

Mathematical Anxiety among Senior High School (SHS) Students in Agona West Municipality of Ghana

¹Jackson Jessel Aboagye-Agbi, ²Jones Apawu, ³Nana Akosua Owusu-Ansah, ⁴Mark Mishiwo

¹Accra College of Education, Department of Mathematics and ICT Education, P. O. Box LG 221, Legon-Accra, jacksonaboagye86@gmail.com/ j.aboagye-agbi@acce.edu.gh, +23354 835 5164/ +23350 202 8998, ORCID: <https://orcid.org/0000-0002-7632-1914>

²University of Education, Winneba, Department of Mathematics Education, P. O. Box 25, Winneba, jonesapawu2010@gmail.com/ japawu@uew.edu.gh, +23324 448 7323/ +23320 969 9305, ORCID: <https://orcid.org/0000-0002-1091-9964?lang=en>

³University of Education, Winneba, Department of Mathematics Education, P. O. Box 25, Winneba, ansahnana10@yahoo.com/ naowusu-ansah@uew.edu.gh, +23324 491 1841, ORCID: <https://orcid.org/0000-0003-4184-4595>

⁴Akatsi College of Education, Department of Mathematics and ICT Education, P. O. Box PMB, Akatsi, markmishiokim@gmail.com, +233 20 902 9236, <https://orcid.org/0000-0002-8411-7278>

Corresponding Author: ¹Jackson Jessel Aboagye-Agbi

Abstract

Mathematical anxiety is critical to influencing the teaching and learning of mathematics. Yet, little is known about the level of mathematical anxiety among Ghanaian students. The study investigates the nature and level of mathematical anxiety among Senior High School (SHS) students in Ghana. A cross-sectional survey design was used to collect quantitative data from 270 final-year students from non-science departments of four (4) public SHSs using a 5-point Likert scale. Frequencies and percentages were used in analysing data collected. Data revealed that mathematical anxiety exists among SHS students; 64% of the respondents have high mathematical anxiety, while only 2% have low mathematical anxiety. However, 34% of the participants exhibit moderate mathematical anxiety. Findings provide awareness of the high level of mathematical anxiety among SHS students in the Agona Municipality of Ghana, and further studies are recommended to measure the prevalent cases of mathematical anxiety of students in other regions.

Keywords: Mathematical Anxiety, Nature of mathematical anxiety, Levels of anxiety, teaching of mathematics, learning of mathematics

Accepted 5/5/2025

Published 29/5/2025

INTRODUCTION

The ability of a nation to effectively compete in the worldwide market today on a larger scale depends on the mathematical literacy of its citizens (Sofowora, 2014). Nevertheless, the understanding of mathematical concepts has become more challenging for many high school students compared to any other subject (Achieve, 2011; ACT, 2010c). In Ghana, Abotowuro (2015) discovered that the average pass rate in Elective

Mathematics in the West African Senior School Certificate Examination (WASSCE) of Ghanaian candidates from 2007 to 2014 was 45.5%, which indicates that 54.5% of candidates who sat for WASSCE from 2007 to 2014 failed every year. Moreover, at the Junior High School (JHS) level, the performance in mathematics of Ghanaian students is among the worst in the world (TIMSS, 2011 cited in Mullis et al., 2012). This

performance is not surprising due to the common myth that mathematics is difficult as a subject of study (Capuno et al., 2019; Chestnut et al., 2018; Lamichhane & Belbase, 2017). According to Lamichhane and Belbase (2017), mathematics is perceived as a difficult subject due to its nature and also individuals' preconceived notions about mathematics and the anxiety individuals have for mathematics. Anxiety drives the feeling and passion of many students away from studying mathematics and has greatly affected students' performance in mathematics at schools as well as job places (Recber et al., 2018; Soni, 2016). Haase et al. (2019) found out that most students tend to avoid taking mathematics courses in higher education due to the impressions created by the individuals about mathematics as a complex subject. Sofowora (2014) observed that students who enrolled in non-science-related degree programmes were senior high school (SHS) leavers whose mathematics scores were low. Additionally, research has shown that a serious and common obstacle for many students' poor performance and difficulty in learning mathematics across all grade levels is mathematical anxiety (Christie, 2011; Haase et al., 2019; Paul & Hlanganipai, 2014). According to Nadeak et al. (2020), anxiety is a state of arousal that surfaces through bodily, emotional, and mental changes an individual experiences when faced with a stimulus. These bodily, emotional, and mental feelings of anxiety can lead to fear, distress, shame, inability to cope, sweaty palms, nervous stomach, difficulty in breathing, and loss of ability to concentrate (Perrotta, 2019; Peters, 2008). The American Psychological Association [APA] (2014) also defined anxiety as an emotion characterised by feelings of tension, worrying thoughts, and physical changes like increased blood pressure. Anxiety can cause stress, an emotional experience that takes over our mind and body. So, the fear of learning or doing math, known as mathematical anxiety, shows a dislike for math-related information or a fear of handling numbers or equations, which can affect a person's performance and make it harder for them to learn later on (Haase et al., 2019).

