IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

Exploring College Students' Perspectives on Strategies to Overcome Mathematics Anxiety at the Senior Secondary Level

[1]Dr. Sabiruddin Molla, [2]Saba Sultana

[1]Assistant Professor, Postgraduate Department of Education, St. Xavier's College (Autonomous), Kolkata Kolkata-700016, West Bengal, India

[2]Assistant teacher, Garia Harimati Devi Uchcha Balika Vidyalaya (H.S.), Kolkata-700084, West Bengal, India

Abstract: Mathematics anxiety can negatively affect students' performance, confidence, and future career opportunities, especially in STEM fields. This study explores college students' perspectives on strategies to overcome mathematics anxiety at the senior secondary (10+2) level. It examines how students manage or overcome anxiety, the influence of teachers' attitudes and instructional methods, and the cyclical nature of anxiety transmission. Insights from this research aim to inform effective strategies for reducing mathematics anxiety, enhancing students' confidence and learning outcomes, and providing guidance for teachers to support students in developing positive attitudes toward mathematics**.**

Keywords – Mathematics anxiety, Senior secondary students, College students' perspectives, coping strategies, Teacher influence, STEM education, Learning outcomes, Instructional support

1. INTRODUCTION

Mathematics is the cradle of all creations. Everyone needs mathematics in their day-to-day life. Mathematics is an important school subject because it is not only essential for real life but also provides access to undergraduate courses in fields such as engineering, psychology, sciences, and social sciences. With knowledge of mathematics, we learn to think logically and solve many problems in everyday life. From home to the workplace, mathematical tools have become a part of our day-to-day life. In many circles of computer literacy, technological, and mathematical competence are perceived as essential skills. Mathematics is truly the gateway to engineering and all other scientific and technological fields such as Data Science, Machine learning, AI etc. Furthermore, as mathematics becomes part of daily life, the need for proper teaching and learning has become extremely important. Because of this increased demand, schools are expected to educate students and make them "mathematically equipped." In today's high-tech world, it is very important for young children to build confidence in mathematics to thrive in an ever-increasingly dynamic and competitive society (Furner & Berman, 2003). At one time, mathematical literacy might have been defined as knowing basic number facts and having proficiency with fundamental skills and procedures. However, there is an increasing need for students to understand and be able to use mathematics to adapt to the rapid changes of the world.

Math anxiety is a problem for many school and college students—not only those in developmental math courses. This anxiety can be so acute for some that it becomes dysfunctional and interferes with the cognitive processes needed for mastering math skills. When anxiety is combined with difficult circumstances, its effects on students' educational lives are compounded. However, if a technique were found that facilitates the alleviation of math anxiety through improved pedagogies, information, and resources, teachers could help remedy students' math anxiety while enabling them to acquire the necessary math skills required for degree completion.

I.1. Concept of Math Anxiety:

Math anxiety is an acquired emotional reaction that can occur when a person engages in activities such as attending a math class, listening to a lecture, solving math problems, or discussing mathematical concepts. Moreover, such anxiety can occur in elementary school children, high school students, and college students (Tobias, 1993). Math anxiety causes children to fear mathematics, hindering their ability to make it a relevant part of their everyday lives. According to Sheila Tobias (1993), millions of adults are blocked from professional and personal opportunities because they fear mathematics or perform poorly in it. For many, these negative experiences persist throughout their adult lives. One definition of math anxiety is "the panic, helplessness, paralysis, and mental disorganization that arises among some people when they are required to solve a mathematical problem" (Tobias & Weissbrod, 1980). Math anxiety is a serious and pervasive problem, especially in the community-college setting. Students may experience math anxiety in many forms and degrees, ranging from "freezing up" during a math exam to avoiding anything involving numbers altogether. Symptoms may be physical or psychological. Mathematics anxiety has also been defined as feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations. Math anxiety can cause individuals to forget and lose their self-confidence (Tobias, 1993). According to Marilyn Burns (1998), nearly two-thirds of American adults have a hatred of and deep fear of mathematics. This fear is deeply rooted and often begins with a child's first experience of institutional mathematics. Math anxiety is an emotional reaction to mathematics, often rooted in past unpleasant experiences that hinder future learning. It can range from mild discomfort with numerical operations to a complete avoidance of mathematics classes (Mathison, 1977). Research has linked mathematics anxiety to teaching practices, teacher attitudes, and students' academic performance (Williams, 1988). Richardson and Suinn (1972) described math anxiety as "feelings of tension and anxiety that interfere with the manipulation of mathematical problems in a wide variety of ordinary life and academic situations" (p. 551). Intellectual factors such as learning styles, persistence, self-doubt, and dyslexia also influence the development of math anxiety (Harper & Daane, 1998; Trujillo & Hadfield, 1999). People with math anxiety often feel incapable of handling tasks involving mathematics, a condition sometimes referred to as *math phobia*. Over the past decade, its incidence among college students has risen significantly, even influencing students' choices of college majors based on the level of required mathematics. Although math anxiety is primarily an emotional problem, it can interfere with learning and ultimately result in academic difficulties. Ken Shores (2005) explained that a mild case of math avoidance can quickly develop into severe math anxiety if left unaddressed. Anxious students may avoid math or put forth little effort, leading to gaps in their skills and increased difficulty with advanced concepts, thus creating a cycle of anxiety and avoidance. Shores emphasized that, with support from both teachers and parents, students can overcome this anxiety. Teachers must provide a positive, relevant, and supportive learning environment, while parents can help by making everyday math connections to boost children's confidence. Ultimately, math anxiety reflects a widespread feeling of frustration or helplessness about one's ability to do mathematics—a feeling shared by many, even highly skilled individuals. This study aims to explore strategies for studying mathematics, completing assignments, and preparing for exams to help students approach mathematics with confidence and success.

I.2. Needs to Overcome Math Anxiety

Mathematical skills are essential for an individual's life experiences. In modern times, overcoming math anxiety is necessary for the following purposes:

- To remove students' difficulties related to both mathematical and overall academic achievement.
- To enable students to solve math-related problems in everyday life as well as academic settings.
- To provide practice with challenging mathematical tasks.
- To build confidence in individuals' ability to tackle mathematical problems.
- To help students master the academic content effectively.
- To give individual attention to students who struggle with numbers, such as balancing budgets or handling calculations.
- To create a healthy and supportive atmosphere for better learning.
- To encourage students to share their thought processes and justify their answers, either verbally or in writing.
- To promote a deeper understanding of mathematical concepts.
- To help students face classroom situations with confidence.
- To make students comfortable expressing their mathematical abilities.
- To enable students to utilize their maximum potential.
- To prepare students to face challenges such as entrance exams, competitive tests, and other difficult tasks, while supporting weaker learners.
- To provide students with better career opportunities.

I.3. Review of Related Literature

Students with high levels of mathematics anxiety tend to have negative attitudes toward mathematics, lack motivation to engage in it, and perceive mathematics as less useful than other academic areas (Ashcraft & Ridley, 2005; Jameson, 2010). Mathematics anxiety negatively affects students' mathematics performance and self-confidence and can begin as early as Grades 3 and 4 (Jackson & Leffingwell, 1999). Ma and Cartwright (2003) argue that although all students experience some level of anxiety toward mathematics, the level of anxiety among females appears to be greater than among males. Early avoidance of mathematics may limit opportunities for females to pursue lucrative careers in mathematics and science later in life (Altermatt & Kim, 2004). Similarly, "when otherwise capable students avoid the study of mathematics, their options regarding careers are reduced, eroding the country's resource base in science and technology" (Hembree, 1990, p. 34). Researchers (Fiore, 1999; Geist, 2010; Sheilds, 2006; Sloan, 2010; Stuart, 2000) have shown that teachers can produce, increase, or reduce mathematics anxiety among students at all levels of schooling through their attitudes, behaviours, teaching methods, and instructional strategies. Teachers with mathematics anxiety have been found to be less effective at conveying essential mathematical concepts that are critical for students' academic growth. Such teachers tend to allocate less time to teaching these important concepts and often employ avoidance techniques in the classroom (Dunkle, 2010; Hembree, 1990). Overall, mathematics-anxious teachers devote less instructional time to teaching mathematical concepts and problem-solving strategies (Bush, 1989).

In addition, the mathematics requirements for West Bengal students majoring in elementary education are minimal. Consequently, one can pursue a career as an elementary school teacher despite having mathematics anxiety and a history of avoiding the subject. Studies have shown that teachers who are anxious about mathematics are likely to be anxious about teaching mathematics (Hadley & Dorward, 2011) and that such teachers tend to have lower levels of mathematics teaching self-efficacy (Bursal & Paznokas, 2006; Swars et al., 2006). When individuals with mathematics anxiety teach the subject, their anxiety can be transferred to their students (Bekdemir, 2010; Brady & Bowd, 2005; Vinson, 2001). If these students' mathematics anxiety is not addressed, some may later become teachers themselves and transmit the same anxiety to their students, supporting the notion that mathematics anxiety among teachers and students can be cyclical in nature (Brady & Bowd, 2005; Smith, 2004). To break this recurring cycle, it is essential to conduct a thorough examination of the causes and effects of teachers' mathematics anxiety on their teaching practices, particularly those emerging in the early grades. Such research could inform the development of intervention strategies to disrupt the cycle of mathematics anxiety.

A country's ability to compete in the global knowledge economy depends on its capacity to meet the increasing demand for high-level skills. Evidence from accumulated analyses of economic outcomes shows that the quality of a country's education has powerful economic effects and that economic growth is strongly influenced by the skills of its workforce (Hanushek & Wößmann, 2010). In addition to driving the economy, skills can transform lives, generate prosperity, and promote social inclusion (OECD, 2013c). A workforce skilled in science, technology, engineering, and mathematics (STEM) is essential for future growth and innovation. As Drew (2011) notes, "STEM education is a vital preparation for today's high-tech information economy" (p. 1). Although only 4% of the nation's workforce consists of scientists and engineers, this group disproportionately creates jobs for the remaining 96% (Raytheon, 2015). The U.S. Bureau of Labor Statistics estimates that over 8.6 million jobs requiring STEM skills will exist by 2018, highlighting the critical importance of mathematics to the future success of today's children (Raytheon, 2015). Moreover, beyond its role in the job market, mathematics is increasingly essential in everyday life.

