Fear of Mathematics among B.Tech First Year Students in Telangana and Andhra Pradesh

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Abstract

Mathematics is a foundational subject in engineering education, yet many first-year B.Tech students experience significant fear or anxiety toward this discipline. This study explores the prevalence of mathematics anxiety among B.Tech first-year students of engineering colleges of Telangana and Andhra Pradesh, identifies underlying causes, assesses its impact on academic performance, and suggests possible coping strategies. Employing a mixed-method approach, surveys and interviews were conducted among students of various engineering colleges. Findings reveal that fear of mathematics stems from multiple factors, including lack of foundational knowledge, ineffective teaching methods, and peer pressure. The study underscores the need for supportive pedagogical interventions to help students overcome this fear and improve their academic success.

Key words: Math Anxiety, Engineering students, peer pressure, Examination tension

1. Introduction

Mathematics is often considered the backbone of engineering education, underpinning subjects ranging from mechanics and electronics to computer science and thermodynamics. Success in these subjects depends heavily on students' understanding of mathematical concepts and problem-solving skills. However, despite its importance, many students entering engineering programs face intense anxiety or fear when confronted with mathematics, even though they have learnt mathematics almost for twelve years in schooling and have subjected to various examination entrance tests that contain mathematics as a major subject. This fear, often referred to as *math anxiety*, is characterized by feelings of tension, worry, or apprehension that interfere with mathematics performance.

The transition from high school to university-level mathematics can be particularly challenging for first-year B.Tech students. This phase demands rapid assimilation of abstract mathematical theories and application skills, often without sufficient scaffolding. Several studies suggest that fear of mathematics can lead to poor academic performance, lower self-confidence, and even increased dropout rates in engineering courses.

This paper aims to investigate the extent of mathematics fear among B.Tech first-year students of engineering colleges of Telangana and Andhra Pradesh and explore the various causes contributing to this phenomenon. Furthermore, it examines the consequences of this fear on academic outcomes and proposes practical strategies to alleviate it. Addressing these challenges is vital to improve students' learning experiences and retention in engineering programs.

2. Literature Review

The concept of mathematics anxiety was first systematically studied by Richardson and Suinn (1972), who defined it as a feeling of tension and anxiety that interferes with math performance. Since then, numerous researchers have explored its psychological and educational dimensions.

Ashcraft (2002) emphasized that math anxiety negatively affects working memory capacity, which is essential for solving mathematical problems. Students experiencing math anxiety often struggle to process information efficiently, leading to errors and avoidance behaviors.

Hembree (1990), in a meta-analysis of math anxiety research, identified several contributing factors: poor prior math experiences, negative attitudes from teachers or parents, and societal stereotypes about math abilities. These factors can create a cycle of fear and failure, reinforcing students' aversion to mathematics.

In engineering education, mathematics anxiety is particularly problematic. Kaya (2010) noted that engineering students with high anxiety levels tend to avoid math-intensive tasks, which hinders their overall academic performance. Similarly, in Indian engineering colleges, Rao and Kumar (2018) observed that math anxiety is linked with teaching methods that emphasize rote learning and lack of conceptual clarity.

Interventions such as remedial classes, active learning, and counselling have shown promise in reducing math anxiety and improving student outcomes (Betz, 1978; Tobias, 1993). However, the specific causes and manifestations of math anxiety among first-year B.Tech students remain underexplored, highlighting the need for further research.

3. Methodology

To comprehensively understand the fear of mathematics among first-year B.Tech students, adopted a mixed-method research design, combining quantitative and qualitative approaches this study.

3.1 Participants

The participants included 450 first-year B.Tech students of engineering colleges of Telangana and Andhra Pradesh enrolled across Nine engineering colleges. Five colleges were chosen from Telangana and four from Andhra Pradesh. The colleges were selected to represent diverse academic environments, including one government and eight private institutions, four urban and five rural institutions. The sample included almost equal number of students from various all nine engineering branches such as Mechanical, Electrical, Civil, Electronics and Computer Science engineering.

3.2 Data Collection

Data was collected in two phases:

- **Quantitative Phase:** A standardized Mathematics Anxiety Rating Scale (MARS) was administered. The scale comprised 30 items measuring different aspects of math anxiety, including emotional responses, physiological symptoms, and cognitive worries. Students rated their agreement on a 5-point Likert scale.
- **Qualitative Phase:** Following the survey, 20 students from each institution, who scored in the high anxiety range were invited for semi-structured interviews. These interviews explored personal experiences with mathematics, perceived causes of fear, and coping mechanisms.

