



East African Journal of Education Studies

eajes.eanso.org

Volume 6, Issue 2, 2023

Print ISSN: 2707-3939 | Online ISSN: 2707-3947

Title DOI: <https://doi.org/10.37284/2707-3947>

ENSO

EAST AFRICAN
NATURE &
SCIENCE
ORGANIZATION

Original Article

Mathematics Anxiety and Academic Performance of Senior High School Students in Sagnarigu Municipality, Ghana

Christopher Saaha Bornaa^{1*}, Hardi Abdul Rahaman² & Abdulai Boare Iddrisu³

¹ C. K. Tadam University of Technology and Applied Sciences, P. O. Box 24, Navrongo, Ghana.

² Tamale Islamic Science Senior High School, P. O. Box 1485, Tamale, NR, Ghana.

³ Kalpohin Senior High School, P. O. Box 137, Tamale, NR, Ghana.

* Author for Correspondence ORCID ID: <https://orcid.org/0000-0003-2508-6114>; Email: abdulaiboare@gmail.com

Article DOI: <https://doi.org/10.37284/eajes.6.2.1358>

Date Published: **ABSTRACT**

13 August 2023

Keywords:

*Level of Anxiety,
Mathematics,
Level of Performance,
Senior High School
Students.*

Numerous experts have now pointed to Mathematics Anxiety as the reason why students achieve poorly in maths at all educational levels. Research has examined the relationship between math anxiety and students' academic performance in advanced nations; however, less focus is given to this topic in the Ghanaian context, particularly in the Sagnarigu municipality, where the performance of pupils in school has been poor for more than ten years. This made it necessary to investigate the topic thoroughly to determine if mathematical anxiety and academic achievement are related. To do this, the investigators used a quantitative approach and an analytical cross-sectional design to select 385 students at random from two senior high schools. While student academic reports served as secondary data to gauge learners' success in mathematics, a 20-item math anxiety questionnaire was the primary tool utilised to gauge students' level of arithmetic fear. The relationship between the primary and outcome variables was examined using Pearson product-moment correlation. Performance in mathematics declines as math anxiety rises, as indicated by the two variables' strong negative association ($r = -0.85$). Because mathematics anxiety is a well-established predictor of performance in mathematics, the study urges all stakeholders to pay close attention to it and take aggressive action to stop it.

APA CITATION

Bornaa, C. S., Rahaman, H. A. & Iddrisu, A. B. (2023). Mathematics Anxiety and Academic Performance of Senior High School Students in Sagnarigu Municipality, Ghana *East African Journal of Education Studies*, 6(2), 347-366. <https://doi.org/10.37284/eajes.6.2.1358>.

CHICAGO CITATION

Bornaa, Christopher Saaha, Hardi Abdul Rahaman and Abdulai Boare Iddrisu. 2023. "Mathematics Anxiety and Academic Performance of Senior High School Students in Sagnarigu Municipality, Ghana". *East African Journal of Education Studies* 6 (2), 347-366. <https://doi.org/10.37284/eajes.6.2.1358>

HARVARD CITATION

Bornaa, C. S., Rahaman, H. A. & Iddrisu, A. B. (2023) "Mathematics Anxiety and Academic Performance of Senior High School Students in Sagnarigu Municipality, Ghana", *East African Journal of Education Studies*, 6(2), pp. 347-366. doi: 10.37284/eajes.6.2.1358.

IEEE CITATION

C. S., Borna, H. A., Rahaman & A. B., Iddrisu, "Mathematics Anxiety and Academic Performance of Senior High School Students in Sagnarigu Municipality, Ghana" *EAJES*, vol. 6, no. 2, pp. 347-366, Aug. 2023.

MLA CITATION

Borna, Christopher Saaha, Hardi Abdul Rahaman & Abdulai Boare Iddrisu. "Mathematics Anxiety and Academic Performance of Senior High School Students in Sagnarigu Municipality, Ghana". *East African Journal of Education Studies*, Vol. 6, no. 2, Aug. 2023, pp. 347-366, doi:10.37284/eajes.6.2.1358

INTRODUCTION

Nothing in life can be divorced from mathematical logic and understanding. Therefore, without mathematics, learning and existence on Planet cannot work correctly (Khadijat & Saidat, 2022). In addition, understanding mathematics would help people understand the natural world and sharpen their attention (Uludag, 2022). Demedts et al. (2022) emphasise how being more mathematically literate increases one's opportunities, improves overall health, and increases one's social utility. Since mathematics is now more than merely an academic discipline or course of study, it has become a crucial skill for both personal and professional development. For this reason, many nations, like Spain, have made the study of mathematics a legal requirement (organic Law 8/2013), which obliges every citizen to possess a sufficient understanding of mathematics as well as the ability to apply it to situations when necessary (Trujillo-Torres et al., 2020).

Studies indicate that when mathematical skills are cultivated early in a kid's life, the youngster will flourish not merely in mathematics in subsequent years but also in other academic areas. Samante and Alave (2021) did make the claim that academic success, in general, is guaranteed by arithmetic proficiency. A nation's math instruction is comparable to an individual's protein consumption. After realising how crucial mathematics is to a country's prosperity, the Ghanaian government mandated all students take it in elementary and high school (Olaewe, 2012). Due to this, arithmetic is one of the subjects that all students in Ghana and many other nations are required to take beginning in early school and continuing through college. To increase future prospects and maintain productive lives both at school and in their daily lives, mathematics

education is mandated for kids around the world (Kaushal et al., 2022). Learning mathematics gives us the knowledge, equilibrium, and self-drive we need to solve problems, use good judgment in daily life, and create more chances for tomorrow.

Shakmaeva (2022) argued that the standard of mathematics education provided in a nation had a significant impact on that nation's technological and scientific advancement. He goes on to say that a nation's failure to develop its mathematics will result in failure in all other areas of growth. In addition, Fatawu and Offei (2022) said that the entire globe rests its hopes on technology, that everything about technology is mathematics and that mathematics education is the bedrock and key tool for global advancement in science, innovation, and industry. Mathematical understanding can be applied to many different fields and languages, and it provides a general framework for a number of fields, particularly astrology, engineering, and mechanics. Poorghorban et al. (2018) believe that as mathematics is the foundation of technology and the world is founded on technology, good mathematics achievement and education should be highly valued. Moreso, Vargas (2021) believes that because mathematics is the basis for science and technology, it is essential for success in today's modern world and for overcoming the obstacles of daily life. Estonanto (2018) argues that the rise of a nation's economy can also be predicted by mathematics, according to studies. He argues that in terms of economic growth, nations with high mathematics achievement rates outperform those with low mathematics achievement rates. Due to the emphasis they placed on mathematical education, nations like Singapore, Japan, China, and the United States were seen as being among the most economically developed in the world. The expectations that

business has of the educational system have shifted as a result of recent developments in science and technology. Businesses increasingly look for graduates who can come up with new solutions to problems, overcome obstacles, etc. According to some, only mathematics can satisfy commercial demands (Serim, 2022). Numerous fields in higher education have been designated as requiring a strong foundation in mathematics, and one is likely to be refused the chance to study those subjects if their math grade is insufficient.

Rozgonjuk et al. (2020) advocated that mathematics should be a required course of study at all pre-tertiary levels of education because a large number of fields rely on the application of mathematical thinking and because of its connection to all sciences. Most colleges demand mathematics as a precondition for entrance since other tertiary-level disciplines of study also require analytical skills, which have a strong correlation to the knowledge of mathematics. Most postsecondary schools in Ghana do not accept applicants who fail mathematics because of the importance of the subject, regardless of how well they perform in other disciplines. For instance, teacher training institutions in Ghana do not admit candidates who received a mathematics grade of less than C6, regardless of their other grades.

Despite the importance of mathematics, as previously indicated, worldwide mathematics performance has not been good (Fokuo et al., 2022). A major obstacle and one of the main reasons why most people in Africa stop their education after secondary school is that the majority of African nations performed below average or average in both basic and secondary school mathematics. This lowers the number of exceptional students who may pursue math degrees at universities (Brezavšček et al., 2020). When compared to other grades with a general indefinite trend of performance, senior high graduates' performance in mathematics at the West African Senior School Certificate Examination (WASSCE), which served as a benchmark of achievement at the senior high school level, is characterised by a high percentage

of candidates receiving a grade F9 (fail). This percentage has remained largely stable over the years (Abreh et al., 2018).