As jobs in tomorrow's economy increasingly require knowledge of mathematics and as new technologies demand the ability to apply mathematics in practical ways (Zaslavsky, 1994), it is evident that the well-being of our nation partly depends on the ability of youth and adults to succeed in mathematics (Tobias, 1987). As early as the late 1970s, mathematics was recognized as the "critical filter" for many well-paying and promising careers (Sells, 1978). While mathematics is important to careers in varying ways and degrees, having confidence in one's ability to handle mathematical problems as they arise is essential (Zaslavsky, 1994). Beyond solving applied problems, mathematics enables individuals to work confidently with data, analyze arguments logically, and communicate effectively about technical matters. Adults with mathematics anxiety are at a disadvantage, even with the "help" of graphing calculators and spreadsheets—now common tools in modern society. A solid understanding of the fundamentals is necessary to use these mathematical tools effectively.

Several studies have examined the factors contributing to mathematics anxiety. Shaikh (2013) investigated factors influencing mathematics anxiety and their effect on performance. The study identified various sources of anxiety, including perceived difficulty, fear of asking questions, inability to concentrate, worry about poor performance, strict teachers, parental monitoring of homework, and peer ridicule. Environmental factors produced the highest level of anxiety, while physical factors most strongly influenced mathematics performance. Similarly, Ashcraft and Moore (2009) highlighted cognitive factors such as low motivation, insufficient working memory, and limited mathematical ability as contributors to anxiety, noting that arousal of mathematics anxiety can lead to an "affective drop" affecting performance. Venkatesa and Karimi (2009) explored the relationship among mathematics anxiety, mathematics performance, and academic hardiness in high school students. They found a significant negative correlation between mathematics anxiety and performance but no significant relationship with academic hardiness. Gender differences were significant in anxiety levels, with females reporting slightly higher anxiety, though performance did not differ significantly. Nuray and Ozlem (2007) examined 1,440 university students and found that mathematics anxiety was related to department, class, and academic performance, but not to gender, highlighting context-specific variations.

The impact of mathematics anxiety on performance has been documented across multiple studies. Pourmoslemi, Erfani, and Firoozfar (2013) found a positive relationship between mathematics anxiety and performance among undergraduate students, suggesting that moderate anxiety may influence attention and effort. Zakaria, MohdZain, Ahmad, and Erlina (2012) reported that psychological factors, including anxiety, significantly affected secondary school students' achievement in mathematics. Similarly, studies by Reys, Suydam, and Lindquist (1995) emphasized that classroom practices, such as de-emphasizing speed tests and reducing competition, could mitigate the negative effects of anxiety on learning outcomes.

A substantial body of research has investigated interventions and strategies to reduce mathematics anxiety. Alken (2013) explored primary school teachers' methods for alleviating anxiety, finding that motivating students, making mathematics relevant, using examples and exercises, incorporating games, and obtaining parental support were effective. However, the study was limited to teachers' perspectives, suggesting the need for further research including students' views. Jackson and Leffingwell (1999) emphasized the importance of creating supportive learning environments and highlighted the long-term impact of teachers'

behaviors and attitudes on students' mathematics anxiety. Other studies have focused on instructional approaches. Ngirande and Mutodi (2014) recommended effective teaching strategies to address higher anxiety among female students. Smith (2004) identified teacher unawareness as a significant contributor to student anxiety, while Martinez and Martinez (2003) emphasized that teaching methods directly influence the development or reduction of anxiety. Shanahan et al. (2006) suggested that in-class games should align with learning outcomes to enhance engagement and reduce anxiety. Fiore (1999) and Zettle and Raines (2000) further highlighted the teacher's role in influencing students' mathematical confidence and the importance of planning targeted interventions. Historical studies also provide insight into foundational strategies. Baroody and Costlick (1998) described a cycle of mathematics anxiety and self-defeating beliefs, emphasizing early intervention. Shepard (1981) and Tobias (1990) recommended the inclusion of repeated examples and exercises to reinforce learning and reduce negative feelings toward mathematics. Reys, Suydam, and Lindquist (1995) highlighted communication and reflection in the classroom as effective methods to enhance students' mathematical power and reduce anxiety.

I.4. Rationale of the study

Researchers have long recognized that affective factors are closely related to learning. Although many view mathematics as a logical and impersonal branch of knowledge, it often evokes stronger emotions than any other school subject (Zaslavsky, 1994). These emotions, in turn, can influence both the learning and application of mathematics. The specific type of anxiety associated with learning mathematics is commonly referred to as *mathematics anxiety*. Williams (1972) suggested that while high levels of anxiety may serve as a motivator for simple tasks, they are more likely to interfere with performance as tasks become increasingly complex.

The present study is based on the assumption that the more we understand how students at the 10+2 level overcome mathematics anxiety, the more effectively we can prevent its occurrence and assist those who experience it. Identifying the strategies students use to successfully overcome mathematics anxiety is the central focus of this investigation.

I.5. Statement of the Problem

It has been observed that mathematics anxiety is increasing among school students. This study aims to explore strategies for learning mathematics and reducing mathematics anxiety among 10+2 level students. Accordingly, the research problem is stated as: *"Exploring College Students' Perspectives on Strategies to Overcome Mathematics Anxiety at the Senior Secondary Level."*

I.6. Research gap

The review of related studies reveals that most research on this topic has focused on identifying the causes of mathematics anxiety and proposing possible strategies to overcome it. These studies primarily emphasize the factors contributing to mathematics anxiety and methods for addressing it. The proposed study aims to explore students' perspectives on overcoming mathematics anxiety and to identify effective strategies for 10+2 level students.

I.7. Objectives of the Study

1. To explore students' perspectives on overcoming mathematics anxiety at the senior secondary (10+2) level.
2. To identify strategies and approaches that can help students overcome mathematics anxiety.

2. Methodology

The methodology for the study provides an overview of the research, including details of the research design, the sample, and the methods of data collection and analysis.

2.1. Sample

This is a survey-type study. To conduct the research, 100 mathematics students (aged 19 to 23 years) from different colleges under the University of Calcutta (C.U.) were randomly selected. The participants were drawn from 12 different colleges in Kolkata. This age group was chosen to explore students' opinions based on their understanding and perceptions of strategies to overcome mathematics anxiety among senior secondary students. This diverse sample provides a robust basis for analyzing trends and patterns in mathematics anxiety and the various strategies used to cope with it.

2.2. Tools used in the Study

To collect the primary quantitative data, a self-developed questionnaire will be used by the researcher, consisting of two sections. The questionnaire comprises 22 closed-ended statements constructed using a three-point Likert psychometric scale. In Section I, participants will be required to provide their personal information, including name, age, gender, college name, course, and other necessary details. In Section II, the Likert scale will be used to assess the participants' degree of agreement regarding strategies to overcome mathematics anxiety. The questionnaire was administered to senior secondary (10+2 level) students to gather their opinions on overcoming mathematics anxiety.

2.3. Statistical Technique

The data collected from participants aged 19 to 23 years were analyzed using various statistical techniques. Quantitative methods, specifically descriptive statistics, were employed for data analysis. Responses from the questionnaires were converted into percentages, and the findings were presented through graphical representations, including bar diagrams and pie charts.

2.4. Delimitation of the study

The study has several defined delimitations. Only the opinions of 100 students aged 19 to 23 years, all enrolled in colleges within West Bengal, specifically in the Kolkata region, were taken as the sample. The study was restricted to B.Sc. Mathematics Honors students under the University of Calcutta. Only 12 colleges affiliated with the University of Calcutta were selected. The geographical scope was confined to Kolkata, West Bengal, India, and the study focused on college students' perspectives on strategies to overcome mathematics anxiety at the senior secondary level. These delimitations specify the context, scope, target population, timeframe (six months), and sample size (which was relatively small).

3. Data Analysis and Interpretation

Table 1. *Distribution of Participants by Caste/Category and Gender*

Caste/Category	Female (%)	Male (%)	Total (%)
SC (Scheduled Caste)	12	8	10
ST (Scheduled Tribe)	2	2	2
OBC (Other Backward Classes)	34	14	24
General	52	62	57
Total	**100**	**100**	**100**

Note. Percentages for the total column represent the average of male and female participants combined.

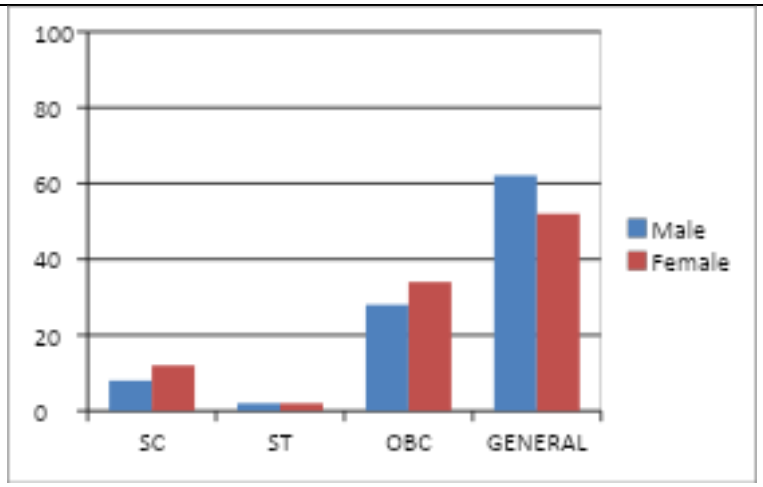

Figure 1. *Showing the Distribution of Participants by Gender and Social Category*

Interpretation: From Figure 1, it can be observed that among the female participants, 12% belong to the SC category, 2% to the ST category, 34% to the OBC category, and 52% to the General category, whereas among the male participants, 8% belong to the SC category, 2% to the ST category, 14% to the OBC category, and 62% to the General category. When both genders are combined, the overall distribution indicates that **57%** of participants belong to the **General** category, **24%** to the **OBC** category, **10%** to the **SC** category, and only **2%** to the **ST** category.

