Project Report

On

MATHEMATICAL ANXIETY AMONG SCHOOL STUDENTS

Submitted

in partial fulfilment of the requirements for the degree of

BACHELOR OF SCIENCE

in

MATHEMATICS

by

NIKITHA SAVIO V R (AB21BMAT045)

Under the Supervision of

PARVATHY T S

DEPARTMENT OF MATHEMATICS

ST. TERESA'S COLLEGE (AUTONOMOUS)

ERNAKULAM, KOCHI-682011

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ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM

CERTIFICATE

This is to certify that the dissertation entitled, **MATHEMATICAL ANXIETY AMONG SCHOOL STUDENTS** is a bonafide record of the work done by Ms. **NIKITHA SAVIO V R** and under my guidance as partial fulfilment of the award of the degree of Bachelor of Science in Mathematics at St. Teresa's College (Autonomous), Ernakulam affiliated to Mahatma Gandhi University, Kottayam. No part of this work has been submitted for any other degree elsewhere**.**

Date: 17/03/2024

Place: Ernakulam

PARVATHY TS

Assistant professor

Department of Mathematics

ST. Teresa's college (Autonomous)

Ernakulam

Dr. Ursala Paul

Assistant Professor and Head,

Department of Mathematics,

St. Teresa's College(Autonomous),

Ernakulam.

EXTERNAL EXAMINERS

1…… **2……**

DECLARATION

I hereby declare that the work presented in this project is based on the original work done by me under the guidance of Parvathy T S, Assistant Professor, Department of Mathematics, St. Teresa's College (Autonomous), Ernakulam and has not been included in any other project submitted previously for the award of any degree.

ERNAKULAM

Date: 17/03/2024 **NIKITHA SAVIO V R -AB21BMAT045**

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Ernakulam

Date: 17/03/2024 NIKITHA SAVIO V R-AB21BMAT045

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CHAPTER 1

INTRODUCTION

Mathematics is an integral part of the educational journey, serving as a fundamental building block for various academic and real-world pursuits. Mathematics plays a pivotal role in the academic and cognitive development of high school students, serving as a foundation for various disciplines and real-world applications. However, the significance of mathematics is often juxtaposed with the prevalent issue of math anxiety among students. This project seeks to explore and comprehend the factors contributing to mathematical anxiety among high school students, as well as its impact on academic performance and overall well-being.

Mathematical anxiety is characterized by feelings of tension, fear, and apprehension related to engaging with mathematical concepts and problem-solving. High school students, in particular, often experience heightened stress when confronted with mathematical tasks, potentially influencing their attitudes, motivation, and success in the subject.

Understanding the roots of mathematical anxiety is crucial for educators, parents, and policymakers to develop targeted interventions and support mechanisms. This project aims to delve into the various dimensions of mathematical anxiety, examining both internal and external factors that contribute to its prevalence among high school students.

1.1 Significance of the study

This study on mathematical anxiety among high school students is significant as it can provide insights into the prevalence and impact of anxiety on students' mathematical performance. Understanding these factors can aid educators in developing targeted interventions to alleviate anxiety and enhance learning outcomes. Additionally, the findings may contribute to educational policies aimed at creating a more supportive learning environment for students facing mathematical challenges.

1.2 Objectives

- To determine the level of mathematical anxiety among high school students.
- To assess the academic performance of students in mathematics.
- To check if there is any association between mathematical anxiety and their grades.
- To identify the potential risk factors for high mathematical anxiety among school students.
- To evaluate the effectiveness of intervention programmes in reducing mathematical anxiety among school students using statistical analysis.

1.3 Types of data

Data are individual pieces of factual information recorded and used for the purpose of analysis. There are two types of data- primary and secondary. Primary data is the data that has been generated by the researcher himself/herself through surveys, interviews and experiments, specially designed for understanding and solving the research problem at hand. A questionnaire was created with questions based on all the objectives to collect data from the students. This personalized approach helped us to gather the primary data from the source itself- the students.

1.4 Processing of data

Processing data involves several key steps to transform raw information into a usable and meaningful format:

1. Data Collection: collect raw data from various sources, such as surveys, experiments, or sensors.
2. Data Entry: enter collected data into a system or database for further handling.
3. Data Transformation: Convert data into a structured format, often involving normalization or standardization.
4. Data Storage: Store processed data in databases or other storage systems for easy access.

5. Data Analysis: Apply statistical methods or other techniques to extract insights, patterns, or trends.
6. Data Interpretation: Make sense of the analysed data and draw meaningful conclusions.
7. Data Presentation: Communicate results through visualizations, reports, or other formats.

Whether done manually or through automated systems, data processing is fundamental in various fields, aiding decision-making and providing valuable insights.

