' performance in mathematics, providing empirical insights specific to the Sagnarigu Municipality's educational landscape. The investigation aims to explore potential gender differences in mathematics anxiety, recognizing the significance of gender in influencing individuals' experiences with math anxiety. Addressing this research gap holds promise for unveiling insights that could inform educational strategies to enhance mathematics learning experiences and outcomes, fostering a deeper understanding of the underlying factors contributing to gender-based disparities in mathematics anxiety within the Sagnarigu Municipality.

Research objectives

1. To determine the level of mathematics anxiety among senior high school students in the Sagnarigu Municipality.
2. To establish whether gender influences the level of mathematics anxiety among senior high school students in the Sagnarigu municipality

Research question

What is the level of mathematics anxiety among senior high school students in the Sagnarigu Municipality?

Research hypothesis

H₀₁: There is no significant difference in the mathematics anxiety level of male and female students among senior high schools in the Sagnarigu municipality.

LITERATURE REVIEW

Level of mathematics anxiety among senior high school students

There is a plethora of data on the anxiety of young students in senior high schools especially maths anxiety. Tolibao and Moneva (2021) highlight the prevailing sentiment among senior high school students, indicating a substantial fear of mathematics. This observation underscores the pervasive nature of mathematics anxiety within this particular demographic. The acknowledgment

of high fear levels towards mathematics sheds light on the emotional challenges that students encounter when engaging with the subject. By identifying this phenomenon, the researchers draw attention to the urgent need for interventions and strategies that alleviate math anxiety, thereby fostering a more conducive learning environment that empowers students to overcome their fears and develop the skills and confidence necessary to excel in mathematics education. They further asserted that almost all senior high school students possess at least a moderate form of mathematics anxiety. Very interestingly, under-scores the tangible and concerning impact of mathematics anxiety on students' well-being. The phenomenon of school sick bays being filled with students as mathematics exams approach vividly illustrates the profound influence of anxiety on physical health. The heightened anxiety surrounding mathematics exams can trigger physiological reactions that lead to stress-related symptoms, ultimately affecting students' overall wellness. The attribution of this phenomenon to high levels of mathematics anxiety highlights the tangible consequences of this emotional challenge, emphasizing the imperative of addressing math anxiety not only for its impact on academic performance but also for the holistic health and well-being of students. The study employed a one-shot survey design to assess math anxiety levels among 510 second-year senior high school students in Saudi Arabia, drawn from a larger population of 5,403. Utilizing a Mathematics Anxiety Scale, the researchers administered the survey to gauge the extent of anxiety experienced by the students. Following an exploratory factor analysis of the collected data, the study concluded that students exhibited a high level of math anxiety. The findings indicated that secondary school students were grappling with a notable and concerning prevalence of mathematics anxiety, which the researcher emphasized as requiring urgent attention. It's important to note that 20 of the collected questionnaires were excluded from the analysis due to their incomplete nature, potentially influencing the overall outcome of the study. This exclusion highlights a potential limitation in the research, as incomplete data could impact the comprehensive understanding of the factors contributing to math anxiety levels among the surveyed students. Despite this limitation, the study's overall findings underscore the urgency of addressing the alarming rate of mathematics anxiety among secondary school students in Saudi Arabia and the significance of implementing interventions that foster a supportive and anxiety-reducing learning environment.

In contrast to studies indicating high levels of mathematics anxiety, certain research endeavors have reported a lower prevalence of math anxiety among senior high school students. For example, in a quantitative study conducted by Escalera-Chávez et al. (2016) within the city of Rioverde, a sample of 353 students was surveyed to assess levels of math anxiety. The study's nationwide

findings revealed a diverse distribution of math anxiety levels among the participants: 51.3% exhibited a low level of math anxiety, 29.9% experienced a moderate level, and the remaining portion reported having a high level of anxiety related to mathematics. This study underscores the variability in math anxiety experiences among students and offers insights into the prevalence of different anxiety levels within the surveyed population. The results highlight the importance of recognizing and addressing these varying levels of anxiety to inform effective educational strategies that cater to the unique needs of students in different contexts and support their mathematical learning experiences.

Gender and level of mathematics anxiety

The research conducted by Mutodi and Ngirande (2014) revealed significant gender differences in mathematics anxiety among the surveyed students. Their findings pointed to girls generally experiencing higher levels of math anxiety in comparison to boys. The study's results indicated that males exhibited a lower degree of fear and anxiety towards mathematics, with a mean anxiety level of 1.988, whereas females had a slightly higher mean anxiety level of 2.025. However, it's important to note that the study's inclusion of a larger number of boys than girls could have potentially influenced these observed gender differences. This emphasizes the necessity of interpreting the results with caution and considering the potential impact of sample composition on the outcomes. The study's findings align with broader discussions on gender differences in mathematics anxiety, highlighting the need for continued research to comprehensively understand the complex interplay between gender, anxiety, and mathematics performance, and to address these disparities in ways that promote equitable learning experiences for all students. In line with the broader discourse on gender differences in mathematics anxiety, Escalera-Chávez *et al.* (2017) conducted a study that revealed distinct gender-related patterns in anxiety levels concerning mathematics. Their findings indicated a significant gender gap in math anxiety, with women experiencing higher levels of anxiety compared to men. The study's identification of a critical ratio of -4.113, surpassing the critical value of 1.96 with a significance level of 0.05, pointed towards a statistically meaningful difference in anxiety levels between the genders. This corroborates with previous research highlighting the trend of women generally exhibiting greater math anxiety than their male counterparts. The study's results underscore the persistent nature of gender-based disparities in mathematics anxiety, reinforcing the importance of addressing this phenomenon to foster more inclusive and equitable learning environments where all students can engage with and excel in mathematics without the