Table 2. *Participants' Mathematics Anxiety Levels by Gender*

Level of Mathematics Anxiety	Typical Range (For a 5-point Likert Scale)	Male (n)	Female (n)	Total (n)
Low	Mean score ≤ 2·5	37	36	73
Moderate	2.6 – 3.5	11	13	24
High	≥ 3·6	2	1	3
Total		**50**	**50**	**100**

Note. *n* = number of participants.

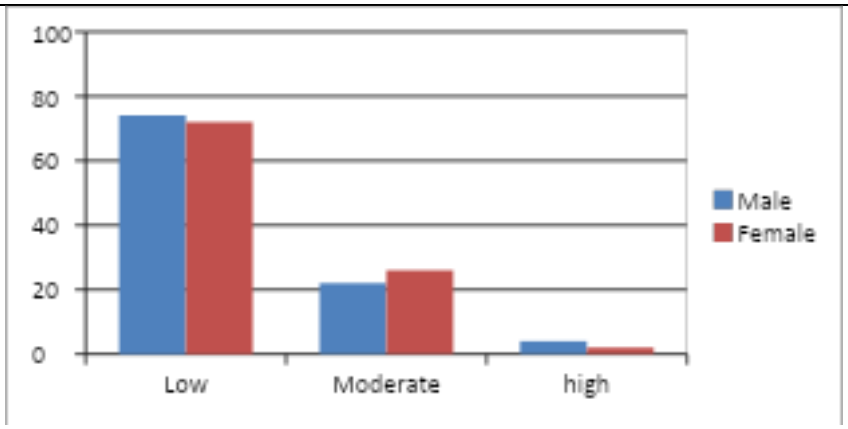

Figure 2: Showing the Distribution of Participants by Level of Mathematics Anxiety and Gender

Interpretation: Figure 2 & Table 2 indicates the distribution of participants according to their levels of mathematics anxiety and gender. The results indicated that 73 (37 males and 36 females) of the 100 participants experienced a low level of mathematics anxiety, 24 (11 males and 13 females) experienced a moderate level, and 3 (2 males and 1 female) experienced a high level of mathematics anxiety.

Overall, the data suggest that while mathematics anxiety exists among students, the majority of them experience it at a low or moderate level rather than a high level. Gender-wise, the distribution shows a fairly balanced representation, with no major differences observed between male and female participants across anxiety levels.

Table 3. Education Level at Which the Participants First Experienced Mathematics Anxiety

Education level	Male *n* (%)	Female *n* (%)	Total *n* (%)
Elementary school (1–5)	5 (10)	7 (14)	12 (12)
Middle school (6–8)	6 (12)	11 (22)	17 (17)
High school (9–12)	9 (18)	5 (10)	14 (14)
College/ University	8 (16)	6 (12)	14 (14)
Don't remember	5 (10)	3 (6)	8 (8)
Never	17 (34)	18 (36)	35 (35)

Note. Values in parentheses represent percentages.

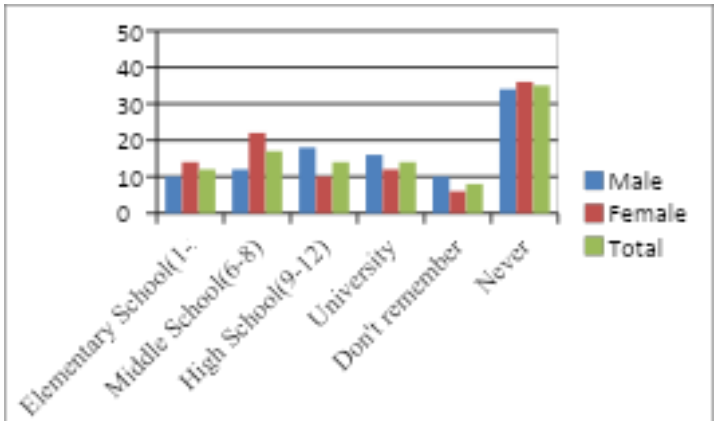

Figure 3. Percentages of participants reporting the stage of education at which they first experienced mathematics anxiety.

Interpretation: Figure 3 presents the education levels at which participants first reported experiencing mathematics anxiety. The largest proportion of respondents (35%) indicated that they had never experienced mathematics anxiety. Among those who did, middle school (17%) and high school (14%) were the most commonly reported periods, followed closely by university (14%). A smaller percentage reported first experiencing mathematics anxiety in elementary school (12%) or stated that they could not remember (8%). Gender differences were also observed: female participants were more likely to report experiencing mathematics anxiety during middle school (22%) compared to males (12%), whereas male participants reported slightly higher rates of mathematics anxiety during high school (18%) compared to females (10%). Overall, these results suggest that mathematics anxiety most often emerges during secondary education, with some variation across gender.

Table 4: Students' Perception of Whether Mathematics Anxiety Diminishes with Time

Response	Male (N=50)	Female (N=50)
Yes	38 (76%)	34 (68%)
No	12 (24%)	16 (32%)

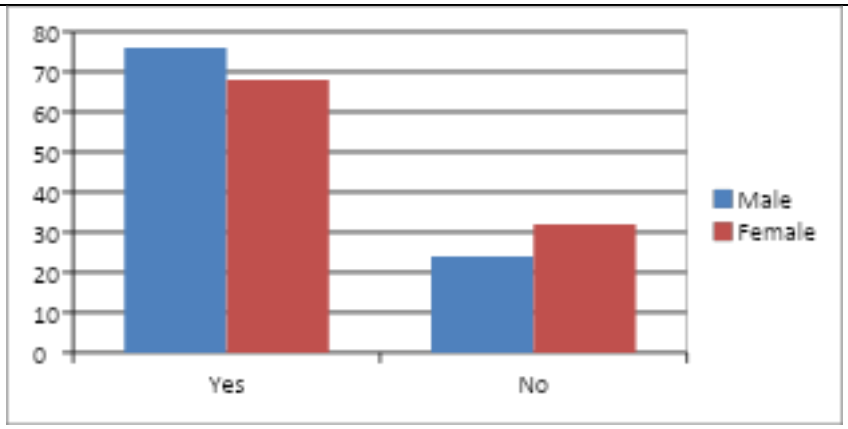

Figure 4. Students' Perception of Whether Mathematics Anxiety Diminishes with Time.

Interpretation: From Table 4 and Figure 4, it is observed that 76% of male students and 68% of female students responded "Yes," indicating their agreement with the statement that mathematics anxiety diminishes with time. However, 24% of male and 32% of female students disagreed with this statement, responding "No." This indicates that while most students perceive a reduction in mathematics anxiety as they progress academically, females tend to experience a slightly more persistent level of anxiety than males.

Table 5. *Responses on the Effectiveness of the "Reward Yourself" Strategy in Reducing Mathematics Anxiety*

Responses	Male (%)	Female (%)
Yes	86	74
No	14	26

Note. Percentages represent the proportion of male and female respondents who reported that rewarding themselves helps reduce mathematics anxiety.

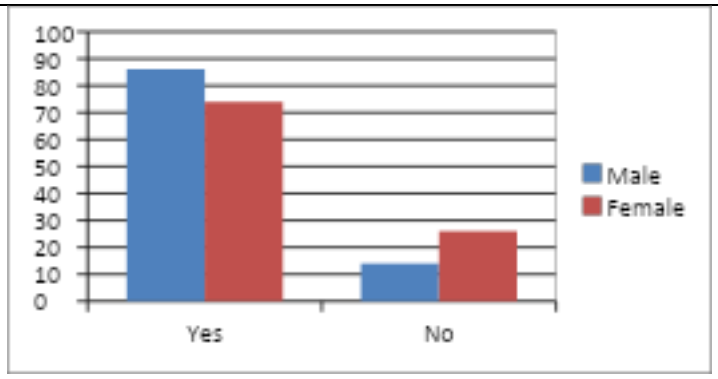

Fig 5. Showing the Responses on the Effectiveness of the "Reward Yourself" Strategy in Reducing Mathematics Anxiety

Interpretation: From Figure 5, it is observed that 86% of male students and 74% of female students responded "Yes," indicating that they agree with the statement, *"Rewarding yourself is helpful for solving a hard problem and also helps to reduce mathematics anxiety."* However, 14% of male students and 26% of female students did not think so; they responded "No" to the statement. This suggests that most students, particularly males, perceive self-reward as an effective strategy for overcoming difficult problems and reducing mathematics anxiety.

Table 6. *Students' Perceptions of the Primary Sources Contributing to Negativity Toward Mathematics*

Sources	Male (%)	Female (%)
Parents	22	28
Teachers	40	46
Media	12	12
Friends	26	14

Note. Percentages represent the proportion of male and female students who identified each source as contributing to the development of negative attitudes toward mathematics.