Considering the situation in Ghana, Bruce (2016) published a startling statistic, quoting 813,790 students who graduated from high school between 2006 and 2013 but were denied entry to university education because they received a D7 or lower in mathematics. Furthermore, a recent study by Ansah et al. (2020), after a five-year review of SHS students' math performance (WASSCE) from 2013 to 2017, revealed that more than half of those who sat the test during that time period could not earn the grade of C6 or above in mathematics, which is necessary for entrance to universities and institutions. This prevented many talented young Ghanaians from following their hearts' desires. Results from the Northern Region are worst compared to the national average, and this calls for further research to reveal the causes.

Numerous investigators have found it crucial to look into the factors that result in this poor performance in order to draw attention to these factors so that measures could be put in place to if not stop but reduce the canker as poor math achievement has an impact on many aspects of humanity, specifically the life. This is because low mathematical success or poor achievement in mathematics of students around the world, particularly in Ghana, has caused public outcry (Akinoso, 2020).

Several studies have looked at the determinants of poor performance in mathematics (Ayebale et al., 2020; Senajonon, 2013). For instance, Ayebale et al. (2020) listed a number of significant factors that influence students' math performance, including the classroom environment, the teachers' attitudes, the students' attitudes toward mathematics, the student's prior arithmetic proficiency, and gender-related features. One could classify gender-related and earlier math experiences as personal factors. Evidence that arithmetic anxiety plays a significant influence on children's low academic performance in math is beginning to emerge. Due to the increased understanding that mathematics plays a

significant role in students' understanding of the topic, mathematics instructors are more aware of the students' fear of mathematics as a crucial component in the mathematical learning environment (Senajonon, 2013). Numerous studies show that many students experience some level of math anxiety and that this worry appears to be a major factor in mathematics success.

Uludag (2022) said that the success of students is greatly affected by math anxiety, and those who struggle with mathematics anxiety are less likely to succeed in careers in science, technology, engineering, and other mathematics-related fields. Even six-year-old students experience math anxiety. According to Bedetti and Elisei (2019), Over 30% of secondary school students from Organization for Economic Co-operation and Development (OECD) countries report experiencing stress and anxiety while working on math problems and homework, and 59% reportedly worry that they will struggle with the subject. This suggests that math anxiety is a widespread problem that needs to be addressed among secondary school pupils. The majority of this research comes from developed economies; thus, it might not apply to countries with limited resources like Ghana. Many studies identified math anxiety as a cause for low performance in mathematics as these students usually show strong disapproval, full avoidance, or enormous detrimental nervousness when asked to perform calculations, and this may lower their interest which will eventually affect their frequency in engaging in mathematics.

Anxiety in math was first described in 1954 by Gough as "Mathema phobia" (Clarke, 2021) Fokuo et al. (2022) reported that students typically experience mathematical anxiety in school, which results in the development of negative attitudes toward the subject and poor performance in math classes. Kelly et al. (2022) projected that 93% of the total citizens of the United state of America of all ages experience some level of math anxiety, which can range from mathematical inference activities like stabilising a ledger to reviewing a quantifiable scientific study, analysing and making meaning out of a voting

result, or making judgments about whether informative attached broadcast news may be factually inaccurate etc. Because of the growing concern over math anxiety being a cause of low performance, numerous schools and institutions in the developed world have now started to provide math anxiety development courses in an effort to help students overcome their math anxiety to improve performance (Napier, 2017).

Numerous studies have shown that a learner's anxiety about mathematics has a significant impact on his or her success in academia and career selection in the future or serves as an obstacle to the learning of mathematics. For instance, Appiah Essuman et al. (2021) demonstrated that mathematics anxiousness lowers achievement and has a long-lasting detrimental repercussion on academic performance.

If this barrier fails to be eliminated, it could lead to subpar mathematical performance as well as a lack of interest in the subject. In order to establish a basis for the subsequent course of action, it is imperative to take action as soon as it is practical to ascertain whether mathematics anxiety has any relationship to academic performance.

The senior high school stage is a critical period in a student's academic journey, where the foundations of various subjects, including mathematics, are further developed and solidified. At this stage, students face increasing academic demands and expectations, and their attitudes and perceptions toward mathematics can significantly impact their performance in the subject.

The Sagnarigu Municipality, located in the northern part of Ghana, represents a unique educational context where mathematics anxiety and its potential influence on academic performance may be particularly relevant. Understanding the prevalence and effects of mathematics anxiety among senior high school students in this municipality is crucial for educators, policymakers, and other stakeholders to develop targeted interventions and support

mechanisms to enhance student's learning experiences and academic outcomes.

Despite the recognition of mathematics anxiety as a significant issue, limited research has been conducted on this topic within the specific context of the Sagnarigu Municipality. Prior studies in other regions have shown that mathematics anxiety can lead to decreased motivation, avoidance behaviours, and reduced self-efficacy in mathematics, ultimately impacting academic achievement negatively. Therefore, this study aims to bridge the gap in the literature by investigating the relationship between mathematics anxiety and academic performance among senior high school students in the Sagnarigu Municipality.

Statement of the Problem

It is impossible to overstate the value of mathematics, which is crucial for both scholastic success and the smooth operation of our daily lives. For Ghana as a nation to advance quickly in the twenty-first century, high-quality mathematics instruction is necessary, especially at the junior and senior high school levels (Karikari et al., 2020). Numerous causes contribute to the poor performance of many students in mathematics, and many of them occasionally purposefully avoid it. Studies have attempted to comprehend these factors, and anxiety is one among them as Siaw et al. (2020) accounted that Math Anxiety is one of the key factors that keep students from being successful in the subject.

In order to compete in the global market, there is a strong need for graduates in the STEM fields today. As a result, many governments and organisations have invested and continue to invest heavily in infrastructure and equipment to promote STEM education (Foley et al., 2017). Since mathematics is the foundation of STEM education, educators today place a lot of stress on student's mathematical ability and knowledge, especially in light of the growing interest in STEM fields (Siaw et al., 2020).

However, despite the efforts made by Governments, individuals and organisations

towards STEM education, most students still have a fear of mathematics which has been argued as a crucial component of STEM (Rozgonjuk et al., 2020). Mathematics anxiety is identified as a potential barrier to performance in STEM education strategies; interventions to improve STEM success should rather be targeted at mathematics anxiety instead (Daker et al., 2021).

According to Deleg et al. (2022), a greater percentage of students still have some form of hate and phobia for mathematics as a discipline, and their dislike for it keeps increasing yearly. Such students always feel uneasy whenever mathematics is mentioned. Their outlook regarding the subject is becoming more negative, and the majority of them struggle with maths due to their chronic anxiety about it.

Math anxiety can be eliminated completely or brought down drastically in students when we have a better view and comprehension of how it is connected to performance in mathematics Siaw et al. (2020) have written that knowing how the degree of anxiety in mathematics relates to students' achievement in mathematics may hold the key to assisting students in achieving arithmetic proficiency. In agreement with the above, Marshall et al. (2017) argue that when a mathematics-anxious person becomes aware that their status (level of fear of mathematics) is related to their success in mathematics, they will adapt to get rid of that fear.

While numerous studies have looked into the relationship between the fear of mathematics and success in maths among senior high schools in the developed world, little information is available in Ghana, and no research has been done in this area according to what is known to the researcher in the northern region at large and particularly in Sagnarigu Municipality to find out whether or not anxiety for mathematics is related to academic performance. As a result, the current study attempts to fill in this gap.

It is against this backdrop that the present research seeks to measure the relationship between mathematics anxiety and students performance

among Senior High School Students in the Sagnarigu Municipality.

Research Objective

To examine the relationship between Mathematics Anxiety and Performance.

Research Hypothesis

H₀: There is no significant relationship between Mathematics Anxiety and Performance among Senior High Schools Students in the Sagnarigu Municipality.

LITERATURE REVIEW

Negative Relationship Between Mathematics Anxiety and Performance

According to Tolibao and Moneva (2021), students with high levels of mathematics anxiety perform in a “bad state”. Their study found a moderate negative correlation between mathematics anxiety and performance. As pupils’ degree of arithmetic anxiety declines, their mathematical proficiency rises. However, a chi-square analysis shows a value of 6.6 with a degree of freedom to be, which was less than the critical value of 9.49. This led to the conclusion that there is no substantial relationship between pupils’ academic performance and their degree of maths anxiety and that performance grade in general mathematics is not affected by math anxiety. Iyamuremye et al. (2022) findings indicated a negative correlation between senior high school performance and their level of mathematics performance. The relationship found was moderate and insignificant. Also, Omar et al. (2022) study revealed that though students’ mathematics anxiety has some relationship with their performance, this relationship has no effect. Their study found a weak correlation ($r = -.138$) between the two variables. The p-value found was higher than 0.05. suggesting that students’ level of mathematics anxiety has no influence over their performance.