1.5 Scope & Limitations of study

Scope of the study:

1. Population: The study focuses on high school students from classes 8 to 12
2. Geographical Area: Data is collected from schools in different parts of Kerala to represent a diverse range of high school environments.
3. Math Anxiety Components: The research will investigate the causes and effects of mathematical anxiety

Limitations of the study:

1. Sample Size: Due to resource constraints, the study will have a limited sample size of 453 high school students.
2. Self-Reporting Bias: Acknowledging the potential for self-reporting bias, as participants may subjectively interpret and report their levels of mathematical anxiety.
3. Generalization: Findings may not be generalized beyond the selected high school student population and the specific geographical areas covered in this study.
4. External Factors: External factors, such as socio-economic status may influence mathematical anxiety but are not within the direct scope of this study.

CHAPTER 2
LITERATURE REVIEW

Literature Review 1

One of the research projects for our study is "Study of mathematics anxiety in high school students and its relationship with self-esteem and teachers' personality characteristics". Here it aims to investigate the relationship between mathematics anxiety, self-esteem, and teachers' personality characteristics among high school students. The study was conducted in Ardabil city, Iran, during the academic year of 2007-2008. The statistical universe of this research included all high school students of Ardabil city and their math teachers. The number of samples was 480 male and female students in first, second, and third-grade high school and pre-university level and their math teachers.

Mathematics anxiety is a common phenomenon among students, and it has been found to have a negative impact on their academic performance and achievement. Several studies have been conducted to investigate the factors that contribute to mathematics anxiety among students. For instance, Shoran (2001) developed and validated a scale to measure mathematics anxiety among high school students and identified some of the factors related to mathematics anxiety.

Self-esteem is another important factor that has been found to be related to mathematics anxiety. Students with low self-esteem tend to experience higher levels of mathematics anxiety compared to those with high self-esteem. Several studies have investigated the relationship between self-esteem and mathematics anxiety. For instance, Sarmad et al. (1997) used the Cattell Anxiety Scale to evaluate the validity of the Mathematics Anxiety Rating Scale (MARS) and found a significant correlation between the two scales. Shokrani (2002) used the Test-Retest and Internal Consistency (Cronbach's alpha) methods to assess the reliability of MARS and found a high correlation coefficient between subjects' scores in two cases of test and retest.

Teachers' personality characteristics have also been found to be related to students' mathematics anxiety. For instance, Abbasi et al. (2013) found that teachers' personality characteristics, such as their level of empathy, emotional stability, and openness to experience, were negatively related to students' mathematics anxiety. This finding

suggests that teachers who possess these personality traits may be better equipped to help students overcome their mathematics anxiety.

In terms of the methodology used in this study, the researchers employed a correlational design and used the stratified sampling method to select the participants. The researchers collected data using a questionnaire that included the Mathematics Anxiety Rating Scale (MARS) and the Self Esteem Inventory. The data were analysed using SPSS tools, one-way ANOVA, Scheffe post hoc test, the t-test, and the correlation coefficient.

The results of the study indicated a negative significant relationship between students' mathematical anxiety and their self-esteem. The researchers also found that mathematics anxiety in the Technical-Math group was significantly lower than that of the Humanities group. Furthermore, mathematics anxiety in the Experimental Science group was significantly lower than that of the Humanities group, but there was no significant difference between the Experimental Science and Technical-Math groups.

In conclusion, this study provides valuable insights into the factors that contribute to mathematics anxiety among high school students. The findings suggest that educators and mental health professionals should pay attention to students' self-esteem and teachers' personality characteristics when designing interventions to help students overcome their mathematics anxiety.

Literature Review 2

The next research project "Mathematical anxiety among secondary school students in relation to their gender, locality and types of schools" deals with the common phenomenon among students of all ages, but it is particularly prevalent among secondary school students. According to Wigfield and Meece (1988), students in the 9th grade report the same level of worry about mathematics as those in higher grades, while girls tend to report more negative affective reactions to mathematics than boys. This suggests that mathematical anxiety is not only a problem for students who struggle with the subject, but also for those who excel in it.

One possible cause of mathematical anxiety is a lack of confidence in one's ability to solve mathematical problems. This can be due to a variety of factors, including a lack of exposure to mathematical concepts, poor teaching methods, or a negative attitude towards mathematics in general. In addition, students who experience anxiety in other areas of their lives may be more likely to experience mathematical anxiety as well (Hembree, 1990).

Another possible cause of mathematical anxiety is the abstract nature of mathematical concepts. Unlike other subjects, such as history or literature, mathematics deals with concepts that are not directly observable in the real world. This can make it difficult for students to understand and apply mathematical concepts, leading to frustration and anxiety (Ashcraft & Krause, 2007).

Despite the prevalence of mathematical anxiety among secondary school students, there are a number of strategies that teachers can use to help students overcome this problem. One approach is to provide students with a supportive learning environment that encourages them to take risks and make mistakes. This can help to build students' confidence in their ability to solve mathematical problems and reduce their anxiety levels (Ma & Kishor, 1997).