hindrance of gender-related anxieties. Also, the study conducted by Karimi and Venkatesan (2009) aligns with the broader trend of gender disparities in mathematics anxiety. Their findings indicated that females exhibited a higher anxiety level, with a mean score of 69.41, compared to their male counterparts, who had a lower mean score of 63.81. This outcome reinforces the consistent observation that females tend to experience higher levels of mathematics anxiety than males. This aligns with the established understanding of gender differences in relation to mathematics anxiety, where societal factors, expectations, and stereotypes contribute to heightened anxieties among female students. The study's results underscore the need for targeted interventions and educational strategies that address these disparities, ensuring that all students, regardless of gender, are provided with the support and resources necessary to cultivate a positive and confident relationship with mathematics. The findings of Villamizar Acevedo *et al.* (2020) study echo the pattern observed in various research endeavours, indicating that female students tend to exhibit higher levels of anxiety in comparison to their male peers. Notably, their study also acknowledges a potential influencing factor—the composition of the sample. The inclusion of a greater number of girls compared to boys within the sample could have potentially skewed the results. This caveat emphasizes the need for careful interpretation of the findings and an awareness of potential biases introduced by sample demographics. While the observed gender difference aligns with the broader discourse on gender-based mathematics anxiety, this aspect highlights the importance of a balanced and representative sample to ensure the accuracy and validity of conclusions. Recognizing the potential impact of sample composition on the study's outcomes is essential when discussing gender-related differences in mathematics anxiety and underscores the need for future research to employ rigorous methods that address such biases. Zakaria *et al.* (2012) finds a mean score for math anxiety among male students to be 1.99 which was somewhat lower than the mean mathematics anxiety score for female students, which was 2.00. Also, Ducay and Alave (2021) in terms of gender, found girls ($M=2.72$, $SD=0.30$) to be more mathematically anxious than boys ($M=2.68$, $SD=0.41$). In trying to find whether or not the difference is significant, an independent t-Test value ($t = -0.09$, $p>0.05$) was obtained indicating no significant difference in math anxiety levels between boys and girls. That is to say, gender does not influence math anxiety. However, more females were included than males which could affect the findings. Also, the sample was too small considering the population (entire nation) which will make it difficult to generalize. Similarly, the findings of Essuman *et al.* (2021) demonstrated no statistically significant difference in mathematics anxiety between male and female students [$t(818) = -1.912$, $p=0.057$, 2-tailed] at 0.05 alpha level, with

female students reporting higher anxiety in mathematics ($M=74.24$, $SD=6.01$) than their male colleagues ($M=86.12$, $SD=7.20$). Also, Jekayinfa and Owonuwa (2022) studied one hundred and thirty-three students (71 males and 62 females) and the findings indicate that males ($M = 39.5$, $SD = 7.50$) were less anxious than females ($M = 43.0$, $SD = 8.09$). However, there was no substantial difference between male and female students' anxiety mean scores ($t(72) = 1.894$; $P > 0.05$). Even though women's anxiety mean score (43.0) was marginally higher than men's (39.5), and this difference is not statically important. In line with the above, females ($M= 51.50$, $SD= 10.2$) were more mathematics anxious than males ($M= 48.53$, $SD=11.40$) in the study of Zakaria and Nordin (2008). However, at the 5% level of significance, it was discovered that the value of "t" is 1.89, which is lower than the table value of "t" (1.96). It means that there is no gender difference in the level of mathematics anxiety among students in secondary schools. Akhoun (2021), also indicated that females ($M = 125.54$) exhibited greater anxiety than males ($M = 118.66$). There was no discernible difference in the level of anxiety between male and female senior secondary school students, based on a t-value of 1.79 which is not significant at 0.05 levels ($p>0.05$). Inconsistent with that, Iyamuremye *et al.* (2022) used a total of 415 students, with their ages ranging from 12 to 18 (mean = 14.8, Standard deviation = 1.1) with males made up more of the sample than females ($n=248$, 60%) to indicate that males ($M=3.65$) have less anxiety than their female counterparts ($M=3.73$). Though the difference was said to be less significant with a P-value of 0.32 which was greater than the alpha value of 0.05. In agreement, Sevindir *et al.* (2014) reported that female students had a greater level of mathematics anxiety compared to their male colleagues. A t-test analysis applied to the 482 sample indicates no significant difference in anxiety levels between boys and girls. Through Commodari and La Rosa (2021) study, math anxiety was found to be more prevalent in girls than in males. However, there were no appreciable variations in the amount of anxiety ($p>0.05$). To add to that, Szczygiel (2020) used a longitudinal design in his study where 369 children (205 girls, 164 boys) were selected and the outcome revealed that females ($M= 6.18$) in the study were more math anxious than the males ($M=5.17$) despite including more girls than boys in the sample. In a related study (von Bergen, 2020) in Zurich accounted that, 640 people were examined—320 males and 320 females—and the results show that women typically report having more arithmetic anxiety than men do. Also, in agreement are Ambaranti and Retnowati (2019) who indicated that boys (mean= 85.133) were found to be less anxious about arithmetic than girls (mean=87.144), but the difference was not significant. However, more girls (132) were included in the study than boys (86) which could have potentially affected the findings. Also, using a sample size of 238 SSS II students, the study of Agnes and Mathew

