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Math Anxiety among Secondary School Students: Causes and Consequences in Azerbaijani Schools

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Statement of authenticity

I have read ADA University's policy on plagiarism and certify that, to the best of my knowledge, the content of this thesis, entitled "Math Anxiety among Secondary School Students: Causes and Consequences in Azerbaijani Schools", is all my own work and does not contain any unacknowledged work.

Hereby I declare that this master thesis, my original investigation and achievement, submitted for the master's degree at ADA University has not been submitted for any other degree or examination.

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Abstract

This study investigates the causes and consequences of math anxiety among lower secondary students (grades 5, 6, and 7) in Azerbaijan, with a particular focus on its cognitive, emotional, and environmental dimensions. Utilizing a mixed-methods research design, the study draws on the data collected from sixty student surveys and semi-structured interviews with six mathematics teachers across two schools in Baku, Azerbaijan. The research addresses three questions: What cognitive, environmental and social factors contribute to math anxiety? What are perceived influences of math anxiety on students' academic performance in mathematics? Are there any gender differences in students' experiences of math anxiety?

Findings of this study reveal that math anxiety is a prevalent and multifaceted phenomenon. Surveyed students commonly reported anxiety during high-stakes evaluations, often triggered by fear of mistakes, high parental expectations, and peer judgment. The teacher interviews supported these findings, highlighting emotional disengagement, avoidance behaviors, and cognitive overload as recurring issues. The study also found a negative correlation between math anxiety and performance; gender differences emerged as well, where female students were more likely to experience and internalize anxiety and exhibit emotional responses, while male students tended to mask their anxiety or disengage silently.

This research contributes local empirical evidence to the literature on math anxiety and underscores the need for targeted interventions. Recommendations include fostering a supportive classroom environment, promoting growth mindsets, and engaging parents in constructive dialogues. The study concludes with suggestions for further research, including further longitudinal and intervention-based studies to explore causality and effective strategies for reducing math anxiety.

Keywords: *math anxiety, student performance, math performance, cognitive factors, environmental influences, parental influences, gender differences, secondary education in Azerbaijan*

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Chapter 1: Introduction

Introduction

Mathematics can play a crucial role in shaping students' academic trajectories in Azerbaijan, where high achievement in this subject is encouraged. The popular consensus in the country (and in most countries), amongst wider society is that maths and sciences are the most important subjects in the school curriculum (Robinson, 2006). The study by Purbaningrum et al. (2023), is consistent with decades of past research, and highlights that there are many factors that affect math performance of the school students worldwide, including parental pressure, teacher expectations, peer influence, social stereotypes, performance-based praise and criticism, quality of teaching, access to resources, and students' prior knowledge. However, one crucial but often overlooked factor is math anxiety, a psychological condition that can severely hinder students' abilities to succeed (Eidlin-Levy et al., 2023).

This research aims to explore the prevalence, causes and impact of math anxiety among Azerbaijani secondary school students, which could limit students' academic potential and their career opportunities in some fields. To better understand the scope of math anxiety and its potential consequences, this study seeks to answer the questions (see Appendix A):

RQ1. What are the cognitive, environmental and social factors contributing to math anxiety of secondary level school students in Azerbaijan?

RQ2. What are the perceived influences of math anxiety on students' academic performance in Mathematics?

RQ3. Are there any gender differences in students' experiences of math anxiety?

The literature is reviewed in Chapter 2, with particular attention to the major theoretical frameworks explaining the development of math anxiety, including how it is experienced across different student demographics. Chapter 3 outlines the research methodology employed, including the sampling strategy, data collection tools, and analytical

procedures. Chapter 4 presents the findings from both the student surveys and teacher interviews. Chapter 5 offers a critical discussion of these findings in relation to the original research questions and existing literature, while Chapter 6 concludes the thesis by summarizing key insights, limitations, and suggesting directions for future research.

This study's exploration of math anxiety contributes not only to the existing body of research but also provides valuable insights for Azerbaijani educators, curriculum designers, and school psychological professionals regarding the need to address emotional well-being in the secondary-school system. A supportive learning environment is a must for students where they can develop a positive and confident relationship with mathematics going on to pursue careers in related fields.

Research Problem Statement

Despite its impact on student outcomes, math anxiety is under-studied in Azerbaijan. The issue is overshadowed by efforts to improve math curricula, with little attention given to the psychological well-being of students (Kazimli, 2023). As a secondary-level math teacher, I have noticed that many educators and curriculum designers concentrate primarily on covering content before the exams, often neglecting the considerable workload imposed on students. This focus on content delivery can lead to overwhelming demands, which in turn contribute to significant stress among students. This oversight may have far-reaching implications, particularly for students who may disengage from math-related subjects and careers due to the long-term effects of math anxiety. Complying with this, Eidlin-Levy et al. (2023) found that math anxiety directly predicted the frequency of math for high school and university students' career choices.

Chapter 2: Literature Review

This literature review examines current research on math anxiety, focusing on both global and local contexts to identify the themes on factors impacting students' math performance and the consequences math anxiety has on the math performance. One definition of math anxiety (MA) comes from Richardson and Suinn (1972), who described it 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" (p. 551). As definition suggests, there can be a significant impact of math anxiety upon academic performance that makes it essential to research and understand. In fact, Živković et al. (2023) showed a positive relation between enjoyment in math and math achievement, confirming the importance of positive emotions in improving math performace.

Where academic success in mathematics is emphasized, pressure on students to perform leads to increased levels of math anxiety. It becomes more than just a fear of failure encompassing a range of emotional responses that interfere with a student's performance. Pizzie (2022) mentions in his study that math anxiety negatively impacts performance, interfering with working memory and leading to decreased effectiveness in processing mathematical tasks. The study further suggests that beyond the emotional and physiological distress it causes, math anxiety leads to the impairment of mathematical reasoning and basic numeracy.

Internationally, math anxiety has been widely studied, with researchers finding a range of cognitive and environmental influences (discussed in the upcoming sections); however, local research in Azerbaijan remains limited. One notable exception is Kazimli (2023), who explored math anxiety among female students, noting that societal pressures and a lack of female role models in STEM fields contribute to heightened math anxiety among girls. This study aims to address the gap in Azerbaijani research by offering insights into the

manifestation and implications of math anxiety among Azerbaijani secondary school students.

This literature review follows Hart's (2018) literature review model and aims to analyze definitions, theoretical frameworks, contributing factors, and the impact of math anxiety on performance.

2.1. Definitions

What is MA (Math Anxiety)?

The academic exploration of math anxiety begins in 1954, when Mary Fides Gough coined the term "mathemaphobia" (p. 290) to capture the phobic reactions that many individuals experience toward mathematics. Richardson and Suinn (1972) are the scholars who created the first standardized scale to measure math anxiety. Buckley and Ribordy (1982) define math anxiety as an "…inconceivable dread of mathematics that can interfere with manipulating numbers and solving mathematical problems within a variety of everyday life and academic situations" (p.1).

According to Zay and Kurniasih, (2023) math anxiety is a globally prevalent issue among secondary school students. Despite this, MA is not recognized as a disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (Guze, 1995). However, research suggests that mathematics presents challenges severe enough to qualify as a genuine phobia for many individuals (Ashcraft & Ridley, 2005).

Given that this study focuses on secondary-level students in Azerbaijan, the scope of the research aligns with the country's definition of general secondary education which encompasses grades five through nine and is compulsory including the 9th grade. During this stage, students complete a final assessment, after which they receive an official state certificate, acknowledging their completion of general secondary education (Ministry of Education and Science, 2009).

Mathematics, as a subject, is the backbone of the STEM subjects, which stands for Science, Technology, Engineering, and Mathematics (Sanders, 2009). Science and Mathematics are at the forefront of STEM Education mainly because these are the most recognizable fields that most people can relate to in terms of academia (White, 2014).

2.2. Theoretical framework

This study primarily employs Cognitive Learning Theory to analyze math anxiety's impact on academic performance, with emphasis on Social Cognitive Theory and Behavioral Cognitive Theory as two branches. According to Dweck (2006), students' mindsets shape whether they approach learning goals with a positive or negative attitude, influencing the level of effort they put into achieving them. She argues that mindsets affect various areas of children's lives, including both their academic and athletic success. Above mentioned theories will provide a comprehensive lens for understanding both the cognitive disruptions and environmental influences linked to math anxiety and its consequences on the academic performance.

Behavioral Cognitive Theory, developed by Aaron Beck in 1960's, explores how external stimuli and internal responses are interconnected in learning environment of a student (Chand et al., 2023). In terms of anxiety, this theory addresses how anxiety interferes with cognitive functions, particularly working memory. Research by Ashcraft and Ridley (2005) and Ashcraft and Krause (2007) illustrates that math anxiety can impair working memory, thus limiting students' mathematical reasoning and problem-solving abilities. This interference in cognitive processing supports the idea that anxiety creates obstacles to math performance by disrupting working memory which is a key component in mathematical cognition (Ashcraft & Krause, 2007).

Social Cognitive Theory developed by Bandura in 1980s, highlights learning as a social process, shaped by interactions among individuals, their environment, and observed behaviors (Bandura & National Inst of Mental Health, 1986). This theory explores the role of

environmental and social influences on learning outcomes of students. Kazimli (2023) suggests that in Azerbaijani families, high expectations around grades can reinforce math anxiety, as girls especially feel pressure to excel academically to gain approval from teachers and family members. In the light of Social Cognitive theory, it is highlighted how family and teacher expectations can perpetuate stereotypes, which may lead to math anxiety.

When it comes to frameworks focused on MA directly, two primary frameworks, Deficit Theory of James Collins and the Debilitating Anxiety Model of Dewey Larson, offer insight into the cycle between math anxiety (MA) and academic performance (Samante & Alave, 2021). The Deficit Theory suggests that low initial performance can provoke anxiety, while the Debilitating Anxiety Model posits that anxiety itself leads to poorer future performance. Studies provide mixed support for each model, with some findings aligning with the Deficit Theory and others supporting the Debilitating Anxiety Model. Moreover, there is a third perspective as Reciprocal Theory, which suggests the existence of a bidirectional relationship between math anxiety (MA) and math performance, where poor performance can trigger MA, which in turn further impairs performance in a reinforcing cycle (Carey et al., 2016). For the summarized visual representation of these three models, see Appendix B.

2.3. Factors Contributing to Math Anxiety

In the literature, the studies show that MA emerges from a complex combination of cognitive, environmental, and social factors.

1. Cognitive Factors

Cognitive deficiencies in working memory and attentional biases significantly impact math anxiety (Ashcraft & Ridley, 2005). According to Beilock and Willingham (2014), individuals with math anxiety often experience feelings of tension, apprehension, and fear in various mathematical contexts. Rubinsten et al. (2015) mention that individuals with math anxiety demonstrate heightened focus on negative stimuli, which can exacerbate anxiety and

hinder cognitive processing. These cognitive disruptions contribute to rigid thinking and avoidance behaviors, as noted by Furner and Gonzalez-De Hass (2011), thereby making it challenging for students to engage in problem-solving.

