Anxiety's Impact on Mathematics Ability in Tanzanian Secondary School Students: A Singida District Case Study

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Abstract

Professionals in the fields of science, technology, engineering, and mathematics are in greater demand globally. Numerous governmental and commercial organizations have redesigned education and encouraged training to improve workers' and students' math and science proficiency in order to successfully meet this need. Programs for education and training usually aim to increase participants' understanding of mathematics and science.

Tanzania's consistently low mathematics success has alarmed including the government, which has led them to investigate potential reasons for the poor performance. It is thought that students' experiences with mathematics anxiety have an impact on their mathematical achievement. This study looked into how secondary school students in Singida district's area performed academically in relation to mathematics' anxiety. The study's sample consisted of 1150 students who were selected from twelve secondary schools in the Singida area.

To gather data, standardized questionnaires with closed-ended questions were distributed to participants. The study made use of the respondents' terminal examination results in mathematics. To examine the gathered data, both descriptive and inferential statistics were applied. Overall, the findings demonstrated a statistically significant (0.025-two tailed) impact of mathematics anxiety on students' academic performance in mathematics. A correlation coefficient, $r=0.425$ suggests a substantial positive association or relationship between the impact of math's anxiety and Mathematics performance. When all other factors are maintained constant, a regression analysis using the equation $y=0.536x+3.567$ shows that mathematics anxiety has impact on Mathematical ability. It is recommended that Mathematics teachers remain cognizant of the potential for their students to have arithmetic anxiety in light of the findings. Moreover, it is suggested that additional research be done with a bigger sample size to confirm the claim.

keywords; Mathematics Anxiety, Anxiety, Mathematics ability, Secondary school.

Introduction

Mathematics anxiety, which is defined as a feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations (Richardson, Frank C and Suinn, Richard M, 1972).It is an important component of the affective domain that plays a key role in students' engagement with mathematics (Goldin, Gerald A and Epstein, Yakov M and Schorr, Roberta Y and Warner, Lisa B, 2011).

Anxiety is one of several emotional and behavioral issues (Vitasari, 2010). Anxious students approach their academic pursuits with a sluggish attitude, which results in low exam scores, incomplete assignments, and a diminished desire to learn. Psychological symptoms of anxiety in pupils include nervousness before lessons, panic attacks, test-induced blankness, helplessness during assignments, and disinterest in challenging subjects. Physiological symptoms include sweaty hands, a cold feeling, anxiety, fear, rapid breathing, a raised heart rate, and upset stomach that occur simultaneously (Putri, 2020).

Students who suffer from anxiety tend to behave passively in their academic pursuits; they don't study with excitement, do poorly on exams, and don't finish assignments to the required standard.

As they strive to become middle class citizens, Tanzanians are now emphasizing science, mathematics, and technology more (Kitta, 2004). However, pupils' ability in mathematics is currently dropping, and their interest in studying the subject is waning. Despite the general consensus that mathematics is a vital subject for people's intellectual growth as well as the general development of a country, a sizable percentage of pupils worry about or eventually come to despise the subject throughout their time in school (Mutegi, 2021). Hembree (1990) asserts that as mathematics is a requirement for science and technology, if students do not study it, the nation's scientific and technological resource base will be weakened.

Mathematics anxiety is the term used to describe the existence of unpleasant emotions that impede one's ability to solve mathematical problems. It is more than just a dislike of mathematics, it results in a pattern of total avoidance when students avoid situations that call for mathematics knowledge and avoid taking mathematics classes. Hembree (1990) asserts that if pupils skip studying mathematics, the nation's foundation in science and technology is jeopardized because it is a prerequisite for many other topics in science and technology.

Patricia (1986) highlighted that success in the technical and non-technical fields of education, business, social sciences, behavioral sciences, humanities, and the arts requires a strong foundation in mathematics. Math anxiety affects students' daily lives as well as their academic trajectories. It can even worsen stress, which is known to be connected to a variety of other issues. As a result, enhancing students' Mathematical abilities in the classroom is crucial since it sets the stage for their future careers. Mathematics is one of the most significant disciplines covered in the curricula of all schools worldwide. It's a field with direct links to other subjects, especially scientific and technical ones. Furthermore, it is mandatory for students to take Mathematics in both elementary and senior school (Chi, Nguyen Phuong, 2021).