Another approach is to use teaching methods that are tailored to students' individual learning styles. For example, some students may benefit from visual aids or hands-on activities, while others may prefer more traditional lecture-style instruction. By adapting their teaching methods to meet the needs of individual students, teachers can help to reduce anxiety and improve academic performance (Perun, Elliot, & Maier, 2009).

In conclusion, mathematical anxiety is a common problem among secondary school students that can have a significant impact on their academic performance and overall well-being. However, by understanding the causes of mathematical anxiety and implementing effective teaching strategies, teachers can help students to overcome this problem and achieve success in mathematics.

CHAPTER 3
METHODOLOGY

For our comprehensive study on mathematical anxiety among school students of classes eight to twelve, we first meticulously crafted a 25-question questionnaire aimed at delving into the intricate relationship between math anxiety and academic performance. The questionnaire which was distributed to students belonging to different schools, garnered an impressive 450-plus responses, forming the foundation for our analytical attempts. The questionnaire included sections on academic performance in mathematics, self-reported levels of anxiety and potential risk factors contributing to mathematical anxiety.

We carefully used statistical methods like the chi-square test and Pearson correlation coefficient testto examine the data. These analytical tools enabled us to rigorously assess students' academic proficiency in mathematics, explore potential correlations between math anxiety and grades, pinpoint risk factors contributing to heightened mathematical anxiety, and gauge the effectiveness of intervention programs. As we continued our research, we thoroughly analysed the collected data.

Throughout the research process, ethical considerations were paramount, and the confidentiality and anonymity of participants were carefully maintained. The collaboration with school administrators and teachers played a crucial role in facilitating smooth data collection. Their valuable input not only ensured the representativeness of our sample but also enriched our interpretations of the data. This examination helped us understand the links between math anxiety and academic performance, revealing insights into the things that influenced math anxiety. Our main aim was to understand how math anxiety affects school students. Our study on mathematical anxiety among school students not only captures the complex interplay between mathematical anxiety and academic performance but also unveils potential risk factors and assesses the effectiveness of interventions, contributing valuable insights to the field of education psychology and provides practical implications for educators, policymakers, and intervention program developers aiming to create a more supportive learning environment for students facing mathematical anxiety challenges. With this understanding, we aimed

to use what we knew to create specific ways to help students with math anxiety, making it easier for them to learn in a conducive environment.

3.1 Karl Pearson correlation coefficient test

The Pearson correlation coefficient is a statistical measurement that assesses the relationship or association between two continuous variables. It is recognized as the most effective approach for evaluating the association between variables of interest due to its reliance on the covariance method. It provides details regarding the extent of the association or correlation, along with the direction of the relationship. The sign of the coefficient suggests the direction of the relationship; a + sign indicates a positive relationship, while a – sign indicates a negative relationship. Coefficient values range from +1 to -1, with +1 indicating a perfect positive relationship, -1 denoting a perfect negative relationship, and 0 indicating the non-existence of any relationship. When the value approaches ± 1, it is considered a perfect correlation: when one variable increases, the other variable tends to increase as well (for positive correlations) or fall (for negative correlations. Pearson correlation measures only linear associations and may not capture nonlinear relationships.

3.2 Chi Square test

The chi-square test serves as a significance test, originally introduced by Karl Pearson in 1900. It proves significant for comparing experimental outcomes with theoretical expectations based on hypotheses. This statistical tool measures the association or independence between categorical variables, estimating the degree of deviation between observed and expected frequencies. A higher chi-square statistic indicates a notable relationship. As a result, the chi-square test turns out to be a valuable option in enhancing our comprehension and interpretation of the association between the two categorical variables in question. To study a hypothesis concerning the distribution of a categorical variable, it is important to employ a chi-square test or a similar nonparametric test. These categorical variables may take the form of either nominal or ordinal variables. Hypothesis testing serves as a technique for examining sample data to derive conclusions about a population, facilitating in discerning which sample information better substantiates

specific population claims. The Null Hypothesis (H_0) postulates that the event will not occur, and the study's outcome remains unaffected unless there is evidence to the contrary. The Alternate Hypothesis (H_1) presents a logical contradiction to the null hypothesis, with acceptance occurring when the null hypothesis is rejected.

CHAPTER 4

DATA ANALYSIS

3.3 CORRELATION TEST

4.1.1

	Column 1	*Column 2*
Column 1	1	0.478905
Column 2	0.478905	1

Table 4.1

r=0.478905 indicates that there is no strong correlation between enjoyment of learning math and the proficiency in the subject.

4.1.2

	Column 1	*Column 2*
Column 1	1	0.820073
Column 2	0.820073	1

Table 4.2

r=0-820073indicates that there is a correlation between respondents' self-rated overall performance in mathematics and their score level in the most recent mathematics test.