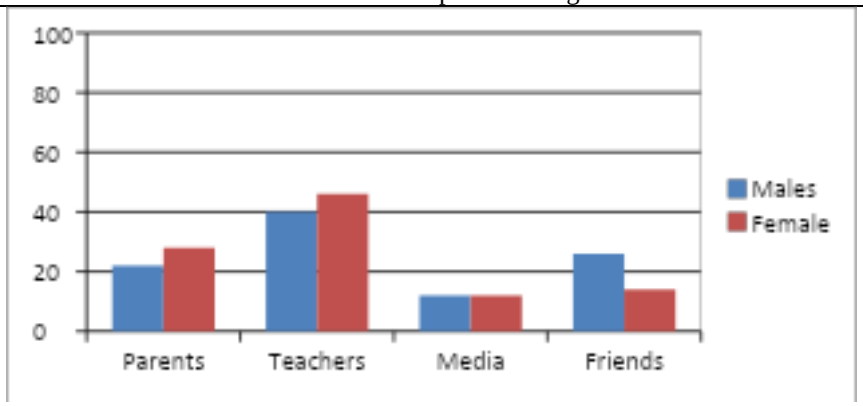

Figure 6. Students' Perceptions of the Primary Sources Contributing to Negativity Toward Mathematics

Interpretation: From Figure 6, 22% of male and 28% of female students identified parents as a source of negativity toward mathematics, 40% of male and 46% of female students identified teachers, 12% of both male and female students identified media, and 26% of male and 14% of female students identified friends. This indicates that teachers are perceived as the most influential source of negative attitudes toward mathematics.

Table 7. *Strategies Used to Improve Students' Performance in the Mathematics Classroom*

Strategies	Males (%)	Females (%)
Positive Reinforcement	24	36
Get a Tutor	28	30
Reframe Anxiety	20	14
Make Math Fun!	28	20

Note. The table shows the percentage of male and female students who preferred various strategies to improve their mathematics performance.

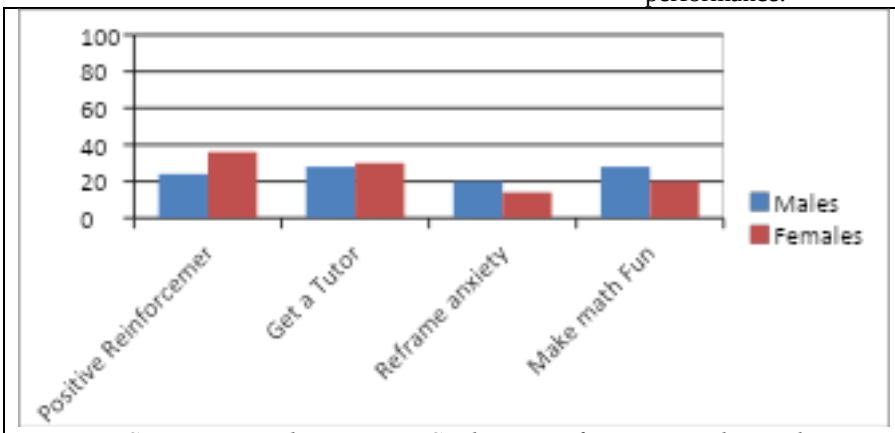

Figure 7. *Strategies Used to Improve Students' Performance in the Mathematics Classroom*

Interpretation: From Figure 7, it is evident that 24% of male and 36% of female students agree that positive reinforcement is the best strategy to improve students' performance in the mathematics classroom. Similarly, 28% of male and 30% of female students believe that getting a tutor is most effective. In addition, 20% of male and 14% of female students consider reframing anxiety as helpful, while 28% of male and 20% of female students agree that making math fun enhances students' performance in the mathematics classroom.

Table 8. *Students' Rankings of Coping Strategies from 1 (Most Useful) to 5 (Least Useful)*

Strategy	Rank 1 (%)	Rank 2 (%)	Rank 3 (%)	Rank 4 (%)	Rank 5 (%)
Brain Breaks	62	18	13	5	2
Deep Breathing	18	28	15	28	10
Coloring	5	25	21	28	21
Expressive Writing	10	8	2	26	54
Humor	5	21	49	13	13

Note. The table presents students' rankings of various coping strategies, where Rank 1 indicates the most useful and Rank 5 indicates the least useful strategy.

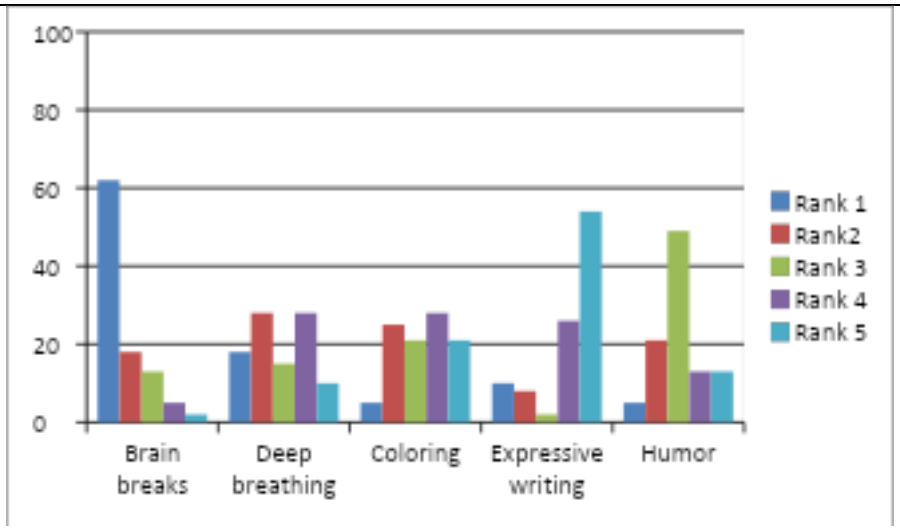

Figure 8. Students' Rankings of Coping Strategies from 1 (Most Useful) to 5 (Least Useful)

Interpretation: The questionnaire also asked about the overall reactions and takeaways that students had, rather than focusing only on individual strategies. Participants were instructed to rank each strategy according to how useful they perceived it to be, with a rank of 1 indicating the most useful and 5 indicating the least useful. Figure 8 presents the percentage distribution of students' rankings for each coping strategy. Overall, the results indicate that *brain breaks* were perceived as the most useful strategy, whereas *expressive writing* was ranked as the least useful by most students.

Table 11. *Students' Opinions on Meditation and Yoga in Relieving Tension and Stress*

Response	Male Students (%)	Female Students (%)
Yes	60	72
No	34	18
Don't know	6	10
Total	100	100

Note. The majority of both male (60%) and female (72%) students agreed that meditation and yoga help to relieve tension and stress. A smaller proportion of students disagreed (34% male and 18% female), while a few were uncertain (6% male and 10% female).

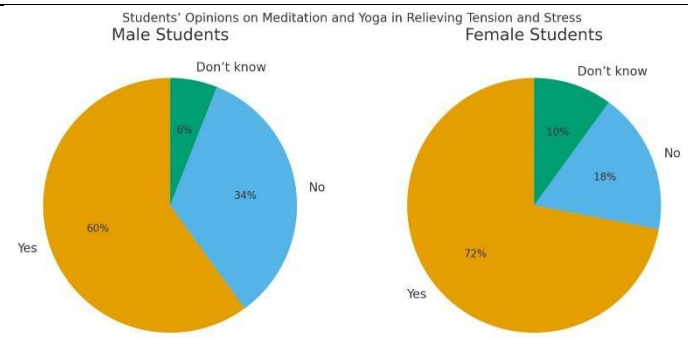

Figure 9. *Students' Opinions on Meditation and Yoga in Relieving Tension and Stress*

Interpretation: From Figure 9, it is observed that 60% of male students and 72% of female students responded "Yes," indicating that they agree with the statement *"Meditation and yoga help to relieve my tension and stress."* However, 34% of male and 18% of female students disagreed with the statement, responding "No." Additionally, 6% of male students and 10% of female students selected "Don't know." Overall, it is evident that although a few male and female students disagreed, the majority believed that meditation and yoga help reduce mathematics anxiety.

Table 10. *Students' Preferred Methods for Relieving Tension and Stress*

Method	Male Students (%)	Female Students (%)
Do Nothing	4	6
To Get a Deep Breath	56	28
Meditation & Yoga	30	56
Walking & talking	10	10
Total	100	100

Note. This table summarizes the stress-relief methods chosen by male and female students.

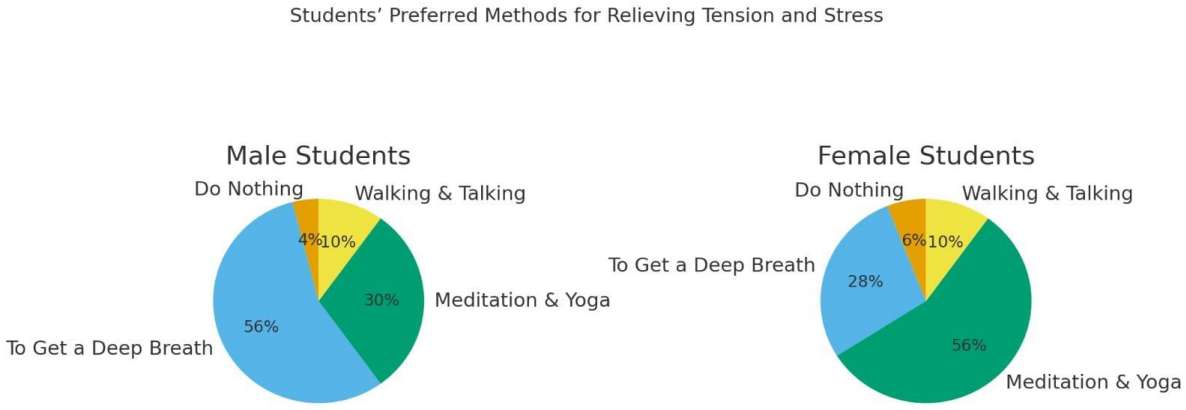

Figure 10. *Students' Preferred Methods for Relieving Tension and Stress*

Interpretation: From Table 10 and Figure 10, it is observed that both male and female students adopt various methods to cope with stress. The majority of male students (56%) prefer *taking a deep breath* to relieve tension, while most female students (56%) practice *meditation and yoga* for stress relief. A small proportion of both male (4%) and female (6%) students reported doing nothing to manage their stress. Meanwhile, 10% of both male and female students engage in *walking and talking* as a coping strategy. Overall, it is evident that female students are more inclined toward meditation and yoga, whereas male students tend to prefer deep-breathing exercises as their primary stress-relief method.