Rajkumar, Hema (2021), and Švecová (2018) define mathematical anxiety as a feeling of tension, apprehension, or fear that interferes with the manipulation of numbers and the solving of ordinary life and academic situations. Haase et al. (2019) emphasised that mathematical anxiety is a serious and pervasive problem, and like other forms of anxiety, students may feel depressed and not be capable of completing mathematical tasks or may avoid attempting mathematics courses. Pradeep (2006), as cited in Udil et al. (2017), also described mathematical anxiety as a state of a sinking feeling, uncertainty and dejection at doing and understanding mathematics. This dejection towards mathematics greatly affects the student's ability to perform well and their desire to continue learning

mathematics. Mathematical anxiety can influence students' mathematical performance by affecting memory and creating nervousness and an inability to concentrate (Juniati & Budayasa, 2020; Dowker, 2019; Pizzie et al., 2020; Putri et al., 2020), and this nervousness happens when the avoidance of a mathematics situation leads to poor mathematics preparation. Mathematical anxiety exists in some adults (Hart & Ganley, 2019), including teachers (Gresham & Burleigh, 2019), and it is influenced by people's beliefs. Teaching students with mathematical anxiety makes the mathematics teacher's job extremely difficult, if not impossible. However, knowing the level of students' mathematical anxiety would be of great importance to the SHS mathematics teacher. Knowledge of the nature and the level of mathematical anxiety of students will assist teachers in identifying students' fears and how to address their problems.

Derling et al. (2021) and Sorvo et al. (2019) found out that mathematical anxiety exists among students of 4th and 5th grade in elementary schools and argued that mathematical anxiety in basic school students indicates that its onset coincides with early years of schooling, which could be due to social learning from parents and teachers with mathematical anxiety or negative perceptions of mathematics. Studies have shown that mathematical anxiety affects student achievement and attitude towards mathematics and may lead to poor performance and avoidance of mathematics or seeing mathematics as a punishment or something that induces stress (Garba et al., 2020; Olanrewaju, 2019; Shamim & Akhtar, 2021). Other studies (e.g., Asante, 2012; Awanta, 2004; Bruce, 2016; Garba et al., 2020; Olanrewaju, 2019; Tapia & Marsh, 2004) have created the awareness that mathematical anxiety is widespread among SHS students and pre-service teachers in Ghana and the world. However, none of these studies revealed the level of the students' mathematical anxiety, which has created a gap between the awareness of the existence of mathematical anxiety and its level among SHS students. The study assumed that the more a teacher understands the level of the mathematical anxiety of students, the more he/she will be able to prevent or reduce it and also help students overcome it.

Biological studies on mathematical anxiety showed that people who are anxious about math have a weak ability to ignore distractions, which uses up their working memory on things that aren't important (Mutodi & Ngirande, 2014; Sevindir et al., 2014). According to Jones (2006), cited in Paul and Hlanganipai (2014), students who performed poorly in tests and examinations claim that they become confused and are unable to focus on the task at hand or keep thinking about how poor they are at mathematics. Mathematical anxiety disrupts the ongoing, task-relevant activities of working memory, slowing down performance and degrading its accuracy. To address students' poor performance due to mathematical anxiety,

it is expedient to determine the level of mathematical anxiety students exhibit.

Mathematical anxiety is a common psychological factor among SHS students in Ghana (Asante, 2012; Awanta, 2004; Bruce, 2016). Many researchers (e.g., Asante, 2012; Awanta, 2004; Bruce, 2016; Bull, 2009; Chinn, 2009; Prevatt et al., 2010) have conducted studies to determine the influence of mathematical anxiety on students. Some of these studies indicated that the level of a student's mathematical discomfort and anxiety directly affects their achievement and progress in mathematics (Bull, 2009).

Literature justified that mathematical anxiety exists among Ghanaian SHS students (Bruce, 2016; Akakpo et al., 2013; Asante, 2012; Awanta, 2004), and it has a considerable correlation with student success in mathematics (Ciftci, 2019; Huang et al., 2019; Van Mier et al., 2019), but its level of mathematical anxiety has not been identified. Hence, this study investigated the nature of mathematical anxiety among SHS students of Agona West Municipality of Ghana, and an attempt was made to classify the level of anxiety into high, moderate and low anxieties.

METHODOLOGY

The study employed a quantitative research approach with the lens of a cross-sectional survey design. A cross-sectional survey is a research design in which the researcher administers questionnaires or interviews to a sample or the entire population and statistically analyses the data to describe the attitudes, opinions, behaviours, or characteristics of the population (Creswell, 2014). The study was investigative; hence, major emphasis was on gaining ideas and insights. According to Queirós et al. (2017), the quantitative research method focuses on

objectivity and is especially appropriate when there is the possibility of collecting quantifiable measures of variables and inferences from samples of a population.

A purposive sampling procedure was used to select the population. The population comprised 1,300 SHS students from four (4) public SHS in Agona West Municipality in Ghana offering non-science programmes. Creswell (2014) describes purposive sampling as the sampling method in which the researcher intentionally selects participants and sites to engage in a study. Non-science students were selected because they usually have low performance in mathematics examinations. According to Cates and Rhymer (2003), students with higher levels of mathematical anxiety had considerably lower computational fluency in all areas of mathematical computations, and these students, in turn, had low levels of achievement in mathematics and chose to diverge their programmes of study from science-related courses. Form three (3) students were selected because of their maturity at the SHS level, and also, mathematics achievement at Form 3 can affect the individual's choice of career onwards. The sample size for the study was 300 students from the four public schools (see Table 1). Yamane's (1967) formula was used to calculate the overall sample sizes (see Equation 1), while Equation 2 was used to determine the number of participants from each subgroup by their number relative to the entire population.