Etuk et al. (2021) study also found an inverse relationship between the two variables. However, their findings indicated that the regression output

had an F-ratio of 478.286 with a p-value of .000, which was less than the alpha level of 0.05, indicating a substantial impact of math anxiety on academic achievement in the Calabar Education Zone. An adjusted multiple coefficients of determination R^2 (i.e., .7162) of 0.513 indicates that math anxiety contributed to 51.3% of the variance in academic performance in mathematics. Also, the low beta value (-.716) suggested that math anxiety had a detrimental effect on scholastic performance in mathematics. Hence, math anxiety is strongly inversely correlated with academic success in mathematics. Similarly, Khaliq (2020), in his descriptive survey to investigate the association between mathematics anxiety and academic performance using the Pearson product-moment coefficient of correlation (r), reveal that academic performance among students and mathematics anxiety is moderately inversely correlated, with $r(298) = -.57$, $p = .001$. As a result, it was concluded that there is a statistically significant inverse association between learners’ math achievement and their mathematics anxiety. This means that a rise in students’ fear of maths lowers their scholastic success in mathematics.

Ducay and Alave (2021) said that high performers are more self-assured and have a deeper mastery of mathematics than poor scorers and that high performers have low mathematics anxiety while low performers have high mathematics anxiety. This conclusion was drawn after a descriptive correlational study was used to find the relationship between maths anxiety and with the performance of grade ten students in Sicaba high school. The findings showed that academic achievement and mathematical anxiety were found to be moderately negatively correlated. Math performance suffers when math anxiety is higher (Article, 2021). A sample of 1050 senior high students was found to have a significant moderately negative correlation ($r = -0.419$) between mathematics anxiety and achievement in mathematics. Also, Chang and Beilock (2016) found a negative relationship between math anxiety and math performance in their study.

Cuevas and Berou (2016) argued that those who struggle with math are less adept at the subject than their non-math-anxious peers. In other words, arithmetic anxiety is only a cover for subpar math skills. It was added that math anxiety is linked to issues with fundamental numerical processing, which is assumed to serve as the foundation for more complex mathematical abilities. It was further revealed that high-math-anxious persons have lower event-related potential (ERP) amplitude in the early stages of numerical processing, stronger numerical distance and size effects, and a bigger amplitude of the ERP distance effect. Thus, a less exact grasp of numerical magnitudes may contribute to poor arithmetic performance linked with math anxiety. Their study on “students’ self-efficacy and anxiety correlate with performance” found that students’ level of mathematics anxiety and achievement in mathematics is significantly strongly inversely correlated. According to this finding, students’ academic success is inversely correlated with their level of mathematics anxiety, with higher mathematics anxiety being associated with worse academic achievement and vice versa.

In addition, Alam (2018) carried out a study to look at Aligarh secondary school students’ arithmetic achievement and math anxiety, and 200 people were chosen at random as a sample. The data was gathered using the Mathematics Anxiety Rating Scale - India (MARS - I). The findings showed a substantial inverse association between secondary school pupils’ mathematics achievement and mathematics anxiety. The study also discovered a statistically significant relationship between secondary school students’ mathematics anxiety and math achievement in terms of gender.

To add up to this, Zakaria et al. (2012) said that, depending on the level of mathematics, there are significant disparities (negative) in the mean mathematics performance scores ($df = 2, 194, p < 0.05$). This implies High achievers have lower levels of anxiety, but underachievers in math have higher levels of nervousness. Their study attributed the inverse relationship to the fact that high performers are more confident and hence less

anxious than poor achievers. In relation to this, Monoranjan Bhowmik's (2017) study indicated a weak ($r = -0.29$) but significant ($p < 0.05$) negative association between math anxiety and performance. This suggests that math accomplishment grades decline as math anxiety scores rise.

Also, Carey et al. (2019) in their work concluded that mathematics anxiety is strongly inversely proportional to performance in mathematics. It was indicated that those with higher levels of arithmetic anxiety typically perform worse in mathematics. More to this, Karimi & Venkatesan (2009) also reported a significant weak negative correlation between maths anxiety and performance with ($r = -0.21, p < .01$). This means that students with high anxiety were found to perform low in maths while those who perform high score in mathematics had a low level of anxiety. Al-Shannaq and Leppavirta (2020) examined the relationship between math anxiety and performance among 179 fresh university students in Finland using the Electromagnetics Mathematics Anxiety Rating Scale. The findings indicated a weak negative relationship between arithmetic anxiety and performance, and no gender variations in math anxiety were found. The study discovered that there were no substantial differences in mathematics anxiety scores.

Zakaria and Nordin (2008) said that mathematics anxiety needs to be given serious attention by every educational institution. Their study findings indicated a weak negative association between mathematics anxiety and performance ($r = -0.32$) but a significant one ($p < 0.05$). Mutlu (2019) took data from 288 participants using a math anxiety scale and math achievement test. The result indicated a strong negative association ($r = -.597$) between math anxiety and math performance of the students. The mean math scores of high achievers and medium achievers did not, however, differ significantly. This suggests that the amount of arithmetic anxiety among students who struggle with the subject is similar to that of poor achievers. However, the results depict a significant difference between the mean scores of

the math anxiety of the low achievers and the average achievers.

In a study on the impact of math anxiety on mathematical achievement by Salahot (2022), he argued that math anxiety prevents children from thinking positively about arithmetic, which leads to low self-esteem, disillusionment, and academic failure. It was also revealed that if not taken care of, math-anxious students would finally avoid maths due to their fear of it. His study findings demonstrated a negative correlation between math anxiety and math performance. Students with inadequate math skills scored much higher on a mathematics anxiety scale than students with strong skills. Also, research by Deleg et al. (2022) demonstrated that a variety of math anxiety-related factors have an impact on students' arithmetic ability. The findings of their study discovered that there is an inverse relationship between them. When performing arithmetic activities, students who have a high level of mathematics anxiety struggle with issues like worry which impairs their understanding of the subject's material as well as their attitude to and performance of the subject. It was added that when doing basic mathematical activities, students who struggle with math anxiety experience fear and depression and that their mathematical efficiency is significantly impacted by math anxiety.

Brezavš̃ (2020) revealed a concerning trend of significant anxiety levels among undergraduate students, as well as the negative effects on academic performance. According to the personality anxiety level frequencies found, students who frequently suffer from high anxieties have their academic performance affected negatively. According to Dagaylo-An and Tancinco (2016), students who struggle with math anxiety have negative side effects such as stress, nervousness, and rejection, and their performance is severely hampered. It was added that students who struggle with math anxiety lack confidence in their aptitude for the subject and take the bare minimum of mathematics courses, which severely restricts their prospects for a profession. This is

regrettable, particularly as society depends more on mathematical knowledge.

Zakaria et al. (2012) posited that the degree of arithmetic anxiety among pupils is closely correlated with math achievement. Student achievement and mathematical anxiety are inversely correlated. Due to this inverse link, students who have a lot of arithmetic anxiety will perform poorly in math. Students frequently feel stressed, worn out, and terrified, or they may think math is unimportant and will generally refuse to learn it. It was added that While children who perform well in arithmetic have lower levels of anxiety, those who perform poorly in math have higher levels. This is so because high achievers comprehend mathematics well and are more self-assured than low achievers. Math test scores are typically lower for children who are anxious. On the other hand, pupils who experience less worry typically perform better in math. Also, their findings showed that students' math anxiety has a negative and significant impact on their mathematical proficiency, so the more students experience math anxiety, the lower their math proficiency will be.

Ibrahim Sayyadi Umaru Musa Yar (2021) found that there is a negative significant link between mathematics anxiety and academic achievement ($r = -0.872$, $p < 0.05$) of secondary school students in Katsina, Nigeria. This means that as anxiety levels rise, academic achievement declines and conversely. Also, significant one-way Analysis of Variance (ANOVA) results for a sample of 482 students by Sevindir et al. (2014) reveals that mathematics anxiety is adversely correlated with mathematical performance. Their findings showed that pupils with higher grades were less nervous, and those with lower scores were more anxious about math. Cahyawati et al. (2023) also found a negative correlation with a path coefficient of -2.8 between mathematics anxiety and performance in mathematics at a p value of 0.00 which was indicated as significant. Math anxiety was said to have a considerable detrimental effect on academic performance. It implies that academic achievement increases with decreased levels of mathematics anxiety.