(2019) to identify the relationship between mathematical anxiety with students' performance in mathematics among senior school students in Nigeria revealed that at 0.05 alpha levels from the t-test result, there was no statistically significant difference in the influence of gender on mathematics anxiety. This suggests that students' fear of mathematics is not influenced by their gender; either male or female. However, the mean anxiety score of girls was higher than boys. Khasawneh *et al.* (2021) sampled 126 males and 217 females in a cross-sectional study and the findings show a mean anxiety score of 23.46 and 26.94 respectively. The results indicated that girls are more anxious than boys. Further analysis shows that the difference is significant. Anbar *et al.* (2022) findings also revealed boys' mean anxiety score to be 26.92 and girls' 30.20 indicating that boys were less mathematics anxious than girls. The difference was significant showing that gender influences mathematics anxiety with females being the most vulnerable. Also, Lunardon *et al.* (2022), stated that in comparison to males, females performed better on the math anxiety scale meaning that girls are more math anxious than boys. There was a statistically significant difference between the two groups ($t(138) = 3.26$, $p = 0.001$, Cohen's $d = 0.55$) indicating that gender is a predictive variable of mathematics anxiety. Bruce (2016) also noticed that males ($M =13.67$) were more math anxious than their female counterparts ($M = 12.38$) when he researched to find the level of mathematics anxiety among secondary school students in Kimbu. However, the difference was not significant. A significant difference was found between female and male anxiety (9.4000; $p<0.05$) by Asikhia (2021). Male students ($M =52.11$) were found to have high anxiety than females ($M=42.71$). However, more males were included than females which is likely to have an impact on the findings. Related to the above, Arup and Bijoya (2019) also found that boys ($N=150$) had a higher mean score of 45.38 for anxiety than girls ($N=150$) whose anxiety mean score was 43.08 in Bengal. A 't' score ($t= - 2.55$) with degrees of freedom being 298 demonstrates that there is a significant difference between boys and girls in mathematics anxiety (table value of 't' at 0.05 level is 1.96). As a result, there were noticeable gender-based differences in high school pupils' mathematics anxiety and the conclusion was that females suffer less math anxiety as compared to males. Also, in a survey study by Gupta and Maji (2022), data gathered from 200 Indian school children ($M = 110$; $F = 90$) finds that boys are more anxious than girls as far as mathematics is concerned. However, no gender difference was found in mathematics anxiety. Similarly, Cipora *et al.* (2018) did indicate in their study that there's no significant difference in mathematics anxiety levels based on gender. However, they discovered that gender inequalities varied by field of study category and were only evident in the STEM group—not in any other fields of study categories. However, males recorded higher anxiety scores than females. Although,

more females (418 female and 197 male) were included than males which could affect their findings. Thus, it was concluded that gender does not predict anxiety. Prahmana *et al.* (2021) also used a random sampling technique to select two thousand hundred and sixty-three students from both private and public senior high schools in Yogyakarta. The study also showed that mathematics anxiety among male students was higher than among female students.

METHODOLOGY

The research methodology employed in the study was rooted in a quantitative approach, which aimed to explore the relationship between gender and mathematics anxiety. The rationale behind selecting a quantitative strategy lies in its capacity to employ statistical tools that enable precise analysis of correlations between variables. This method allowed the researcher to quantify the extent of association between gender and mathematics anxiety, facilitating a comprehensive and systematic examination of this relationship across a broad sample. By utilizing numerical data, the study could objectively measure and quantify the degree of mathematics anxiety experienced by different genders, enhancing the rigor and objectivity of the analysis. Furthermore, the quantitative approach enabled the exploration of patterns and trends in a large dataset, which in turn supported the formulation of generalizable conclusions about the relationship between gender and mathematics anxiety within the study population.

To effectively investigate the interplay between gender and mathematics anxiety, an analytical cross-sectional design was chosen for the study. This design was particularly suited for the research objectives as it allowed the collection of data from a diverse group of individuals at a single point in time. The analytical cross-sectional design is adept at assessing the association between two variables within a specific time frame, aligning well with the quantitative nature of the study. By collecting data from the senior high school students in the Sagnarigu Municipality at a single instance, the study could capture a snapshot of the current state of gender-based mathematics anxiety levels. This design facilitated the exploration of trends and correlations in the data, enabling insights into how gender and mathematics anxiety might be interconnected. Overall, the combination of a quantitative approach and an analytical cross-sectional design provided a robust framework for investigating the intricate relationship between gender and mathematics anxiety in the study's context.