Anxiety
During the literature review, several definitions of anxiety were found. Hembree (1990) claims that anxiety has a complex structure, and one approach to describe these components is as an emotion of fear. In the words of (Nadide and Kandemir, 2020 "anxiety can be characterized as a feeling of subjective tension and concern that arises with a specific combination of cognitive, emotional, physiological, and behavioral indicators." Behavioral, physiological, emotional, and cognitive components of anxiety are therefore widely acknowledged (Morris, 1981). Educators define mathematics anxiety as a particular kind of state anxiety that appears in situations that are assumed to be connected to the application of mathematics. Numerous definitions found in the literature review emphasize the role that mathematics anxiety plays in people's negative attitudes toward mathematics and feelings of helplessness (Bekdemir, 2009). Haase, Guimarães, and Wood (2019) claim that math's anxiety is an irrational condition that prevents students from learning mathematics and limits their opportunities for employment, leaving them in awe of the subject. Because of this, it exposes students to failure and keeps them from reaching their greatest potential (Miller & Mitchell, 1994).

Impact Of Mathematics Anxiety
Mathematics anxiety is defined as the sense of tension or fear that people feel when they are faced with the need to perform mathematical tasks in daily and school life (Richardson, 1972). Therefore, it may cause forgetfulness and loss of self-confidence (Tobias, 1993). A large portion of students decide not to pursue careers in Mathematics because of these anxieties. Actually, "individuals with high mathematics anxiety enroll in fewer mathematics courses, attain lower grades in their courses, and exhibit lower mathematics achievement and abilities compared to their peers with low mathematics anxiety" (Mann, 2019). In a similar spirit, Richardson and Suinn (1972) stressed that a student's mathematics anxiety may cause them to struggle in basic arithmetic classes or when they try to graduate to more challenging math's courses. Mathematics anxiety is an adverse emotional response to mathematical events, either hypothetical or real. In this case, the impacts of arithmetic anxiety are particularly crippling. Mathematical anxiety is associated with low self-esteem, disinterest in the subject, and complete avoidance (Skuren, 2020).

This study assumed that

i. There was no gender difference in attitudes towards the subject

ii. Negative attitudes prevented the learners from realizing their success in the subject

(LANGAT, 2015)

iii. All schools sampled had the adequate facilities, infrastructure and staff

iv. Learners targeted, knew where they range in terms of performance in the subject

v. The respondents would co-operate and provide genuine information during data collection

vi. Findings of the study would be used to generalize all schools in the county. (LANGAT, 2015)

Table 1: National form four Mathematics results for the twelve school from Singida district.

Year	Pass rate		Failure rate	
	Candidates	**Percentage**	**No.of candidates**	**Percentage**
2017	217/945	22.9	728/945	77.1
2018	192/992	19.2	806/998	80.8
2019	212/962	22	750/962	78
2020	202/950	21.3	748/950	78.7
2021	219/1050	20.9	831/1050	79.1
2022	261/1232	21.2	971/1232	78.8

Source; **Necta (CSEE) results from 2017 to 2022 statistics**.

The Necta (CSEE) results from 2017 to 2022 statistics are presented graphically (scatter plot) as shown below.
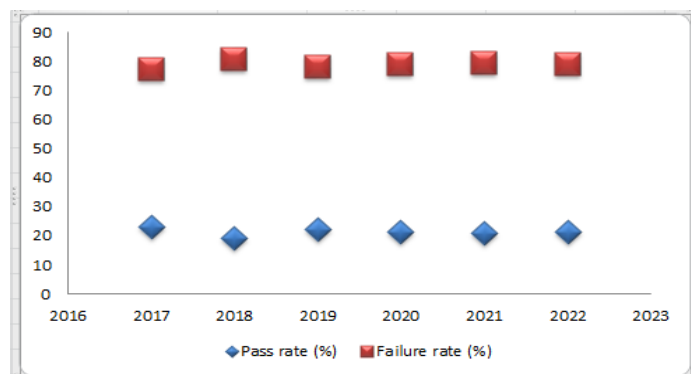
The results show that the pass rate is very low across the years, the pass rate indicated above was graded from grade D (30-40 marks), grade C (41-60)marks, grade B (61-80) and grade A (81-100)marks. Again, the results show that there is a mass failure as shown in the figure above because the majority of the students score grade F, in which it's marks is below 29 i.e (0-29) marks (Tanzania, 2017).

