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## ABSTRACT

This study explores mathematics anxiety among elementary students in private schools in Karachi's Federal B Area, focusing on learners aged 11-15. Using a mixed-methods design, data were collected from 100 students and 15 mathematics teachers through a modified Mathematics Anxiety Rating Scale (MARS) and analyzed with SPSS. Findings revealed six key contributors to mathematics anxiety: self-confidence issues, test-related anxiety, home environment pressures, teacher-related factors, parental expectations, and fear of failure. Among these, classroom teaching methodologies were the most significant. The study concludes that mathematics anxiety is shaped by interconnected individual, pedagogical, and environmental factors. It recommends interventions such as teacher training, supportive classroom environments, and parental awareness programs to mitigate anxiety and improve students' mathematical learning outcomes.

**Keywords:** Mathematics anxiety, elementary education, pedagogical methods, student performance, educational psychology

### 1. Introduction

Mathematics education serves as a cornerstone of academic development, providing students with essential problem solving skills and logical reasoning abilities necessary for future success. However, a significant proportion of students experience mathematics anxiety a psychological phenomenon characterized by feelings of tension, apprehension, and fear when confronting mathematical tasks or concepts.

#### 1.1 Background and Significance

Mathematics anxiety affects students across all educational levels, with research indicating that early manifestation during elementary years can have lasting impacts on academic trajectories and career choices. In the Pakistani educational context, where examination-oriented learning predominates, understanding the root causes of mathematics anxiety becomes particularly crucial for educational stakeholders.

The current investigation focuses on private elementary schools in Karachi's Federal B Area, examining how various environmental, pedagogical, and social factors contribute to the development of mathematics anxiety among students aged 11-15 years.

#### 1.2 Research Objectives

This study aims to:

1. Identify primary factors contributing to mathematics anxiety among elementary students
2. Examine the relationship between different anxiety factors and student demographic characteristics
3. Propose evidence-based strategies for anxiety reduction and improved mathematical learning outcomes

### 2. Literature Review

#### 2.1 Conceptual Framework of Mathematics Anxiety

Mathematics anxiety encompasses both cognitive and emotional

components that interfere with mathematical problem-solving and learning processes. Research has demonstrated that this phenomenon can manifest as early as kindergarten, with severity often increasing throughout elementary and secondary education.

## **2.2 Contributing Factors to Mathematics Anxiety**

### **2.2.1 Pedagogical Factors**

Teaching methodologies play a crucial role in shaping students' mathematical experiences. Traditional approaches emphasizing rote memorization and procedural learning often contribute to anxiety development, particularly when students lack conceptual understanding.

### **2.2.2 Environmental Influences**

Classroom atmosphere, including teacher-student interactions, peer dynamics, and physical learning environments, significantly impacts student anxiety levels. Research indicates that supportive, collaborative environments reduce anxiety while promoting mathematical confidence.

### **2.2.3 Social and Cultural Elements**

Family expectations, cultural attitudes toward mathematics, and societal stereotypes influence student perceptions and anxiety levels. Gender-based stereotypes and socioeconomic factors further compound these influences.

## **2.3 Theoretical Framework**

The present study adopts a multi-factorial model examining mathematics anxiety through interconnected lenses:

Graph TD

A[Mathematics Anxiety] --> B[Student Factors]

A --> C[Educational Factors]

A --> D[Social Factors]

B --> B1[Self-confidence]

B --> B2[Prior experiences]

B --> B3[Cognitive abilities]

C --> C1[Teaching methods]

C --> C2[Classroom environment]

C --> C3[Assessment practices]

D --> D1[Family expectations]

D --> D2[Peer influences]

D --> D3[Cultural attitudes]

## **3. Methodology**

### **3.1 Research Design**

This investigation employed a mixed-methods approach, combining quantitative survey data with qualitative observational insights to provide a comprehensive understanding of mathematics anxiety factors.