One of the most significant cognitive factors contributing to math anxiety is the fear of failure. Students who underperform in mathematics often develop negative beliefs regarding their own competence, which consequently leads to the avoidance of mathematical tasks. Research suggests that this avoidance behavior is especially prevalent among learners who either fear the failure or consider mathematics as unimportant in their lives (Furner & Berman, 2005). The major characteristics of mathematics as subject, such as its emphasis on logic, precision, attention to detail and problem-solving, can also increase fear of failure in some students, resulting in a dislike or aversion towards the subject (Richardson & Suinn, 1972). Such emotional response not only discourages the students' effort and persistence but also reinforces a cycle in which their anxiety increases and performance decline. Supporting this negative correlation between MA and math performance, recent findings in Tanzania reveal that among many various causes of underachievement, fear of mathematics was the only factor with which majority of the respondents strongly agreed (Salahot, 2022). These findings suggest that cognitive perceptions of failure in mathematics are not only demotivating but also directly impact students' academic performance and emotional well-being in math learning process.

2. Environmental Factors

Environmental influences, such as teaching styles and parental expectations, play an essential role in shaping students' math anxiety. Chernoff and Stone (2014) point out that math anxiety mostly stems from the learning environment, including the teacher's authoritative approach, a focus on correct answers coupled with a fear of mistakes, pressure to provide the answer before the student feels prepared, and the potential judgment from peers as a result of a poor performance.

Unfortunately, sometimes the traditional teaching methods emphasize correct answers over mastery which can be a source of increased anxiety. Finlayson (2014) suggest that math anxiety often stems from the way students are taught math. Factors such as the teacher's authoritative style, the focus on correct answers, fear of making mistakes, pressure to respond quickly, and the risk of public critique from the classmates in traditional teaching settings can contribute to the increased math anxiety.

Additionally, parental influence plays a critical role in the development of math anxiety. Krpan (2018) concludes that children often enter school with math anxiety already instilled in them by their parents, which significantly intensifies their challenges in the classroom environment. This connection highlights the importance of recognizing both educational practices and family attitudes in understanding the causes of math anxiety among students.

3. Social Factors: Gender Influences

One noteworthy social factor contributing to math anxiety (MA) is gender influences. Many studies indicate that girls typically demonstrate higher levels of MA compared to boys (Hyde et al., 1990; Flessati & Jamieson, 1991; Pajares, 2004; Beilock et al., 2010; Bieg et al., 2015; Geary et al., 2019). These findings are often linked to gender stereotypes, which negatively affect female students' performance. For instance, Luo and Chen (2024) mention that "Specifically, female students who believe that boys are better at math than girls tend to achieve lower math scores compared to those who do not hold this belief. Moreover, this negative impact is particularly noticeable among female students in the lower-performing group" (p. 11). Such stereotypes can create a psychological phenomenon known as the self-fulfilling prophecy, which refers to "a false definition of the situation evoking a new behavior that makes the originally false conception come true" (Merton, 1948, p. 195).

Gender expectations and biases significantly influence math anxiety within the local context as well. Kazimli (2023) explains that stereotypes portraying girls as less capable in

mathematics, combined with family pressures and a lack of female role models, contribute to increased levels of MA among female students.

2.4. Impact on Academic Performance

From scholarly research findings, it is evident that math anxiety significantly affects academic performance, with notable correlations between high anxiety levels and poor academic outcomes. Ashcraft and Krause (2007) conclude that students with elevated math anxiety tend to perform poorly on standardized math tests. Suárez-Pellicioni et al. (2016) corroborate this negative association, noting that students with math anxiety consistently show lower achievement across educational levels. Such findings underscore the role of math anxiety in fostering avoidance behaviors. Ashcraft et al. (2007) conclude that math anxiety leads to math avoidance, which consequently can lead to a pattern where students avoid engaging with the subject as much as possible, often choosing not to take any math courses beyond what is required for graduation, thereby hindering their mathematical proficiency and opportunities for future academic or career advancement.

Furthermore, the implications of math anxiety extend to students' career choices. Megreya and Al-Emadi (2023) suggest that the students who track their careers in Arts related fields are the ones who have experienced higher levels of math anxiety back in school. This observation aligns with Kazimli's (2023) findings in the local context, which suggests that high school students in Azerbaijan frequently choose their career paths based on their strengths in particular subjects, resulting in a significant gender disparity in areas such as education and engineering, influenced by societal stereotypes and expectations.

2.5. Interventions and Coping Strategies

To address math anxiety, various strategies have been proposed in the global literature. For instance, Maloney and Beilock (2012) claim that if deficiencies in fundamental mathematical competencies make students more vulnerable to math anxiety, then the early identification of at-risk students and applying targeted exercises aimed at strengthening their

basic mathematical skills and managing their anxiety, could be beneficial. They suggest that enhancing foundational numerical and spatial processing skills may contribute to a reduction in the likelihood of developing math anxiety in the further stages.

Another coping strategy with MA is therapies aimed at reducing anxiety. Rubinstein et al. (2015) suggest that math anxiety could be tackled down through therapies designed to decrease the anxiety, such as cognitive behavioral therapy and exposure therapy in which people are being gradually exposed to the thing that they are afraid of, resulting in them being more comfortable in such settings.

2.6. Summary

The literature on math anxiety highlights a multifaceted issue influenced by cognitive limitations, environmental factors, and social factors. A critical gap exists in the studies on MA in Azerbaijan, highlighting the need for further research about the causes and consequences of it. This study addresses these gaps by examining math anxiety in Azerbaijani secondary schools, using the Cognitive Learning framework to provide insights into the psychological and academic dimensions of the matter. The findings from this research are expected to contribute to the academic understanding of math anxiety, the factors contributing to it, and its implications.

Chapter 3: Methodology

3.1 Research Objectives

The objective of this study was to examine the prevalence of math anxiety (MA) among lower secondary school students in Azerbaijan, explore its causes, and examine its perceived effects on the academic performance in mathematics. The study also aimed to address gender-related differences in math anxiety, based on the existing literature that

suggested higher MA rates among female students (Beilock et al., 2010; Bieg et al., 2015; Flessati & Jamieson, 1991; Geary et al., 2019; Hyde et al., 1990; Kazimli, 2023; Luo & Chen, 2024; Pajares, 2004). This chapter covers the research design, data collection methods, sampling strategies, analysis techniques, trustworthiness, ethical considerations, and limitations, ensuring a comprehensive and transparent methodology.

3.2 Research Design (see Appendix C)

Guided by an interpretivist research paradigm, the study aimed to explore how math anxiety is perceived and experienced by students within the educational context. This study employed the mixed-methods design, combining quantitative and qualitative data collection and analysis techniques to provide a comprehensive understanding of math anxiety (Creswell, 2014). The quantitative component involved analyzing scaled survey responses from students to identify patterns in math anxiety experiences of students and observation patterns of interviewed teachers. The qualitative component included student surveys with open-ended questions and semi-structured teacher interviews. According to Creswell (2014), qualitative methods allow for the exploration of complex phenomena in their natural context, enabling the researcher to examine the underlying experiences, perceptions, and dynamics that contribute to them. This approach makes it possible to investigate both the subjective experiences of math anxiety and its potential impact on academic performance. By gathering separate insights from students and teachers, the study aimed to capture perspectives from both sides on the causes and consequences of math anxiety. The decision to utilize student surveys and semi-structured teacher interviews was based on their ability to facilitate detailed, open-ended responses that encouraged participants to reflect on their experiences and observations, thereby providing a grounded understanding of their insights.

3.3 Research Site and Participants

The study focused on two schools in Baku, Azerbaijan: one private and one public. Convenience sampling was utilized for their selection, based on accessibility and practicality.

This decision was also guided by the need to capture a diverse range of educational experiences within the context of Azerbaijan's school system. The inclusion of both school types was intended to ensure contextual breadth, not to facilitate an analytical comparison between the two sectors. The aim was to explore common factors influencing students' math anxiety across different institutional settings, rather than conduct a comparative study. By examining math anxiety in these educational environments, the study sought to understand how various contextual factors may influence the prevalence and nature of math anxiety, without making direct comparisons between public and private school contexts.

Lower Secondary Focus

The study is limited to lower secondary level (grades 5, 6, and 7). These grades mark the transition from basic arithmetic to advanced mathematical concepts, a period where students' academic identities begin to form. Higher secondary students are excluded in this study, because grades 8 and 9 are primarily focused on preparing for final general secondary exams conducted by State Examination Center (SEC) and grades 10 and 11 are dedicated to undergraduate admission preparation (Order No. 13 of the President of the Republic of Azerbaijan, 2013). These higher secondary students may experience intense stress and anxiety related to exam preparation, which extends beyond the scope of math anxiety alone. The overwhelming academic burden at this stage, including preparing for high-stakes exams, could introduce confounding variables that are unrelated to math anxiety itself, making it difficult to isolate and study the specific effects of math anxiety during this period. Consequently, the study focuses on lower secondary students in grades 5 to 7 to ensure a clearer and more accurate analysis of math anxiety without the confounding influence of these broader academic pressures.

3.4. Sampling Strategy (see Appendix D)

Two schools (one public and one private, as mentioned before) were selected based on convenience sampling. This choice was largely influenced by practical considerations related to access to these schools.

In each school, student surveys and teacher interviews were conducted. For student surveys, a quota sampling was utilized to ensure balanced representation across grades and gender. Each school contributed with 30 students, with the equal distribution across grades 5, 6, and 7 (10 students per grade) and gender (5 boys and 5 girls in each grade).

For teacher interviews, purposeful sampling was used to select 3 math teachers from each school. Using this sampling method, teachers who regularly interacted with the selected grades (5, 6, and 7), had strong observation skills, and were confident with their ability to contribute to the research were prioritized.

3.5. Data Collection Methods

Student surveys and teacher interviews were utilized as data collection tools to capture both quantitative patterns and qualitative insights related to math anxiety. Surveys provided broad data on student experiences, while interviews offered in-depth perspectives from educators, allowing for more holistic understanding of the issue. The aim was to explore the cognitive and environmental factors contributing to math anxiety, its association with math performance, and any gendered differences in its manifestation.

1. Student surveys

Being the first phase of the data collection process, student surveys consisted of neutral, age-appropriate, and non-leading questions to ensure students feel comfortable and provide authentic responses. Given the sensitivity of the students' age group (11–13 years old), survey questions were carefully designed to avoid introducing the concept of math anxiety explicitly, so as not to influence or distress the students. Instead, questions indirectly explored their experiences and feelings about learning and performing in math (see Appendix E).

The survey responses were collected individually and anonymously to ensure confidentiality and encourage honest answers.

2. Teacher Interviews

The second part was semi-structured interviews with the math teachers from the same two schools. The goal was to get their reflections on students' experiences of math anxiety and its impacts on performance, as well as any observed gender differences.

The interviews were conducted in a conversational tone to create a collegial atmosphere, using the researcher's role as a math teacher. Teachers were asked open-ended, non-leading questions to obtain their professional observations on math performance trends, thoughts, and experiences. Interviews were audio-recorded with participants' consent and transcribed for analysis.

3.6 Data Analysis Techniques and Integration of Findings

Qualitatively, the analysis of the data obtained from both survey and interviews followed thematic and content analysis, a method for identifying and categorizing recurring themes within the qualitative data. According to Jowsey et al. (2021), thematic analysis is a flexible approach that allows researchers to interpret the qualitative data in a rigorous and structured manner. In addition, quantitatively, descriptive analysis of multiple-choice survey (MCQ) responses was conducted to identify patterns and trends in students' reported experiences with math anxiety, offering a complementary perspective to the qualitative findings.