These results have proven that in recent times, less than a quarter (1/4) of the students in the Singida district were passed in mathematics subject which have the criteria to enter into second cycle institutions. Research evidence exists to validate the fact that examination anxiety affects the academic performance of students (Bentil, 2020) as one factor that contributes to this failure. Consistently, this study hypothesizes that the poor pupils' Mathematics performance could be attributed to the Mathematics anxiety they experience during examinations.

Methodology

This study examined the impact of mathematics anxiety on academic achievement in secondary school students in Singida district using a quantitative technique and a correlation research design (Lubawa, 2021). This design was chosen because it shows how two variables are related to one another. The projected study population consisted of 10234 students enrolled in Singida district's private and public secondary schools. For the study, twelve (12) secondary schools run by the Singida district were selected at random. 1150 students were chosen for the study using simple random sampling and the Yamane method. The study employed closed-ended, standardized questionnaires that were distributed to participants in order to gather data. To assess each participant's level of skill in the topic, the results of the end of term Mathematics examination were recorded on a checklist (Haydon, 2012). Descriptive and inferential statistics were run on the gathered data using SPSS version 26. The results of mathematics anxiety were described in a descriptive way using the frequency, percentage and mean. Inferential statistics for correlation and multiple regression analysis were employed by the researcher (Cohen, 2013). The correlation coefficient was used to look at how mathematics anxiety affected secondary school students at Singida district's academic performance in the subject. In order to determine how math anxiety affected math performance, a multiple regression analysis was used. The correlation coefficient 0.025 was the significance threshold used to study the hypothesis. The researcher conferred with other research experts to validate the research tool , they assessed the questionnaires and provided recommendations for enhancement. The reliability of each questionnaire item was assessed using Cronbach's alpha coefficients (Spiliotopoulou, 2009). Eight participants were requested to complete the surveys and tests as a pilot group. After determining the Cronbach's alpha coefficient, the reliability coefficient of 0.752 was discovered, demonstrating the dependability of the data (Bryman and Bell 2012).

Findings And Discussion

The aim of the research was to examine the impact of Mathematics' anxiety on the performance of secondary school pupils in Tanzania. Initially, to examine the impact of mathematics anxiety in the Singida scenario, each participant was asked to rate their response to eight (8) things using a five-point Likert scale. Based on the mean values, the five-point scale intervals are defined as follows: Regarding average ratings, the intervals above one (1) but less than 2.5 signify negative agreement, mean values equal to 2.5 but less than 3.5 signify neutral and mean values equal to 3.5 but less than 5.0 signify positive agreement (Aguilera, 2021). A detailed analysis of the outcomes may be found below.

Statements	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Total score	Mean score	Result
A_1	24.2	8.9	2.8	25.2	29.8	1120	3.32	Neutral
A_2	24.4	20.4	3.6	15.6	27.9	1139	3.02	Neutral
A_3	16.6	12.5	4.3	25.6	31.7	1124	3.48	Neutral
A_4	34.6	20.9	4.9	17.6	12.6	1113	2.489	Negative
A_5	36	18.1	3.1	17.6	15	1112	2.526	Neutral
A_6	14.5	8.4	2.6	26.6	38.7	1125	3.73	Positive
A_7	53.4	15.8	2.9	8.7	11.2	1140	2.004	Negative
A_8	28.9	14.7	3.6	15.8	29.6	1147	3.028	Neutral

SOURCES; FIELD WORK 2023.

The above letter i.e A_1 up A_8 stands for the following statements;

A_1= My challenge in selecting a science combination is rooted in my poor Mathematics grades.