Table 14. Students' Opinions on Taking Short "Brain Breaks" During Class

Response Option	Male Students (%)	Female Students (%)	Total (%)
Yes	82	84	83
No	16	12	14
Don't Know	2	4	3
Total	100	100	—

Note. This table shows students' responses to the statement *"I like taking short brain breaks during class to relax."* The majority of both male and female students agreed with the statement.

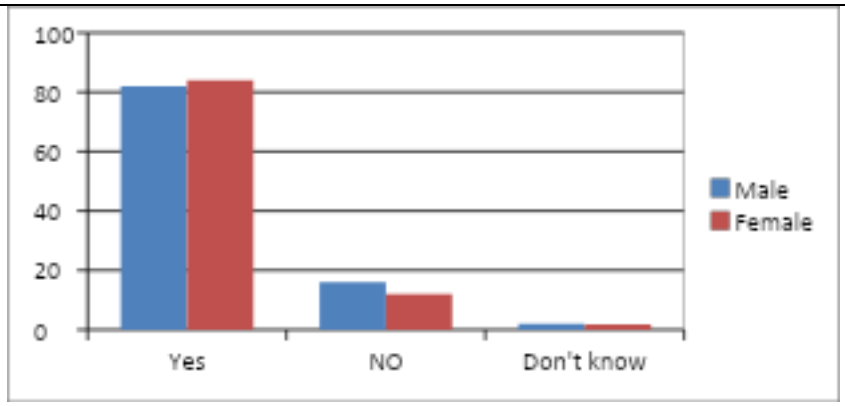

Figure 11. Students' Opinions on Taking Short "Brain Breaks" During Class

From Figure 11, it is observed that 82% of male and 84% of female students responded "Yes" to the statement *"I like taking short brain breaks during class to relax."* Meanwhile, 16% of male and 12% of female students stated that they do not like to take short breaks during class. Additionally, 2% of male and 4% of female students either did not wish to reveal their opinion or were uncertain, and thus answered "Don't know." From the graph, it can be concluded that the majority of students prefer taking short brain breaks during class to relax.

Table 12. Students' Use of Positive Coping Strategies to Reduce Math Anxiety

Response Option	Male Students (%)	Female Students (%)	Total (%)
Yes	52	42	47
No	30	32	31
Don't Know	18	26	22
Total	100	100	—

Note. This table presents students' responses to the statement *"I regularly use positive coping strategies (such as deep breathing or listening to music) to reduce math anxiety."* The results show that a higher percentage of male students reported using such strategies compared to female students.

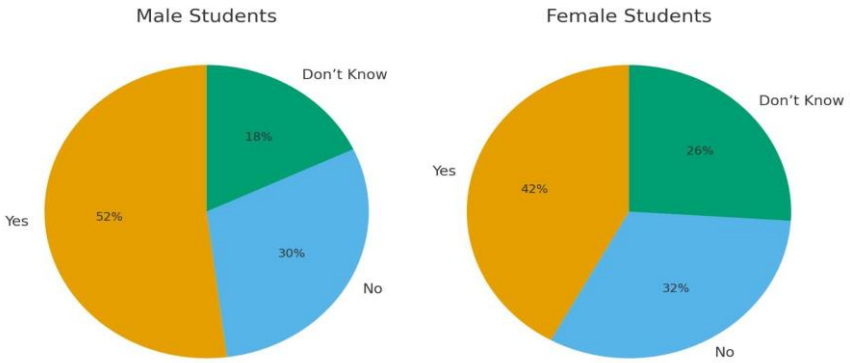

Figure 12. Students' Use of Positive Coping Strategies to Reduce Math Anxiety

Interpretation: Here are the pie charts comparing male and female students' responses regarding their use of positive coping strategies to reduce math anxiety. From Table 12 and Figure 12, it is observed that 52% of male students and 42% of female students responded "Yes," indicating that they regularly use positive coping strategies (such as deep breathing or listening to music) to reduce math anxiety. However, 30% of male and 32% of female students reported that they do not use any positive coping strategies to manage their stress and math anxiety. Additionally, 18% of male and 26% of female students selected "Don't know," suggesting that they either did not wish to disclose their opinion or were uncertain.

Table 13. Students' Enjoyment of Classroom Activities to Practice Coping Strategies for Math Anxiety

Response Option	Male Students (%)	Female Students (%)	Total (%)
Yes	20	12	16
No	24	26	25
Don't Know	56	62	59
Total	100	100	—

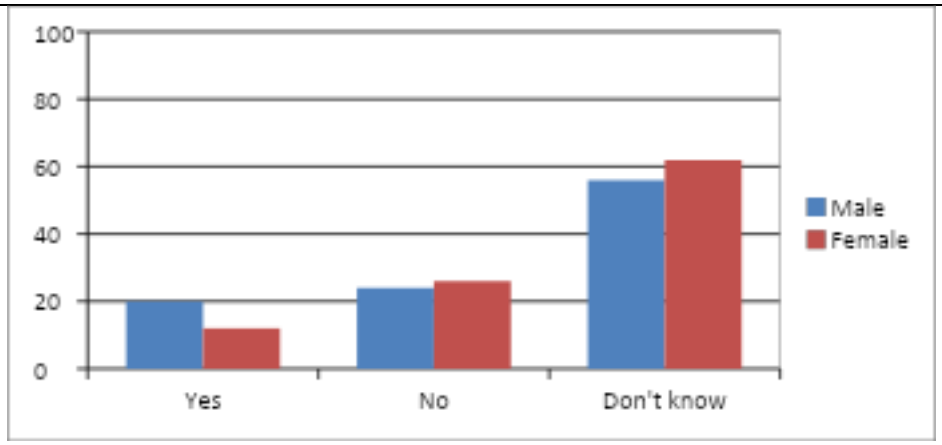

Figure 13. Students' Enjoyment of Classroom Activities to Practice Coping Strategies for Math Anxiety

From Figure 13, it is observed that 20% of male and 12% of female students responded "Yes," indicating that they enjoy classroom activities designed to practice coping strategies for math anxiety. However, 24% of male and 26% of female students responded "No," suggesting that they do not enjoy such activities. The majority of students selected "Don't know," with 56% of males and 62% of females indicating uncertainty or reluctance to express their opinion.

Table 14. Students' Opinions on Whether Activity-Based Learning Reduces Math Anxiety (by Gender)

Response	Male (%)	Female (%)	Total (%)
Yes	40	24	32
No	20	30	25
Don't know	42	46	44
Total	100	100	100

Note. The table presents the percentage distribution of male and female students' opinions regarding whether activity-based learning reduces math anxiety.

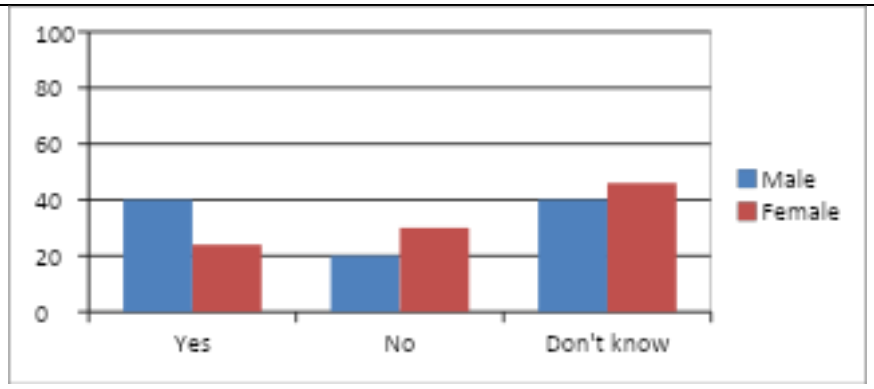

Figure 14. Students' Opinions on Whether Activity-Based Learning Reduces Math Anxiety (by Gender)

Interpretation: From Table 14 and Figure 14, it is observed that 40% of male and 24% of female students responded 'yes', indicating that they agree with the statement that *activity-based learning reduces math anxiety*. However, 20% of male and 30% of female students disagreed, responding 'no'. Meanwhile, 42% of male and 46% of female students remained neutral, responding 'don't know'. A higher percentage of male students agreed that activity-based learning reduces math anxiety, while a larger proportion of female students remained neutral or disagreed.

Table 15. Students' Opinions on Whether Peer Learning Increases Confidence and Reduces Math Anxiety (by Gender)

Response	Male (%)	Female (%)	Total (%)
Yes	36	48	42
No	24	32	28
Don't know	40	30	35
Total	100	100	100

Note. The table presents the percentage distribution of male and female students' opinions regarding whether peer learning increases confidence and reduces math anxiety.

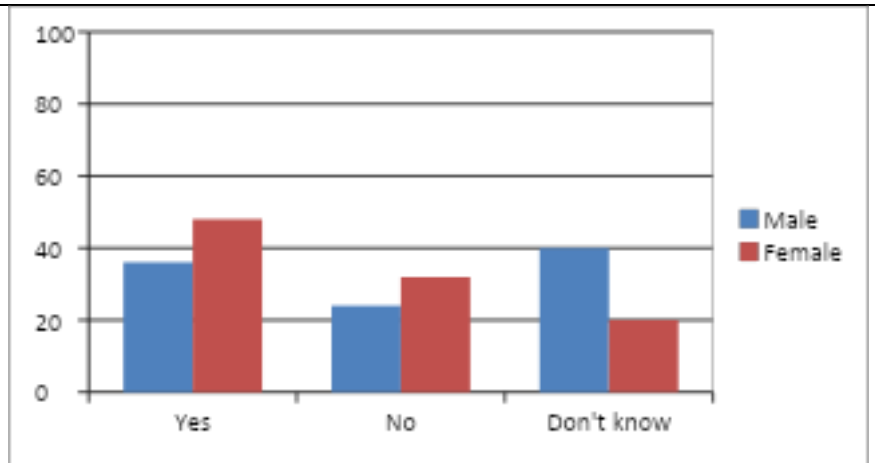

Figure 15. *Students' Opinions on Whether Peer Learning Increases Confidence and Reduces Math Anxiety (by Gender)*

Interpretation: From Figure 15, it is observed that 36% of male and 48% of female students responded 'yes', indicating that they agree with the statement that *peer learning increases confidence and reduces math anxiety*. However, 24% of male and 32% of female students disagreed, responding 'no'. Meanwhile, 40% of male and 30% of female students remained neutral in their responses. A higher percentage of female students agreed that peer learning increases confidence and reduces math anxiety, while a larger proportion of male students remained neutral.