The integration of student surveys and teacher interview data focused on identifying consistencies and discrepancies between the math anxiety experiences reflected by students and teachers' observations of related factors. For example, if students reported certain aspects of math learning, such as specific topics or classroom dynamics, as anxiety-triggering, teachers' insights on these topics were examined to see if they aligned with observed patterns in student behavior or performance. Similarly, if students self-reported any challenges in

particular types of tasks (e.g., timed quizzes or multi-step problem solving), teachers' reflections on how students approach these tasks were compared to identify any commonalities or differences in understanding.

Additionally, if any gendered differences were identified in student surveys regarding the sources or intensity of math anxiety, those were cross-referenced with teachers' observations about how boys and girls demonstrate anxiety-related behaviors in the classroom.

To sum up, this triangulation of the two sets of data provided a framework for exploring the complex relationship between emotional, cognitive and social factors related to math anxiety and its impact on students' academic outcomes.

3.7 Trustworthiness and Validity

Trustworthiness of this study was ensured by adopting strategies to establish the credibility, dependability, confirmability, and transferability of the findings. The credibility of the research was made sure through triangulation, which involved integrating multiple data sources such as student surveys and teacher interviews. Triangulation was used to enhance the reliability and validity of the research findings by corroborating data across student surveys and teacher interviews (Heale & Forbes, 2013), which maintained the reduction of the likelihood of bias and increase of confidence in the validity of results.

Peer review was conducted by academic supervisors, who critically evaluated the methodology, analysis, and conclusions of this research. Peer review involved presenting key research findings to experts in the field to gather constructive feedback, thus ensuring the study's credibility and quality (Kelly, et al., 2014) and providing the additional layer of validation, ensuring the research process complied with academic standards.

Confirmability was supported using an audit trail, where all decisions made during data collection, coding, and analysis were documented. Confirmability ensures that the study's results are objective and free from researcher bias, maintaining the trustworthiness of

the findings (Kakar, et al., 2023). An audit trail refers to a detailed record of the research process, including data collection and decision-making steps, providing transparency and allowing others to verify the research path (Merriam & Tisdell, 2016). The application of such transparency allowed any external reviewer to follow the research process and verify that the findings were coming from the data rather than researcher bias.

Dependability was further reinforced through consistent application of the coding framework during qualitative analysis, ensuring that identified themes accurately reflected participants' responses.

Adaptability is essential in research as it allows the study to remain responsive to new insights or emerging trends, enhancing its relevance and credibility (Martin et al., 2012). As the research progressed, the researcher remained responsive to new insights that arised from participants' feedback and interactions during the data collection process. This flexibility allowed for modifications in data collection methods or the reconsideration of questions if necessary, ensuring that the study remained relevant and accurately reflected participants' experiences. This adaptability contributed to the overall credibility of the study.

By implementing these measures, the study upheld its commitment to producing credible, dependable, and ethically sound findings to contribute to the understanding of math anxiety in the Azerbaijani educational context.

3.8 Ethical Considerations

This study adhered to the ethical guidelines outlined by the British Educational Research Association (BERA, 2024) to ensure the protection and rights of all participants. Informed consent was obtained from all participants, including the schools, students and teachers, before their inclusion in the study. For student participants, parental consent was also obtained through a detailed consent form outlining the study's objectives, procedures, and data usage. The consent forms clearly stated that participation was voluntary and that

participants had the right to withdraw at any point without any negative consequences (see Appendix F for consent forms).

Confidentiality was strictly maintained throughout the research process. Personal identifiers such as participant or school names were anonymized during data collection and analysis to protect the privacy of participants. Data was securely stored in password-protected files accessible only to the researcher. No information was shared with any third parties.

Moreover, transparency in data handling was prioritized. Participants were informed of how their data would be analyzed and reported. Additionally, they were informed of their right to access a summary of the research findings if they wished, further supporting the principle of transparency.

Respect for participants was made sure at all stages. The questions were designed to minimize discomfort or distress, and participants had the option to withdraw from the research, or to skip any questions they find sensitive to answer.

3.9 Limitations

Short Time Frame: A key limitation of this study is the two-month timeframe allocated for data collection and analysis. As Creswell (2014) notes, time limitations can affect the depth of data collection, potentially leading to missed opportunities for gathering comprehensive insights. With such a short period, the researcher might face challenges in fully exploring all perspectives, which could limit the depth of the findings and uncovering unexpected patterns or complex factors.

Sample Size and Scope: The study focused on two schools in Baku, which might limit the generalizability of its findings to other schools of Azerbaijan. As noted by Creswell (2014), a limited sample size and geographical focus can reduce the external validity of a study, as findings may not be representative of the broader population. In particular, the

exclusion of rural schools could result in findings that do not fully capture the diversity of student experiences with math anxiety.

Grade-Level Scope: By excluding upper secondary students, this study overlooked how older students experienced math anxiety. Research suggests that anxiety could evolve as students progress through their education, with upper secondary students facing more intense academic pressure due to exams (Ashcraft & Ridley, 2005). Therefore, excluding these grades might provide an incomplete understanding of how math anxiety impact students at different stages of their academic careers.

Self-Reporting Bias: Since the data collection involved student surveys, there was a potential for self-reporting bias. As highlighted by Podsakoff et al. (2003), self-reported data might be influenced by students' reluctance to disclose their true feelings or fear of stigma related to math anxiety. It could lead to underreporting or overreporting of math anxiety levels, which might affect the accuracy of the findings.

Despite these limitations, the methodology was designed to provide a detailed and reliable analysis of math anxiety among lower secondary students, which could serve as groundwork for further research in this topic.

Chapter 4: Findings

4.1. Student Survey Findings

This section presents an analysis of survey responses from 60 middle school students (grades 5, 6 and 7) about their experiences with math anxiety. Both quantitative (multiple-choice) data and qualitative (open-ended) responses were employed to identify overall anxiety levels, differences by gender and grade, common themes in student comments, and relationships between key factors. The findings were organized into thematic categories, with integrated quotes from respondents to illustrate points, and charts to visualize important trends.

Math Anxiety Trends

Most students reported experiencing some degree of math anxiety, especially in high-pressure situations like exams. When asked how they feel during math tests, out of 60 students, 63.3% described feeling anxious, using phrases like “nervous”, “so stressed”, or “a bit scared”. Only 13.3% reported feeling neutral or calm, and 10% described themselves as

confident (e.g., “Chill, no stress” or “not nervous at all”). This finding confirms that test-related anxiety is highly prevalent, while genuine calmness or confidence is present in only about one-fifth of students (see Appendix G for detailed table).

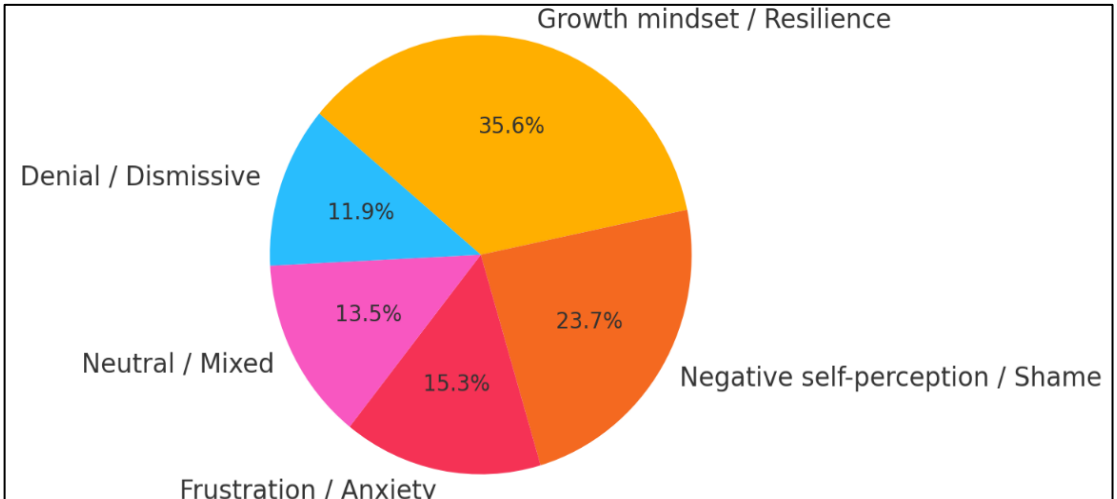
Math anxiety also emerged in everyday learning situations, though to a lesser extent. When confronting new math problems, student reactions were generally neutral to positive. Specifically, 36.7% reported feeling positive or very positive, and 46.7% felt neutral. Only a small share, 10.0% and 6.7%, expressed negative or very negative feelings, respectively. For instance, only two fifth-graders described their initial reactions to new problems as “very negative”, suggesting that strong anxiety in day-to-day tasks is relatively uncommon.

Students’ broader attitudes toward math compared to other school subjects reflected a similarly mixed pattern. 43.3% of students reported positive or very positive feelings toward math as a subject. However, 30.0% said their attitude was neutral or similar to other subjects, and 26.7% openly disliked math. These figures suggest that while many students appreciate or value math, a considerable portion remain either indifferent or discouraged by it.

Another key dimension of math anxiety is the emotional impact of making mistakes. Students’ responses showed that errors are often interpreted not just as academic setbacks, but as reflections of their intelligence or self-worth, especially under pressure. Open-ended answers revealed five clear emotional patterns: growth mindset, negative self-perception, frustration, neutral, denial. Below, see **Figure 1** for the percentage distribution among 60 students in these five patterns.

Figure 1

Emotional Responses to Math Mistakes



Based on the responses of the students to the survey question about their feelings when they make mistakes, it is found out that 36% of the students demonstrated a growth mindset, viewing mistakes as a normal and valuable part of learning. “Mistakes help me improve” many students said, with adding “I fix it and move on”. In contrast, 24% of students expressed shame or negative self-perception because of mistakes, using phrases like “I feel dumb”, “I’m not smart”, or “I disappointed my parents”. This group strongly links mistakes to personal failure and tends to internalize anxiety. Moreover, 15% associated mistakes with anxiety or frustration, especially in exam settings or when errors are repeated. “I get nervous when I make too many mistakes” said one respondent. Another noted: “I feel annoyed or discouraged”. Furthermore, 14% gave neutral or conditional responses, indicating that mistakes were acceptable in general but more distressing during formal evaluations. “I feel okay about them unless it’s a test” was a common comment regarding this portion. Lastly, 12% displayed a dismissive or emotionally detached attitude, downplaying the impact of errors. “Doesn’t bother me” was one of responses demonstrating this theme. Similarly, some students claimed, “I rarely make mistakes” or “Everyone makes mistakes, so what?”.

These findings highlight that while some students adopt a resilient mindset, a significant portion (almost 40%) experience mistakes as emotionally disruptive events, which increase their anxiety, especially when linked to fear of judgment or self-doubt.

Grade-Level Differences

Comparative analysis of student responses across Grades 5, 6, and 7 reveals developmental trends in both emotional attitudes toward mathematics and help-seeking

behaviors. These trends suggest that coping mechanisms evolve as students progress through middle school.

1. Emotional Attitudes Toward Mathematics: In Grade 5, students demonstrated the most polarized emotional responses to mathematics. Specifically, 40% of fifth-grade respondents described their attitude as “very positive”, with statements such as “I love math problems”. However, an equal proportion (40%) expressed a strong dislike for the subject, exemplified by comments such as “I dislike math because I feel weak at algebra”. Only 10% identified math as a “positive” subject, and another 10% viewed it as “similar” to others. This extreme variation may reflect the less stable self-concept typical of younger learners, which can manifest either as overconfidence or as heightened anxiety depending on personal experience and perceived competence.