Equation 1. Sample Size Equation

Sample size = $\frac{N}{1+N(\alpha)^2}$, where N is the total population, α = 0.05 (95% confidence level)

Equation 2. Sample per School

Sample size per school = $\frac{n}{N} \times S$, where n is the individual school population, N is the overall population and S is the computed overall sample size.

Table 1. Sample size

Schools	No. of Non-Science students in form 3	Sample size
A	500	115
B	50	13
C	675	155
D	75	17
Total	1300	300

Gorard (2003), as cited in Cohen et al. (2013), suggested that a survey study that contains much likely variability increases the sample size. Moreover, Singh and Masuku (2014) were of the view that where random sampling is used, the sample size needs to reflect the population and the amount of heterogeneity in the population. Furthermore, Cohen et al. (2013)

recommended that confidence level and confidence interval should be considered in determining sample size for a probability sample rather than only considering the population size. A proportionate sampling strategy was used to determine the number of participants from each subgroup relative to the entire population, and a simple random sampling technique was used in selecting the

sample size for the survey. The simple random sampling technique was chosen to create room for an equal chance of individuals in each selected institution who are equally qualified to participate and also enable the generalisation of finding(s) (Cohen et al., 2013).

A 5-point Likert scale questionnaire (i.e., Modified Mathematics Anxiety Rating Scale [Mod-MARS]) containing 40 closed-ended items was used to collect data from participants. The questionnaire was adapted from Richardson and Suinn (1972) and categorised into three sections to cater for factors that lead to fear and panic towards mathematics tasks, factors that trigger negative emotional feelings towards mathematics tasks and factors that lead to the exhibition of negative attitudes towards mathematics tasks, which are all components of anxiety. Content and face validity of the questionnaire were ensured, and a pilot study was conducted before administering the questionnaire to the participants. The Cronbach alpha coefficient computed in the study for the three sections of the items that made up the Mod-MARS was 0.892, 0.834 and 0.702, respectively, which made the subscales reliable since the values are greater than 0.70

(Fraenkel & Wallen, 2006; Nardi, 2018; Patton, 2002). Three hundred (300) copies of the questionnaire were administered to the respondents. However, 270 (90%) completed questionnaires were retrieved from the students. Descriptive statistics was used to analyse data collected.

RESULTS AND DISCUSSIONS

The results of the analysis of the three sections of Mod-MARS is presented separately after which an overall summary report was coiled out to define the nature and level of students' mathematics anxiety.

Fear and panic towards mathematics tasks

Fifteen (15) items were extracted from literature as factors associated with an individual's mathematical anxiety and the results are shown in Table 2.

Table 2. Analysis of responses on fear and panic towards mathematics tasks

Questions	Responses				
	Never	Rarely	Sometimes	Most of the time	Always
1. I become disturbed when I have to go to the mathematics class.	73(27.0)	5(1.9)	145(53.7)	30(11.1)	17(6.3)
2. I feel uncomfortable when asked to go to the board or being called to answer a question in a mathematics class.	48(17.8)	20(7.4)	112(41.5)	45(16.7)	45(16.7)
3. I am afraid to ask my teacher questions in mathematics class	132(48.9)	17(6.3)	62(23.0)	28(10.4)	31(11.5)
4. I tend to lose my attention in mathematics class.	90(33.3)	16(5.9)	105(38.9)	30(11.1)	29(10.7)
5. I fear mathematics tests more than any other subjects.	52(19.3)	23(8.5)	78(28.9)	40(14.8)	77(28.5)
6. I am afraid I would not be able to keep up with the rest of my colleagues in mathematics class.	93(34.4)	23(8.5)	81(30.0)	35(13.0)	38(14.1)
7. I do not know how to study for mathematics tests.	44(16.3)	25(9.3)	86(31.9)	49(18.1)	66(24.4)
8. I understand what is taught clearly in mathematics class but when I go home it is like I have never attended mathematics class.	41(15.2)	25(9.3)	81(30.0)	48(17.8)	75(27.8)
9. I feel worried about buying a mathematics textbook.	151(55.9)	15(5.6)	49(18.1)	23(8.5)	32(11.9)

Questions	Responses				
	Never	Rarely	Sometimes	Most of the time	Always
119. Aboagye-Agbi et al.					
10. I become more confused when I picked my mathematics homework book to work on.	85(31.5)	21(7.8)	100(37.0)	29(10.7)	35(13.0)
11. I fear discussing mathematics issues with my colleagues.	130(48.1)	25(9.3)	54(20.0)	29(10.7)	32(11.9)
12. When I hear the word 'mathematics' I become disturbed.	89(33.0)	18(6.7)	84(31.1)	32(11.9)	47(17.4)
13. I panic when I see my mathematics teacher coming to class.	96(35.6)	19(7.0)	86(31.9)	30(11.1)	39(14.4)
14. Mathematics has been my worst subject in life.	44(16.3)	30(11.1)	56(20.7)	35(13.0)	105(38.9)
15. I am much worried about mathematics than any other subject.	25(9.3)	28(10.4)	66(24.4)	29(10.7)	122(45.2)