A study by Yu et al. (2021) revealed that mathematics performance is inversely correlated with math anxiety ($r = -0.20$, $p = 0.01$). In addition, Maloney et al. (2015), in trying to find the correlation between students' math anxiety and mathematics achievement, sampled 438 students in the investigation, and the outcome revealed that math anxiety is negatively related to mathematics achievement. It was found that the higher the anxiety score value, the lower the mathematics achievement test score. This led to the conclusion that mathematics anxiety is a great predictor of mathematics performance. The findings of Szczygiel (2020) also showed a weakly negative correlation between math anxiety and math achievement. The findings indicate that math anxiety has a limited and unfavourable relationship with arithmetic achievement.

Also, Oda et al. (2021) studied 21,544 Canadian students aged 15 years (10,943 girls), and after analysing the data obtained, it was observed that a strong negative correlation ($r = -0.50$, $p < 0.001$) exists between mathematic performance and mathematics anxiety indicating that poor math performance among students is largely influence by their level of math anxiety. That is to say, the higher the level of anxiety, the worst the student performs in mathematics. In a survey study by Gupta and Maji (2022), data was gathered from 200 Indian schoolchildren ($M = 110$; $F = 90$). A strong negative correlation was found between anxiety and performance in mathematics ($r = -0.72$, $p < 0.005$). The finding suggests that mathematics performance is highly predicted by math anxiety. What is more, in O'Leary et al. (2017) study, bivariate interactions were utilised to analyse the relationship between math anxiety and test scores. Results showed a strong, substantial negative ($r = -0.62$) association between the two variables, showing that as respondents' math grades dropped, math anxiety rose.

Iyamuremye (2023) conducted a similar study in Musanze, Northern Rwanda, where he looked at 730 senior high two students made up of 292 males and 438 females with an average age of 14.8 from six public educational institutions.

These institutions were picked as they consistently scored poorly on nationwide mathematics examinations. After the analysis, mathematics anxiety was stronger and inversely associated with math achievement. A correlation coefficient of -0.69 was obtained, indicating a strong correlation. Yakubu et al. (2019) employed a correlational survey research approach to sample 420 final-year senior high school students from fifteen (15) public senior high schools in the Kafanchan Educational Zone, Kaduna state, Nigeria, in their investigation of the association between mathematics anxiety and performance with 210 men and 210 women included in the sample, which was chosen using simple random sampling. The primary tool used to gather data was a four-point Likert scale on math anxiety. As a tool for data analysis, Pearson's Product Moment Coefficient (r) was employed. The results analysis showed a -0.620 -correlation coefficient between the two variables. This implies that there is a strong negative correlation between test anxiety and pupils' performance in mathematics. Also, Živković et al. (2022) studied 105 high school students in Italy at four separate schools (aged 11 to 14; $M = 12.62$; $SD = 0.67$). The outcome shows math anxiety having a strong negative (-0.52) correlation with mathematics scores.

Positive Relationship Between Mathematics Anxiety and Performance

In the study, Mitchell and George (2022) used the Spearman rank order correlation to reveal the association between math performance and anxiety. The results showed a positive significant relationship. In relation to that Luu-Thi et al. (2021) found out that the scores in mathematics from students correlated positively with their mathematics anxiety. The relationship was indicated to be moderate and positive, with a 0.487 correlation coefficient and a p -value less than 0.01 , which indicates that the results are significant. The average maths score increases in direct proportion to the degree of math anxiety. Findings from the study of Siaw et al. (2020) also indicated a weakly positive connection ($r = 0.134$,

$p < 0.005$) between the degree of anxiety in mathematics.

Additionally, Appiah Essuman et al. (2021) investigated the connection between mathematics learners' mathematical achievement and their degree of mathematical fear in the Ghanaian district of Bongo. The outcome demonstrated that academic performance is positively correlated with mathematics anxiety levels. This result showed that academic performance was positively correlated with examination anxiety. Similarly, Dodongan (2022) used Pearson Product moment correlation to indicate that a significant positive correlation exists between anxiety in mathematics and academic achievement in mathematics. It was determined that there is a substantial correlation between anxiety in mathematics and students' academic success in mathematics ($r = 0.137$, $p = 0.012$). This means that an increase in anxiety would lead to an increase in performance and vice versa. Also, Yahya and Amir (2018) discovered a moderate positive ($r = .350$) link between math anxiety and math performance in fourth-year secondary school students. This suggests that an increase in mathematics anxiety will result in an increase in performance. Riboroso et al. (2018) found a moderate positive correlation ($r = 0.418$) between students' high school grade and their level of mathematics anxiety.

METHODOLOGY

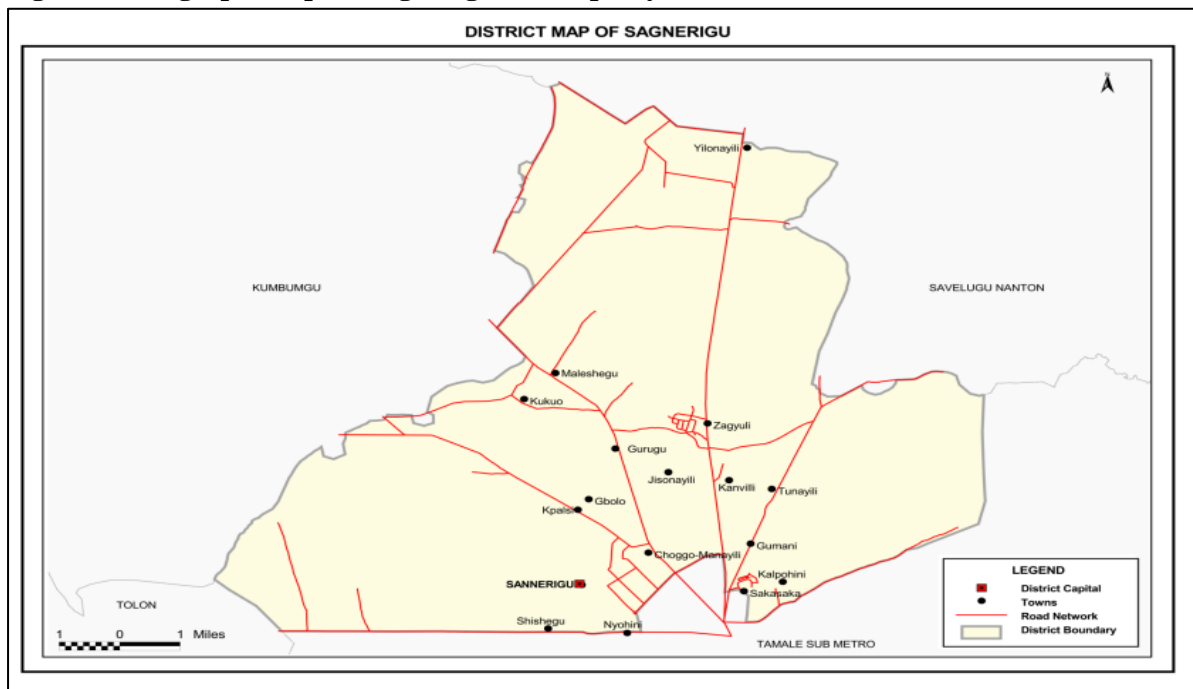
Study Area

One of the recently established districts in Ghana's Northern Region is the Sagnarigu Municipality. According to the Ghana Statistical Service (GSS, 2021), Sagnarigu Municipality has a population of about 342,000 people, of which 50.6% are men and 49.4% are women. The Municipality has 23,447 dwellings, with an average household size of six people (GSS, 2021). Sixty per cent (60%) of people aged 11 and over are educated, compared to 40% who are illiterate. Male literacy rates are higher (68.3%) than female literacy rates (52.0%). In the district's total population of people aged three years and older, (33.7%) have never attended school, (44.7%) are