By Grade 6, responses became more balanced and moderate. This time 30% of students described their attitude as “very positive”, while 15% chose “positive” and 20% reported a neutral stance. Although 35% still indicated dislike for math, several students qualified their responses in nuanced ways. For instance, one student noted, “I feel okay, I get help from my teacher or my mom” and another commented, “Sometimes I get bored, but mostly I like it”. This distribution suggests a gradual improvement in emotional regulation and confidence (compared to grade 5), which may indicate growing adaptation to academic demands in mathematics.

In Grade 7, responses trended further toward emotional neutrality. Here, 20% of students reported being “very positive” and another 20% were “positive”. However, the largest portion (35%) classified their attitude as “similar” to other subjects, and 25% expressed dislike. Students often used emotionally neutral or pragmatic language, such as “Math is okay, just like other subjects” or “I get help from support teachers, so it’s fine”. This shift may signal increased cognitive maturity and a more performance-oriented mindset.

2. Help-Seeking Behavior: Help-seeking behavior also varied across grade levels. In Grade 5, students primarily relied on informal sources for academic support. According to the survey data, among 5th graders, 20% received help from family members, and another 20% mentioned assistance from private or support teachers, and 35% used online tools such as ChatGPT. One student remarked, “I usually get help from my parents and the internet”, highlighting the accessibility and familiarity of these resources for younger students.

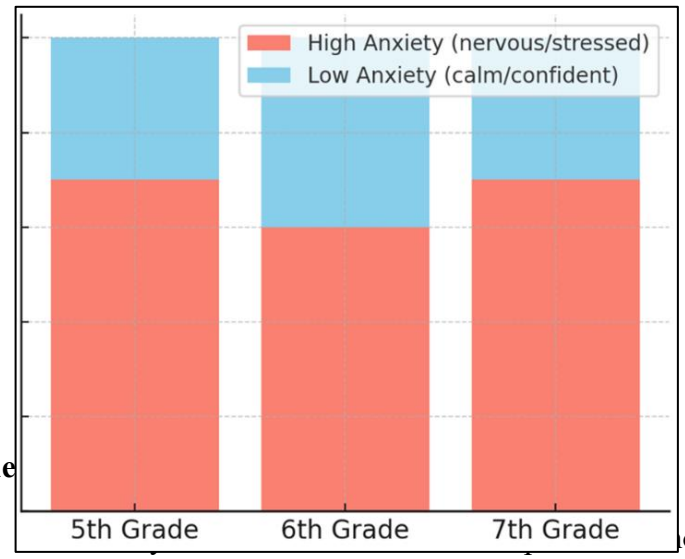
In Grade 6, help-seeking became more diversified. While 20% of students still cited parents or family as their primary source of help, 25% now reported turning to private tutors or structured academic support. This transitional pattern suggests that older students benefit more from formal assistance, even as they continue to rely on home-based resources.

By Grade 7, students demonstrated a notable shift toward professionalized academic support. Only 15% indicated that they primarily seek help from parents, while 35% mentioned reliance on private tutors or support teachers. Several students referred specifically to “support lessons” or “individualized tutoring”, suggesting a growing academic needs.

Two unexpected, but noteworthy results emerged in the comparison across grade levels. Firstly, math anxiety did not appear to increase sharply from Grade 5 to Grade 7, contrary to patterns observed in previous research (Devine et al., 2012; Ma, 1999), which often suggest a developmental rise in academic anxiety (see **Figure 2** below). Another unexpected finding was a strong presence of digital tools and AI platforms (e.g., ChatGPT, Gemini) as sources of academic support. Several students explicitly mentioned turning to these technologies when struggling with math, particularly in lower grades. Contrary to existing literature suggesting limited autonomous use of academic digital tools among younger students (Selwyn, 2016; Livingstone & Haddon, 2009), findings indicate that especially fifth graders are actively engaging with platforms like ChatGPT for problem-solving and support in math.

Figure 2

Math Anxiety Levels by Grade



Gendeow male and female students experience and express math anxiety. While both groups included students with a range of emotional responses, notable gendered trends emerged across multiple domains.

In terms of **exam-related anxiety**, 70% of girls reported feeling nervous during math tests, compared to 57% of boys who described themselves as less confident or anxious. Open-ended responses reinforced this disparity: several boys described their emotional state in neutral terms such as “not nervous” or “just normal”, whereas girls were more likely to report fear or tension in anticipation of assessments.

A similar gendered contrast was evident in **reactions to mistakes**. Among boys, 30% reported that mistakes did not bother them, while another 20% indicated they viewed mistakes as acceptable or part of the learning process. In contrast, 50% of girls described making mistakes in terms that indicated negative self-evaluation or emotional discomfort, often using language such as “dumb” or “sad”. These findings suggest that while a significant number of boys either externalize or dismiss errors, girls are more likely to internalize them, thereby amplifying their math anxiety.

Gender differences also manifested in **classroom participation**. Only 13% of boys stated that they rarely or never volunteered to solve problems at the board, whereas 27% of

girls reported similar reluctance. This discrepancy may reflect greater anxiety among female students about public performance or fear of being incorrect in front of peers.

Regarding **parental expectations**, both genders acknowledged external pressure, but the emotional intensity of their responses diverged. While 37% of boys admitted feeling pressure from parents, they typically offered non-emotive responses such as “They expect an A, and I know I will get it”. In contrast, 40% of girls wrote about parental expectations using emotionally charged language. For example, one seventh-grade girl stated that after being frequently reminded about math performance, “I started to hate math”. This pattern suggests that girls may be more sensitive to external academic expectations and more inclined to link those expectations to self-worth or emotional distress.

In terms of **self-perceived performance**, no significant gender gap emerged: 50% of both male and female students rated themselves as “above average” in mathematics. However, a gender gap was apparent in peer-based **help-seeking behavior**. While 23% of boys reported that they “always” collaborate with classmates to solve math problems, only 10% of girls reported the same. The majority of female students indicated less frequent peer interaction, citing either uncertainty or preference for teacher-led support.

Although these gender differences were evident, it is important to emphasize that the patterns reflect tendencies rather than fixed trends. For instance, several male students did express vulnerability, with one stating that he becomes “sad” when making mistakes and another reporting stress despite liking math. Similarly, a few female students reported high confidence in their mathematical ability, with one describing herself as “not nervous at all” during tests, and others linking their confidence to preparation and consistent academic success. Overall, male students demonstrated a slightly higher degree of self-assurance, whereas female students were more likely to express anxiety related to performance, public exposure, and social evaluation.

4.2. Teacher Interviews: Findings

This section presents findings from semi-structured interviews conducted with six secondary mathematics teachers. Their responses provide deeper insights into the emotional, cognitive, and environmental manifestations of math anxiety, as well as the social and pedagogical contexts that shape students' academic behavior. Thematic analysis of the data revealed several recurring patterns that relate to students' emotional regulation, learning behaviors, and classroom engagement (see Appendix H for thematic table of interview findings).

One prominent theme was **students' reliance on teacher support**. Teachers frequently described students as highly dependent on step-by-step guidance, lacking confidence to approach tasks independently. Teacher D commented, "They expect everything on the board to copy, no initiative", emphasizing the passivity that often accompanies anxious learners. The teacher suggested that this dependence suggests a lack of self-efficacy and highlights the importance of scaffolding in instruction for students with math anxiety.

In discussing **teaching styles**, teachers emphasized that certain pedagogical strategies either alleviate or exacerbate math anxiety. According to them, traditional, logic-heavy instruction tended to increase tension among students, particularly those who depend on rote memorization. Teacher C explained, "Students who rely heavily on memorization struggle more when they are expected to apply logic, especially when real-world application is required". Conversely, simplified instructions, visual aids, and reduction of time pressure were reported to help students manage stress, with Teacher B remarking, "Simplifying instructions and visuals reduces anxiety".

The role of **external pressure**, particularly from parents and peers, was another recurring theme. 4 teachers noted that students are usually burdened by expectations from home. Teacher B remarked, "Even before I distribute the exam papers, they tell how anxious they are about disappointing their parents". Additionally, according to teachers' responses, peer dynamics contributed to anxiety, especially in collaborative settings. According to

Teachers A and E, "…they hesitate in group tasks, worried they'll be wrong", illustrating that fear of judgment often inhibits participation.

Gender-based differences were also reported by teachers in how students express anxiety. Teachers noted that girls tend to internalize academic pressure, often seeking reassurance or withdrawing from participation, while boys are more likely to mask discomfort through disinterest or avoidance. For example, Teacher E stated, "Girls tear up or go quiet. Boys avoid admitting confusion" and Teacher F noted, "Girls hesitate at the board, even when they know the answer". These gendered expressions align with broader social patterns in emotional responses and suggest the need for differentiated support strategies.

Finally, the interview insights confirmed that math anxiety had an impact on **academic performance**, particularly in high-pressure contexts. Teachers widely agreed that timed quizzes, board work, and spatial reasoning tasks such as geometry frequently triggered performance declines. "Timed quizzes are the worst, they freeze up", observed Teacher D. Similarly, Teachers A and B noted, "The fear of being wrong in front of others paralyzes them", reinforcing how anxiety undermines even well-prepared students in public problem-solving situations. Teacher F added that geometry and spatial measurement tasks "seem to trigger more anxiety because students can't visualize the problems", highlighting specific content areas that provoke heightened stress.

In summary, the teacher interviews suggest that math anxiety is multidimensional, characterized by behavioral avoidance, emotional self-doubt, physical symptoms, and social inhibition. Responses include simplified and visual instruction, supportive classroom dynamics, and sensitivity to both social-emotional and gender-specific experiences as strategies to decrease MA. Teachers emphasized the importance of structured guidance and contextual awareness in reducing anxiety and improving student engagement and performance in mathematics.

Chapter 5: Discussion

The discussion of this study's findings is organized around the its three research questions (RQ1, RQ2, RQ3) to directly address each facet of math anxiety investigated. By structuring the analysis by research question, it integrates both student survey findings and teacher interview insights, providing a comprehensive interpretation of the results. In the following sections, each research question (RQ) is discussed in turn, with a focus on interpreting the findings, comparing student and teacher perspectives, and relating them to broader educational contexts.

5.1. RQ1: What are the cognitive, environmental and social factors contributing to math anxiety of secondary level school students in Azerbaijan?

1. Fear of mistakes and self-image. Both students and teachers identified a profound fear of making mistakes as a core component of math anxiety. Students' open-ended responses revealed that some of them (14) equate mathematical mistakes with personal failure or lack of intelligence. Phrases such as "I feel dumb", "disappointed in myself", and "not smart enough" were common, indicating a widespread fixed mindset linking math success to innate ability. This mindset manifests as low self-confidence and negative self-talk: anxious students tend to second-guess themselves even when their approach is correct. Teacher participants corroborated this finding, observing that anxious learners often hesitate or freeze when asked to solve problems in front of the class. The emotional weight of mistakes is evident: students experience frustration and embarrassment, and even high-achieving individuals can succumb to anxiety-induced self-doubt in high-pressure settings. Approximately 50% of students reported emotional discomfort when making mistakes, often describing feelings of incompetence or shame. Notably, a smaller group, roughly 35%,

espoused a more growth-oriented attitude (e.g., viewing mistakes as "normal" or learning opportunities), and these students generally rated their performance more positively. This contrast suggests that students with a growth mindset are buffered against anxiety, whereas those who interpret errors as failures experience more intense fear. These findings align with research by Dweck (2006) and Finlayson (2014), who emphasize the role of mindset in shaping students' academic resilience and stress response. In sum, cognitive beliefs about mistakes and resulting emotions (shame, fear of judgment) emerged as key internal factors fueling math anxiety. This pattern is consistent with broader literature linking self-efficacy and mindset to academic stress, suggesting that strong self-confidence and resilience to errors tend to mitigate anxiety, while a poor self-image amplifies it (Ashcraft et al., 2007).

