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Impact of Test Anxiety and Coping Strategies Among Secondary School Students' Engagement in Mathematics

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Abstract

This study examines how test anxiety and coping strategies affect mathematics engagement among secondary school students. The research was carried out in UC #10, District Bin Qasim, Landhi, and included 41 private schools across Karachi with a student enrollment of approximately 2,516 (BSEK enrollment). With the aid of stratified random sampling, 63 students were chosen. Through Pearson correlation and moderation analysis, the results indicated that while coping strategies buffer some of the negative effects of test anxiety on engagement, high test anxiety disengages students from active participation. Realistic recommendations are offered to address low engagement at the school level through administrative policy changes.

Key Words: Test Anxiety, Coping Strategies, Students' Engagement

Introduction

Mathematics anxiety is a pervasive concern that impedes learners from both studying and achieving academic success. The subset of secondary students grappling with profound academic pressure are arguably the worst affected. This study analyzes the impact of test anxiety and coping strategies on student engagement in mathematics with an emphasis on developing actionable recommendations aimed at schools..

Mathematics is a subject that most people find to be very challenging, and thus it evokes a lot of stress and disengagement. In research conducted by Ashcraft and Krause (2007), it was found that anxiety worsens the conditions of affecting memory as well as problem-solving. Maloney and Beilock (2012) noted that math anxiety leads students to often avoid participating in activities related to mathematics. Effective coping tools, which include deep breathing, early preparation, and help seeking, shall help mitigate anxiety Von der Embse et al., 2021).

Control-Value Theory of Achievement Emotions (Pekrun, 2006) suggests that individuals will feel anxious if they perceive low control over a task that they value. Therefore, teaching coping strategies which help them regain control would lower their anxiety and enhance their participation.

Suárez-Pellicioni et al. (2016) confirmed that test anxiety affects the functioning of the brain and emotions; academic performance is thereby diminished. Von der Embse et al. (2021) assessed school-based interventions which not only reduced anxiety but also

increased engagement. Ramirez et al. (2018) pointed out that good teacher-student relationships decrease anxiety and make students more confident to perform better; however, this study has some limitations. First, it took only 63 students from private schools in just one district of Karachi; therefore, these results cannot be generalized.

Objectives of the Study

1. To examine how test anxiety affects students' engagement in mathematics.
2. To analyze the link between coping strategies and student engagement.
3. To assess whether coping strategies reduce the negative impact of test anxiety.

Hypotheses

1. There is a significant relationship between test anxiety and student engagement in mathematics among secondary school students.
2. There is a significant relationship between students' coping strategies and the impact of test anxiety on their engagement in mathematics among secondary school students.

Literature Review

Mathematics is the core subject that has a close relationship with the development of logico-cognitive nature. In spite of this fact, test anxiety towards mathematics currently grips most secondary students. The condition is distress and fear at the time of evaluation that hampers memory and attention among learners; it apparently influences performance not only in developed nations but also in developing countries (Ashcraft & Krause, 2007). Test anxiety is a condition characterized by psychological factors; worrying, about sweat and fast heartbeat, mental blocks. It affects the recall of memory and interferes with problem-solving ability under time conditions. Engagement refers to a student's emotional, cognitive, and behavioral investment in learning (Fredricks et al., 2004). Coping is defined as the cognitive and behavioral efforts to manage specific external and/or internal stressful demands that are appraised as taxing or exceeding the resources of the person (Lazarus & Folkman, 1984). Research conducted in the Pakistani context (e.g., Khan et al., 2022; Rehman & Butt, 2023) supports the idea that examination anxiety is a significant predictor of reduced academic performance, particularly in mathematics. These studies also indicate that gender and socioeconomic background often mediate the severity of anxiety and the availability of effective coping resources. Rehman & Butt (2023) found that students who practiced active coping (e.g., time management, asking for help) reported lower anxiety and better performance.

The Control-Value Theory of Achievement Emotions (Pekrun, 2006) proposes that emotions stem from the sense of control in learning and the importance placed on academic activities. When students feel they have little control or are stressed by the significance of a task, anxiety tends to rise. Pekrun's theory offers a valuable framework for comprehending how anxiety can impede engagement and how efforts focused on enhancing control and competence can encourage resilience. Multiple global studies support this perspective. Suárez-Pellicioni et al. (2016) utilized neuroimaging methods to reveal that anxiety impairs brain areas involved in numerical processing. Von der Embse et al. (2021) carried out school-based studies indicating that mindfulness practices, positive feedback from teachers, and low-stakes assessments greatly alleviated anxiety.