3.3 Data Analysis

Quantitative data were analyzed using descriptive statistics to determine the prevalence and severity of math anxiety. Correlation analysis examined relationships between anxiety scores and academic indicators such as high school math grades and semester exam results.

Qualitative interview transcripts were coded using thematic analysis. Recurring themes regarding causes, effects, and coping strategies were identified to provide deeper insight into the phenomenon.

3.4 Ethical Considerations

Participation was voluntary, and confidentiality was ensured. Students were informed about the study's purpose and their right to withdraw at any time.

4. Results

4.1 Prevalence of Mathematics Anxiety

Analysis of the survey data revealed that 62% of the participants experienced moderate to high levels of mathematics anxiety. Specifically:

- 25% of students reported severe anxiety symptoms such as panic attacks or avoidance of math-related courses.
- 37% reported moderate anxiety, characterized by nervousness before exams and difficulty concentrating during math tasks.
- 38% showed mild or no anxiety.
- 69% of the students who have reported anxiety symptoms are from rural background.

Interestingly, students with lower scores in high school mathematics exhibited significantly higher anxiety levels ($r = -0.58$, $p < 0.01$), suggesting that prior academic preparation is a crucial factor.

4.2 Causes of Fear

Thematic analysis of interviews identified three primary causes:

- **Lack of Foundational Knowledge:** Many students reported gaps in basic mathematical concepts, making it difficult to grasp new material. Some mentioned that their high school curriculum was rushed or lacked clarity, leading to confusion and loss of confidence.
- **Teaching Methods:** A majority expressed dissatisfaction with traditional lecture styles that prioritized rapid content delivery over interactive learning. Several students noted that they rarely had opportunities to ask questions or engage in problem-solving during classes.
- **Peer Pressure and Comparisons:** Many students felt anxious due to comparisons with high-achieving classmates. The competitive atmosphere in engineering colleges often intensified fear of failure, leading to self-doubt and avoidance of challenging math problems.

4.3 Impact on Academic Performance

Students with high math anxiety reported:

- Decreased confidence in their abilities.
- Reluctance to participate in math-related discussions or group work.

- Poorer performance in mathematics examinations and assignments compared to peers with low anxiety.

Some interviewees admitted that fear sometimes caused them to skip classes or avoid studying math altogether, further exacerbating the problem.

5. Discussion

The findings confirm that fear of mathematics is a significant issue among first-year B.Tech students of engineering colleges of Telangana and Andhra Pradesh, consistent with prior international and national research. The high prevalence (62%) of anxiety suggests that this is not an isolated problem but a systemic challenge.

The study highlights that lack of foundational knowledge plays a critical role. Students entering engineering programs without a strong grasp of basic math concepts are more vulnerable to anxiety. This points to the need for early diagnostic assessments and remedial education.

The dissatisfaction with teaching methods reveals the importance of pedagogical innovation. Passive lectures that fail to engage students or address their individual difficulties contribute to fear and disengagement. Active learning strategies, including collaborative problem-solving and use of digital tools, could enhance understanding and reduce anxiety.

The social environment, including peer pressure and competition, also exacerbates fear. Creating a supportive and inclusive classroom culture where mistakes are viewed as learning opportunities rather than failures may help alleviate this.

The impact of mathematics fear on academic outcomes is profound. Reduced confidence and avoidance behaviors limit students' capacity to succeed, potentially influencing their entire engineering career. Hence, addressing math anxiety early is crucial for improving retention and performance in engineering education.

6. Recommendations

Based on the findings, and based on the opinion of the students, the following recommendations are proposed to mitigate fear of mathematics among first-year B.Tech students:

6.1 Counseling and Psychological Support

Institutions should provide academic counselling and psychological services to help students manage anxiety. Workshops on stress management, time management, and positive mind-set development can empower students.

6.2 Assessment and Evaluation Reforms

Assessment methods should emphasize understanding and application rather than rote memorization. Providing multiple attempts or project-based assessments can reduce pressure and fear.

6.3 Creating a Supportive Peer Environment

Encouraging peer study groups and mentorship programs can foster collaboration and reduce feelings of isolation.

7. Conclusion

Fear of mathematics among first-year B.Tech students of engineering colleges of Telangana and Andhra Pradesh is a pervasive challenge that hampers academic performance and overall learning experience. This study identified multiple factors contributing to math anxiety, including inadequate preparation, teaching methods, and peer pressure. The consequences of this fear are evident in reduced confidence, avoidance behaviors, and lower academic success.

Addressing this issue requires a comprehensive approach involving remedial education, innovative teaching practices, student support services, and a nurturing learning environment. Engineering institutions that implement these strategies will likely see improved student outcomes, higher retention rates, and better-prepared graduates capable of meeting the demands of the engineering profession.

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