Percentages in parenthesis

From Table 2, two items—"worried about mathematics more than any other subject" and "mathematics has been my worst subject in life"—appear to top the list, as most respondents (45.2% or 122 individuals and 38.9% or 105 individuals, respectively) identified these items as factors that contribute to fear and panic regarding mathematics tasks, which in turn increases one's level of mathematical anxiety. Anis et al. (2016), Andrew and Browns (2011), Geist (2015), and Mutawah (2015) found that an individual with mathematics anxiety will avoid mathematics and activities that require computation, which directly causes issues with their academic and everyday lives. Table 2 also indicates that 53.7% sometimes become disturbed when they have to go to mathematics class, which is worrying because if students don't go to the class, then how do they learn? Also, 41.5% are sometimes uncomfortable working on the board or when asked a question, and a total of 33.4% of students feel the same way. This makes it a total of 73.9% of students who are uncomfortable; this is an indication that most students have fear and panic about mathematics. It is encouraging that 48.9% of the students are never afraid to ask teachers questions and 48.1% do not panic to discuss mathematics issues with their colleagues, which shows that the teacher-student

relationship as well as the peer-to-peer relationship factor causing fear and panic is irrelevant.

Additionally, other items which garnered more responses include fear of mathematics tests more than any other subjects and not knowing how to study for mathematics tests; this result raises eyebrows on the assessment of mathematics. Furthermore, many students responded that they understand what is taught clearly in mathematics class, but when at home, it appears as if one has never attended mathematics class. This result confirms Anis et al.'s (2016) and Mutawah's (2015) finding that mathematics anxiety might affect retaining lectures, testing situations, or completing complex calculations, and that mathematics anxiety does not just affect the actual computation of mathematics problems, but it impacts the working memory that affects the mathematical portion of mathematics anxiety.

Negative emotional feelings towards mathematics tasks

To examine the negative emotional feelings of an individual towards a mathematics task, 15 items were extracted from literature and the results are shown in Table 3.

Table 3. Descriptive statistics of responses on negative emotional feeling towards mathematics task

Questions	Responses				
	Never	Rarely	Sometimes	Most at times	Always
1. I am sure I cannot learn mathematics.	111(41.1)	89(33.0)	36(13.3)	22(8.1)	12(4.4)
2. I will never go in for any mathematics-related programme in my further education.	52(19.3)	77(28.5)	47(17.4)	47(17.4)	47(17.4)
3. No teacher can make me like mathematics.	100(37)	99(36.7)	29(10.7)	23(8.5)	19(7.0)
4. I am not sure I can do mathematics myself.	84(31.1)	71(26.3)	32(11.9)	52(19.3)	31(11.1)
5. I study mathematics because it is a compulsory subject.	38(14.1)	42(15.6)	29(10.7)	93(34.4)	68(25.2)
6. There is little need for mathematics in most job places.	59(21.9)	36(13.3)	32(11.9)	81(30.0)	62(23.0)
7. Most of the ideas in mathematics are not very useful.	61(22.6)	72(26.6)	37(13.7)	54(20.0)	46(17.0)
8. No matter how hard I try, I cannot understand mathematics.	104(38.5)	74(27.4)	34(12.6)	31(11.5)	27(10.0)
9. I will like a job that does not use any mathematical knowledge.	40(14.8)	69(25.6)	37(13.7)	65(24.1)	59(21.9)
10. I can get along perfectly well in everyday life without mathematics.	53(19.6)	81(30.0)	35(13.0)	58(21.5)	43(15.9)
11. Mathematics is for smart people.	91(33.7)	55(20.4)	32(11.9)	45(16.7)	47(17.4)
12. I worried that other students might understand mathematics problems better than I.	48(17.8)	54(20.0)	30(11.1)	88(32.6)	50(18.5)
13. I worried that I will not be able to complete every assignment in a mathematics course.	64(23.7)	73(27.0)	40(14.8)	54(20.0)	39(14.4)
14. I worried that I will not be able to get an 'A' in my mathematics course.	78(28.9)	54(20.0)	28(10.4)	59(21.9)	51(18.9)
15. Everyone's mathematics ability is determined at birth.	112(41.5)	67(24.8)	30(11.1)	32(11.9)	29(10.7)

Percentages in parenthesis

From Table 3, 59.6% of students study mathematics because it is a compulsory subject. Also, 53.0% of the respondents always have the feeling that there is little need for mathematics in most job places; 46.0% at all times feel they will like a job that does not use any mathematical knowledge; and 51.1% feel continuously worried that other students might understand mathematics problems better than they do. Meanwhile, 74.1% of the respondents said they never feel that they cannot learn mathematics, 73.7% said they never had a feeling that a teacher can make them like mathematics, and 57.4% of the respondents said they have never had

any feeling of not being sure that they can do mathematics themselves. Moreover, 65.9% of the respondents had never felt that no matter how hard they tried, they could not understand mathematics; 54.1% felt mathematics was for smart people; and 66.3%, under no circumstances, felt everyone's mathematical ability was determined at birth. According to Blazer (2011), increased reliance on examination testing has been responsible for the high negative emotions that students had towards mathematics, thus increasing their level of mathematical anxiety. Luttenberger et al. (2018) discovered that mathematics anxiety manifests itself on an emotional,

cognitive, and physiological level and leads to outcomes such as decreases in achievement. On an emotional level, individuals suffer from feelings of tension, apprehension, nervousness, and worry (Papousek et al., 2012).