4.1.3

	Column 1	*Column 2*
Column 1	1	0.42192
Column 2	0.42192	1

Table 4.3

r=42192indicates that there is no strongcorrelation between the rating of overall performance in mathematics and the understanding of math concepts taught in the class.

4.1.4

	Column 1	*Column 2*
Column 1	1	0.550484
Column 2	0.550484	1

Table 4.4

r=0.550484suggests that there is a significant positive correlation between the self-reported understanding of math concepts taught in the class and the ability to solve math problems independently.

4.1.5

	Column 1	*Column 2*
Column 1	1	0.431323
Column 2	0.431323	1

Table 4.5

r=0.431323 suggests that there is no strong positive correlation between anxiety during a math test and feeling inferior compared to peers.

4.1.6

	Column 1	*Column 2*
Column 1	1	0.45993
Column 2	0.45993	1

Table 4.6

r=0.45993indicates that there is no strongcorrelationbetween feeling anxious during math tests and its impact on math test performance.

4.1.7

	Column 1	*Column 2*
Column 1	1	0.524564
Column 2	0.524564	1

Table 4.7

r=524564suggests that there is a significant positive correlation between feeling not as good as peers and feeling like you are going to fail a math test.

4.1.8

	Column 1	*Column 2*
Column 1	1	0.483463
Column 2	0.483463	1

Table 4.8

r=0.483463 indicates that there is no strong correlation between feeling like you are going to fail a math test and feeling like giving up when solving problems.

4.1.9

	Column 1	*Column 2*
Column 1	1	-0.00751
Column 2	-0.00751	1

Table 4.9

Heresince r=-0.00751, we can say that there is no relation between understanding the math concepts taught in the class and comfortability in approaching math teacher for help.

4.1.10

	Column 1	*Column 2*
Column 1	1	-0.40576
Column 2	-0.40576	1

Table 4.10

Since r=-0.40576, there is no significant correlation between feeling like you can solve math problems on your own and feeling like giving up when solving problems.

4.1.11

	Column 1	*Column 2*
Column 1	1	0.414049
Column 2	0.414049	1

Figure 4.11

r=0.414049 indicates that there is no strong correlation between experiencing physical symptoms while doing maths problems and having past traumatic or negative experiences on maths.

4.2 CHI SQUARE TEST

4.2.1 Relationship between enjoying learning maths and overall performance in mathematics.

Null Hypothesis, H_0: There is no relationship between enjoying learning maths and overall performance in mathematics.

Alternate Hypothesis, H_1: There is a relationship between enjoying learning maths and overall performance in mathematics.

Do you enjoy learning maths?	How would you rate your overall performance in mathematics?				Grand Total
	Excellent	Good	Average	Not satisfactory	
Yes	39	165	85	20	309
No	3	30	46	65	144
Grand Total	42	195	131	85	453

Observed Frequency

Do you enjoy learning maths?	How would you rate your overall performance in mathematics?				Grand Total
	Excellent	Good	Average	Not satisfactory	
Yes	28.64900662	133.013245	89.35762	57.9801325	309
No	13.35099338	61.98675497	41.64238	27.0198675	144
Grand Total	42	195	131	85	453

Expected Frequency

$\chi^2 = \sum (O - E)^2 / E$

where O= observed frequency and E= expected frequency.

Degree of freedom = (r-1) (c-1), where r = number of rows and c= number of columns

Level of significance = 0.05

P value =$9.68911E^{-25}$

Since $p < 0.05$, we reject H_0

Therefore, from the study we came to the conclusion that there is a relation between enjoying learning maths and overall performance in mathematics.

4.2.2 Relationship between enjoying learning maths and score level in maths.

H_0: There is no relationship between enjoying learning maths and score level in maths

H_1: There is a relation between enjoying learning maths and score level in maths.

Do you enjoy learning maths?	What is your score level in the most recent maths test?				Grand Total
	Excellent	Good	Average	Below average	
Yes	54	139	103	13	309
No	9	25	59	51	144
Grand Total	63	164	162	64	453

Observed Frequency

Do you enjoy learning maths?	How would you rate your overall performance in mathematics?				Grand Total
	Excellent	Good	Average	Not satisfactory	
Yes	42.97350093	111.86755	110.5033113	43.655629	309
No	20.02649007	52.1324503	51.496688874	20.344371	144
Grand Total	63	164	162	64	453

Expected Frequency

$\chi^2 = \sum (O - E)^2 / E$

where O= observed frequency and E= expected frequency.

Degree of freedom = (r-1) (c-1), where r = number of rows and c= number of columns

Level of significance = 0.05

P value = 2.64641 E^{-21}

Since $p < 0.05$, we reject H_0

Therefore, from the study we came to the conclusion that there is a relation between enjoying learning maths and score level in mathematics.

4.2.3 Relationship between comparison with peers and understanding math concepts.

H_0: There is no relation between comparison with peers and understanding math concepts.

H_1: There is relation between comparison with peers and understanding math concepts.