Study area

The study is focused on the Sagnarigu Municipality (Figure 1), one of the recently established districts within Ghana's

Northern Region. Geographically situated between latitudes 9.4687° north and longitudes 0.8654° west. The municipality spans a land area of approximately 114.29 square kilometers. Its elevation, reaching 189 meters, further characterizes its landscape. With its relatively new establishment, Sagnarigu Municipality holds the potential to offer insights into contemporary educational dynamics within the region.

The demographic composition of the municipality is of notable significance. According to data from the Ghana Statistical Service (GSS, 2021), the population of Sagnarigu Municipality is estimated to be around 342,000 people. The gender distribution is relatively balanced, with 50.6% being men and 49.4% women. The 23,447 dwellings within the municipality accommodate an average household size of six people, indicating a propensity for larger family structures. The municipality designation as a centre of education in the area makes it a pertinent location for the study. Its emerging status, combined with its demographic characteristics, offers a unique context to explore educational phenomena, such as the observed mathematics anxiety levels among senior high school students. Investigating this specific municipality can provide insights into the broader educational landscape of the Northern Region and contribute to the formulation of targeted interventions to address mathematics anxiety and its potential impact on academic achievement.

Study population

The target population of the study encompasses all senior high school students within the Sagnarigu Municipality. Encompassing various schools and educational institutions within this specific geographic area, the target population is defined by students who are currently enrolled in senior high schools. By focusing on this comprehensive group of students, the study aims to capture a representative cross-section of the municipality's educational landscape. This approach ensures that the research findings can be generalized to the broader senior high school student population in Sagnarigu, allowing for insights into mathematics anxiety levels that are reflective of the diverse student body and academic environments present within the municipality.

Sample and sampling procedure

In order to facilitate the research process, a subset of the senior high school student population in the Sagnarigu Municipality was selected as the study's sample. Employing a simple random sampling technique known as the lottery method, two schools were chosen out of the four schools present in the municipality. This method ensures that each school had an equal opportunity to be selected.

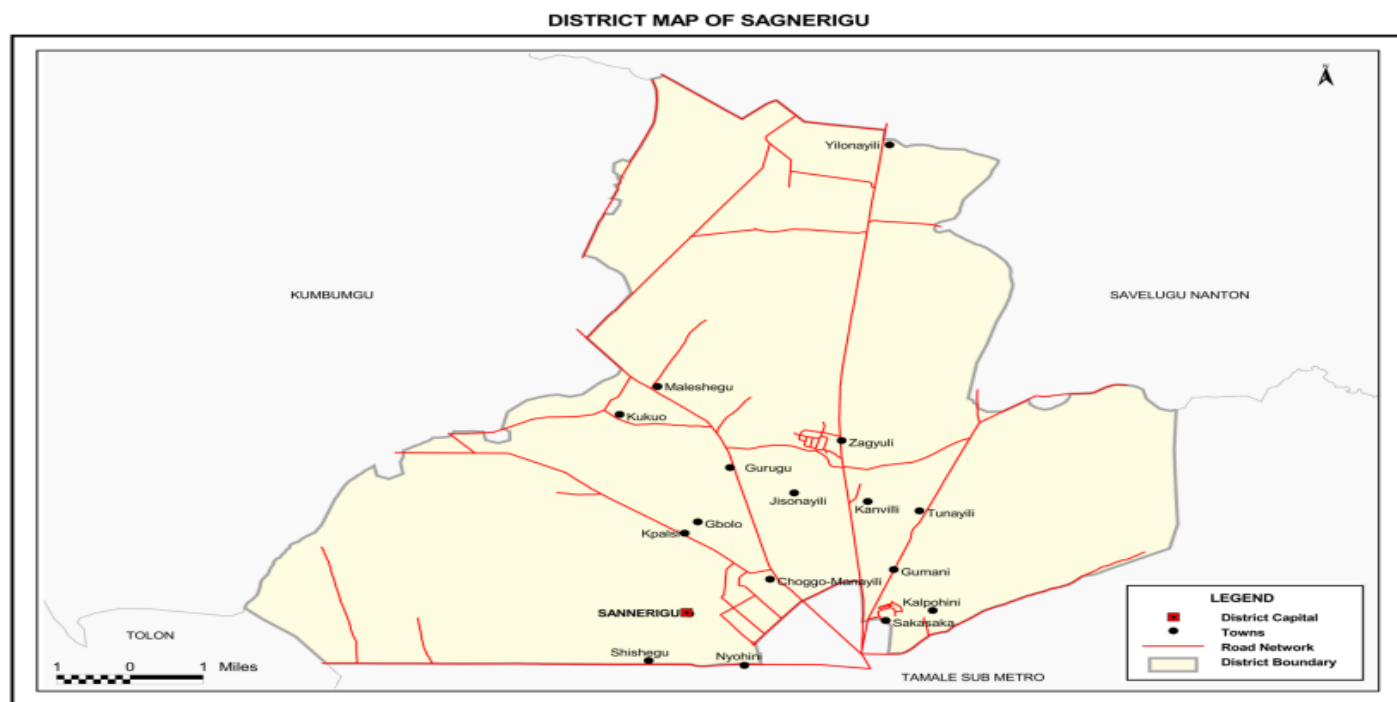


Figure 1. Geographical plan of Sagnerigu Municipality (Source: Ghana Statistical Service, 2014).