2. Teaching styles. The study found that teaching styles significantly influence students' experiences of math anxiety, as reflected in both teacher interviews and student responses. The interviewed teachers consistently highlighted the impact of instructional approaches and classroom dynamics on students' emotional engagement. For instance, as some mentioned, "students who rely heavily on memorization struggle more when they are expected to apply logic", suggesting that traditional, logic-heavy instruction can lower the performance, leading to the heighten anxiety in students accustomed to memorized learning. And most of the teachers had a consensus that simplifying instructions, using visuals, and reducing the amount of time pressure can help students who experience anxiety, showing how responsive teaching can mitigate stress. Student open-ended responses further illustrated this dynamic. One student wrote, "When I make a mistake on the board, I want to cry because Ms. Z looks at me sooo angrily". This finding aligns with Chernoff and Stone's (2014) argument that math anxiety often stems from environmental conditions, especially when teaching is overly authoritative, overly focused on correctness, or dismissive of mistakes. In contrast, another student shared, "I feel okay when I make a mistake because my teacher always helps me to correct it" and another expressed, "I love math because I have the best

math teacher in the world", pointing to the positive effects of emotionally supportive teaching. Together, these findings reinforce the literature's emphasis on environmental influences, particularly teaching style, as a key factor in either intensifying or alleviating math anxiety in students (Carey et al., 2016).

3. Parental pressure. Outside the individual's mindset, the environmental context plays a significant role in math anxiety. A particularly important factor is parental expectations and pressure. A majority of surveyed students responded "yes" when asked if their parents have expectations for their math performance, and many described these expectations as very high (often expecting an "A" or "A*" grade). The students' emotional reactions to this pressure ranged from motivation to stress. Some students did not take parental demands very seriously; for example, a few (mostly boys) responded that while their parents expect top grades, "it doesn't bother" them or they simply "do their best". However, more students reported feeling "sad", "bad", or under "a lot of pressure" due to fears of disappointing their parents. One student even wrote, jokingly but revealingly, that if he scored below 70%, it would be "bye to me", implying extreme consequences at home. These comments demonstrate how fear of parental disappointment contributes to emotional strain. The teachers also confirmed that parental pressure is a double-edged sword: while high expectations can motivate some students, they frequently observed that students facing intense, rigid expectations from parents exhibited higher anxiety and emotional distress. In the interviews, teachers noted that these students tend to react more strongly to setbacks; for instance, a low grade might trigger worry or defeat because the child anticipates a negative parental reaction. This evidence from both data sources suggests that parental behavior and communication styles significantly influence students' math-related emotional well-being. Supportive, understanding parents can boost a student's confidence, whereas extremely demanding or comparison-driven parents may instill fear of failure in math. These findings

align with earlier studies emphasizing the emotional weight of parental influence on math anxiety (Rubinsten et al., 2015; Živković et al., 2023).

4. Classroom climate and peer influences. Within school, the classroom environment and peer interactions are other critical environmental factors. While students did not often explicitly discuss general classroom atmosphere in the surveys, teachers strongly emphasized its role. Classroom climates that foster open dialogue, allow for mistakes, and reduce time pressure were associated with lower anxiety levels. In contrast, rigid, high-pressure settings tended to heighten stress, especially among students with lower confidence. Teachers observed that many anxious students avoided volunteering to answer questions or work at the board. For instance, by seventh grade, a greater number of girls than boys reported "never" or "rarely" volunteering, suggesting that a portion of the class (particularly female students) felt uncomfortable or afraid of public mistakes. Teachers described this public exposure, such as solving problems at the board, as a frequent anxiety trigger. Teacher A explained that students "hesitate in group tasks, worried they'll be wrong" and Teacher F noted that "girls hesitate at the board, even when they know the answer". These remarks reflect the performance-based fear that permeates classrooms where mistakes are penalized socially. Teachers also noted a reluctance among boys to seek help from classmates, suggesting that some male students feel compelled to maintain an image of capability, even at the expense of learning. Although peer influence can at times be a source of academic support, for highly anxious students it appears to be a source of judgment and discomfort. This emerging insight, specifically the role of classroom environment, adds nuance to existing models of math anxiety, suggesting that instructional tone and peer dynamics play a moderating role (Krpan, 2018).

In summary, several cognitive, environmental and social factors such as fear of making mistakes, teaching styles, parental expectations, classroom practices, and peer dynamics interact with students' cognitive beliefs and emotional regulation to shape the

intensity of math anxiety. The data suggest that supportive and understanding environments at home and in school can help reduce anxiety, while judgmental, rigid, or high-pressure settings tend to amplify it. Therefore, RQ1 findings confirm that math anxiety is a product of both internal and external influences. Thus, effective interventions must address both domains: encouraging a growth mindset and emotional resilience in students, as well as guiding teachers and parents toward creating environments that prioritize learning over performance. These conclusions are in strong agreement with the existing literature on mindset, anxiety, and school culture (Dweck, 2006; Finlayson, 2014; Krpan, 2018; Rubinsten et al., 2015; Živković et al., 2023).

5. 2. RQ2: What are the perceived influences of math anxiety on students' academic performance in Mathematics?

Math anxiety does not only influence how students feel, it also has tangible consequences on their academic performance. The student survey data and teacher interviews together paint a clear picture of an inverse relationship between anxiety and performance in math. In general, the surveyed students who reported higher anxiety tended to rate their own math performance lower, and specific anxieties, especially during exams, often translated into difficulties demonstrating their knowledge under pressure.

Impact on test performance

One of the clearest links between anxiety and performance emerged in the context of exams and other evaluations. Surveyed students described math tests as a significant stressor, 63.3% admitted feeling very nervous, "stressed" or even "scared" before and during exams. This anxiety is not a vague discomfort, it is usually tied to concrete performance fears, such as "what I will do if I get a bad grade". As a result, anxious students may approach tests with a sense of nervousness, which can undermine their test-taking abilities. Interviewed teachers provided powerful corroborating evidence of this phenomenon. All the interviewed teachers observed that students with high math anxiety often perform below their actual ability level in

high-stakes situations. They recounted how some learners who can solve problems during regular practice or understand the material well would “blank out” or forget steps when facing timed exams or when asked to solve a problem in front of the class. Common outcomes of anxiety noted by teachers include skipping important steps in a solution, making arithmetic mistakes they wouldn’t usually make, or being unable to start a problem despite knowing the first steps. These performance disruptions are often rooted in cognitive overload, a state in which excessive anxiety consumes the working memory resources students would otherwise use to solve math problems (Ashcraft & Ridley, 2005). As Pizzie (2022) notes, anxiety significantly interferes with cognitive processing, particularly under pressure. This pattern also aligns with the cognitive interference theory proposed by Ashcraft and Ridley (2005), which suggests that anxiety reduces working memory capacity during complex tasks. In sum, the qualitative evidence supports what quantitative trends hinted at, students with higher anxiety, especially in exam contexts, tend to perform more poorly than their less anxious peers. This establishes a negative feedback loop, in which underperformance reinforces the very anxiety that caused it (Ashcraft and Krause, 2007).

Furthermore, certain types of performance measurements seem especially affected by anxiety. Both students and teachers noted that timed tasks and public performance exacerbate stress. From the student perspective, knowing that an exam clock is ticking or that others might be comparing scores contributes to pressure. The teachers similarly observed that oral performances, like working at the board or answering aloud, are particularly challenging for anxious students. These students often freeze in front of their peers, even if they understand the material. Additionally, the teachers pointed out that multi-step or abstract problems, such as algebraic equations or geometry tasks requiring spatial reasoning, often trigger anxiety and higher error rates. Although the student surveys did not probe content areas specifically, the teacher insights imply that anxiety can disproportionately impair performance on cognitively demanding or layered tasks.

Coping strategies and support

Despite the negative impact of anxiety, the findings also highlight the ways students attempt to manage it and how support systems influence outcomes. Several students mentioned that thorough preparation helped reduce stress. One student, for example, noted feeling confident "if I am fully prepared, I feel good", suggesting that mastery helps to defeat anxiety. Others described practical cognitive strategies such as "trying not to stress before exams" or deliberately focusing on the task rather than on the possible consequences, reflecting mindful approach. These tactics reported by students indicate a strong awareness of the anxiety-performance relationship and reflect common coping mechanisms centered around preparedness, focus, and emotion regulation.

From the teachers' perspective, external support is key to mitigating the performance-related effects of math anxiety. Teachers highlighted that students perform better when instructional conditions are flexible and emotionally safe, such as offering additional time or reassurance. This insight is consistent with the survey findings, students who reported multiple sources of support, e.g., teachers, parents, tutors, peers, or tools like ChatGPT, also reported stronger confidence and perceived achievement. In contrast, a small subgroup, 5%, reported having no accessible support system, these students described the highest levels of anxiety and the lowest levels of academic confidence. This sharp contrast illustrates that access to reliable support can buffer the cognitive impact of anxiety and facilitate better performance under stress.

In summary, the findings for RQ2 indicate that math anxiety and academic performance are inversely related, higher anxiety impairs concentration, disrupts working memory, and leads to lower performance, particularly in high-pressure settings like exams and oral problem-solving. This relationship is well-supported by the literature on cognitive interference and performance breakdown under stress (Ashcraft and Krause, 2007; Ashcraft and Ridley, 2005; Pizzie, 2022). However, students are not passive in this equation, many

actively engage in coping strategies, and those who have access to consistent academic support tend to manage their anxiety more effectively. These findings suggest that improving math performance requires more than skill-building, it also involves anxiety-reduction practices, access to help, and classroom environments that emphasize understanding over speed or perfection.

RQ3: Are there any gender differences in students' experiences of math anxiety?

The third research question examined whether math anxiety is experienced differently by male and female students. The survey and interview data together suggest that gender does play a role in how students internalize and express math anxiety, although it is important to note that both girls and boys in this study experience anxiety to varying degrees. The differences observed are more about degree and manifestation: female students more openly reported anxiety-related behaviors and feelings, while male students often presented as more confident or less visibly anxious, even if they were struggling. These findings mirror broader trends noted in educational research, which show that girls are more likely to report academic anxiety and lower self-confidence in STEM subjects despite equivalent performance (Luo & Chen, 2024; Hyde et al., 1990; Beilock et al., 2010).

Female students and math anxiety.

Across multiple indicators, female students in the survey showed higher levels of math anxiety. For instance, 70% of girls reported feeling nervous before math tests, compared to 57% of boys. Girls were also more likely to report negative emotions tied to making mistakes; among the students who described feeling "not smart", "dumb", or "disappointed" when making an error, often linking mistakes directly to self-worth, female students constitute 65%, compared to boys, 35%. Qualitative responses frequently included strong emotional language. Some girls wrote that their parents' constant focus on grades made them "start to hate" math or feel that they "can't express" themselves during lessons. This suggests

that, for many girls, math anxiety is deeply intertwined with self-esteem and fear of judgment, consistent with findings by Pajares (2004) and Flessati and Jamieson (1991).