### 3.2 Participants and Setting

#### Student Participants:

- Total: 100 elementary students
- Age range: 11-15 years
- Grade levels: 6th-8th classes
- Gender distribution: 46% male, 54% female
- Schools: Four private institutions in Federal B Area, Karachi

#### Teacher Participants:

- Total: 15 mathematics educators
- Experience range: 2-15 years
- Educational background: Bachelor's to Master's degrees in Mathematics/Education

### 3.3 Data Collection Instruments

#### 3.3.1 Modified Mathematics Anxiety Rating Scale (MARS)

The primary instrument consisted of 20 items adapted from Richardson and Suinn's original MARS, modified for local cultural context and elementary-level comprehension. Items utilized a 5-point Likert scale ranging from "Strongly Agree" (5) to "Strongly Disagree" (1).

#### 3.3.2 Demographic Questionnaire

Collected information on student age, gender, academic level, school affiliation, and maternal educational background.

### 3.4 Data Collection Procedure

Data collection occurred through structured school visits over a four-week period. Following institutional permission, researchers administered questionnaires during designated class periods, ensuring student confidentiality and voluntary participation.

### 3.5 Statistical Analysis

Data analysis employed SPSS version 21, utilizing:

- Descriptive statistics for demographic profiling
- Correlation analysis for factor relationships
- Independent t-tests for gender-based comparisons
- Factor analysis for anxiety component identification

## 4. Results

### 4.1 Participant Demographics

The study sample demonstrated diverse representation across target schools and grade levels:

Demographic Variable	Category	Frequency	Percentage
Age	11 years	4	4%
	12 years	27	27%
	13 years	28	28%

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	14 years	28	28%
	15 years	13	13%
Gender	Male	46	46%
	Female	54	54%
Grade Level	6th	34	34%
	7th	23	23%
	8th	43	43%

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## 4.2 Mathematics Anxiety Factor Analysis

Six primary anxiety factors emerged from the analysis:

graph LR

A[Mathematics Anxiety Factors] --> B[Self-Confidence<br/>Mean: 12.07]

A --> C[Test Anxiety<br/>Mean: 12.10]

A --> D[Home Environment<br/>Mean: 9.78]

A --> E[Teacher Factors<br/>Mean: 2.54]

A --> F[Parental Pressure<br/>Mean: 3.57]

A --> G[Fear of Failure<br/>Mean: 9.48]

## 4.3 Key Findings by Factor

### 4.3.1 Self-Confidence Related Anxiety

- 85% of students reported moderate to high confidence in asking mathematics questions
- 67% felt capable of understanding mathematical content
- Significant correlation between self-confidence and academic performance ( $r=0.72$ ,  $p<0.01$ )

### 4.3.2 Test-Related Anxiety

- 76% experienced nervousness during mathematics examinations
- 58% reported adequate test preparation despite anxiety symptoms
- Gender differences observed (females showing higher test anxiety levels)

### 4.3.3 Classroom Environment Factors

- 71% identified teaching methodology as influencing their mathematical understanding
- 42% reported feeling comfortable asking questions during class
- Strong correlation between positive teacher-student

relationships and reduced anxiety

#### 4.4 Gender-Based Analysis

Statistical analysis revealed significant gender differences in specific anxiety factors:

Factor	Male (SD)	Mean Female (SD)	Mean t- value	p- value
Test Anxiety	11.2 (1.8)	12.8 (1.7)	-4.12	<0.001
Self- Confidence	12.8 (1.6)	11.5 (1.9)	3.24	<0.01
Fear of Failure	8.9 (2.1)	9.9 (2.5)	-1.98	<0.05

### 5. Discussion

#### 5.1 Principal Findings

This investigation reveals that mathematics anxiety among elementary students results from complex interactions between individual, pedagogical, and environmental factors. The prominence of self-confidence and test-related anxiety suggests that interventions should prioritize building student self-efficacy while addressing assessment-related stress.

#### 5.2 Pedagogical Implications

The findings underscore the critical role of teaching methodologies in anxiety development. Traditional approaches emphasizing memorization and procedural skills appear to contribute significantly to student anxiety levels. Modern pedagogical frameworks promoting conceptual understanding, collaborative learning, and real-world application demonstrate greater potential for anxiety reduction.