The total sample size of 385 respondents was determined using Andrew Fisher's formula, which takes into account factors like the desired level of confidence and margin of error. To allocate the number of respondents from each selected school, the population proportion of students in each school was divided by the total sample size, resulting in 212 respondents chosen from School A and 173 respondents chosen from School B. This approach ensured that the study captured a representative group of students from different schools within the municipality, enabling meaningful analysis and interpretation of the data regarding mathematics anxiety levels among senior high school students.

A simple random sampling technique was used to select the number of participants from each school. This technique gives every individual in the population an equal chance of being selected for a sample. Using Microsoft Excel, a unique identifier was assigned to each student in the population. Excel's random number generator was then used to generate 385 random numbers within the range of the total number of students. These random numbers correspond to the ID numbers of the selected students.

Data instruments

In order to assess the level of mathematics anxiety among

respondents, a 20-item mathematics anxiety scale was employed, adapted from the work of Richardson and Suinn (1972). According to Caroline Margaret Ford (2021), a measurement was first created by Richardson and Suinn in 1972 primarily to examine mathematical anxiety. This instrument was designed to capture various aspects of mathematics-related apprehension and discomfort. Notably, the scale comprises statements framed in a negative manner, aimed at probing individuals' levels of anxiety towards mathematics. Respondents were prompted to rate their agreement with each statement using a five-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree." It's important to highlight that on this scale, a higher degree of agreement with the statements actually signifies a greater presence of mathematics anxiety, with "Strongly Agree" reflecting elevated levels of such anxiety. The overall score for each participant was computed by summing up their responses across all 20 items, thereby producing a total score ranging from 20 to 100.

Based on this computed total score, the level of mathematics anxiety for each participant was subsequently determined. The established score ranges provided a framework for interpreting the results: scores falling between 20 and 46 were indicative of low mathematics anxiety, suggesting that the individual experiences minimal distress related to mathematics. Scores ranging from 47 to 75 pointed to a moderate level of mathematics

anxiety, indicating a moderate degree of discomfort or apprehension towards the subject. Conversely, scores exceeding 75 were associated with high mathematics anxiety, signifying a considerable level of unease and distress when faced with mathematical tasks or concepts. This categorization into low, moderate, and high anxiety levels allowed for a nuanced understanding of the respondents' relationship with mathematics, aiding researchers in identifying trends and patterns in mathematics anxiety within the sampled population.

Before commencing the main study, a preliminary pilot study was meticulously conducted to ensure the validity and reliability of the research instrument. The process began with the researchers acquiring an introductory letter from C.K. Tadam University of Technology and Applied Science that was submitted to the school authorities where the study was conducted, outlining the study's objectives and seeking permission for its implementation. Subsequently, a formal discussion was held with the school administration to obtain official authorization. It's worth noting that throughout this procedure, no coercion or pressure was exerted on any potential participants, ensuring that their voluntary involvement was fully respected. From the school's nominal roll, a random sample of 50 students was drawn for the pilot study. These selected students were then provided with a comprehensive explanation of the research's purpose before being administered the questionnaire. The primary aim of this exercise was to evaluate the instrument's reliability by examining the consistency of responses it elicited from participants. Upon analysing the data collected, a remarkably high Cronbach's alpha reliability coefficient of 0.901 was calculated. This compelling result underlines the instrument's strong dependability and underscores its exceptional performance. In addition to this, to bolster the instrument's credibility, accomplished researchers well-versed in the pertinent field were engaged to critically evaluate and validate the research instrument, thereby ensuring its robustness for subsequent application in the main study.

Data analyses

After collecting the raw data on Mathematics Anxiety scores for a sample of students, including their gender, appropriate data checks were done to avoid missing values, outliers, and errors. Necessary cleaning of the data was done to ensure its accuracy and completeness. Categories for Mathematics Anxiety levels were determined. That is "Low," "Moderate," and "High" based on the score ranges explained above. The frequency (count) of students falling into each category was determined using SPSS software, specifically descriptive statistics and the percentage of students in each category

was equally determined using the same package and tool. With regard to gender, descriptive statistics was used to determine the mean Mathematics Anxiety score for each gender group (e.g., males and females). The Mann-Whitney U Test was then performed to compare the mean Mathematics Anxiety scores between genders at a 95% confidence interval. The Mann-Whitney U Test was used because it is a non-parametric test suitable for comparing two independent groups when the data may not meet the assumptions of a parametric test.