Teachers confirmed this tendency, noting that anxious girls tend to ask for clarification and openly express their worries. They were often described as attentive and active in small group work, but hesitant to take on public tasks. As mentioned in Findings section about the gendered differences, girls reported more "never" or "rarely" volunteering to answer questions at the board, compared to boys. The teachers attributed this to a lack of confidence or fear of making mistakes in front of others, rather than actual lack of knowledge. Several girls were reported to avoid participation unless they were completely sure of their answer, reflecting a form of perfectionism that aligns with their expressed anxiety.

Male students and math anxiety.

In contrast, male students on average displayed a more confident or casual attitude toward math challenges, though this did not mean they were unaffected by anxiety. Around 43% of boys still reported feeling nervous before math exams, but their open-ended responses rarely included strong emotional language. When asked about parental expectations, 33% of boys acknowledged pressure but often minimized its emotional impact with responses like, "Yes, but it doesn't bother me" or "I am just doing my best". These comments suggest a tendency to downplay discomfort, possibly influenced by gender norms, discourage emotional expression (Flessati & Jamieson, 1991).

Teacher interviews revealed that boys were often reluctant to seek help when they did not understand a concept. One teacher observed that "boys avoid admitting confusion" and instead might withdraw or make jokes to mask uncertainty. Male students were also observed to make mistakes more often under observation, and teachers linked this to the rushed or careless performance when being watched.

A few boys did acknowledge anxiety more directly. For instance, 10% explicitly mentioned seeking support from classmates or online tools, suggesting variability in coping approaches among male students. Nonetheless, the overall pattern remained: boys were less likely to articulate academic fear and more likely to defeat it. These differences support existing literature on gendered coping responses to school-based stress (Beilock et al., 2010; Hyde et al., 1990).

Taken together, the gender differences in this study revolve less around actual ability and more around the differences between genders regarding their emotional processing and outward expression of math anxiety. Girls were more likely to report anxiety openly, fear public failure, and link their academic success to self-worth. Boys, in contrast, tended to underreport anxiety, avoid help-seeking, and emphasize self-reliance, even when that led to performance errors. These patterns reflect broader social dynamics and may also be shaped by cultural stereotypes. In the Azerbaijani context, as in some other cultures, girls may be socialized to internalize responsibility and strive for perfection, while boys may feel pressure to appear confident and emotionally detached.

In conclusion, answer to the RQ3 highlights that the gender has a role in how math anxiety is experienced, expressed, and responded to in classroom contexts. While both girls and boys face math-related stress, their behaviors and coping mechanisms differ from each other. These insights emphasize the importance of gender-sensitive approaches in addressing math anxiety, such as building safe environments for girls to take academic risks and encouraging boys to seek support without stigma. Tailoring support strategies in light of these differences may help all students manage math anxiety more effectively and equitably (Kazimli, 2023; Luo & Chen, 2024; Beilock et al., 2010).

The discussion of the three research questions provides a multidimensional understanding of how math anxiety is experienced among secondary school students in Azerbaijan. Factors such as fear of making mistakes, low self-confidence, high parental

expectations, teachers' role and peer dynamics were found to be central in shaping students' math anxiety (RQ1). The influence of anxiety extended beyond emotions to academic outcomes: students with higher anxiety, especially in test settings, demonstrated reduced concentration, skipped steps, and made more errors (RQ2). These performance issues were not a result of poor ability, but rather reflected cognitive overload and panic, consistent with established findings in the literature. Gender-based patterns (RQ3) revealed that while both girls and boys are affected by math anxiety, they express and manage it differently. Female students were more likely to report anxiety openly, link success to self-worth, and avoid public participation out of fear of mistakes. Male students, in contrast, often downplayed their anxiety, avoided help-seeking, and attempted to maintain a confident image, sometimes at the expense of accuracy. These gendered behaviors were shaped in part by sociocultural norms and expectations (Kazimli, 2023). Together, the findings underscore that math anxiety is a complex and contextually embedded phenomenon, which requires both academic and emotional support. Addressing it effectively will demand interventions that are not only pedagogically sound, but also sensitive to students' psychological needs, social environments, and identity-related experiences.

The findings of this study align meaningfully with several theoretical models introduced in the literature review, offering a robust framework for understanding math anxiety among secondary school students. First, Social Cognitive Theory helps explain how environmental pressures, such as parental expectations and classroom dynamics, interact with individual self-beliefs to generate anxiety. The study revealed that many students internalized fear of failure due to high external expectations and peer judgment, and that gendered socialization shaped how boys and girls responded to these pressures, aligning with Bandura's (1986) emphasis on the social origins of cognitive-emotional processes. Second, the findings support Behavioral Cognitive Theory, particularly in showing how anxiety impairs students' cognitive functions. Students who reported high anxiety during exams often

experienced disrupted concentration, skipped procedural steps, and forgot methods they normally understood. These findings reflect the model's assertion that anxiety compromises working memory and executive functioning, consistent with the work of Ashcraft and Krause (2007). Third, the study strongly supports the Reciprocal Theory, which views the relationship between anxiety and academic performance as cyclical. Evidence from both students and teachers illustrated a feedback loop in which anxiety undermines performance, which in turn reinforces further anxiety, which is complying with Ashcraft and Krause's (2007) findings. Together, these theoretical lenses not only validate the observed experiences of Azerbaijani students but also emphasize the need for comprehensive interventions that target both emotional resilience and structural support to disrupt this cycle.

Chapter 6: Conclusion

Implications

This thesis explored the nature, causes, and academic consequences of math anxiety among lower secondary students in Azerbaijan by drawing conclusions from student survey and teacher interview findings to address three central research questions. The findings provide a detailed understanding of how math anxiety manifests in classroom settings, how it influences academic performance, and how gender may shape the experience of it. Together,

the results contribute to the limited literature on student emotional well-being in mathematics education within the Azerbaijani context.

The first research question focused on the cognitive, emotional, and environmental factors contributing to math anxiety. The data revealed that students' anxiety often stems from internal pressures such as fear of failure and low self-confidence, as well as external factors including parental expectations, teaching styles, and classroom dynamics. Many students associated mistakes with personal incompetence, and environments emphasizing speed and public performance increased their discomfort. On the other hand, emotional support was perceived to decrease the anxiety. This dual role of internal and external influences highlights the complex origins of math anxiety and suggests that solving it requires a combination of supportive teaching methods and efforts to improve how students think and feel about math.

The second research question examined the relationship between math anxiety and academic performance. The evidence suggests that anxiety decreases students' ability to perform under pressure, particularly in test situations and public tasks such as board work. Students reported blanking out, skipping steps, or making avoidable errors when anxious, while teachers observed that even capable students could struggle to demonstrate knowledge in evaluative settings. These performance limitations appeared not to stem from gaps in understanding but from the disruptive cognitive effects of anxiety. This conclusion means that the performance and emotional well-being are deeply related in the learning process.

The third research question investigated gender-based differences in the experience and expression of math anxiety. While students of both genders expressed anxiety, girls were more likely to report negative emotions and to hesitate in classroom participation, whereas boys often appeared to be a confident and were less open about their discomfort. These findings reflect both personal dispositions and broader social expectations around academic competence and emotional expression. Although not universal, these trends suggest that

interventions may benefit from being gender-sensitive, helping all students regardless of gender to develop healthy strategies for managing anxiety.

This study has several implications. First, the evidence affirms that math anxiety is a significant barrier to learning and academic success. Second, it underscores the importance of supportive classroom environments where mistakes are normalized, help-seeking is encouraged, and emotional safety is prioritized. Third, the findings suggest that effective responses must involve multiple stakeholders – teachers, parents, and curriculum developers – all of whom influence the psychological landscape in which students learn math.

Limitations

There are several limitations of this study to consider. The study was based on a relatively small, non-random sample from two urban schools, which limits the generalizability of the findings. The use of self-reported data, while rich in subjective insight, carries potential for bias; particularly the students' performance evaluations were based on perception rather than objective test data. Moreover, due to the cross-sectional design and time constraints of this study, it was not possible to assess how students' anxiety levels or performance might change over time, even though the nature of the topic suggests that such changes are important to explore (Ashcraft & Ridley, 2005).

Future Research Implications

Future research could build on this foundation by expanding to a broader, more diverse sample that includes rural schools and a wider range of socioeconomic backgrounds. Longitudinal studies tracking anxiety and academic outcomes over time would also offer valuable insight. In addition, intervention-based research which would explore the impact of specific strategies such as teacher training, parent-child communication trainings, and student coping techniques could help determine how to support students emotionally and academically. Exploring social and cultural influences on math anxiety, especially in relation

to gender norms and achievement pressure, would also deepen the understanding of this issue.

In summary, this thesis highlights the need to view math anxiety not as a peripheral concern but as a central issue in students' academic development. While the condition is widespread, it is also addressable. By paying closer attention to the emotional dimensions of learning, educators and policymakers can contribute to more inclusive, supportive, and effective math education practices.

References

Ashcraft, M. H., & Krause, J. A. (2007). Working memory, math performance, and math anxiety. *Psychonomic Bulletin & Review, 14*(2), 243–248.

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? The nature and origins of mathematical learning difficulties and disabilities*. Paul H. Brookes Publishing. pp. 329–348

Ashcraft, M. H., & Ridley, K. S. (2005). Math anxiety and its cognitive consequences: A tutorial review. In J. I. D. Campbell (Ed.), *Handbook of mathematical cognition* Psychology Press. pp. 315–327

Bandura, A., & National Inst of Mental Health. (1986). Social foundations of thought and action: A social cognitive theory. Prentice-Hall, Inc.

Beilock, S. L., & Willingham, D. (2014). Ask the cognitive scientist-math anxiety: Can teachers help students reduce it? *American Educator, 38*, 28-33. https://eric.ed.gov/?id=EJ1043398

Beilock, S. L., Gunderson, E. A., Ramirez, G., & Levine, S. C. (2010). Female teachers' math anxiety affects girls' math achievement. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 107*(5), 1860–1863. https://doi.org/10.1073/pnas.0910967107

Bieg, M., Goetz, T., Wolter, I., & Hall, N. C. (2015). Gender stereotype endorsement differentially predicts girls' and boys' trait-state discrepancy in math anxiety. *Frontiers in Psychology, 6*, 1404. https://doi.org/10.3389/fpsyg.2015.01404

British Educational Research Association [BERA]. (2024). Ethical Guidelines for Educational Research (5th ed.). https://www.bera.ac.uk/publication/ethical-guidelines-for-educational-research-fifth-edition-2024

Buckley, P., & Ribordy, S.C. (1982). *Mathematics anxiety and the effects of evaluative instructions on math performance*. Publisher?