How often do you feel like you are not as good as compared to your peers?	How often do you feel like you understand the math concepts taught in the class?				Grand Total
	Always	Most of the time	Rarely	Never	
Always	6	17	43	4	70
Sometimes	16	107	93	19	235
Rarely	13	61	30	1	105
Never	13	21	7	2	43
Grand Total	48	206	173	26	453

Observed Frequency

.

How often do you feel like you are not as good as compared to your peers?	How often do you feel like you understand the math concepts taught in the class?				Grand Total
	Always	Most of the time	Rarely	Never	
Always	7.417218546	31.83222958	26.732892	4.01766	70
Sometimes	24.90066225	106.8653422	89.746137	13.48786	235
Rarely	11.12582781	47.74834437	40.099338	6.02649	105
Never	4.556291391	19.55408389	16.421634	2.467991	43
Grand Total	48	206	173	26	453

Expected Frequency

$\chi^2 = \sum (O - E)^2 / E$

where O= observed frequency and E= expected frequency.

Degree of freedom = (r-1) (c-1), where r = number of rows and c= number of columns

Level of significance = 0.05

P value = 1.44427E $^{-08}$

Since p< 0.05, we reject H_0

Therefore, from the study we came to the conclusion that there is a relation between comparison among the peers and understanding math concepts.

4.2.4 Relationship between comparison with peers and the ability to do math problems on their own.

H_0: There is no relation between comparison with peers and the ability to do math problems on their own.

H_1: There is relation between comparison with peers and the ability to do math problems on their own.

How often do you feel like you are not as good as compared to your peers?	Do you feel like you can solve math problems on your own?				Grand Total
	Always	Most of the time	Rarely	Never	
Always	7	9	44	10	70
Sometimes	7	81	121	26	235
Rarely	6	53	44	2	105
Never	9	22	11	1	43
Grand Total	29	165	220	39	453

Observed Frequency

How often do you feel like you are not as good as compared to your peers?	Do you feel like you can solve math problems on your own?				Grand Total
	Always	Most of the time	Rarely	Never	
Always	4.481236203	25.496689	33.995585	6.0264901	70
Sometimes	15.04415011	85.596026	114.12804	20.231788	235
Rarely	6.721854305	38.245033	50.993377	9.0397351	105
Never	2.752759382	15.662252	20.883002	3.7019868	43
Grand Total	29	165	220	39	453

Expected Frequency

$\chi^2 = \sum (O - E)^2 / E$

where O= observed frequency and E= expected frequency.

Degree of freedom = (r-1) (c-1), where r = number of rows and c= number of columns

Level of significance = 0.05

P value = $1.4249E^{-09}$

Since $p < 0.05$, we reject H_0

Therefore, from the study we came to the conclusion that there is a relation between comparison among the peers and ability to solve math problems on your own.

4.2.5 Relationship between comparison with the peers and giving up while solving a math problem.

H_0: There is no relation between comparison with peers and giving up while solving a math problem.

H_1: There is relation between comparison with peers and giving up while solving a math problem.

How often do you feel like you are not as good as compared to your peers?	How often do you feel like giving up while solving math problems?				Grand Total
	Always	Sometimes	Rarely	Never	
Always	30	28	9	3	70
Sometimes	59	128	43	5	235
Rarely	10	53	37	5	105
Never	2	9	19	13	43
Grand Total	101	218	108	26	453

Observed Frequency

How often do you feel like you are not as good as compared to your peers?	How often do you feel like giving up while solving math problems?				Grand Total
	Always	Sometimes	Rarely	Never	
Always	15.60706402	33.686534	16.68874	4.01766	70
Sometimes	52.39514349	113.09051	56.02649	13.487859	235
Rarely	23.41059603	50.529801	25.03311	6.0264901	105
Never	9.587196468	20.693157	10.25166	2.4679912	43
Grand Total	101	218	108	26	453

Expected Frequency

$\chi^2 = \sum (O - E)^2 / E$

where O= observed frequency and E= expected frequency.

Degree of freedom = (r-1) (c-1), where r = number of rows and c= number of columns

Level of significance = 0.05

P value = $3.89212E^{-19}$

Since $p < 0.05$, we reject H_0

Therefore, from the study we came to the conclusion that there is a relation between comparison among the peers and giving up while solving a math problem.

4.2.6 Relationship between feeling anxious while having a math test and failing a math test

H_0 : There is no relation between feeling anxious while having a math test and failing a math test.

H_1 :There is no relation between feeling anxious while having a math test and failing a math test.