doing so right now, and (21.5%) have done so in the past. It includes a wide variety of urban and rural towns, each with its own distinctive socioeconomic and cultural traits. Many senior high schools serve as important educational institutions in the region, and the municipality is well renowned for its emphasis on education. The Sagnarigu Municipality is located in a flat area with sporadic rural hamlets and small areas of urban growth. A primarily tropical climate with distinct wet and dry seasons prevails throughout the area. Savannas and agricultural lands are among the vegetation, and they support the local economy. The population is diverse in terms of ethnicity and socioeconomic background. While some families may have a long history of respecting education and actively encouraging their wards' academic endeavours, other families may experience socioeconomic difficulties that may limit students' access to educational opportunities and resources. In the Sagnarigu Municipality, there are several senior high schools, each with a varied level of resources and educational quality. While some schools may struggle with low resources, others may have access to better facilities, seasoned teachers, and teaching aids. Given the study's focus on "Mathematics Anxiety and Academic Performance of Senior High School Students," it is critical to understand the importance of mathematics education in the Sagnarigu Municipality's senior high school curricula. Student's academic performance and attitude toward the topic may be impacted by mathematics anxiety, a condition marked by fear and trepidation about the subject. In order to compile a representative sample of students from various origins and educational settings, researchers for this study collected data from several senior high schools located within the town. The results of this study may shed light on how common mathematics anxiety is among senior high school students in the Sagnarigu Municipality and whether it has an effect on their academic performance. The Municipality was picked since it is the centre of education in the Northern Region and houses all educational institutions from basic to tertiary, with performance in mathematics

being low. The poor performance may be a result of mathematics anxiety.

Figure 1: Geographical plan Sagnarigu municipality



Source: (Ghana Statistical Service, 2014)

Research Design and Approach

The study looked at the relationship between math anxiety and performance using a quantitative approach. Because it allowed the researcher to utilise statistical tools to properly examine the relationships between the variables, the quantitative approach was chosen. An analytical cross-sectional design was used for the study because it allowed the researcher to gather data from a sizable group of people at one specific time. This strategy, suitable for quantitative studies, can be used to find the association between two variables.

Population

All senior high school students in the Sagnarigu Municipality are the study's target population.

Sample and Sampling Procedure

Simple random sampling was used to select two schools from among the four offered by the municipality. The researcher computed the sample size by using Andrew Fisher's formula for sample size determination. A margin of error of

0.05 for the data, a confidence level of 95% was adopted, which was converted to 1.96 using the Z-score table. This formula was used since it is recommended by (Charan & Biswas, 2013) as the best sample size determiner for Analytic Cross-Sectional studies as well as suitable for situations where participants are selected through a simple random approach.

The sample size was calculated mathematically using the formula:

$$\text{Sample size} = \frac{(Z\text{-score})^2 \times p \times (1-p)}{d^2}$$

Where Z-score denotes the proportion of likelihood or assurance that the confidence level contains the actual parameter for the population whenever the researcher selects a random sample on several occasions, the p-value represents the proportion of students estimated to have mathematics anxiety (50%), and the d-value represents the margin of error. The margin of error is also referred to as the confidence level, and it specifies the degree of unpredictability or assurance in the process of selecting the

participant as well as the degree of scepticism in each statistic.

$$\text{Hence, Sample size} = \frac{(1.96)^2 \times 0.5 \times (1 - 0.5)}{0.05^2} = 385$$

Sampling Procedure

The population proportionate to size was used to choose those participating in each of the two chosen institutions. Thus, a total of 173 students (males: 92, females: 81) and 212 students (males: 108, females: 104) from each school participated.

The study participants were chosen at random using the nominal roll of each school with the aid of Microsoft Excel. Following the sorting, the top 385 students (first 173 and 212 from both schools) were chosen.

Data Collection Instruments

To gauge the respondents' level of mathematics anxiety, a 20-item mathematics anxiety scale adapted from Richardson and Suinn (1972) was used. The instrument is a 98-item mathematics anxiety instrument that contains statements of math anxiety. According to Caroline Margaret Ford (2021), a measurement was first created by Richardson and Suinn in 1972 primarily to examine mathematical anxiety. A standardised self-report questionnaire based on Richardson and Suinn's (1972) 20-item mathematics anxiety scale was created to measure the level of anxiety senior high school pupils in the Sagnarigu Municipality primarily face when dealing with mathematics. The measure seeks to capture several facets of the students' possible emotions, fears, and worries related to mathematics. Each item illustrates a distinct facet of math phobia. These questions were worded as statements that described how the students felt and perceived mathematics. For instance, "When I have to solve math problems, I get nervous."

"I am concerned that my math test results will be poor." The pupils were given a response scale (1–5) that ranged from strongly disagree to strongly agree for each item. The responses were graded using the scale's predetermined scoring criteria (20–46 for low anxiety, 47–74 for moderate

anxiety, and 75–100 for high anxiety). The response options were given numerical values, and the total scores across all the statements were added up to measure the pupils' level of math anxiety. Thus, while lower scores imply lower levels of anxiety, higher scores indicate higher levels of anxiety. Business senior high school was used to conduct a pilot study. An introductory letter was sent to the school by the researcher, and permission was given after a formal discussion with the school authorities. Neither the researcher nor the school administration required any subjects to participate in the study against their will. Fifty (50) students were randomly selected using the nominal roll of the school. Students selected were briefed on the purpose of the study, after which they were given the questionnaire to respond. This was done to assess the instrument's dependability. After examining the data, a Cronbach's alpha reliability value of 0.901 was discovered. This shows that the instrument was trustworthy and implies an outstanding performance. Expert researchers in the field of the study evaluated and validated the instrument.

The researchers gathered information on the students' real scores on their first-semester mathematics exams in order to measure student performance in the subject. This information, which was gathered from school records, offers an impartial assessment of how each student performed in the subject during that particular academic year.

RESULTS

Table 1 below displays the statement of mathematics anxiety (aspects of anxiety) measured and investigated. From *Table 1* it can be seen that each domain has a mean of more than 3. The mean scores represent the average responses of the senior high school students to the various statements related to different aspects of mathematics anxiety. The scale for each statement likely ranges from 1 to 5 or a similar range, with higher values indicating stronger agreement with the statement (higher anxiety) and lower values indicating lower agreement (lower anxiety). Where 1 represents "strongly disagree", and 5

represents “strongly agree,” a mean score above 3 suggests that, on average, the student’s responses to the statements lean towards the higher end of

the scale, indicating a moderate to a high level of agreement with the aspects of mathematics anxiety being measured.

Table 1: Item analysis of students’ level of mathematics anxiety

Statement of Mathematics Anxiety	M	SD
I always feel relieved when not chosen to answer a question in a mathematics class	3.23	1.281
I feel anxious when I start writing a mathematics test or exams	3.34	1.326
I cannot ask any questions about what I did not understand in math class	3.31	1.275
I find it more difficult to learn mathematics than any other subject	3.31	1.290
I always worry that I will fail mathematics so I don’t study it	3.29	1.253
I get nervous when I learn that the next lesson in mathematics	3.27	1.269
I panic when I am not able to recall a procedure for solving a mathematics question	3.31	1.251
I find it difficult to understand concepts in mathematics	3.31	1.229
I cannot solve mathematics questions when somebody is watching me	3.26	1.247
I hate to look through mathematics textbooks	3.28	1.248
I do not like parts of other subjects that deal with mathematics	3.27	1.242
When I think about the frequently selected topics required for passing mathematics, I feel I cannot make it	3.24	1.276
I feel anxious while waiting for the result of a math exam	3.42	1.183
I am often late to a mathematics class because I feel uncomfortable during mathematics lessons	3.22	1.224
I am afraid of giving an answer in a mathematics class even if I know it	3.31	1.222
I cannot concentrate on anything again whenever I am to write a mathematics exam	3.31	1.204
I feel anxious when sitting in class and waiting for the mathematics teacher	3.28	1.218
I can reject helping a child with his/her homework because I am afraid of facing a question that I cannot solve	3.23	1.206
I wish not to do a mathematics-related course in the university or college	3.33	1.284
Valid N listwise (385)		

Source: Field Data, 2023

Table 2 shows the results of students’ level of mathematics anxiety. It could be observed from the table that School A (M= 66.26, SD= 24.337) is highly mathematical anxious as compared to School B (M= 65.16, SD= 22.804). Each school

has a mean mathematics anxiety score above the average, which indicates that the level of mathematics anxiety among the students is above average and at a high level.