Carey, E., Hill, F., Devine, A., & Szűcs, D. (2016). The Chicken or the Egg? The Direction of the Relationship Between Mathematics Anxiety and Mathematics Performance. *Frontiers in Psychology, 6*. https://doi.org/10.3389/fpsyg.2015.01987

Chand, S. P., Kuckel, D. P., & Huecker, M. R. (2023). Cognitive Behavior Therapy. *StatPearls*. https://www.ncbi.nlm.nih.gov/books/NBK470241/

Chernoff, E. J., & Stone, M. (2014). An examination of math anxiety research. *Gazette - Ontario Association for Mathematics, 52*(4), 29-31. https://ada.idm.oclc.org/login?url=https://www.proquest.com/scholarly-journals/examination-math-anxiety-research/docview/1563633518/se-2

Creswell, J. W. (2014). Research Design: Qualitative, Quantitative and Mixed Methods Approaches (4th ed.). Thousand Oaks, CA: Sage.

Devine, A., Fawcett, K., & Szűcs, D. (2012). Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. *Behav Brain Funct* 8*, 33.* https://doi.org/10.1186/1744-9081-8-33

Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random House.

Eidlin-Levy, H., Avraham, E., Fares, L., & Rubinsten, O. (2023). Math anxiety affects career choices during development. *International Journal of STEM Education*, *10*(1). https://doi.org/10.1186/s40594-023-00441-8

Finlayson, M. (2014). Addressing math anxiety in the classroom. *Improving Schools, 17*(1), 99-115. https://doi.org/10.1177/1365480214521457

Flessati, S. L., & Jamieson, J. (1991). Gender differences in mathematics anxiety: An artifact of response bias? *Anxiety Research, 3*(4), 303–312. https://doi.org/10.1080/08917779108248759

Furner, J., & Berman, B. (2005). Confidence in their ability to do mathematics: The need to eradicate math anxiety so our future students can successfully compete in a high-tech, globally competitive world. *Dimensions in Mathematics, 18*(1), 28-31 https://www.exeter.ac.uk/research/groups/education/pmej/pome18/furner_math_anxiety_2.htm

Furner, J. M., & Gonzalez-DeHass, A. (2011). How do students' mastery and performance goals relate to math anxiety? *Eurasia Journal of Mathematics, Science & Technology Education, 7*(4), 227–242. https://doi.org/10.12973/ejmste/75209

Geary, D. C., Hoard, M. K., Nugent, L., Chu, F., Scofield, J. E., & Hibbard, D. F. (2019). Sex Differences in Mathematics Anxiety and Attitudes: Concurrent and Longitudinal Relations to Mathematical Competence. *Journal of Educational Psychology, 111*(8), 1447–1461. https://doi.org/10.1037/edu0000355

Goetz, T., Bieg, M., Lüdtke, O., Pekrun, R., & Hall, N. C. (2013). Do girls really experience more anxiety in mathematics? *Psychological Science*, *24*(open in a new window), 2079–2087. https://doi.org/10.1177/0956797613486989

Gough, Sister Mary Fides, O. P. (1954). Why Failures in Mathematics? Mathemaphobia: Causes and Treatments. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 28*(5), 290–294. https://doi.org/10.1080/00098655.1954.11476830

Hart, C. (2018). *Doing A Literature Review: Releasing the Research Imagination*. SAGE Publications.

Heale, R., & Forbes, D. (2013). Understanding triangulation in research. *Evidence-based nursing*, *16*(4), 98. https://doi.org/10.1136/eb-2013-101494

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

Hyde, J. S., Fennema, E., & Lamon, S. J. (1990). Gender differences in mathematics performance: A meta-analysis. *Psychological Bulletin, 107*(2), 139–155. https://doi.org/10.1037/0033-2909.107.2.139

Flessati, S. L., & Jamieson, J. (1991). Gender differences in mathematics anxiety: An artifact of response bias? *Anxiety Research, 3*(4), 303–312. https://doi.org/10.1080/08917779108248759

Kakar, Z. U. H., Rasheed, R., Rashid, A., & Akhter, S. (2023). Criteria for assessing and ensuring the trustworthiness in qualitative research. http://dx.doi.org/10.56249/ijbr.03.01.44

Kazimli, C. (2023). *Reasons Behind Female Students' Math Anxiety in Azerbaijan.* Society, Baku Research Institute. https://bakuresearchinstitute.org/en/reasons-behind-female-students-math-anxiety-in-azerbaijan/

Kelly, J., Sadeghieh, T., & Adeli, K. (2014). Peer Review in Scientific Publications: Benefits, Critiques, & A Survival Guide. EJIFCC, 25(3), 227–243. https://pmc.ncbi.nlm.nih.gov/articles/PMC4975196/

Krpan, K.M. (2018). *Teaching math with meaning: Cultivating efficacy through learning competencies, grades K-8*. North York, ON: Pearson.

https://www.pearsoncanadaschool.com/pd/products/teaching-math-with-meaning.html

Livingstone, S., & Haddon, L. (2009). EU Kids Online: final report 2009. http://eprints.lse.ac.uk/39351/

Luo, Y., & Chen, X. (2024). The Impact of Math-Gender Stereotypes on Students' Academic Performance: Evidence from China. *Journal of Intelligence, 12*, 75. https://doi.org/10.3390/jintelligence12080075

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/10.2307/749772

Maloney, E. A., & Beilock, S. L. (2012). Math anxiety: Who has it, why it develops, and how to guard against it. *Trends in Cognitive Sciences, 16*(8), 404–406. https://doi.org/10.1016/j.tics.2012.06.008

Martin, A. J., Nejad, H., Colmar, S., & Liem, G. A. D. (2012). Adaptability: Conceptual and Empirical Perspectives on Responses to Change, Novelty and Uncertainty. *Australian Journal of Guidance and Counseling, 22*(1), 58-81. https://doi.org/10.1017/jgc.2012.8

Megreya, A. M., & Al-Emadi, A. A. (2023, Janar 9). The impacts of math anxiety, science anxiety, and gender on arts versus sciences choices in Qatari secondary schools. *PeerJ, 11*, e14510. https://doi.org/10.7717/peerj.14510

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative Research: A Guide to Design and Implementation* (4th ed.). Jossey Bass.

Merton, R. K. (1948). The Self-Fulfilling Prophecy. The Antioch Review, 8(2), 193–210. https://doi.org/10.2307/4609267

Office of the President of the Republic of Azerbaijan. (2013, October 24). *Order No. 13, Decree of the President of the Republic of Azerbaijan, Reg. 3.1.4*. Office of the President of the Republic of Azerbaijan. https://e-qanun.az/framework/32559

Pajares, F. (2004). Gender Differences in Mathematics Self-Efficacy Beliefs. In A. M. Gallagher & J. C. Kaufman [Eds.], *Gender Differences in Mathematics: An Integrative Psychological Approach*, pp.294–315. Cambridge University Press

Pizzie, R. (2022, November 1). Mind, brain, and math anxiety. In M. Danesi [Ed.] *Handbook of Cognitive Mathematics,* pp. 349–383. https://doi.org/10.1007/978-3-031-03945-4_29

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879. https://psycnet.apa.org/doi/10.1037/0021-9010.88.5.879

Purbaningrum, Mayang & Ramadhan, Sahrul & Thauzahra, Raudya. (2023, October 17). Why is Math Difficult? Beliefs That Affect Students' Mathematics Skills. *Jurnal Paedagogy:*

Jurnal Penelitian dan Pengembangan Pendidika, 10(4). 1000-1009 https://doi.org/10.33394/jp.v10i4.8652

Ramirez, G., Shaw, S. T., & Maloney, E. A. (2018). Math Anxiety: Past Research, Promising Interventions, and a New Interpretation Framework. *Educational Psychologist*, *53*(3), 145–164. https://doi.org/10.1080/00461520.2018.1447384

Richardson, F. C., & Suinn, R. M. (1972). The Mathematics Anxiety Rating Scale: Psychometric data. *Journal of Counseling Psychology, 19*(6), 551–554. https://doi.org/10.1037/h0033456

Rubinsten, O., Eidlin, H., Wohl, H., & Akibli, O. (2015). Attentional bias in math anxiety. *Frontiers in Psychology, 6*. https://doi.org/10.3389/fpsyg.2015.01539

Salahot, E. (2022). The Effects of Mathematics Anxiety on Mathematics Performance among Secondary School Students in Tanzania: A Case of Arusha City Council. (2022). *International Journal of Scientific Research and Management (IJSRM)*, *10*(12), 425-436. https://doi.org/10.18535/ijsrm/v10i12.m001

Samante, J., & Alave, A. (2021). Anxiety and Performance in Mathematics of Grade Four Pupils. *Globus, 10*. https://10.46360/globus.edu.220211001

Sanders, M. (2009). STEM, STEM Education, STEM Mania. *Technology Teacher, 68*, 20-26. https://doi.org/10.17763/haer.57.1.j463w79r56455411

Selwyn, N. (2011). *Education and Technology: Key Issues and Debates*. Continuum International Publishing Group, London.

Suárez-Pellicioni, M., Núñez-Peña, M.I., & Colomé, À. (2016). Math anxiety: A review of its cognitive consequences, psychophysiological correlates, and brain bases. *Cognitive, Affective, & Behavioral Neuroscience, 16*(1), 3–22. https://doi.org/10.3758/s13415-015-0370-7

Republic of Azerbaijan. (2009). *The Constitution of the Republic of Azerbaijan, 833-IIIQ – Law of the Republic of Azerbaijan "On Education"*. Republic of Azerbaijan. https://e-qanun.az/framework/18343

Then, K., Rankin, J., & Ali, E. (2014). Focus Group Research: What Is It and How Can It Be Used? *Canadian Journal of Cardiovascular Nursing*, *24*. 16-22.

White, D. (2014). What is STEM education and why is it important? *Florida Association of Teacher Educators Journal, 14*, 1-8.

https://www.researchgate.net/publication/264457053_What_is_STEM_education_and_why_is_it_important

Zay, D. & Kurniasih, M. (2023). Exploring math anxiety towards the students' computer self-efficacy in learning mathematics. *Mosharafa: Jurnal Pendidikan Matematika, 12*, 113-124. https://doi.org/10.31980/mosharafa.v12i1.1621

Živković, M., Pellizzoni, S., Doz, E., Cuder, A., Mammarella, I., & Passolunghi, M. C. (2023). Math self-efficacy or anxiety? The role of emotional and motivational contribution in math performance. *Social Psychology of Education*, *26*(3), 579–601. https://doi.org/10.1007/s11218-023-09760-8