Table 16. Students' Opinions on Whether Using Real-Life Applied Examples Reduces Math Anxiety (by Gender)

Response	Male (%)	Female (%)	Total (%)
Yes	56	48	52
No	24	22	23
Don't know	20	30	25
Total	100	100	100

Note. The table shows the percentage distribution of male and female students' opinions regarding whether using real-life applied examples rather than pure mathematics can help reduce math anxiety.

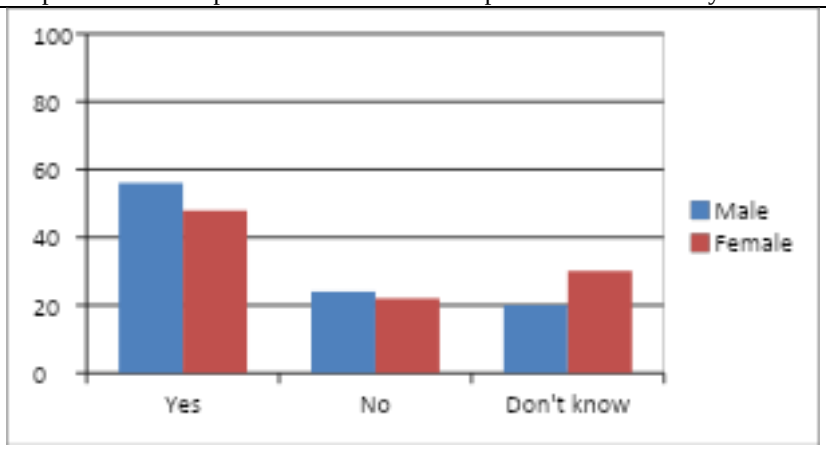

Figure 16. *Students' Opinions on Whether Using Real-Life Applied Examples Reduces Math Anxiety (by Gender)*

Interpretation: From Figure 16, it is observed that 56% of male students and 48% of female students responded 'yes', indicating that they agree with the statement that *using real-life applied examples rather than pure mathematics can help reduce math anxiety*. However, 24% of male and 22% of female students disagreed with the statement, responding 'no'. Meanwhile, 20% of male and 30% of female students remained neutral, responding 'don't know'. A higher percentage of male students agreed that using real-life applied examples reduces math anxiety, while a larger proportion of female students remained neutral.

Table 17. Students' Opinions on Whether Practicing Math Every Day Reduces Math Anxiety (by Gender)

Response	Male (%)	Female (%)	Total (%)
Yes	66	82	74
No	12	12	12
Don't know	22	6	14
Total	100	100	100

Note. The table shows the percentage distribution of male and female students' opinions regarding whether practicing math every day helps reduce math anxiety.

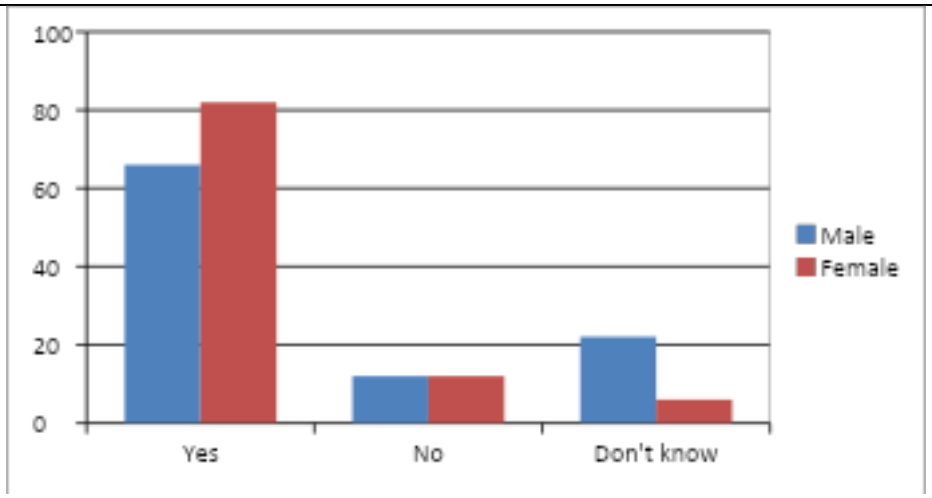

Figure 17. *Students' Opinions on Whether Practicing Math Every Day Reduces Math Anxiety (by Gender)*

Interpretation: From Figure 17, it is observed that 66% of male and 82% of female students believe that practicing math every day helps reduce math anxiety. However, a few students disagreed with this statement, with 12% of male and 12% of female students responding 'no'. Meanwhile, 22% of male students and 6% of female students remained neutral, responding 'don't know'. A majority of both male and female students agreed that practicing math every day helps reduce math anxiety, with female students showing a higher level of agreement.

Table 18. Students' Opinions on Whether Getting Acquainted with Good Study Techniques Reduces Math Anxiety

Response	Male Students (%)	Female Students (%)
Yes	76	82
No	8	14
Don't Know	16	4
Total	100	100

Note. This table shows that most male (76%) and female (82%) students agree that getting acquainted with good study techniques helps reduce math anxiety.

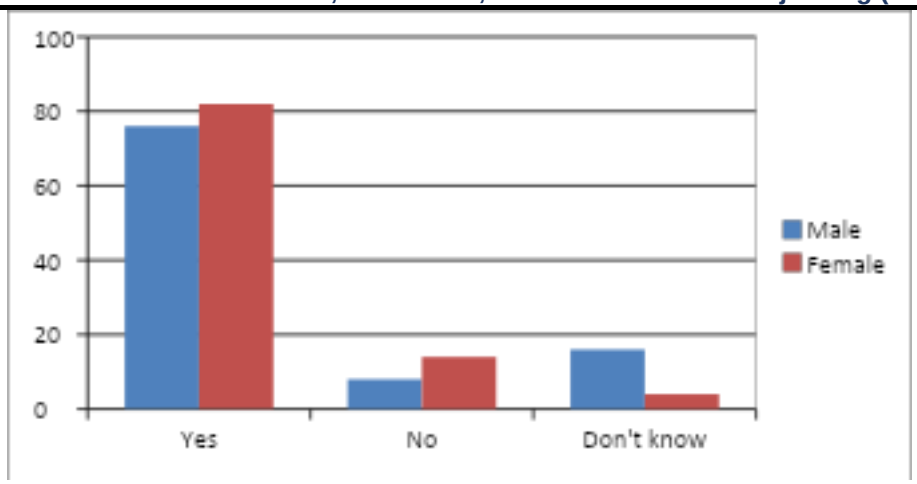

Figure 18. *Students' Opinions on Whether Getting Acquainted with Good Study Techniques Reduces Math Anxiety*

Interpretation: From Figure 18, it is seen that 76% of male and 82% of female students say 'yes', meaning they agree with the statement, *"Getting acquainted with good study techniques reduces math anxiety."* However, 8% of male and 14% of female students disagree with this statement, responding 'no'. Meanwhile, 16% of male and 4% of female students respond 'don't know'. The data indicate that most students, regardless of gender, believe that adopting good study techniques helps reduce math anxiety.

Table 19. Students' Opinions on Whether Focusing on Past Successes Helps Reduce Math Anxiety

Response	Male Students (%)	Female Students (%)
Yes	54	62
No	32	18
Don't Know	14	20
Total	100	100

Note. This table shows that a greater proportion of female students (62%) than male students (54%) agree that focusing on past successes helps reduce math anxiety.

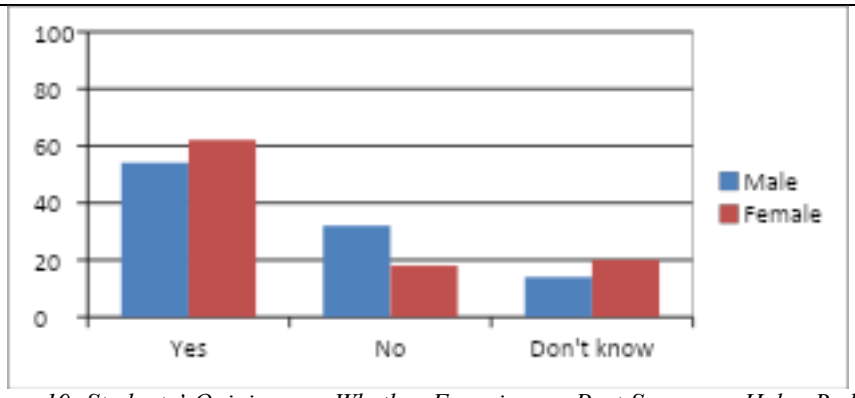

Figure 19. Students' Opinions on Whether Focusing on Past Successes Helps Reduce Math Anxiety

Interpretation: From Figure 19, it is seen that 54% of male and 62% of female students say 'yes', meaning they agree that focusing on past successes helps reduce math anxiety. Meanwhile, 32% of male and 18% of female students do not agree with the statement, responding 'no'. Additionally, 14% of male and 20% of female students respond 'don't know'. It can be concluded from the table that most female students agree with the statement.

Table 20. Students' Opinions on Whether Practicing Relaxation Techniques Helps Reduce Math Anxiety

Response	Male Students (%)	Female Students (%)
Yes	84	76
No	2	4
Don't Know	14	20
Total	100	100

Note. This table shows that most male (84%) and female (76%) students agree that practicing relaxation techniques such as deep breathing and visualization helps reduce math anxiety.