Table 2: Group Statistics on Mathematics Anxiety of Students in Selected Schools

Variable	Name of School	N	Mean Score	SD	Std. Error Mean
Math Anxiety	A	212	66.26	24.337	1.671
	B	173	65.16	22.804	1.734

Source: Field Data, 2023

Table 2 shows the results of students’ performance in Mathematics. It could be observed from the table that students in school B (M= 52.13, SD= 27.344). It can be inferred that only School B obtained a core slightly above the

average score. This means that the performance of students in mathematics is not very good. Also, School B performed better than School A (M= 49.54, SD= 25.838) students.

Table 3: Group Statistics on Mathematics Performance of Students in Selected Schools

Variable	Name of School	N	Mean	SD	Std. Error Mean
Performance	A	212	49.54	25.838	1.964
	B	173	52.13	27.344	1.878

Source: Field Data, 2023

It is likely that the differences in performance may be a result of the differences in Mathematics Anxiety and performance. Hence, the researchers find the relationship between these two variables (Mathematics Anxiety and Performance) by testing the null hypothesis using the Pearson Product Moment Correlation, as shown in *Table 3*.

H₀: There is no statically significant relationship between mathematics anxiety and mathematics performance among Senior High School Students in The Sagnarigu Municipality.

The relationship between anxiety in mathematics and academic success in mathematics is displayed in *Table 4*. As demonstrated in the table, it is vividly clear that mathematics performance has a perfect correlation ($r = 1$) with maths performance but a negative correlation ($r = -0.85$) with math anxiety. Similarly, mathematics anxiety has a negative correlation ($r = -0.85$) with mathematics performance and a perfect correlation ($r = 1$) with mathematics anxiety. The correlation coefficient ($r = -.85$) between math anxiety and performance in maths indicates a strong negative correlation.

Table 4: Pearson Correlations Analysis of Mathematics Anxiety and Performance

	Mathematics Performance	Math Anxiety	p-value
Maths Performance	1	-0.85	< 0.001
Math Anxiety	-0.85	1	

Source: Field Data, 2023

The results of the Pearson correlation test revealed a statistically significant negative relationship between mathematics anxiety and students' performance. At a 95% confidence level, the p-value was found to be less than 0.001 indicating a significant difference. As a result, the null hypothesis H_0 was rejected

DISCUSSION

The study ascertained a strong negative correlation between mathematics anxiety and performance. At a 95% confidence interval, a p-value less than 0.001 was obtained. This means that mathematics anxiety has a significant negative influence on performance. Possible explanations for this strong inverse association between mathematical anxiety and performance may include performance pressure and the timing of the mathematical task, as revealed by Caroline Margaret Ford (2021).

The findings are consistent with Omar et al. (2022), whose study revealed a Pearson Correlation test, $r = -.773$, showing a negative correlation between math achievement and math anxiety. Mathematics performance declines as mathematic anxiety rises and vice-versa. The findings also corroborate the findings of Ibrahim Sayyadi Umaru Musa Yar (2021). Unlike this study, his study considers a qualitative approach

with a small sample size, and data was drawn from three different schools with a stratified sampling technique. His findings demonstrate that there is a high adverse correlation between mathematics anxiety and academic performance ($r = -0.872$, $p < 0.05$), meaning that whenever anxiety levels rise, academic performance falls, and the opposite is also true. Mathematics anxiety has also been found to have a negative relationship with academic performance by Gupta and Maji (2022). In their study of mathematics anxiety and performance among Indian school students, a survey design and a qualitative approach were adopted. Data was gathered from 200 Indian secondary school children (M = 110; F = 90). A strong negative correlation was found between anxiety and performance in mathematics ($r = -0.72$, $p < 0.005$). The finding suggests that mathematics performance is highly predicted by math anxiety.

However, this study is not in line with Luu-Thi et al. (2021), Whose study showed a positive relationship between students' degree of fear of mathematics with that of their mathematical performance, indicating that an increase in mathematics anxiety would lead to an increase in performance. The differences in their findings and this study could be attributed to the data analysis tools as well as the sampling technique. While this

study employed Pearson correlation and simple random sampling technique, their study rather utilised Linear regression and convenient sampling. Also, the current study contradicts Siaw et al. (2020) that there is an inverse relationship between mathematics anxiety and performance. Their study found that a student's increased mathematics anxiety may influence how well they perform on their final exam in mathematics. In this case, individuals that experience math anxiety may be driven and concentrate on strengthening their mathematical comprehension in order to score better grades in mathematics. Their study, unlike this study, considered only science students, and this could be the difference in results as there is a general belief that science students are less anxious about mathematics as compared to others.

It is reasonable to deduce from the results of this study, and corroborated findings like Ibrahim Sayyadi Umaru Musa Yar (2021) and Omar et al. (2022) that mathematics anxiety has a strong significant relationship with performance and an increase in the level of math anxiety would lead to a decrease in performance.

CONCLUSION

The results of the study suggest that secondary school students' performance in mathematics is low, whereas their Math Anxiety is high. The anxiety of mathematics was established to have a strong and inverse relationship with mathematical achievement. Math anxiety may affect a student's ability to do mathematical activities because of mental and psychological problems associated with it. Concentration issues, restrictions in working memory, and unfavourable thoughts that prevent problem-solving are all caused by math anxiety. However, math anxiety is not the only contributing factor to poor performance. Math achievement may also be significantly influenced by other elements like self-assurance, motivation, instructional strategies, and personal learning preferences. While some people struggle with math despite having modest levels of anxiety, others may have math anxiety but yet function well academically. Therefore, the mathematics

Anxiety Level of the students must be brought down to the minimum level, as high Math Anxiety would result in poor performance. Students' sensitisation on mathematics anxiety should be encouraged in various schools, and counselling services in various schools should include mathematics anxiety.

Recommendation

The study found mathematics performance to have been strongly negatively related to the anxiety about mathematics. Thus, mathematics anxiety is likely to be a strong determiner of maths performance. It is significant to highlight that there are numerous tactics and interventions that can be used to lessen math fear. A helpful learning environment, encouraging positive attitudes toward math, adopting efficient teaching techniques, and addressing unfavourable beliefs and misconceptions about arithmetic are a few examples of these. People can increase their mathematics achievement by treating math fear and encouraging a positive outlook. It is suggested that math educators should look into the factors that cause math anxiety so that appropriate measures can be put in place to eliminate those factors. Also, math educators must make it a habit of assessing the math anxiety level of their students regularly to provide appropriate remedies to the math anxious ones. Mathematics teachers should provide avenues for practice by giving more practice exercises.

REFERENCES

- Abreh, M. K., Owusu, K. A., & Amedahe, F. K. (2018). Trends in Performance of WASSCE Candidates in the Science and Mathematics in Ghana: Perceived Contributing Factors and the Way Forward. *Journal of Education*, 198(1), 113–123. <https://doi.org/10.1177/0022057418800950>
- Akinoso, S. O. (2020). *Mathematics Anxiety and Personality Characteristics of Secondary Schools Students in Lagos State, Nigeria. October.*
- Alam, M. (2018). Study of Mathematics Anxiety and Mathematics Achievement among Secondary School Students. *International*