Negative attitude towards mathematics tasks

To investigate an individual's negative attitude towards a mathematics task, 10 items were extracted from literature and the results are shown in Table 4.

Table 4. Descriptive statistics of negative attitude towards mathematics tasks as a result of portraying mathematical anxiety

Questions	Responses				
	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. Mathematics as a subject during my Primary and Junior High school years was my least favourite.	42(15.6)	58(21.5)	29(10.7)	88(32.6)	53(19.6)
2. I have always struggled with anything that involves numeracy from my primary school days.	63(23.3)	68(25.2)	41(15.2)	62(23.0)	36(13.3)
3. My performance in mathematics during my early school years was hardly above average.	50(18.5)	54(20.0)	21(7.8)	99(36.7)	46(17.0)
4. I often do not like mathematics lesson periods because it bores me.	53(19.6)	66(24.4)	38(14.1)	67(24.8)	46(17.0)
5. Mathematics course during my Junior High school years was easier to understand compared to mathematics at Senior High.	26(9.6)	37(13.7)	30(11.1)	103(38.1)	74(27.4)
6. Mathematics during my basic school years has never been interesting to me.	79(29.3)	86(31.9)	28(10.4)	47(17.4)	30(11.1)
7. I will like to spend less time learning mathematics at school.	59(21.9)	70(25.9)	32(11.9)	74(27.4)	35(13.0)
8. I am never bothered to learn mathematics.	49(18.1)	79(29.3)	34(12.6)	72(26.7)	36(13.3)
9. I hardly read my mathematics textbook before coming to class.	46(17.0)	57(21.1)	34(12.6)	86(31.9)	47(17.4)
10. Someone does my homework for me most times or else I copy from my colleagues.	70(25.9)	60(22.2)	38(14.1)	61(22.6)	41(15.2)

Percentages in parenthesis

The results in Table 4 revealed that more than half of the respondents agreed that mathematics was their least favourite subject during primary school and Junior High School (JHS). Respondents' performance in mathematics during early school years was hardly above average, and studying mathematics during JHS years was easier to understand compared to mathematics at Senior High, where the top negative attitudes exhibited as a result of mathematical anxiety. However, 61.2% of the respondents disagreed that mathematics during their basic school years had never been interesting, 48.1% differed on the attitude of someone doing homework for

them most times or else copying from colleagues, and 47.8% of respondents were also upset and spent less time learning mathematics at school. Some researchers (Elizabeth, 2008; Mazana et al., 2019) asserted that a negative attitude towards mathematics tasks is a result of one's mathematical anxiety portrayed.

FINDINGS

Table 5 displays the descriptive statistics of the accumulated Mod-MARS scores for 270 senior high school participants on the 3 components of mathematics anxiety. The highest accumulated score obtained was

188, and the lowest was 40 out of the possible 200. Participants were divided into three mathematical anxiety levels. In the first category, participants whose Mod-MARS overall scores were at most sixty (60) were considered as having low mathematical anxiety. In the second category are those whose Mod-MARS overall

scores were within the range of 99 to 61 inclusive and were categorised as having moderate mathematical anxiety. In the third category were those with overall scores of at least one hundred (100), and they were considered as having high mathematical anxiety.

Table 5. *Results on levels of Mathematics anxiety experienced by participants*

Accumulated scores (x)	Frequency	Status
100 and above	174 (64) *	High
99 – 61	92 (34)	Moderate
60 and below	4 (2)	Low
Total	270 (100)	

* Percentages in parenthesis

From Table 5, the results indicated that 174 (64%) of the 270 participants experienced a high level of mathematical anxiety. There was evidence, as more than 50% of them alleged to be worried about mathematics more than any other subject and also grieving that mathematics has been their worst subject in life (see Table 2). In addition to that, there have been many indications that most of the students who have a high level of mathematical anxiety study mathematics because it is a compulsory subject and also have the feeling that there is little application of mathematics in their job careers, and hence many like to be employed in a career that is not mathematics-related (see Table 3). Moreover, it has been verified that 92 (34%) participants experienced a moderate level (see Table 5). A number of participants in this category express neutral attitudes towards mathematics activities, such as being asked to work on a mathematics question on the board and/or being asked to go to mathematics class in general (see Table 2).

However, 4 (2%) were found to experience a low level of mathematical anxiety. Probing the participants' responses revealed that students in the low mathematics anxiety category are never afraid to ask teachers questions in class, do not panic when discussing mathematics issues with their colleagues, and do not worry about purchasing mathematics books (see Table 2). To add to that, close to three quarters of the respondents (see Table 3) express a feeling of liking mathematics and have never felt not sure they can do mathematics themselves.