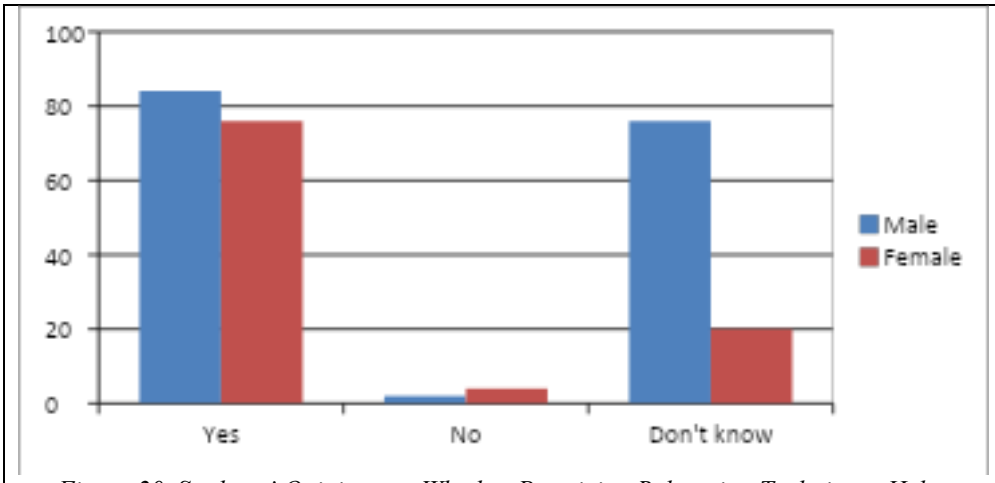

Figure 20. Students' Opinions on Whether Practicing Relaxation Techniques Helps Reduce Math Anxiety

Interpretation: From Figure 20, it is seen that 84% of male and 76% of female students say 'yes', meaning they agree that relaxation techniques such as deep breathing and visualization help reduce math anxiety. However, some students do not share this view—among them, 2% are male and 4% are female. Meanwhile, 14% of male and 20% of female students respond 'don't know'. From the table, it can be concluded that most male and female students agree with the statement that practicing relaxation techniques helps reduce math anxiety.

Table 21. Students' Opinions on Whether Online Learning and Mock Tests Help Reduce Math Anxiety

Response	Male Students (%)	Female Students (%)
Yes	24	38
No	28	12
Don't Know	48	50
Total	100	100

Note. This table shows that while a few students agree that online learning and mock tests help reduce math anxiety, the majority of students gave no clear opinion, responding 'don't know'.

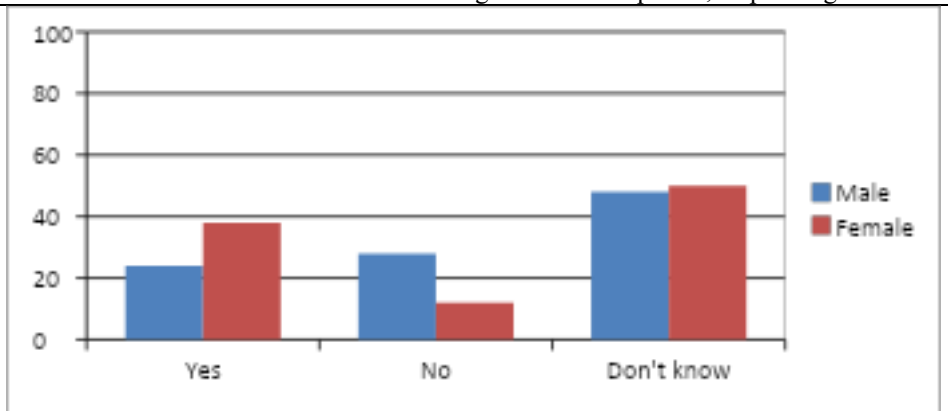

Figure 21. Students' Opinions on Whether Online Learning and Mock Tests Help Reduce Math Anxiety

Interpretation: From Figure 21, it is seen that 24% of male and 38% of female students say 'yes', meaning they agree that online learning and mock tests help reduce math anxiety. Meanwhile, 48% of male and 50% of female students respond 'don't know', giving no clear opinion on the statement. However, a few students do not agree, as they believe that online learning and mock tests do not help reduce math anxiety.

Table 22. Students' Opinions on Whether Self-Belief Helps Reduce Math Anxiety

Response	Male Students (%)	Female Students (%)
Yes	92	82
No	2	4
Don't Know	6	14
Total	100	100

Note. This table shows that most students, both male (92%) and female (82%), believe that self-belief helps reduce math anxiety.

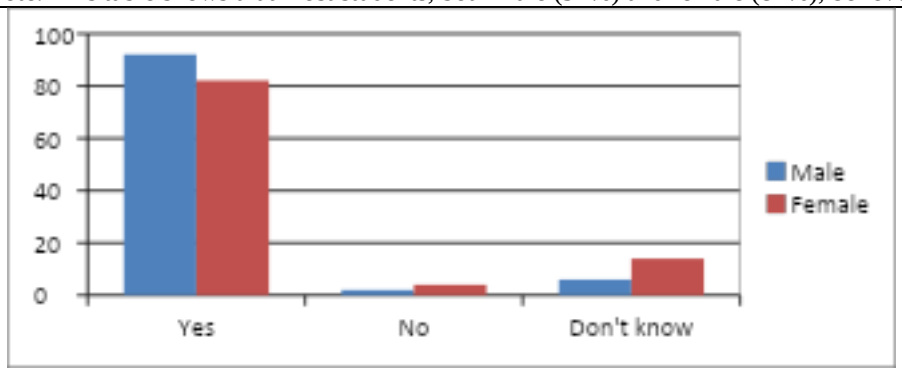

Figure 22. Students' Opinions on Whether Self-Belief Helps Reduce Math Anxiety

Interpretation: From Figure 22, it is seen that 92% of male and 82% of female students say 'yes', meaning they agree that self-belief decreases math anxiety. Meanwhile, 2% of male and 4% of female students do not agree, responding 'no'. Additionally, 6% of male and 14% of female students respond 'don't know'. Overall, the table shows that the majority of students from both genders believe that self-belief helps reduce math anxiety.

4. Limitations and Future Scope

Due to time constraints, the study could not be conducted on a larger scale. It was limited to B.Sc. 3rd-year Mathematics Hons. students, and only gender-wise comparisons were included. Therefore, the results obtained from the present study may not provide a comprehensive understanding of the problems under investigation. Hence, further research is necessary from a broader perspective. Future studies could include primary, secondary, and higher secondary students from rural, urban, and semi-urban areas of West Bengal, covering both government and private institutions.

5. Conclusion

Math anxiety often arises from a student's past negative experiences with mathematics, whether in the classroom or at home. Teachers and parents can unintentionally heighten this anxiety by projecting their own negative attitudes toward the subject. Each adverse experience becomes linked to future math tasks, gradually undermining the student's understanding and confidence. Traditionally, students have been encouraged to memorize mathematical concepts rather than actively engage with problems or grasp the underlying reasoning. This method, coupled with insufficient preparation, significantly contributes to heightened math anxiety in children.

The findings suggest that teachers play a significant role in shaping students' attitudes toward mathematics. While parents, media, and friends also influence perceptions, the higher percentage associated with teachers highlights the importance of positive teacher–student interactions in reducing negativity and fostering a supportive learning environment in mathematics. Overall, the findings suggest that students value engaging and supportive strategies to enhance their mathematics performance. Positive reinforcement, getting a tutor, and making math enjoyable were among the most preferred approaches. In contrast, coping strategies such as brain breaks were rated as highly useful, while expressive writing was considered least effective. These results highlight the importance of interactive and motivating techniques in improving students' learning experiences and reducing anxiety in mathematics classrooms. From the findings presented in Tables 9 and 10 and their corresponding graphs, it is evident that both male and female students adopt various strategies to cope with stress and tension. The majority of students agree that meditation and yoga are effective in reducing anxiety and enhancing emotional well-being. Moreover, while male students commonly rely on deep-breathing techniques, female students tend to prefer meditation and yoga as their primary stress-relief methods. Only a small proportion of both groups remain inactive or uncertain in their approach to managing stress. Overall, the results indicate that awareness and practice of relaxation activities such as yoga and meditation play a significant role in helping students manage anxiety, particularly mathematics-related stress, thereby promoting better mental health and academic performance.

From the analysis of Tables 11 and 12, it can be concluded that most students value relaxation techniques as part of their learning process. A large majority of both male and female students prefer taking short "brain breaks" during class to relax, indicating an awareness of the need for mental refreshment during learning. Similarly, many students reported using positive coping strategies, such as deep breathing or listening to music, to manage stress and reduce math anxiety. These findings suggest that integrating short relaxation activities and stress-management practices into classroom routines may effectively enhance students' focus and emotional well-being in mathematics learning. Based on the findings from Tables 14 and 15, it can be concluded that both activity-based learning and peer learning have a positive influence on reducing math anxiety. Male students tended to agree more with activity-based learning, whereas female students showed higher agreement with peer learning. In both cases, a notable proportion of students remained neutral, indicating that while these strategies are effective for many, some students are uncertain about their impact. Based on the findings from Tables 16 and 17, it can be concluded that instructional strategies involving real-life applied examples and daily practice of mathematics are effective in reducing math anxiety among students. Male students showed slightly higher agreement with using real-life examples, while female students demonstrated stronger agreement with daily practice. In both cases, a small proportion of students remained neutral or disagreed, suggesting that while these strategies are generally beneficial, their impact may vary among individual learners. The findings from Tables 18 and 19 indicate that most students recognize the

importance of positive learning strategies in reducing math anxiety. A majority of both male and female students agree that acquiring good study techniques and focusing on past successes can effectively help manage math anxiety, with female students showing slightly higher levels of agreement in both cases. The findings indicate that students recognize the importance of personal strategies in reducing math anxiety. Most male and female students agree that practicing relaxation techniques (Table 20) and cultivating self-belief (Table 21) effectively help reduce math anxiety. In contrast, opinions on online learning and mock tests (Table 22) are less conclusive, with a majority of students responding 'don't know,' suggesting uncertainty about their effectiveness.