- Journal of Informative and Futuristic Research*, 5(3), 1.
- Al-Shannaq, M. M. M., & Leppavirta, J. (2020). Comparing math anxiety of scientific facilities students as related to achievement and some variables. *International Journal of Instruction*, 13(1), 341–352. <https://doi.org/10.29333/iji.2020.13123a>
- Ansah, J. K., Quansah, F., & Nugba, R. M. (2020). “Mathematics Achievement in Crisis”: Modelling the Influence of Teacher Knowledge and Experience in Senior High Schools in Ghana. *Open Education Studies*, 2(1), 265–276. <https://doi.org/10.1515/edu-2020-0129>
- Appiah Essuman, S., Nyarko, J., & Frimpong, K. (2021). Impact of Mathematics Anxiety on the Academic Performance of Junior High School Pupils in the Bongo District of Ghana Stanley Appiah Essuman, Josephine Nyarko, Kwarteng Frimpong. *International Journal of Social Sciences and Humanities Invention*, 8(09), 6553–6561. <https://doi.org/10.18535/ijsshi/v8i09.05>
- Article, R. (2021). *Journal of Physical Medicine Rehabilitation Studies & Reports Mathematics Anxiety as a Predictor of Academic Achievement in Mathematics among Higher Secondary School Students*. 3(4), 1–2.
- Ayebale, L., Habaasa, G., & Tweheyo, S. (2020). Factors affecting students’ achievement in mathematics in secondary schools in developing countries: A rapid systematic. *Statistical Journal of the IAOS*, 36(S1), S73–S76. <https://doi.org/10.3233/sji-200713>
- Bedetti, C., & Elisei, S. (2019). MATHEMATICS ANXIETY AND COGNITIVE PERFORMANCE IN ADOLESCENT STUDENTS. *Psychiatria Danubina*, Vol. 31, S(August).
- Brezavš, A. (2020). *Factors Influencing Mathematics Achievement of University Students of Social Sciences*.
- Brezavšek, A., Jerebic, J., Rus, G., & Žnidaršič, A. (2020). Factors influencing mathematics achievement of university students of social sciences. *Mathematics*, 8(12), 1–24. <https://doi.org/10.3390/math8122134>
- Bruce, D. (2016). Mathematics anxiety among Ghanaian students: A case study of students of Kinbu Senior High/Technical School, Accra and Hermann-Gmeiner SOS Junior High School, Tema. *Journal of Education and Practice*, 7(15), 75–83.
- Cahyawati, D., Delima, N., & Gunarto, M. (2023). The impact of undergraduate students’ mathematics anxiety and self-concept on their self-regulated learning and academic achievement. *Jurnal Elemen*, 9(1), 183–196. <https://doi.org/10.29408/jel.v9i1.6898>
- Carey, E., Devine, A., Hill, F., Dowker, A., Mclellan, R., & Szucs, D. (2019). Understanding Mathematics Anxiety; Investigating the experiences of UK primary and secondary school students. *Understanding Mathematics Anxiety; Investigating the Experiences of UK Primary and Secondary Schools Students*, 1(March), 63.
- Caroline Margaret Ford. (2021). *The development of mathematical anxiety and its relationship with mathematical performance leading up to National Testing in primary aged. November*.
- Chang, H., & Beilock, S. L. (2016). The math anxiety-math performance link and its relation to individual and environmental factors: A review of current behavioral and psychophysiological research. *Current Opinion in Behavioral Sciences*, 10, 33–38. <https://doi.org/10.1016/j.cobeha.2016.04.011>
- Charan, J., & Biswas, T. (2013). How to calculate sample size for different study designs in medical research? *Indian Journal of Psychological Medicine*, 35(2), 121–126. <https://doi.org/10.4103/0253-7176.116232>
- Clarke, B. A. (2021). The Role of Math Anxiety and Math Self-Efficacy Levels on High School Equivalency Student Math Performance. *ProQuest Dissertations and Theses*, 175. https://www.proquest.com/dissertations-theses/role-math-anxiety-self-efi-cacy-levels-on-high/docview/2649803793/se-2?accountid=26642%0Ahttp://link.periodicos.capes.gov.br/sfxlcl41?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:dissertation&genre=dis
- Cuevas, Ma. M., & Berou, M. (2016). Students’ Mathematics Self-Efficacy and Anxiety as

- Correlates to Academic Performance. *University of Bohol Multidisciplinary Research Journal*, 4(1). <https://doi.org/10.15631/ub.mrj.v4i1.64>
- Dagaylo-An, M. B., & Tancinco, N. P. (2016). Mathematics Anxiety and the Academic Performance of the Freshmen College Students of the Naval State University. *International Journal of Engineering Sciences & Research Technology*, 5(7), 1125–1136.
- Daker, R. J., Gattas, S. U., Sokolowski, H. M., Green, A. E., & Lyons, I. M. (2021). First-year students' math anxiety predicts STEM avoidance and underperformance throughout university, independently of math ability. *Npj Science of Learning*, 6(1). <https://doi.org/10.1038/s41539-021-00095-7>
- Deleg, A., B, A. Z., & Ravdan, M. (2022). *Relationships Between Mathematics Anxiety, Mathematical Performance, and Teacher-Related Factors* (Vol. 2). Atlantis Press SARL. <https://doi.org/10.2991/978-2-494069-41-1>
- Demedts, F., Reynvoet, B., Sasanguie, D., & Depaepe, F. (2022). Unravelling the role of math anxiety in students' math performance. *Frontiers in Psychology*, 13(November), 1–9. <https://doi.org/10.3389/fpsyg.2022.979113>
- Dodongan, E. (2022). Math Anxiety, Learning Engagement and Perceived Usefulness of Technology as Predictors to Performance of Students in Mathematics. *Scientific Journal of Tan Trao University*, 7(24), 12–18. <https://doi.org/10.51453/2354-1431/2021/663>
- Ducay, J. T., & Alave, A. D. (2021). Self-Efficacy, Anxiety, and Academic Performance in Self-Efficacy, Anxiety, and Academic Performance in. *Globus Journal of Progressive Education A Refereed Research Journal*, 11(1), 41–46. <https://doi.org/10.46360/globus.edu.22021109>
- Estonanto, A. J. J. (2018). Impact of Math Anxiety on Academic Performance in Pre-Calculus of Senior High School. *Liceo Journal of Higher Education Research*, 13(2), 32–41. <https://doi.org/10.7828/ljher.v13i2.1059>
- Etuk, I. S., Bassey, B. A., & Owan, V. J. (2021). *Test Item Sequencing and Academic Performance in Mathematics Among SS3 Students in Calabar Education Zone, Cross River State, Nigeria*. April.
- Fatawu, A., & Offei, D. (2022). *Exploring Factors that Hinder Senior High School Students' Academic Performance in Mathematics*. November. <https://doi.org/10.9734/JESBS/2022/v35i121190>
- Fokuo, M. O., Lassong, B. S., & Kwasi, S. F. (2022). Students' Poor Mathematics Performance in Ghana: Are there Contributing Factors? *Asian Journal of Education and Social Studies*, July, 16–21. <https://doi.org/10.9734/ajess/2022/v30i430729>
- Ghana Statistical Service. (2014). Sagnarigu District. *District Analytical Report: Sagnarigu District*, 544.
- Gupta, S., & Maji, S. (2022). *Math Anxiety, Math-self-efficacy, and Math-performance: A Study of Indian School Children*. August.
- Ibrahim Sayyadi Umaru Musa Yar, S. (2021). *Study Habits and Mathematics Performance among Senior Secondary School Students in Katsina Metropolis*. May 2019.
- Iyamuremye, E. (2023). Relationships of mathematics achievement with self-determined motivation and mathematics anxiety among senior two students in Northern Rwanda Heliyon Relationships of mathematics achievement with self-determined motivation and mathematics anxiety among se. *Heliyon*, 9(4), e15411. <https://doi.org/10.1016/j.heliyon.2023.e15411>
- Iyamuremye, E., Ndayambaje, I., & Muwonge, C. M. (2022). Perceptions of Teaching Approach and Academic Performance among Senior Two Students in Musanze: Mediating Role of Mathematics Anxiety and Career Aspiration. *International Journal of Learning, Teaching and Educational Research*, 21(7), 107–126. <https://doi.org/10.26803/ijlter.21.7.6>
- Karikari, A., Achiaa, E. A., Adu, J., & Kumi, E. O. (2020). *Introduction: -*. 8(09), 904–912. <https://doi.org/10.21474/IJAR01/11740>