A_2 = My feelings toward my Mathematics teacher are negative which promote avaindance.

A_3 = Attending a supplementary Mathematics class is necessary for me to improve my understanding.

A_4 = My preference is to read other subjects rather than engaging Mathematics class.

A_5 = I consistently became drowsy in mathematics class.

A_6 = The fear I have for Mathematics plays a role in my academic struggle.

A_7 = Poor attendance at School is attributed to my anxiety and fear of Mathematics.

A_8 = I experience a loss of confidence when faced with Mathematics, especially in the company of peer.

Ramifications of Mathematical Apprehension (Consequences of Understanding Mathematics)

In conclusion, the study discovered that participants were largely indifferent, neither concurring nor disagreeing on the impact of anxiety on secondary school Mathematics performance in Tanzanian students. This was made evident by the composite mean of 2.9496, which denotes a neutral viewpoint. To be more precise, the findings indicated that the only statement that respondents agreed with, with an average mean score of 3.73, was "anxiety about mathematics leads to inadequate performance." Participants expressed a neutral view regarding statements such as "being unable to select a science combination due to low mathematics grades (Spade, 1997)," which obtained an average score of 3.32, and "choosing remedial classes to enhance comprehension," which received an average score of 3.48. Participants were also neutral on the following statements: "I consistently feel sleepy during mathematics class," "I harbor dislike for and avoid my mathematics teacher," which had a mean score of 2.526, 3.02 was the average score for these statements respectively. Additionally, the statements 'I experience a lack of confidence in the presence of my peers owing to mathematical anxiousness' yielded mean averages of 3.028 (Jameson, 2014). Again, the findings indicated that the only statement that respondents disagreed with,were also contested by a few study participants, especially in relation to the statements, "Poor attendance at School is attributed to my anxiety and fear of Mathematics" which had a mean score of 2.004, and "I favor studying other subjects instead of participating in mathematics class," which had a mean score of 2.489. (Salahot, 2022)

Poor Performance Stemming From A Math Phobia (A_6).

The study investigated the potential relationship between anxiety and subpar arithmetic skills. In this regard, 14.5% of participants strongly disagreed with the assertion that a fear of mathematics is the cause of low academic accomplishment. 2.6% of participants had a neutral viewpoint, while 8.4% of individuals disagreed with the statement. On the other hand, 38.7% of respondents strongly agreed with the statement that a fear of mathematics is associated with subpar performance, which was confirmed by 26.6% of respondents. The foregoing findings were corroborated by the mean score of 3.73, which indicated that respondents agreed that arithmetic anxiety affects performance. Students who fear mathematics are less likely to have favorable attitudes toward the topic, which can lead to low self-esteem, disillusionment, and academic underachievement, according to Nathan and Jackob's (2020) research. Studies have shown a connection between test anxiety and math anxiety, suggesting that students' anxiety during tests may have an effect on their poor Mathematics performance. This occurs when students don't study sufficiently for the test, which raises anxiety levels and ultimately results in failing the test or exam (Bentil, 2020).

Snoozing During Math Class (A_5).

The purpose of the study was to determine whether students' poor performance in Mathematics class was caused by them dozing off. 36% of participants strongly disagreed with the statement that they typically doze off in math class in this regard. 18.1% of respondents disagreed with the statement, while 3.1% of respondents were neutral. On the other hand, 17.6% of respondents claimed to frequently drift off in math class, and an additional 15% strongly agreed with this claim. The mean score of 2.526, which showed that respondents had a neutral opinion toward the statement that they frequently dozing off in math class, supported the above results. The notion of napping during class sessions has been seen to effect students' performance. According to a study conducted in the Philippines (Sygaco, 2020), students' sleep patterns are disrupted, which causes exhaustion and uncomfortable periods and eventually results in instances of them dozing off in class. The study emphasized that students require an average of 8 to 10 hours of rest (Johnson,

2006). According to this study, students' poor academic performance in STEM fields science, technology, engineering, and mathematics was exacerbated by the fact that sleeping was more common in these fields. When a pupil is disinterested in mathematics, the likelihood of them nodding off in class increases. Furthermore, (Hershner, 2020) emphasizes the importance of children receiving adequate sleep, emphasizing how it contributes to mental stability and may therefore enhance academic performance.