The findings suggest that students' mathematics performance and anxiety levels are significantly influenced by both teacher guidance and the use of effective learning and coping strategies. Positive teacher–student interactions, supportive classroom practices, and engaging instructional methods—such as activity-based learning, peer learning, real-life examples, and daily practice—help reduce math anxiety. Additionally, personal strategies, including relaxation techniques, meditation, yoga, brain breaks, self-belief, and positive study habits, are widely recognized by students as effective in managing stress and enhancing emotional well-being. While most strategies are valued by both male and female students, slight differences exist in preferences, such as female students favouring peer learning and meditation, and male students preferring activity-based learning and deep-breathing exercises. Overall, the results underscore the importance of combining interactive teaching methods with personal coping strategies to foster a supportive learning environment, reduce math anxiety, and promote better academic and mental health outcomes.

References:

[1] Alexander, L., & Martray, C. (1989). The development of an abbreviated version of the Mathematics Anxiety Rating Scale. *Measurement and Evaluation in Counseling and Development, 22*(3), 143–150. https://doi.org/10.1080/07481756.1989.12022923

[2] Alkan, V. (2013). Reducing mathematics anxiety: The ways implemented by teachers at primary schools. *International Journal of Social Sciences & Education, 3*(3), 795–807.

[3] Ashcraft, M. H., & Moore, A. M. (2009). Mathematics anxiety and the affective drop in performance. *Journal of Psychoeducational Assessment, 27*(3), 197–205. https://doi.org/10.1177/0734282908330580

[4] Ashcraft, M. H. (2002). Math anxiety: Personal, educational, and cognitive consequences. *Current Directions in Psychological Science, 11*(5), 181–185. https://doi.org/10.1111/1467-8721.00196

[5] Ashcraft, M. H., & Faust, M. W. (1994). Mathematics anxiety and mental arithmetic performance: An exploratory investigation. *Cognition & Emotion, 8*(1), 97–125. https://doi.org/10.1080/02699939408408931

[6] Ashcraft, M. H., & Kirk, E. P. (2001). The relationships among working memory, math anxiety, and performance. *Journal of Experimental Psychology: General, 130*(2), 224–237. https://doi.org/10.1037/0096-3445.130.2.224

[7] Ashcraft, M. H., Krause, J. A., & Hopko, D. R. (2007). Is math anxiety a mathematical learning disability? In D. B. Berch & M. M. M. Mazzocco (Eds.), *Why is math so hard for some children?* (pp. 329–348). Paul H. Brookes.

[8] Baroody, A. J., & Costlick, R. T. (1998). *Fostering children's mathematical power: An investigative approach to K–8 mathematics instruction.* Lawrence Erlbaum Associates.

[9] Beilock, S. L., Rydell, R. J., & McConnell, A. R. (2007). Stereotype threat and working memory: Mechanisms, alleviation, and spillover. *Journal of Experimental Psychology: General, 136*(2), 256–276. https://doi.org/10.1037/0096-3445.136.2.256

[10] Dreger, R. M., & Aiken, L. R. (1957). The identification of number anxiety in a college population. *Journal of Educational Psychology, 48*(6), 344–351. https://doi.org/10.1037/h0045894

[11] Engle, R. W. (2002). Working memory capacity as executive attention. *Current Directions in Psychological Science, 11*(1), 19–23. https://doi.org/10.1111/1467-8721.00160

[12] Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition and Emotion, 6*(6), 409–434. https://doi.org/10.1080/02699939208409696

[13] Faust, M. W., Ashcraft, M. H., & Fleck, D. E. (1996). Mathematics anxiety effects in simple and complex addition. *Mathematical Cognition, 2*(1), 25–62. https://doi.org/10.1080/135467996387275

[14] Fiore, G. (1999). Math-abused students: Are we prepared to teach them? *The Mathematics Teacher, 90*(5), 403–406.

[15] Gough, M. F. (1954). Mathemaphobia: Causes and treatments. *The Clearing House, 28*(6), 290–294. https://doi.org/10.1080/00098655.1954.10405673

[16] Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. *Journal for Research in Mathematics Education, 21*(1), 33–46. https://doi.org/10.5951/jresematheduc.21.1.0033

[17] Hopko, D. R. (2003). Confirmatory factor analysis of the Math Anxiety Rating Scale—Revised. *Educational and Psychological Measurement, 63*(3), 336–351. https://doi.org/10.1177/0013164402250972

[18] Hopko, D. R., Mahadevan, R., Bare, R. L., & Hunt, M. A. (2003). The Abbreviated Math Anxiety Scale (AMAS): Construction, validity, and reliability. *Assessment, 10*(2), 178–182. https://doi.org/10.1177/1073191103010002008

[19] Jackson, C., & Leffingwell, R. (1999). The role of instructors in creating math anxiety in students from kindergarten through college. *The Mathematics Teacher, 92*(7), 583–587.

[20] Jordan, N. C., Kaplan, D., Olah, L., & Locuniak, M. N. (2006). Number sense growth in kindergarten: A longitudinal investigation of children at risk for mathematics difficulties. *Child Development, 77*(1), 153–175. https://doi.org/10.1111/j.1467-8624.2006.00862.x

[21] LeFevre, T., DeStefano, D., Coleman, B., & Shanahan, T. (2005). Mathematical cognition and working memory. In J. I. D. Campbell (Ed.), *Handbook of mathematical cognition* (pp. 361–377). Psychology Press.

[22] Martinez, J. G. R., & Martinez, N. C. (2003). Raising middle school math standards without raising anxiety. *Middle School Journal, 35*(3), 27–35.

[23] Ma, X. (1999). A meta-analysis of the relationship between anxiety toward mathematics and achievement in mathematics. *Journal for Research in Mathematics Education, 30*(5), 520–540. https://doi.org/10.5951/jresematheduc.30.5.0520

[24] Mazzocco, M. M. M. (2007). Defining and differentiating mathematical learning disabilities and difficulties. In D. B. Berch & M. M. M. Mazzocco (Eds.), *Why is math so hard for some children?* (pp. 29–47). Paul H. Brookes.

[25] Ngirande, H., & Mutodi, P. (2014). Exploring mathematics anxiety: Mathematics students' experiences. *Mediterranean Journal of Social Sciences, 5*(1), 283–295. https://doi.org/10.5901/mjss.2014.v5n1p283

[26] Nuray, G., & Ozlem, U. (2007). Mathematics anxiety and attitude level of students of the faculty of economics and business administration. *International Mathematical Forum, 2*(3), 131–142.
[27] Pourmoslemi, A., Erfani, N., & Firoozfar, I. (2013). Mathematics anxiety, mathematics performance, and gender differences among undergraduate students. *International Journal of Scientific and Research Publications, 3*(7), 1–6.
[28] Reys, R. E., Suydam, M. N., & Lindquist, M. N. (1995). *Helping children learn mathematics.* Allyn & Bacon.
[29] Richardson, F. C., & Suinn, R. M. (1972). The Mathematics Anxiety Rating Scale. *Journal of Counseling Psychology, 19*(6), 551–554. https://doi.org/10.1037/h0033631
[30] Shaikh, S. N. (2013). Mathematics anxiety factors and their influence on performance in mathematics in selected international schools in Bangkok. *Journal of Education and Vocational Research, 4*(3), 77–85. https://doi.org/10.22610/jevr.v4i3.103
[31] Shanahan, K., Hermans, C., & Haytko, D. (2006). Overcoming apathy and classroom disconnect in marketing courses: Employing Karaoke Jeopardy as a content retention tool. *Marketing Education Review, 16*(1), 85–90. https://doi.org/10.1080/10528008.2006.11488944
[32] Sherard, W. H. (1981). Math anxiety in the classroom. *The Clearing House, 55*(3), 106–110. https://doi.org/10.1080/00098655.1981.10113725
[33] Siegler, R. S., & Booth, J. L. (2004). Development of numerical estimation in young children. *Child Development, 75*(2), 428–444. https://doi.org/10.1111/j.1467-8624.2004.00681.x
[34] Smith, M. R. (2004). *Math anxiety: Causes, effects, and preventative measures* [Senior thesis, Liberty University]. Liberty University.
[35] Steele, D. F., & Arth, A. A. (1998). Math instruction and assessment: Preventing anxiety, promoting confidence. *Schools in the Middle, 7*(4), 44–48.
[36] Tobias, S. (1990). Math anxiety: An update. *NACADA Journal, 10*(1), 47–50. https://doi.org/10.12930/0271-9517-10.1.47
[37] Tobias, S. (1993). *Overcoming math anxiety* (Rev. & expanded ed.). W. W. Norton.
[38] Turner, J. C., Midgley, C., Meyer, D. K., Gheen, M., Anderman, E. M., Kang, Y., et al. (2002). The classroom environment and students' reports of avoidance strategies in mathematics: A multimethod study. *Journal of Educational Psychology, 94*(1), 88–106. https://doi.org/10.1037/0022-0663.94.1.88
[39] Venkatesa, S., & Karimi, A. (2009). Mathematics anxiety, mathematics performance and overall academic performance in high school students. *Journal of the Indian Academy of Applied Psychology, 36*(1), 147–150.
[40] Zakaria, E., Mohd Zain, N., Ahmad, N. A., & Erlina, A. (2012). Mathematics anxiety and the achievement among secondary school students. *American Journal of Applied Sciences, 9*(11), 1828–1832. https://doi.org/10.3844/ajassp.2012.1828.1832
[41] Zettle, R. D., & Raines, S. J. (2000). The relationship of trait and test anxiety with mathematics anxiety. *College Student Journal, 34*(2), 246–258.