RESULTS

Descriptive statistic on students' level of mathematics anxiety

Table 1 presents the outcomes of the assessment of mathematics anxiety levels among the 385 students who constituted the study cohort. As gleaned from the data in Table 1, it becomes evident that a substantial proportion of participants, specifically 233 individuals, demonstrated a considerably high extent of apprehension towards mathematics, translating to 60.5% of the total sample. On the other hand, 145 students, constituting 37.7% of the participants, exhibited a milder manifestation of anxiety in relation to mathematics. Remarkably, only seven students, equivalent to 1.8% of the sample, displayed a moderate level of anxiety. This distribution offers insights into the prevailing degrees of mathematics anxiety within the study population, emphasizing the prominence of high anxiety levels and signaling the need for a closer examination of potential influencing factors, particularly in the context of gender differences.

Hypothesis testing

The suitability of the appropriate statistical test for examining gender differences in the level of mathematics anxiety was determined through the application of the Shapiro-Wilk normality test. As depicted in Table 2, the obtained p-value of 0.01 stands below the predetermined significance threshold of 0.05. This outcome indicates that the distribution of the data does not conform to a normal distribution pattern. Consequently, in light of the non-normal distribution observed, the application of the independent t-Test (parametric) was deemed inappropriate. Instead, the Mann-Whitney test (non-parametric) was employed as a more suitable alternative for assessing potential gender differences in the context of mathematics anxiety levels. This rigorous selection of the statistical test ensures the accuracy and reliability of the subsequent gender-based comparative analysis of mathematics anxiety within the study population.

Table 1. Descriptive statistics of students' level of mathematics anxiety

Variable	Categories	Frequency	Percentage (%)
Level of anxiety	High anxiety	233	60.5
	Low anxiety	145	37.7
	Moderate anxiety	7	1.8

Source: Field Data, 2023.

Table 2. Descriptive statistics of gender and mathematics anxiety.

Variable	Categories	Frequency	Mean	SD	Shapiro-Wilk		
					Statistics	Df	Sig.
Anxiety	Male	200	63.5	24.051	0.636	385	0.01
	Female	185	68.22	22.992			

Source: Field Data, 2023.

Table 3. Mann-Whitney u test on the influence of gender on students' level of anxiety.

Variable	Gender	Number	Z	Sig (2-tailed)	U	Median
Math Anxiety	Male	200	-2.142	0.032	16171.500	80
	Female	185				80

Source: Field Data 2023.

H₀: There is no significant difference in mathematics anxiety between male and female senior high school students in the Sagnarigu Municipality

In order to explore potential gender-based disparities in the extent of mathematics anxiety among students, the Mann-Whitney test was employed in this study. The findings, presented in Table 3 encompass the outcomes of the Mann-Whitney test calculations, which were conducted using a two-tailed analysis and a significance level set at 0.05. To determine the critical value for the test, the Z table was consulted with the value $Z_{0.5(1-0.05)}$, yielding $Z_{0.0475}$, equivalent to 1.96.

The results derived from the Mann-Whitney test revealed notable distinctions between the two genders concerning their levels of mathematics anxiety. Specifically, the group of female participants (median = 80, $n = 185$) and the male counterparts (median = 80, $n = 200$) displayed distinct patterns of mathematics anxiety. The calculated U value amounted to 16171.500, while the z-score was computed as -2.142, and the p-value was determined to be 0.032. This observed p-value is found to be lower than the predetermined alpha value of 0.05, indicating statistical significance. This outcome thereby indicates compelling evidence that a significant discrepancy exists in terms of mathematics anxiety levels between male and female students. Consequently, the null hypothesis H_{01} , positing an absence of gender-based

differences in mathematics anxiety, was found to be unsupported by the data and was thereby rejected in favour of the observed differences between the two genders.

DISCUSSION

Students' level of mathematics anxiety

The study's findings highlight a concerning prevalence of high mathematics anxiety levels among students, with a majority (60.5%) falling into the high anxiety category. This outcome resonates with the results obtained by Zakariya (2018), whose research with second-year senior high school students in Saudi Arabia similarly identified a substantial proportion (65%) of students experiencing high levels of mathematics anxiety. Interestingly, these parallel findings underscore the consistent nature of high mathematics anxiety levels across different educational contexts and provide further support for the assertion that mathematics anxiety is a pervasive issue among students. The congruence between these studies emphasizes the need for tailored interventions that address the multifaceted factors contributing to mathematics anxiety, including the potential influences of gender, to create a more supportive and anxiety-reducing learning environment for all students.

Estonanto (2018) study which investigated the extent of mathematics anxiety among secondary school learners in the Philippines, aligns with the emerging pattern of concerning findings. His research revealed that a significant majority of participants, specifically 76% of them, reported having a high degree of fear towards mathematics. This substantial prevalence of heightened mathematics anxiety levels signifies a noteworthy concern within the educational landscape. The study's results mirror those of previous research, underlining the widespread nature of mathematics anxiety among students. The alarming indications of mathematics anxiety underscore the importance of addressing this issue urgently through targeted interventions that address the emotional and psychological barriers inhibiting students' engagement with mathematics, enabling them to approach the subject with greater confidence and achieve their full potential.