Ramirez et al. (2018) showcased how strong teacher-student relationships can positively impact the reduction of test anxiety and enhance classroom participation. Furthermore, recent research by Chen et al. (2023) indicates that comprehensive wellness initiatives in schools greatly enhance emotional regulation and academic involvement. Additional findings from research conducted by Riaz & Khalid (2021) in Punjab indicated that self-efficacy and support from teachers had a direct impact on students' anxiety, implying that interventions at the policy level could significantly help lower academic stress and boost motivation. These results highlight that test anxiety is both a psychological concern and a systemic problem, necessitating structural assistance from educational institutions. In conclusion, literature underscores a distinct connection between test anxiety and reduced engagement, while also stressing the beneficial impact of coping strategies.

Research Methodology

This study used a quantitative research design. A sample of 63 students was selected via stratified random sampling. A 16-item questionnaire measured math test anxiety, coping strategies, and engagement. The questionnaire included three subscales:

- Math Test Anxiety (6 items, $\alpha = 0.768$)
- Coping Strategies (5 items, $\alpha = 0.765$)
- Student Engagement (5 items, $\alpha = 0.790$)

SPSS was used to perform Pearson correlation and moderation analysis.

Tables and Data Analysis

Table 1: Descriptive Statistics and Reliability

Subscale	No. of Items	Cronbach's Alpha
Math Test Anxiety	6	0.768
Coping Strategies	5	0.765
Student Engagement	5	0.790

Table 2: Pearson Correlation Matrix

Variables	Math Anxiety	Coping	Engagement
Math Anxiety	1	-0.58**	-0.71**
Coping Strategies	-0.58**	1	0.69**
Engagement	-0.71**	0.69**	1
(** $p < 0.01$)			

Table 3: Moderation Analysis Results

Predictor	B	Std. Error	p-value	95% CI
Constant	-3.97	1.7	0.023	[-7.37, -0.58]
Math Test Anxiety	1.18	0.09	0.000	[1.00, 1.36]
Coping Strategies	0.13	0.08	0.087	[-0.02, 0.28]

Predictor	B	Std. Error	p-value	95% CI
Interaction (Anxiety × Coping)	0.29	0.07	0.000	[0.15, 0.43]

Results

The findings indicate a strong negative relationship between test anxiety and student engagement ($r = -0.71$, $p < 0.01$). Coping strategies showed a positive correlation with engagement ($r = 0.69$, $p < 0.01$). The moderation analysis revealed that coping strategies significantly buffer the impact of anxiety on engagement.

Discussion

The study validates how poor engagement is caused by strong math anxiety. Still, self-regulation and preparation help to lessen the effect of anxiety. These findings line up with prior studies and the Control-Value Theory.

Conclusion

Mathematics anxiety often leads to decreased student engagement, making the cultivation of effective coping strategies crucial. Interventions, therefore, should not only target the reduction of anxiety itself but also prioritize the development of students' coping skills. By focusing on both aspects, educators can better support students in managing stress related to mathematics.

Recommendations

1.Implement Coping Skills Training in Curriculum:

Schools should schedule weekly coping skills sessions within homeroom or life skills classes. Programs teaching breathing techniques, time management, and cognitive reframing notably lower student anxiety and increase classroom participation, according recent studies including Chen et al. (2023).
Give teachers or school counselors brief, interesting seminars. Incorporate peer sharing events and real-life problem-solving exercises to teach resilience and help to normalize stress.

2. Teacher-Led Anxiety Awareness Workshops:

• A 2022 Ramirez & Beilock study finds that controlling math anxiety mostly depends on teacher behavior. Regular workshops on anxiety-friendly classroom strategies should be planned by schools for their staff members.
Use teacher training days to show how to administer low-stakes tests, support student voice, and spot indicators of academic stress. Academic coordinators and school counselors can help you follow-up.

Future Research Directions

Future research should focus on including a broader and more varied group of participants, particularly public school students from different districts. Additionally, relying solely on self-reported measures can lead to bias. It's important for future studies to adopt a mixed-methods approach that blends qualitative insights with quantitative data, allowing for a deeper understanding of students' emotional and behavioral reactions.

Longitudinal studies could also investigate the lasting impact of coping interventions and whether early support enhances academic resilience.

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