Studying Different Subjects In The Math Classroom (A_4).
The study focused on topics that students found interesting to learn in math class. The poll found that 20.9% of respondents disagreed with this specific scenario, 4.9% were neutral, and 34.6% strongly opposed. Twelve percent (20%) of respondents also strongly agreed with the statement expressed by seventeen percent of respondents, who stated that they would prefer to study other subjects in math class. According to Casta\n}o (2020), the majority of survey respondents had a negative attitude about choosing to focus on anything else in math class, as demonstrated by their mean score of 2.489.

Notwithstanding the respondents' unbiased judgment, it does offer a potential indicator of students' apathy in mathematics. Math-phobic students risk getting distracted by other activities and losing focus. This theory is supported by Irfan Agus (2021), who concluded that students' academic underperformance is caused by a lack of focus and excitement to learn mathematics. Analogously, Lalu Puji's study from 2021 discovered that a significant element in pupils' Mathematical failure is their lack of attention and focus. According to survey respondents, the complexity of Mathematical formulas and reasoning made the subject difficult for them to understand (Salahot, 2022).

Having Mathematics Fear And Losing Confidence In Front Of Other Students
The purpose of the study was to determine whether participants' anxiety about Mathematics affected their confidence in front of other students. 3.6% of respondents were neutral, 14.7% disliked, and 28.9% strongly disagreed, according to the poll. Furthermore, 15.8% of participants agreed with the statement, and 29.6% of respondents strongly agreed, that their fear of mathematics makes them lose confidence when they are with other students. Overall, respondents to the poll (mean score of 3.028) showed a neutral stance about the notion that their fear of mathematics makes them feel insecure around other pupils (Elkins, 2004). Considering that almost 50% of the participants stated that their mathematics anxiety caused them to feel less confident in front of others, it may be inferred that a notable prevalence of diminished confidence exists among the group. According to Arem's (2009) research, psychological factors, such as a negative attitude toward mathematics, might contribute to mathematics anxiety in students, which can result in decreased confidence and weakened self-assurance. Lack of confidence is a major barrier for pupils who are suffering anxiety related to mathematics, as noted by (Dodd, 1999).

Low Attendance At School Due To Fear Of Mathematics
The purpose of the study was to determine whether the respondents' fear of mathematics affected their attendance at school. In this regard, the claim that the reason for their poor attendance at school is a mathematics phobia was strongly disagreed with by 53.4% of participants; 15.8% agreed, and 2.9% were neutral. However, 8.7% of participants agreed with the statement, and 11.2% strongly agreed that the reason for the participants' low attendance at school is their fear of mathematics. The preceding findings were corroborated by the mean of 2.004, which shows that respondents strongly disapprove of the notion that their lack of attendance at school is due to a fear of mathematics. The results of the study demonstrate that students' fear of Mathematics has no bearing on their attendance at school (Sister Mary Fides Gough, 1954). Still, research from other scholars has demonstrated that students could be reluctant to come to class for a number of reasons, including anxiety about mathematics teachers and concerns about answering questions in front of the class (Magnate, 2022) .

Being Unable To Select A Science Major Because of Low Math Grades
The purpose of the study was to determine whether participants' low Mathematics scores affected their decision to select the scientific combination. The study found that in this case, 2.8% of people were neutral, 8.9% disagreed, and 24.2% strongly disapproved. Furthermore, the remark that their subpar mathematics scores kept them from selecting a science combination was agreed upon by 25.2% of participants, and highly agreed upon by 29.8% of respondents. The average response rate among survey respondents was

3.32, suggesting that most of them were largely unaffected by the assertion that their poor mathematics performance kept them from selecting a scientific combination. Many students have been driven to forgo careers in mathematics because of their fear or anxiety related to the subject, according to Gafoor & Kurukkan (2015). For instance, a survey conducted in 2007 by Scarpello found that 75% of Americans no longer pursue higher education in mathematics or careers in the field. Aversion and trepidation towards mathematics are developed in students who experience mathematical anxiety, leading to poor academic achievement. In Tanzania, individuals with failing mathematics grades are prohibited from taking the employment in sectors such as engineering, clinical medicine, pharmacy, accounting, and finance (Kileo, 2015) .