CONCLUSION AND RECOMMENDATION

The analysis found that most SHS students in Ghana had a high level of mathematical anxiety. This high mathematical anxiety level was attributed to some

behavioural, emotional and negative attitudes and beliefs students exhibit and hold towards mathematics tasks. These traits were revealed as most of the respondents perceived mathematics to be the worst subject in their lives and were much more worried about mathematics than any other subject. The findings of this study support findings of Hatisaru and Murphy (2019) that mathematics was perceived as a difficult subject by many people due to its nature and also individuals' preconceived notions about mathematics and the anxiety individuals have. However, Ohipeni-Ablode (2020) and Awoniyi (2021) pointed out that certain practices, such as assigning mathematical work as punishment for misbehaving in a mathematics class, can cause students to hate or dislike mathematics. In addition, literature revealed that a teacher's attitude and approach are crucial in developing the student's interest or dislike for mathematics (Mazana et al., 2019; Rajkumar & Hema, 2019).

Other factors which emerged from the findings which create panic, fear, negative emotions and negative attitudes in participants connected to the high mathematical anxiety level of students include being forced to go to mathematics class, feeling uncomfortable when asked to solve a mathematics question on the board, loss of attention in mathematics class while a lesson is ongoing, perceiving studying mathematics just because it is a compulsory subject, feeling that there is little need for mathematics in most job places and many more. However, a larger proportion of respondents disclosed that mathematics during their basic school years has been interesting, and they like to spend more time learning mathematics as well as doing their homework by themselves.

Positive attitudes towards learning mathematics and students performing in mathematics are necessary among Senior High School students in Ghana and the world as a whole as far as mathematics education is concerned. The outcome of this study could have

consequences both for future research on mathematical anxiety and for teaching and learning mathematics in senior high school. Therefore, there is a need for teachers, parents and any other education stakeholders to enhance learners' positive attitudes in learning mathematics. To widen the scope of this study, the researchers suggest further studies should be carried out to identify the prevalent causes of senior high school students' mathematical anxiety in Ghana.

Acknowledgement

The authors thank the teachers and the students that made themselves available for the study.

Conflict of Interest Statement

All the authors whose names are mentioned in this manuscript have viewed and approved its contents, and they all declare that they are not connected to or otherwise involved with any organisations or entities that have a financial or non-financial stake in the topics or materials covered in this document. We attest that the contribution is unique and is not already being considered by another publisher.

Author Names: Jackson Jessel Aboagye-Agbi, Jones Apawu, Nana Akosua Owusu-Ansah, Mark Mishiwo

Data Availability Statement

The corresponding author is willing to provide the datasets created during and/or analysed during the current work upon reasonable request.

REFERENCES

- Abotowuro, S. (2015). *Factors influencing the perceived difficulties of Senior High School students in Elective Mathematics*. (Unpublished Master of Science thesis) Kwame Nkrumah University of Science and Technology, Ghana.
- Achieve. (2011). *Closing the expectations gap 2011: Sixth annual 50-state progress report on the alignment of high school policies with the demands of college and careers*. Washington, DC: Author. <http://www.achieve.org/files/AchieveClosingtheExpectationsGap2011.pdf>
- ACT. (2010c). *Mind the gaps: How college readiness narrows achievement gaps in college success*. <http://www.act.org/research/policymakers/pdf/MindTheGaps.pdf>
- Akakpo, G. M., Nyarko, K., Boateng, R., Adjekum, N., & Kwarteng, A. B. (2013). The effect of corporal punishment and math anxiety on math performance among junior high school students in Ghana. *IFE Psychologia: An International Journal*, 21(2), 210-219.
- American Psychological Association (2014). Anxiety. <http://www.apa.org/topics/anxiety/index.aspx>
- Andrews, A., & Brown, D. J. (2015). The effects of math anxiety. *Education*, 135(3), 362-370.
- Anis, Y., Krause, J. A., & Blum, E. N. (2016). The relations among mathematics anxiety, gender, and standardized test performance. *Research in the Schools*, 23(2), 28-37.
- Asante, K. O. (2012). Secondary students' attitudes towards mathematics. *IFE Psychologia: An International Journal*, 20(1), 121-133.
- Awanta, E. K. (2004). Helping students overcome mathematics anxiety. *Mathematics Connection*, 4(1), 39-43.
- Awoniyi, F. C. (2021). Are caning and learning friends or foes in Ghanaian secondary schools?. *Cogent Education*, 8(1), 1862031.
- Blazer, C. (2011). Strategies for reducing mathematics anxiety. *Information Capsule: Research Services*, 1102(1), 1-6.
- 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.
- Bull, H. (2009). Identifying maths anxiety in student nurses and focusing remedial work. *Journal of Further and Higher Education*, 33(1), 71-81.
- Capuno, R., Necesario, R., Etcuban, J. O., Espina, R., Padillo, G., & Manguilimotan, R. (2019). Attitudes, Study Habits, and Academic Performance of Junior High School Students in Mathematics. *International Electronic Journal of Mathematics Education*, 14(3), 547-561.
- Cates, G. L., & Rhymer, K. N. (2003). Examining the relationship between mathematics anxiety and mathematics performance: An instructional hierarchy perspective. *Journal of Behavioral Education*, 12(1), 23-34.
- Chestnut, E. K., Lei, R. F., Leslie, S. J., & Cimpian, A. (2018). The myth that only brilliant people are good at math and its implications for diversity. *Education sciences*, 8(2), 65.