How often do you feel anxious when you have a math test?	How often do you feel like you are going to fail a math test?				Grand Total
	Always	Sometimes	Rarely	Never	
Always	39	35	30	15	119
Sometimes	18	92	66	35	211
Rarely	9	18	31	44	102
Never	1	2	2	16	21
Grand Total	67	147	129	110	453

Observed Frequency

How often do you feel anxious when you have a math test?	How often do you feel like you are going to fail a math test?				Grand Total
	Always	Sometimes	Rarely	Never	
Always	17.6004415	38.615894	33.88742	28.89625	119
Sometimes	31.20750552	68.470199	60.08609	60.08609	211
Rarely	15.08609272	33.099338	29.04636	24.76821	102
Never	3.105960265	6.8145695	5.980132	5.099338	21
Grand Total	67	147	129	110	453

Expected Frequency

$\chi^2 = \sum (O - E)^2 / E$

where O= observed frequency and E= expected frequency.

Degree of freedom = (r-1) (c-1), where r = number of rows and c= number of columns

Level of significance = 0.05

P value = $3.62023E^{-19}$

Since $p < 0.05$, we reject H_0

Therefore, from the study we came to the conclusion that there is a relation between feeling anxious while having a math test and failing a math test.

4.2.7 Relationship between understanding math concepts and giving up while solving a math problem.

H_0: There is no relation between understanding math concepts and giving up while solving a math problem.

H_1 : There is a relation between understanding math concepts and giving up while solving a math problem.

Do you feel like you understand the math concepts taught in class?	How often do you feel like giving up while solving problems?				Grand Total
	Always	Sometimes	Rarely	Never	
Always	11	10	16	11	48
Most of the time	19	111	67	9	206
Sometimes	54	92	24	3	173
Never	17	5	1	3	26
Grand Total	101	218	108	26	453

Observed Frequency

Do you feel like you understand the math concepts taught in class?	How often do you feel like giving up while solving problems?				Grand Total
	Always	Sometimes	Rarely	Never	
Always	10.70198675	23.09933775	11.44370861	2.75496689	48
Most of the time	45.92935982	99.13465784	49.11258278	11.8233996	206
Sometimes	38.57174393	83.25386313	41.24503311	9.92935982	173
Never	5.796909492	12.51214128	6.198675497	1.49227373	26
Grand Total	101	218	108	26	453

Expected Frequency

$\chi^2 = \sum (O - E)^2 / E$

where O= observed frequency and E= expected frequency.

Degree of freedom = (r-1) (c-1), where r = number of rows and c= number of columns

Level of significance = 0.05

P value = $1.85385E^{-19}$

Since $p < 0.05$, we reject H_0

Therefore, from the study we came to the conclusion that there is a relation between understanding math concepts and giving up while solving math problems.

4.2.8 Relationship between solving math problems on your own and giving up while solving a math problem.

H_0 : There is no relation between solving math problems on your own and giving up while solving a math problem.

H_1 : There is a relation between solving math problems on your own and giving up while solving a math problem.

Do you feel like you solve math problems on your own?	How often do you feel like giving up while solving problems?				Grand Total
	Always	Sometimes	Rarely	Never	
Always	7	7	9	6	29
Most of the time	14	73	65	13	165
Sometimes	46	135	34	5	220
Never	34	3		2	39
Grand Total	101	218	108	26	453

Observed Frequency

Do you feel like you solve math problems on your own?	How often do you feel like giving up while solving problems?				Grand Total
	Always	Sometimes	Rarely	Never	
Always	6.465783664	13.95584989	6.9139073	1.6644592	29
Most of the time	36.78807947	79.40397351	39.337748	9.4701987	165
Sometimes	49.05077263	105.8719647	52.450331	12.626932	220
Never	8.695364238	18.76821192	9.2980132	2.2384106	39
Grand Total	101	218	108	26	453

Expected Frequency

$\chi^2 = \sum (O - E)^2 / E$

where O= observed frequency and E= expected frequency.

Degree of freedom = (r-1) (c-1), where r = number of rows and c= number of columns

Level of significance = 0.05

P value = $1.11329E^{-28}$

Since $p < 0.05$, we reject H_0

Therefore, from the study we came to the conclusion that there is a relation between solving math problems on your own and giving up while solving a math problem.

4.2.9 Relationship between time pressure and past traumatic experience in maths

H_0 : There is no relation between concerning about time pressure and having past traumatic or negative experiences in maths.

H_1 : There is relation between concerning about time pressure and having past traumatic or negative experience in maths.

Are you concerned about time pressure when having a math test?	Do you have any past traumatic or negative experience in maths?		Grand Total
	Yes	No	
Yes	147	177	324
No	27	102	129
Grand Total	174	279	453

Observed Frequency

Are you concerned about time pressure when having a math test?	Do you have any past traumatic or negative experience in maths?		Grand Total
	Yes	No	
Yes	124.4503311	199.55	324
No	49.54966887	79.4503	129
Grand Total	174	279	453

Expected Frequency

$\chi^2 = \sum (O - E)^2 / E$

where O= observed frequency and E= expected frequency.