The congruence between this current study's findings and the research conducted by Asikhia (2021) underscores a consistent pattern in identifying high levels of mathematics anxiety among students. Asikhia's study, which involved a descriptive survey with 270 second-year students from Ogun West Senatorial District, further contributes to the mounting evidence of alarming mathematics anxiety levels. Although employing different research methodologies, sampling techniques, and analytical tools, both studies share the common observation that a substantial proportion of students experience elevated levels of mathematics anxiety. The convergence of results across varied research designs and contexts emphasizes the urgency of addressing the pervasive issue of mathematics anxiety and underscores the significance of implementing interventions that cater to the unique challenges and needs of students, enabling them to approach mathematics education with confidence and achieve improved outcomes.

Gender and students' level of mathematics anxiety

The results from the study revealed a significant gender-based difference in mathematics anxiety levels among the participants. Specifically, males displayed a lower level of mathematical anxiety (Mean = 63.50, SD = 24.051) in comparison to females (Mean = 68.22, SD = 22.992). This difference was supported by a p-value of 0.032 at a 95% confidence interval, leading to the rejection of the null hypothesis H_{01} . This implies that students' fear of mathematics is indeed influenced by their gender. This finding resonates with previous research that has consistently suggested a negative correlation between mathematics anxiety and achievement in the subject (Bornaa et al., 2023). As highlighted, individuals with higher mathematics anxiety tend to perform less effectively in mathematics, while those with lower anxiety levels tend

to achieve better results. Furthermore, this study corroborates the broader observation that females tend to be perceived as lower achievers in mathematics, a trend that could potentially be linked to the higher levels of mathematics anxiety often reported among female students. The study's outcomes emphasize the importance of addressing gender-specific anxieties and providing tailored interventions to create a more supportive and inclusive learning environment that enables all students to overcome their anxiety and succeed in mathematics.

The observed lower performance by females in mathematics can indeed be attributed to their heightened levels of mathematics anxiety. The connection between mathematics anxiety and academic performance has been well-established, with research consistently showing that higher anxiety levels are associated with poorer achievement in mathematics. In the context of females, who tend to experience greater mathematics anxiety on average, this correlation is particularly relevant. The anxiety can hinder their cognitive processes, impeding their ability to focus, reason, and problem-solve effectively in mathematical tasks. Consequently, by reducing mathematics anxiety among female students, it becomes plausible to expect an improvement in their performance. Addressing anxiety can create an environment where females can engage with mathematical concepts more confidently, enabling them to allocate their cognitive resources more efficiently and approach challenges with greater clarity. As anxiety decreases, females could potentially close the performance gap and achieve outcomes more on par with their male counterparts. Thus, focusing on strategies to alleviate mathematics anxiety holds the potential to not only enhance female students' academic performance but also promote greater equity in educational outcomes.

The congruence between this study's findings and those of Anbar *et al.* (2022) reinforces the consistent pattern of gender-related differences in mathematics anxiety. Anbar *et al.*'s study echoed the observed trend where boys exhibited a lower mean anxiety score ($M = 26.92$) in comparison to girls ($M = 30.20$), underscoring that boys tend to be less anxious about mathematics. The statistical significance of this difference emphasizes that gender plays a role in influencing mathematics anxiety, with females being particularly vulnerable to higher levels of anxiety. These shared results across studies contribute to a growing body of evidence suggesting a consistent gender pattern in mathematics anxiety, with females more likely to experience elevated levels of anxiety. This supports the assertion that addressing gender-specific factors, such as the emotional challenges associated with mathematics anxiety, is essential to promote more equitable educational environments. By understanding and addressing these disparities, educators and stakeholders can implement targeted interventions that support both

male and female students in overcoming their anxieties and performing optimally in mathematics.

The alignment between the present study's findings and those of Lunardon *et al.* (2022) further show the consistent nature of gender-related differences in mathematics anxiety. Their study similarly observed that females outperformed males on the math anxiety scale, signifying that girls are more prone to experiencing mathematics anxiety compared to boys. The statistical significance of this difference, as indicated by the t-test ($t(138) = 3.26$, $p = 0.001$, Cohen's $d = 0.55$), underscores the predictive role of gender in mathematics anxiety. Despite the variations in research methodologies, designs, settings, and sample sizes between the two studies, the congruence of their results tailored the robustness of the observed gender pattern in mathematics anxiety. These parallel findings emphasize that addressing gender disparities in anxiety experiences is vital for creating an equitable educational environment that supports all students in overcoming their anxieties and thriving in their mathematical pursuits. The convergence of research outcomes across diverse contexts reinforces the urgency of addressing this issue systematically and comprehensively.

However, there is a discrepancy between this study's findings and that of Bruce (2016) indicated the nuanced nature of mathematics anxiety and its potential variations based on different research designs, settings, and sample sizes. Bruce's exploratory design and qualitative approach, conducted with a smaller sample size of 200 students from two different schools in distinct districts, yielded results that indicated males ($M = 13.67$) to be slightly more math anxious than females ($M = 12.38$), although this difference was not statistically significant. Conversely, the present study, employing a cross-sectional design with a larger sample size of 385 students from two senior high schools within the same municipality, indicated that females tend to have higher levels of mathematics anxiety than their male counterparts, and this difference was statistically significant. The divergent outcomes could potentially be attributed to a combination of factors, including the study designs' inherent differences (exploratory vs. cross-sectional), the varied settings and types of schools selected, and the discrepancies in sample sizes. The inclusion of senior and junior high schools from different districts in Bruce's study introduces additional contextual and demographic variables, which might have contributed to the differing results. These variations highlight the complex interplay of factors influencing mathematics anxiety and the importance of considering the specific context, research design, and characteristics of the sample population when interpreting and comparing research outcomes. Despite these differences, both studies contribute valuable insights to the broader discussion on mathematics anxiety, underlining the need for a comprehensive approach to address this issue effectively in diverse educational settings.