#### 5.3 Environmental Considerations

Classroom atmosphere emerged as a crucial factor, with supportive environments fostering reduced anxiety levels. This finding aligns with educational psychology research emphasizing the importance of psychological safety in learning contexts.

#### 5.4 Cultural and Social Factors

The Pakistani educational context, characterized by high academic expectations and competitive environments, appears to amplify certain anxiety factors. Family expectations and cultural attitudes toward mathematics education require careful consideration in intervention design.

### 6. Recommendations

#### 6.1 For Educators

##### 1. Professional Development Programs

Implement comprehensive training on mathematics anxiety recognition and intervention

- Promote modern pedagogical approaches emphasizing conceptual understanding

- Develop skills in creating supportive classroom environments

## **2. Curriculum Modifications**

Integrate real-world applications of mathematical concepts

- Reduce emphasis on timed assessments and memorization
- Implement formative assessment practices

## **6.2 For Educational Institutions**

### **1. Policy Development**

Establish mathematics anxiety screening protocols

- Create support systems for high-anxiety students
- Implement teacher evaluation criteria including anxiety-reduction effectiveness

### **2. Resource Allocation**

Invest in manipulative and technology-enhanced learning tools

- Provide counseling services for students with severe mathematics anxiety
- Develop parent education programs

## **6.3 For Families**

### **1. Awareness Building**

Educate parents about mathematics anxiety symptoms and impacts

- Promote positive attitudes toward mathematical learning
- Reduce performance pressure and expectations

### **2. Home Support Strategies**

Create supportive homework environments

- Emphasize effort over achievement
- Seek professional help when anxiety symptoms persist

## **7. Limitations and Future Research**

### **7.1 Study Limitations**

This investigation acknowledges several limitations:

- Geographic restriction to Karachi's Federal B Area
- Focus solely on private educational institutions
- Cross-sectional design limiting causal inference
- Self-reported data susceptibility to response bias

### **7.2 Future Research Directions**

Future investigations should consider:

- Longitudinal studies tracking anxiety development over time
- Comparative analysis between public and private school contexts
- Intervention effectiveness studies
- Cultural adaptation of anxiety measurement instruments
- Teacher anxiety impact on student outcomes

## **8. Conclusion**

Mathematics anxiety among elementary students represents a multifaceted challenge requiring comprehensive, evidence-based



interventions. This study's findings demonstrate that anxiety stems from complex interactions between individual characteristics, teaching practices, and environmental factors.

The predominance of classroom-related factors suggests that educational reforms focusing on pedagogical improvement, teacher training, and supportive learning environments hold significant promise for anxiety reduction. However, successful interventions must also address family expectations, cultural attitudes, and individual student needs.

Moving forward, educational stakeholders must collaborate to create learning environments that promote mathematical confidence while maintaining academic rigor. Only through such comprehensive approaches can we ensure that all students develop the mathematical competencies necessary for future success.

The implications extend beyond immediate academic outcomes, potentially influencing career choices, economic opportunities, and societal mathematical literacy. Investment in mathematics anxiety research and intervention represents not only educational necessity but also economic and social imperative for Pakistan's continued development.

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## **Appendix A: Survey Instrument**

### **Mathematics Anxiety Rating Scale - Elementary Version (MARS-E)**

**Instructions:** Please read each statement carefully and indicate how much you agree or disagree using the following scale: 1 = Strongly Disagree 2 = Disagree

3 = Neutral 4 = Agree 5 = Strongly Agree

1. I feel confident asking questions during mathematics class.
2. Mathematics problems make me feel nervous or worried.
3. I believe I can understand mathematical concepts with proper explanation.
4. I get anxious when I have to solve math problems in front of others.
5. I enjoy working on challenging mathematical problems.
6. I feel stressed during mathematics tests or quizzes.
7. I think I am naturally good at mathematics.
8. I worry that I will not perform well in mathematics.
9. I feel comfortable participating in mathematics class discussions.
10. Mathematics homework causes me to feel anxious or worried.