Resentment and Avoid the Mathematics Instructor

The goal of the study is to determine whether participants intentionally choose to disregard their mathematics teacher out of resentment. As to the survey results, 20.4% of participants disliked, 24.4% strongly disagreed, and 3.6% of respondents were neutral. In addition, 15.6% of respondents agreed with the assertion that they deliberately ignore and despise their math teacher, and 27.9% strongly agreed with the statement. The survey discovered that, with a mean score of 3.02, participants generally took a neutral position regarding the assertion that they actively avoid and despise their math teacher. Magnate (2022) reports that high-anxious math students often avoid their mathematics teacher during class out of fear that they would be questioned, that they will provide an incorrect answer, or that they will receive criticism. They typically occupy seats at the rear of the space. Some students are reluctant to visit the classroom because they are terrified of their mathematics teacher, according to the researcher's observations based on her experience teaching mathematics. They may also be afraid to participate if they fear they won't have the right answers and will end themselves in trouble. Additionally, some students could decide not to attend class at all because they don't think they're ready for the material or because they haven't received any homework or assignments from the teacher (McMillan, 2000).

Analyzing Multiple Regression and Correlation

The effects of mathematics anxiety on secondary school performance were tested by using regression analysis. The 0.025 level of significance was used with the following hypothesis.

H_N - Mathematics anxiety does not have a significant effect on secondary school students' mathematics performance (Al Mutawah, 2015).

H_A - Mathematics anxiety has a significant effect on secondary school students' mathematics performance. (Al Mutawah, 2015).

The results summary are shown in the table below;

Regression Coefficient on the Effects of Mathematics Anxiety and Students Performance

Model	Unstandardized Coefficient		Standardized Coefficient	T	Sig
	B	Std.error	Beta		
Constant	3.567	.125		9.898	0.000
Anxiety	.536	.0545	.407	6.20	0.000

The importance of mathematics anxiety's effect on secondary school students' mathematics performance is demonstrated in the above table. The null hypothesis might be rejected if the significance level is less than 0.025, it might be confirmed if it is larger than 0.025. The association between math's anxiety and mathematics performance is statistically significant, as the preceding table below demonstrates (two-tailed). This implies that the null hypothesis is rejected and the alternative hypothesis is accepted (Anderson, 2000).

By embracing the alternative hypothesis, the study verifies that mathematics anxiety significantly affects secondary school students' performance in mathematics. The relationship between one independent variable and a dependent variable is displayed using regression equations (Shi, 2009). Therefore, the regression equation in the provided table above for the impact of math's anxiety on mathematics performance is $=0.536x+3.567$. This impact the Mathematics performance when all other factors are held constant.

Again, based on the following properties shown below.

1. The correlation coefficient, r is range between $-1 \leq r \leq 1$ (Ganti, 2020)

2. If the correlation coefficient (r) is greater than zero (0) but less or equal to 1 i.e ($0 < r \leq 1$)

, then the relationship between variables are positive (Asuero, 2006)

3. If the correlation coefficient (r) is greater or equal to -1 but less than zero (0) i.e

($-1 \leq r < 0$), then the relationship between variables are negative.

4. If the correlation coefficient is equal to zero (0), there is no association between variables

(Asuero, 2006)

The investigation show that the correlation coefficient , $r = 0.407$ which fall under property number two (2), it implies there is positive relationship between variables means that Mathematics anxiety influence m performance in Mathematics (Kothari, 2004).

Conclusion
The results of the study indicate that mathematics fear has a significant negative influence on students' performance in Mathematics at a few selected secondary schools in the Singida District. As a result, it is critical to investigate the reasons behind students' Mathematics anxiety as well as to keep looking into effective coping mechanisms.

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