Appendices

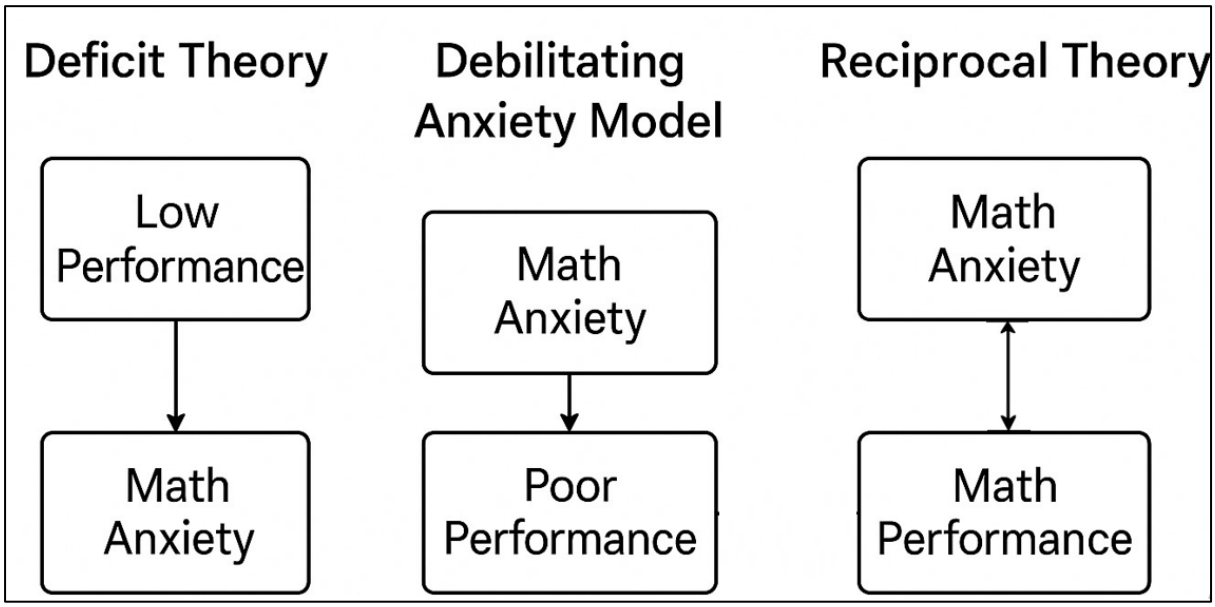
Appendix A

Research questions

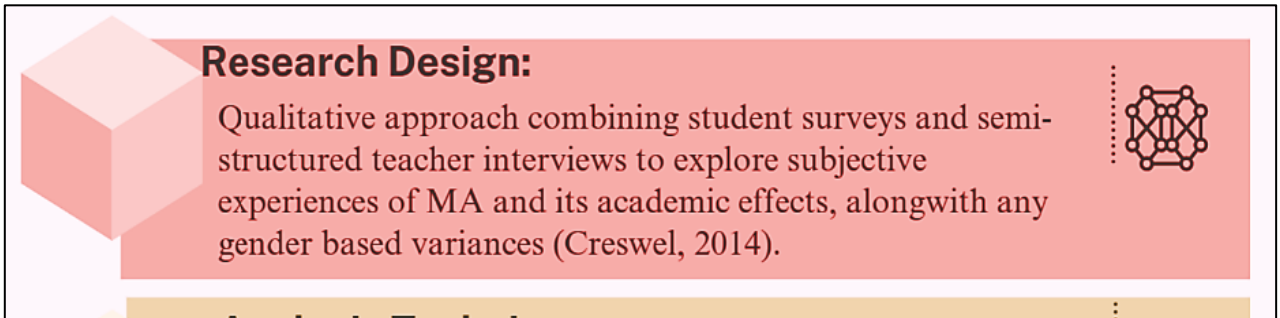
Research Question Number	Research Question
RQ1	What are the cognitive, environmental and social factors contributing to math anxiety of secondary level school students in Azerbaijan?
RQ2	What are the perceived influences of math anxiety on students' academic performance in Mathematics?
RQ3	Are there any gender differences in students' experiences of math anxiety?

Appendix B

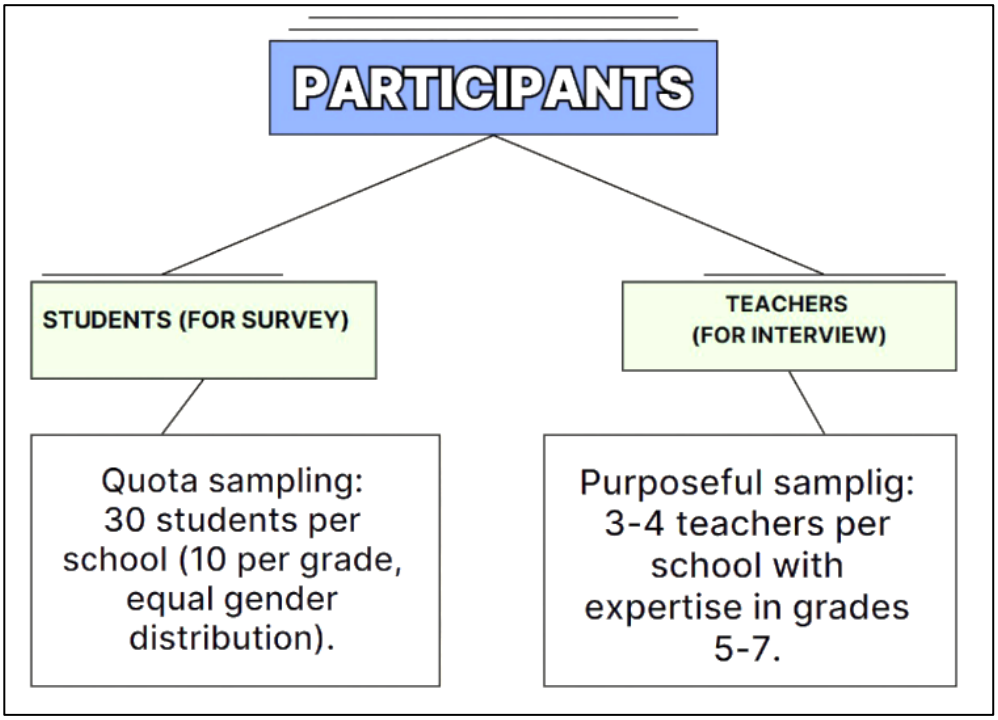
Frameworks focused on Math Anxiety



Appendix C



Appendix D



Appendix E

Student Survey Questions

1. How would you describe your gender?

a) Male b) Female c) Other

2. What grade are you in?

a)5 b)6 c)7

3. When solving a new math problem, how do you feel?

A) Very negative,

B) Slightly negative,

C) Neutral,

D) Positive,

E) Very positive

4. Do you volunteer to solve a math problem in front of the class?

A) Never,

B) Rarely,

C) Sometimes,

D) Often,

E) Always

5. Do you find it hard to focus on math tasks?

A) Never,

B) Rarely,

C) Sometimes,

D) Often,

E) Always

6. Do you sometimes make mistakes in math? How does it make you feel?

-open ended

7. Does your teacher help you when you struggle with math?

A) Not really,

B) Occasionally,

C) Neutral,

D) Often,

E) Very often

8. Do you discuss math problems or math homework with your classmates?
A) Never,
B) Rarely,
C) Sometimes,
D) Often,
E) Always

9. Do you think your parents have expectations about your math grades? Do you have any feelings about this?
-open ended

10. Where do you feel you get most help when it comes to math?
-open ended

11. How do you feel during math exams or tests?
-open ended

12. How much time do you usually spend on math homework compared to other subjects?
A} Much less,
B) Slightly less,
C) About the same,
D) Slightly more,
E) Much more

13. What do you think of your overall performance in math this year?
A) Less than average,
B) Average,
C) Good,
D) Very good

14. How do you feel about math compared to other subjects?

A) Intense dislike,

B) Dislike

C) Similar,

D) Positive,

E) Very positive

Appendix F

Consent Forms

F1: Consent Form for Students

Dear Student,

I want to ask for your help! You are invited to answer some simple questions about how you feel when learning math. Your answers will help us understand what students like you think about math and what makes it easy or difficult.

This is not a test, and there are no right or wrong answers. You can take your time and answer honestly. The survey will take about 30 minutes. Your answers will stay private; no one will know what you wrote, not even your teacher!

You don't have to take part if you don't want to. If a question makes you uncomfortable, you can skip it. If you change your mind, you can stop anytime, and that's totally okay! This won't affect your grades or how your teachers treat you.

If you have any questions, you can ask your teacher or the person giving you this form.

By signing below, you agree to take part in this survey and allow your responses to be used for research purposes.

Signature: _____

Date: _____

F2: Consent Form for Parents/Guardians

Dear Parent/Guardian,

Your child is invited to participate in a research study aimed at understanding students' experiences with math anxiety, its contributing factors, and its impact on academic performance. This research is part of a master's thesis project conducted by Jahan Gasimova,

a master's student in education at ADA University in the Master of Arts in Education Management program.

As part of this study, your child will be asked to complete a short survey about their thoughts and feelings related to math. The survey will take approximately 30 minutes to complete. Participation is entirely voluntary, and your child may choose not to answer specific questions or withdraw from the study at any time without any consequences.

Please be assured that all responses will remain anonymous. Your child's name or any other identifying information will not be included in the data. The findings will be used solely for research purposes. Please be aware that their decision to participate or not, as well as their responses will not affect their grades or how the teachers treat them.

If you have any questions about the study or would like further information, please do not hesitate to contact Jahan Gasimova at *jgasimova7794@ada.edu.az.*

By signing below, you agree to allow your child to participate in this study.

Parent/Guardian Name (Printed): _____

Child's Name (Printed): _____

Parent/Guardian Signature: _____

Date: _____

F3: Consent Form for Teachers

Dear Participant,

This is an invitation to participate in a semi-structured interview as part of a research study conducted by Jahan Gasimova, a master's student in education at ADA University, under the Master of Arts in Education Management program. The aim of this study is to explore math anxiety among secondary school students, its causes, and its impact on

academic performance. Your much-valued participation will contribute to creating insights that could help improve the teaching and learning of mathematics in schools.

The interview will last approximately 30 minutes and will involve questions about your professional observations of students' experiences with math anxiety and its consequences. Participation in this study is entirely voluntary, and you may choose to skip any questions or withdraw at any point without consequences. Your responses will remain anonymous and confidential.

Only the researcher, Jahan Gasimova, will have access to the interview recordings and transcripts. Data will be analyzed without your name or identifying details, ensuring your privacy and confidentiality. Any information gathered will only be used for research purposes.

If you have any questions about this study or require additional information, please feel free to contact Jahan Gasimova at *jgasimova7794@ada.edu.az.*

By signing below, you agree to participate in this study and allow your responses to be used for research purposes.

Name (Printed): _____

Signature: _____

Date: _____

Appendix G

Pattern 1: General Attitudes and Feelings towards Math

Survey Question	Response Category	# of Students (out of 60)	Percentage, %
Q3: Feelings towards new math problems	Positive or Very Positive	22	36.7%
	Neutral	28	46.7%
	Negative	6	10.0%
	Very Negative	4	6.7%
Q11: Feelings during math exams/tests	Anxious	38	63.3%
	Neutral/Calm	8	13.3%
	Confident	6	10.0%
	Mixed/Conditional	8	13.3%

Appendix H

Thematic Overview Table

Themes	Sub-themes	Key Insights
1. Cognitive and Emotional Experiences	Avoidance and Negative Self-Talk	Students express math anxiety through avoidance and verbal self-doubt.
	Dependence on Teacher Support	Many students hesitate to act independently without step-by-step teacher guidance.
	Emotional Disengagement and Somatic Signs	Anxiety manifests physically (e.g., headaches) and emotionally (e.g., frustration, embarrassment).
2. Environmental and Teaching-Related Factors	Teaching Practices and Classroom Dynamics	The way teachers present material and manage the classroom significantly affects anxiety levels.

3. Parental and Peer Influence	Parental Pressure and Expectations	High expectations from parents contribute to pressure and emotional strain.
	Peer Interaction Differences	Some students withdraw from group work due to fear of judgment.
4. Gender Differences	Gender-Based Differences	Girls tend to internalize anxiety; boys may show more reluctance to participate publicly.
5. Math Anxiety and Academic Performance	Anxiety's Impact on Performance	Test settings, especially timed or public tasks, amplify performance anxiety.
	Topic-Specific Anxiety	Algebra and geometry tend to elicit more anxiety, especially those requiring spatial visualization.