Degree of freedom = (r-1) (c-1), where r = number of rows and c= number of columns

Level of significance = 0.05

P value = 1.38868E-06

Since $p < 0.05$, we reject H_0

Therefore, from the study we came to the conclusion that there is a relation between concerning about time pressure and having past traumatic or negative experience in maths.

4.3.0 Relationship between change in performance in maths and engaging in relaxation techniques.

H_0 : There is no relation between change in performance in maths and engaging in relaxation techniques.

H_1: There is relation between change in performance in maths and engaging in relaxation techniques.

How does your performance in maths changed over the past year?	Do you engage in any relaxation techniques?		Grand Total
	Yes	No	
Improved	101	136	237
Remained same	41	103	144
Declined	15	57	72
Grand Total	157	296	453

Observed Frequency

How does your performance in maths changed over the past year?	Do you engage in any relaxation techniques?		Grand Total
	Yes	No	
Improved	82.13907285	154.8609272	237
Remained same	49.90728477	94.09271523	144
Declined	24.95364238	47.04635762	72
Grand Total	157	296	453

Expected Frequency

$\chi^2 = \sum (O - E)^2 / E$

where O= observed frequency and E= expected frequency.

Degree of freedom = (r-1) (c-1), where r = number of rows and c= number of columns

Level of significance = 0.05

P value = 0.00051641

Since $p < 0.05$, we reject H_0

Therefore, from the study we came to the conclusion that there is a relation between change in performance in maths and engaging in relaxation techniques

CHAPTER 5
CONCLUSION AND RESULT

The project "Mathematical anxiety among school students" utilised tools like correlation and chi square test and the following conclusions were made: -

Based on the significant chi-square test results, it can be concluded that there is a relationship between students' enjoyment of learning mathematics and their self-rated overall performance in the subject. This suggests that students who enjoy learning mathematics tend to rate their performance higher overall. Further analysis and exploration may be warranted to understand the nature of this relationship and its implications for educational strategies and interventions. The study also suggests a connection between students' enjoyment of learning mathematics and their recent mathematics test scores. This indicates a correlation between students' attitudes toward mathematics and their actual performance on tests. Specifically, students who express enjoyment in learning mathematics tend to achieve higher scores compared to those who do not enjoy it as much. This highlights the significance of creating a positive learning environment and promoting a favourable attitude toward mathematics to potentially boost students' academic performance. These findings underscore the significance of assessing students' academic performance in mathematics within the framework of their enjoyment of learning the subject.

The frequency with which students feel they are not as good as their peers and their perception of understanding math concepts taught in class are related to their academic performance. This suggests that students who experience higher levels of anxiety about their perceived ability compared to peers, and those who struggle with understanding math concepts, may tend to have lower grades. Addressing these feelings of inadequacy and providing additional support and resources to improve understanding could potentially help alleviate anxiety and improve academic outcomes in mathematics.

The study also reveals that there is an association between students' anxiety in mathematics and their confidence in solving math problems independently. This suggests that students who experience higher levels of anxiety about their perceived ability

compared to peers may also lack confidence in their ability to solve math problems independently. Addressing these feelings of inadequacy and fostering confidence in problem-solving skills could potentially help reduce anxiety and improve academic performance in mathematics.

Another interesting discovery is that, there is an association between students' anxiety in mathematics and their propensity to feel like giving up when solving math problems. Specifically, the frequency with which students feel they are not as good as their peers correlates with their likelihood of feeling like giving up during math problem-solving. This suggests that students who experience higher levels of anxiety about their perceived ability compared to peers may be more prone to giving up when faced with challenging math problems. Addressing these feelings of inadequacy and providing support and encouragement to persevere through difficulties could potentially help reduce anxiety and improve problem-solving skills in mathematics.

We also found that there is a noteworthy association between students' feelings of anxiety before math tests and their perception of their likelihood of failing those tests. Specifically, the frequency with which students experience anxiety before a math test is closely related to their frequency of feeling like they are going to fail the test. This indicates that students who frequently feel anxious before math tests are more likely to also believe they will fail those tests.

There is a notable association between students' understanding of math concepts taught in class and their propensity to feel like giving up when solving math problems. This suggests that students who perceive a better understanding of math concepts are less likely to experience feelings of frustration or defeat when encountering challenging math problems.

The study also indicates that there exists a notable association between students' comprehension of math concepts taught in class and their inclination to feel like giving up when confronted with math problems. The frequency with which students feel they understand the math concepts correlates with their frequency of experiencing feelings of giving up during math problem-solving. This implies that students who perceive a stronger understanding of math concepts are less likely to encounter feelings of frustration or defeat when tackling math problems.

These findings reveal a significant association between students' anxiety levels in mathematics and their academic grades.

Our study also highlights that there is evidence suggesting the effectiveness of intervention programs in reducing mathematical anxiety among school students. Specifically, the changes in students' performance in math over the past year are correlated with their engagement in relaxation techniques to reduce mathematical anxiety. This implies that students who report improvements in their math performance over the past year are more likely to also engage in relaxation techniques to alleviate mathematical anxiety.