The alignment between the results of this study and the findings of Anbar *et al.* (2022) and Lunardon *et al.* (2022) underscores a consistent pattern suggesting that males and females exhibit differing degrees of mathematics anxiety. Anbar *et al.*'s study, Lunardon *et al.*'s study, and the present study collectively point towards a gender-based disparity in mathematics anxiety levels, where females tend to experience higher levels of anxiety compared to males. This convergence of findings underscores the influence of gender as a predictive variable for mathematics anxiety, suggesting that gender plays a significant role in determining students' anxiety levels toward mathematics. The consistency across diverse studies, despite variations in methodologies and contexts, highlights the robustness of the observed gender-related pattern in mathematics anxiety.

Conclusion

Through the conducted study, it was discerned that the level of mathematics anxiety among senior high school students in the Sagnarigu Municipality has reached a significant degree of intensity, ultimately leading to the conclusion that mathematics anxiety is prevalent at a high level within this demographic. The gathered data and analysis of respondents' scores on the adapted mathematics anxiety scale indicated consistent patterns of agreement with negatively worded statements, reflecting a pronounced discomfort and unease towards mathematical concepts. With scores exceeding the established threshold for high mathematics anxiety, it becomes evident that the students' collective responses reflect a pervasive sense of apprehension and distress in relation to mathematics. This conclusion, drawn from the comprehensive assessment of the sample's aggregated responses, underscores the noteworthy presence of mathematics anxiety within the senior high school student population in the Sagnarigu Municipality.

The study also delved deeper into the dynamics of mathematics anxiety by investigating potential gender differences among students. The analysis of mathematics anxiety scores with respect to gender revealed a noteworthy distinction: female students exhibited a higher degree of mathematics anxiety in comparison to their male counterparts. This finding indicates that girls, on average, displayed a greater propensity towards experiencing discomfort and apprehension when confronted with mathematical concepts and tasks. Importantly, the study went beyond mere observation and demonstrated that gender could serve as a predictive factor for students' levels of mathematics anxiety. This suggests that a student's gender plays a role in determining the extent of their mathematical apprehension. Such a discovery can have significant implications for educational practices and interventions, as it sheds light on a potential source of

variability in students' academic experiences and performance. The implications of these gender-related findings are multifaceted. The elevated levels of mathematics anxiety experienced by female students carry potential consequences for their overall academic achievement, particularly in mathematics. The correlation between higher mathematics anxiety and lower achievement suggests that the heightened fear of mathematics among female students may contribute to comparatively lower performance outcomes in this subject. This could stem from factors such as reduced self-confidence, stereotype threat, or societal expectations that may disproportionately affect girls' attitudes and aptitudes in mathematics. Recognizing this gender-based disparity in mathematics anxiety is crucial for educators and policymakers, as tailored interventions targeting the unique challenges faced by female students could help mitigate the negative impact of anxiety on their mathematical learning experiences and achievements.

Recommendation

In light of the study's identification of high levels of mathematics anxiety among Senior High School students in the Sagnarigu Municipality, it is imperative that educational institutions and policymakers implement targeted interventions to address this concerning issue. First and foremost, a comprehensive and inclusive mathematics curriculum should be developed that incorporates pedagogical approaches designed to alleviate mathematics anxiety. Incorporating interactive and experiential learning methods, where students can engage with real-world applications of mathematical concepts, could help demystify the subject and reduce anxiety-inducing perceptions. Additionally, creating a supportive and open learning environment that encourages students to share their concerns and seek assistance when facing mathematical challenges can foster a sense of community and decrease the stigma associated with mathematics anxiety. Educators should also receive training to identify signs of anxiety and employ strategies that build students' self-efficacy and confidence in tackling mathematical tasks. By addressing mathematics anxiety directly through curriculum design, pedagogical approaches, and teacher training, schools can create an environment where students feel empowered to overcome their apprehensions and excel in mathematics.

Furthermore, given the gender-based differences in mathematics anxiety revealed by the study, it is essential to implement gender-sensitive interventions that support female students in particular. Schools should establish mentorship programs or support groups that offer a safe space for female students to discuss their anxieties and receive guidance from mentors or peers who have successfully navigated similar challenges. Encouraging

positive role models and showcasing the achievements of successful female mathematicians can help counteract negative stereotypes and inspire young women to pursue mathematics with confidence. Additionally, targeted workshops on growth mindset, resilience, and coping strategies for managing anxiety could equip both male and female students with valuable tools to navigate the academic demands of mathematics. By acknowledging and addressing gender differences in mathematics anxiety, schools can foster an inclusive learning environment that ensures all students, regardless of gender, have the opportunity to thrive in mathematics and reach their full academic potential.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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