- Karimi, A., & Venkatesan, S. (2009). Mathematics Anxiety, Mathematics Performance and Academic Hardiness in High School Students. *International Journal of Educational Sciences*, 1(1), 33–37. <https://doi.org/10.1080/09751122.2009.11889973>
- Kaushal, R., Rose, S. C., Sehwat, S., Sharma, R., Lata, P., & Gorakhnath, I. (2022). Exploration of the factors of mathematics anxiety and its impact on the achievement of students in mathematics. *International Journal of Health Sciences*, 6(August), 1236–1247. <https://doi.org/10.53730/ijhs.v6ns9.12482>
- Kelly, S., Croucher, S. M., Kim, K. Y., Permyakova, T., Turdubaeva, E., Rocker, K. T., Eskiçorapçı, N., Stanaliev, G., Orunbekov, B., & Rimkeeratikul, S. (2022). A General Math Anxiety Measure. *Education Sciences*, 12(6), 1–14. <https://doi.org/10.3390/educsci12060370>
- Khadijat, A. S., & Saidat, A. M. (2022). *Selected teachers' and students' variables as correlates of senior school students' performance in mathematics in Kwara state, Nigeria. September 2021.*
- Khaliq, A. (2020). *Effect of Mathematics Anxiety on Punjab Public Secondary School Students' Mathematics Achievement Effect of Mathematics Anxiety on Punjab Public Secondary School Students' Mathematics Achievement Introduction Mathematics anxiety is a condition of nervou. December 2016.*
- Luu-Thi, H. T., Ngo-Thi, T. T., Nguyen-Thi, M. T., Thao-Ly, T., Nguyen-Duong, B. T., & Tran-Chi, V. L. (2021). An Investigation of Mathematics Anxiety and Academic Coping Strategies Among High School Students in Vietnam: A Cross-Sectional Study. *Frontiers in Education*, 6(November), 1–14. <https://doi.org/10.3389/educ.2021.742130>
- Maloney, E. A., Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2015). Intergenerational effects of parents' math anxiety on children's math achievement and anxiety. *Psychological Science*, 26(9), 1480–1488. <https://doi.org/10.1177/0956797615592630>
- Marshall, E. M., Wilson, D. A., & Mann, V. E. (2017). Evaluating the effectiveness of maths anxiety awareness workshops. *Journal of Learning Development in Higher.*
- Mitchell, L., & George, L. (2022). Exploring mathematics anxiety among primary school students: Prevalence, mathematics performance and gender. *International Electronic Journal of Mathematics Education*, 17(3), em0692. <https://doi.org/10.29333/iejme/12073>
- Monoranjan Bhowmik. (2017). Correlation Study on Xth Grade Students in Mathematics Achievement with Motivation and Mathematics Anxiety. *International Journal of Research in All Subjects in Multi Languages*, 5(10), 7–12.
- Mutlu, Y. (2019). Math anxiety in students with and without math learning difficulties. *International Electronic Journal of Elementary Education*, 11(5), 471–475. <https://doi.org/10.26822/iejee.2019553343>
- Napier, V. (2017). *Math_Anxiety_Causes_and_Solutions_A_Lite* (p. 20).
- Oda, S., Konishi, C., Oba, T., Wong, T. K. Y., Kong, X., & Onge-Shank, C. St. (2021). Students' Math Self-Concept, Math Anxiety, and Math Achievement: The Moderating Role of Teacher Support. *Journal of Education and Development*, 5(1), 45. <https://doi.org/10.20849/jed.v5i1.866>
- Olaewe, O. O. (2012). *Gender Differential In Academic Performance In Mathematics Among Senior High School Students In The Tamale Metropolis Of Northern Ghana. By Olalere. O. Olaewe (PhD) University For development Studies, Faculty of Mathematical Science Navrongo Camp.* 10.
- O'Leary, K., Fitzpatrick, C. L., & Hallett, D. (2017). Math anxiety is related to some, but not all, experiences with math. *Frontiers in Psychology*, 8(DEC), 8. <https://doi.org/10.3389/fpsyg.2017.02067>
- Omar, S. H., Aris, S. R. S., & Hoon, T. S. (2022). Mathematics Anxiety and its Relationship with Mathematics Achievement among Secondary School Students. *Asian Journal of University Education*, 18(4), 863–878. <https://doi.org/10.24191/ajue.v18i4.19992>

- Poorghorban, M., Jabbari, S., & Chamandar, F. (2018). *Mathematics Performance of the Primary School Students: Attention and Shifting*. 7(3), 117–124. <https://doi.org/10.5539/jel.v7n3p117>
- Riboroso, R. A., Llagas, R. M., Lou, J., & Taan, R. (2018). Mathematics Self Efficacy and Anxiety and Mathematics Performance of Elementary Education Students. *International Journal of Scientific & Engineering Research*, 9(11).
- Richardson, F., & Suinn, R. M. (1972). The Mathematics Anxiety Rating Scale Psychometric Data. *Journal of Counselling Psychology*, 9, 551-554.
- Rozgonjuk, D., Kraav, T., Mikkor, K., Orav-Puurand, K., & Täht, K. (2020). Mathematics anxiety among STEM and social sciences students: the roles of mathematics self-efficacy, and deep and surface approach to learning. *International Journal of STEM Education*, 7(1). <https://doi.org/10.1186/s40594-020-00246-z>
- Salahot, E. D. (2022). *The Effects of Mathematics Anxiety on Mathematics Performance among Secondary School Students in Tanzania: A Case of Arusha City Council*. 10(12), 425–436. <https://doi.org/10.18535/ijssrm/v10i12.m001>
- Samante, J. L., & Alave, A. D. (2021). *Anxiety and Performance in Mathematics of Grade Four*. 11(1), 1– 6. <https://doi.org/10.46360/globus.edu.220211001>
- Senajonon, J. S. (2013). *math_anxiety_and_academic_performance*. Philippine Women's College of Davao.
- Serim, A. B. O. (2022). Examining the Math Anxiety Levels of University Students During Covid-19. *European Journal of Education Studies*, 9(12), 168–185. <https://doi.org/10.46827/ejes.v9i12.4577>
- Sevindir, H. K., Yazici, C., & Yazici, V. (2014). Mathematics Anxiety of Secondary School Students: A Case Study for Kocaeli Area. *Procedia - Social and Behavioral Sciences*, 152, 630–636. <https://doi.org/10.1016/j.sbspro.2014.09.254>
- Shakmaeva, A. (2022). Regulating Math Anxiety and Improving Math Performance: A Review of Intervention Research. *Przegląd Badań Edukacyjnych*, 36(1). <https://doi.org/10.12775/pbe.2022.011>
- Siaw, E. S., Shim, G. T. G., Azizan, F. L., & Shaipullah, N. M. (2020). Understanding the Relationship Between Students' Mathematics Anxiety Levels and Mathematics Performances at the Foundation Level. *Journal of Education and Learning*, 10(1), 47. <https://doi.org/10.5539/jel.v10n1p47>
- Szczygieł, M. (2020). Gender, general anxiety, math anxiety and math achievement in early school-age children. *Issues in Educational Research*, 30(3), 1126–1142.
- Tolibao, J., & Moneva, J. C. (2021). *STUDENT'S ANXIETY IN MATHEMATICS*. April.
- Trujillo-Torres, J. M., Hossein-Mohand, H., Gómez-García, M., Hossein-Mohand, H., & Hinojo-Lucena, F. J. (2020). Estimating the academic performance of secondary education mathematics students: A gain lift predictive model. *Mathematics*, 8(12), 1–23. <https://doi.org/10.3390/math8122101>
- Uludag, E. Y. (2022). Mathematics self-efficacy as a mediator between task value and math anxiety in secondary school students. *International Journal of Curriculum and Instruction* 14(2), March.
- Vargas, R. (2021). A literature review on math anxiety and learning mathematics: A general overview. *Journal of Educational Research and Reviews*, 9(5), 102–108. https://doi.org/10.33495/jerr_v9i5.21.112
- Yahya, S. Z., & Amir, R. (2018). KEBIMBANGAN MATEMATIK DAN PENCAPAIAN MATEMATIK TAMBAHAN [MATHEMATICS ANXIETY AND ADDITIONAL MATHEMATICS PERFORMANCE]. *Journal of Nusantara Studies (JONUS)*, 3(2), 124. <https://doi.org/10.24200/jonus.vol3iss2p124-133>
- Yakubu, J. Z., Bisandu, D. B., & Datiri, D. D. (2019). *Relationship between Mathematics Test Anxiety and Achievement of Senior Secondary Three Students in Kafanchan Educational Zone, Kaduna State*. June.
- Yu, Y., Hua, L., Feng, X., Wang, Y., Yu, Z., Zi, T., Zhao, Y., & Li, J. (2021). True Grit in

Learning Math: The Math Anxiety-Achievement Link Is Mediated by Math-Specific Grit. *Frontiers in Psychology*, 12(April), 1–6.
<https://doi.org/10.3389/fpsyg.2021.645793>

Zakaria, E., & Nordin, N. M. (2008). The effects of mathematics anxiety on matriculation students as related to motivation and achievement. *Eurasia Journal of Mathematics, Science and Technology Education*, 4(1), 27–30.
<https://doi.org/10.12973/ejmste/75303>

Zakaria, E., Zain, N. M., Ahmad, N. A., & Erlina, A. (2012). Mathematics anxiety and achievement among secondary school students. *American Journal of Applied Sciences*, 9(11), 1828–1832.
<https://doi.org/10.3844/ajassp.2012.1828.1832>

Živković, M., Pellizzoni, S., Mammarella, I. C., & Passolunghi, M. C. (2022). Executive functions, math anxiety and math performance in middle school students. *British Journal of Developmental Psychology*, 40(3), 438–452.
<https://doi.org/10.1111/bjdp.12412>