These findings suggest that intervention programs aimed at reducing mathematical anxiety may be associated with positive changes in students' academic performance

CONCLUSIONS

The following conclusions were made from our study: -

- The level of mathematical anxiety among high school students is high.
- The anxiety level among students in the subject and their academic performance are closely related.
- Students who are highly anxious towards mathematics tend to score lower grades and vice versa.
- Difficulty in understanding mathematical concepts, parental expectations and time pressure are the potential risk factors for high mathematical anxiety among school students.
- Intervention programmes have helped students in reducing mathematical anxiety.

CHAPTER 6

BIBLIOGRAPHY

- Al Mutawah, Masooma Ali. "The Influence of Mathematics Anxiety in Middle and High School Students Math Achievement." International Education Studies 8.11 (2015): 239-252.
- Ng, Lay Keow. "Mathematics Anxiety in Secondary School Students." Mathematics Education Research Group of Australasia (2012).
- Sharma, Yogesh. "Alleviating Mathematics Anxiety of Elementary School Students: A Situated Perspective." International Journal of Research in Education and Science 2.2 (2016): 509-517.
- Zakaria, Effandi, et al. "Mathematics anxiety and achievement among secondary school students." American Journal of Applied Sciences 9.11 (2012): 1828.
- Luu-Thi, Huyen-Trang, et al. "An investigation of mathematics anxiety and academic coping strategies among high school students in Vietnam: A cross-sectional study." Frontiers in Education. Vol. 6. Frontiers Media SA, 2021.
- Gupta, S. C., and V. K. Kapoor. Fundamentals of mathematical statistics. Sultan Chand & Sons, 2020.
- Abbasi, Moslem, Mehdi Samadzadeh, and Bita Shahbazzadegan. "Study of mathematics anxiety in high school students and it's relationship with self-esteem and teachers' personality characteristics." Procedia-Social and Behavioural Sciences 83 (2013): 672-677.
- Sangral, Monika, and Sunil Kumar. "MATHEMATICAL ANXIETY AMONG SECONDARY SCHOOL STUDENTS IN RELATION TO THEIR GENDER, LOCALITY AND TYPES OF SCHOOLS." EPRA International Journal of Multidisciplinary Research (IJMR) 9.10 (2023): 289-294

ANNEXURE

Name *

Short answer text

Email id *

Short answer text

Class *

Short answer text

Gender *

- male
- female
- Prefer not to say

Do you enjoy learning maths? *

- Yes
- No

How do you learn maths? *

- By Writing
- By Reading
- By Watching video lessons

How would you rate your overall performance in mathematics? *

- Excellent
- Good
- Average
- Not satisfactory

What is your score level in the most recent mathematics test? *

- Excellent
- Good
- Average
- Below average

Do you think real life applications makes it easier to learn maths? *

- Yes
- No

How does your performance in mathematics has changed over the past year? *

- Improved
- Remained same
- Declined

On an average, how many hours per week do you spend studying mathematics? *

- More than 6 hours
- 3 to 6 hours
- Less than 3 hours

Do you seek any additional help or tutoring in mathematics? *

- Yes
- No

Do you feel that your maths teachers provide sufficient help to succeed in the subject? *

- Yes
- No

Do you feel like you understand the math concepts taught in the class? *

- Always
- Most of the time
- Sometimes
- Never

Do you feel like you can solve math problems on your own? *

- Always
- Most of the time
- Sometimes
- Never

How often do you feel anxious when you have a math test? *

- Always
- Sometimes
- Rarely
- Never

How often do you feel you are not good as compared to your peers? *

- Always
- Sometimes
- Rarely
- Never

How often do you feel like you are going to fail a math test? *

- Always
- Sometimes
- Rarely
- Never

How often do you feel like your math anxiety affects your ability to do well in math tests? *

- Always
- Sometimes
- Rarely
- Never

Do you experience any physical symptoms like sweating or increased heartbeat while doing maths problems? *

- Always
- Sometimes
- Rarely
- Never

Are you concerned about time pressure when taking math test? *

- Yes
- No

Do you feel comfortable approaching your math teacher for help? *

- Yes
- No

How often do you feel like giving up when solving problems? *

- Always
- Sometimes
- Rarely
- Never

How do you approach math homework and assignment? *

- Procastinate
- Complete on time
- Seek help

What do you believe are the main reasons behind your math anxiety? *

- Fear of failure
- Pressure from parents
- Previous negative experiences
- Difficulty in understanding math concepts
- Bad relationship with teachers

Do your parents or guardians express high expectations on your maths performance ? *

- Yes
- No

Do you have any past traumatic or negative experiences on maths? *

- Yes
- No

Do you engage in relaxation techniques to manage mathematical anxiety? *

- Yes
- No