- Chinn, S. (2009). Mathematics anxiety in secondary students in England. *Dyslexia*, 15(1), 61-68.
- Christie, B. (2011). Strategies for reducing math anxiety. *Information Capsule Research Service*, 1-8.
- Ciftci, S. K. (2019). The effect of mathematics teacher candidates' locus of control on math anxiety: structural equation modeling. *European Journal of Education Studies*.
- Cohen, L., Manion, L., & Morrison, K. (2013). *Research methods in education*. Routledge.
- Creswell, J., W. (2014). *Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*, (4th ed.). Boston: Pearson Education, Inc.
- Derling, M., Magda, C., Gabriela, R., & Carmen, V. (2021). Anxiety as a prevailing factor of performance of university mathematics students during the COVID-19 pandemic. *Образование и наука*, 23(2), 94-113.
- Dowker, A. (2019). Mathematics anxiety and performance. In *Mathematics Anxiety* (pp. 62-76). Routledge.
- Elizabeth, J. (2008). Mathematics anxiety in student teachers. *Practitioner Research in Higher Education*, 11, 36-42.
- Fraenkel, J. R., & Wallen, N.E. (2006). *How to design and evaluate research in education*, (5th ed.). New York: McGraw-Hill Publishing Co.
- Garba, A., Ismail, N., Osman, S., & Rameli, M. R. M. (2020). Exploring peer effect on mathematics anxiety among secondary school students of Sokoto State, Nigeria through photovoice approach. *EURASIA Journal of Mathematics, Science and Technology Education*, 16(2).
- Geist, D. E. (2015). Math anxiety and the "math gap": How attitudes toward mathematics disadvantages students as early as preschool. *Education*, 135(3), 328-336.
- Gresham, G., & Burleigh, C. (2019). Exploring early childhood preservice teachers' mathematics anxiety and mathematics efficacy beliefs. *Teaching Education*, 30(2), 217-241.
- Haase, V. G., Guimarães, A. P. L., & Wood, G. (2019). Mathematics and emotions: The case of math anxiety. In *International handbook of mathematical learning difficulties* (pp. 469-503). Springer, Cham.
- Hart, S. A., & Ganley, C. M. (2019). The nature of math anxiety in adults: Prevalence and correlates. *Journal of numerical cognition*, 5(2), 122.
- Hataru, V., & Murphy, C. (2019). "Creature Teachers" Monster" Mathematicians: Students' Views about Mathematicians and Their Stated Attitudes to Mathematics. *International Journal of Education in Mathematics, Science and Technology*, 7(3), 215-221.
- Huang, X., Zhang, J., & Hudson, L. (2019). Impact of math self-efficacy, math anxiety, and growth mindset on math and science career interest for middle school students: the gender moderating effect. *European Journal of Psychology of Education*, 34(3), 621-640.
- Juniati, D., & Budayasa, I. K. (2020). The mathematics anxiety: Do prospective math teachers also experience it? *Journal of Physics: Conference Series* 1663(1), p. 012032).
- Lamichhane, B. R., & Belbase, S. (2017). Images of mathematics held by undergraduate students. *International Journal on Emerging Mathematics Education*, 1(2), 147.
- Luttenberger, S., Wimmer, S., & Paechter, M. (2018). Spotlight on math anxiety. *Psychology research and behaviour management*, 11, 311.
- Mazana, Y. M., Suero Montero, C., & Olifage, C. R. (2019). Investigating students' attitude towards learning mathematics.
- Mullis, I. V., Martin, M. O., Foy, P., & Arora, A. (2012). *TIMSS 2011 international results in mathematics*. International Association for the Evaluation of Educational Achievement. Herengracht 487, Amsterdam, 1017 BT, The Netherlands.
- Mutawah, M. A. (2015). The influence of mathematics anxiety in middle and high school students' math achievement. *International Education Studies*, 8(11), 239-251.
- Mutodi, P., & Ngirande, H. (2014). Exploring mathematics anxiety: Mathematics students' experiences. *Mediterranean Journal of Social Sciences*, 5(1), 283-283.
- Nadeak, B., Naibaho, L., & Silalahi, M. (2020). COVID-19 and Students' Anxiety Management. *International Journal of Innovation, Creativity and Change*, 13(7), 1574-1587.
- Nardi, P. M. (2018). *Doing survey research: A guide to quantitative methods*. Boston, MA: Pearson Education.
- Ohipeni-Ablode, M. (2020). *Validation of the mathematics anxiety rating scale by zakariya with evidence from senior high school students in the asuogyaman district of ghana* (Doctoral dissertation, School of Graduate Studies, Kwame Nkrumah University of Science and Technology).

- Olanrewaju, M. K. (2019). Effects of Collaborative Learning Technique and Mathematics Anxiety on Mathematics Learning Achievement among Secondary School Students in Gombe State, Nigeria. *Asian Journal of University Education*, 15(1), n1.
- Papousek, I., Ruggeri, K., Macher, D., Paechter, M., Heene, M., Weiss, E. M. & Freudenthaler, H. H. (2012). Psychometric evaluation and experimental validation of the statistics anxiety rating scale. *Journal of Personality Assessment*, 94(1), 82-91.
- Patton, M. Q. (2002). Two decades of developments in qualitative inquiry: A personal, experiential perspective. *Qualitative social work*, 1(3), 261-283.
- Paul, M., & Hlanganipai, N. (2014). Exploring mathematics anxiety: mathematics students' experiences. *Mediterranean Journal of Social Sciences*, 5, 283-294.
- Perrotta, G. (2019). Anxiety disorders: definitions, contexts, neural correlates and strategic therapy. *J Neur Neurosci*, 6(1), 042.
- Peters M. D. (2008). *Overcoming school anxiety: How to help your child deal with separation, tests, homework, bullies, math phobia, and other worries*. New York, NY: AMACOM, American Management Association.
- Pizzie, R. G., Raman, N., & Kraemer, D. J. (2020). Math anxiety and executive function: neural influences of task switching on arithmetic processing. *Cognitive, Affective, & Behavioral Neuroscience*, 20(2), 309-325.
- Preis, C., & Biggs, B. T. (2001). Can instructors help learners overcome math anxiety? *ATEA Journal*, 28(4), 6-10.
- Prevatt, F., Wells, T. L., & Li, H. (2010). The contribution of memory and anxiety to the math performance of college student with learning disabilities. *Learning Disabilities Research and Practice*, 25, 39-47.
- Putri, H. E., Wahyudy, M. A., Yuliyanto, A., & Nuraeni, F. (2020). Development of Instruments to Measure Mathematical Anxiety of Elementary School Students. *International Journal of Learning, Teaching and Educational Research*, 19(6), 282-302.
- Queirós, A., Faria, D., & Almeida, F. (2017). Strengths and limitations of qualitative and quantitative research methods. *European Journal of Education Studies*.
- Rajkumar, R., & Hema, G. (2019). Factors affecting mathematical problem solving competence of undergraduate students in facing competitive examinations. *IMPACT: International Journal of Research in Humanities, Arts and Literature (IMPACT: IJRHAL)*, 7 (2), 319, 328.
- Rajkumar, R., & Hema, G. (2021). Competitive exam aspirants on mathematics interest and anxiety: an analysis of undergraduate students. *Science*, 30(94.80), 8-880.
- Recber, S., Isiksal, M., & Koç, Y. (2018). Investigating self-efficacy, anxiety, attitudes and mathematics achievement regarding gender and school type. *Anales de Psicología/Annals of Psychology*, 34(1), 41-51.
- Richardson, F. C., & Suinn, R. M. (1972). The mathematics anxiety rating scale: psychometric data. *Journal of counselling Psychology*, 19(6), 551.
- Sevindir, H. K., Yazici, C., & Yazici, V. (2014). Mathematics anxiety: A case study for Kocaeli University. *Procedia-Social and Behavioral Sciences*, 152, 637-641.
- Shamim, N., & Akhtar, M. (2021). Impact of math's anxiety on Student's attitude towards Quantitative Research at Higher Education Level. *Journal of Education & Humanities Research, University of Balochistan, Quetta-Pakistan*, 12(2), 29-39.
- Singh, A. S., & Masuku, M. B. (2014). Sampling techniques & determination of sample size in applied statistics research: An overview. *International Journal of Economics, Commerce and Management*, 2(11), 1-22.
- Sofowora, S. O. (2014). *Anxiety and lack of motivation as factors affecting success rates in bridging mathematics*. Doctoral dissertation, University of South Africa, South Africa.
- Soni, A. (2016). *Factors influencing students' mathematics achievement and their choice to study further mathematics*. (Doctoral dissertation). Thapar University, Punjab-India
- Sorvo, R., Koponen, T., Viholainen, H., Aro, T., Räikkönen, E., Peura, P., ... & Aro, M. (2019). Development of math anxiety and its longitudinal relationships with arithmetic achievement among primary school children. *Learning and Individual Differences*, 69, 173-181.
- Švecová, V. (2018). Mathematics anxiety and other psycho didactic aspects in university students. *J. Educ. Soc. Policy*, 5, 246-250.

Tapia, M., & Marsh, I. I. G. (2004). An instrument to measure mathematics attitudes. *Academic Exchange Quarterly*, 8(2), 16-22

Udil, P. A., Kusmayadi, T. A., & Riyadi. (2017, August). Profile of mathematics anxiety of 7th graders. In *AIP Conference Proceedings*, 1868(1), 050017. AIP Publishing.

Van Mier, H. I., Schleepen, T. M., & Van den Berg, F. C. (2019). Gender differences regarding the impact of math anxiety on arithmetic performance in second and fourth graders. *Frontiers in psychology*, 9, 2690.

Yamane, T. (1967). *Statistics: An introductory analysis* (No. HA29 Y2 1967).