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ACHIEVEMENT EMOTIONS AS PREDICTORS OF MATH PERFORMANCE AMONG HIGH SCHOOL STUDENTS

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ABSTRACT

This study investigates the relationship between achievement emotions and academic performance in mathematics among high school students, guided by the Control-Value Theory of Achievement Emotions. A sample of 360 randomly selected students from grades 7 to 12 completed surveys assessing seven achievement emotions: enjoyment, pride, anger, anxiety, shame, hopelessness, and boredom. Mathematics grades were analyzed alongside self-reported emotional data. Results indicated very high levels of enjoyment (M = 4.83) and pride (M = 4.83), moderate levels of anger (M = 3.83) and anxiety (M = 3.75), and low levels of shame (M = 2.95), hopelessness (M = 2.50), and boredom (M = 2.80), yielding an overall moderate achievement emotion score (M = 3.64). Academic performance averaged 86.12 (moderate). Pearson's correlation analysis revealed enjoyment ($r = 0.9024$, $p < 0.00001$) and pride ($r = 0.30$, $p = 0.019$) as significant positive predictors of performance, while hopelessness ($r = -0.40$, $p = 0.001$), anxiety ($r = -0.35$, $p = 0.005$), and boredom ($r = -0.30$, $p = 0.01$) showed significant negative correlations. The composite achievement emotion score correlated moderately positively with performance ($r = 0.50$, $p < 0.00001$), rejecting the null hypothesis. Aligning with Control-Value Theory, these findings emphasize the dual role of appraisals in shaping emotions and outcomes. The study advocates for emotion-focused pedagogical interventions to enhance academic success, such as fostering enjoyment and reducing anxiety, thereby bridging emotional and cognitive dimensions in mathematics education.

KEYWORDS: *Education, Achievement emotions, Academic performance, Mathematics, High school students, Control-Value Theory, Emotional regulation, Correlation analysis*

INTRODUCTION

Many students struggle to achieve proficiency in mathematics, making mathematics education a global concern. Based on the Programme for International Student Assessment (PISA) 2018 results, a persistent gap in mathematical achievement was highlighted because many students fail to meet the standard levels of mathematical competency (OECD, 2019). This issue is further compounded by the emotional challenges students face, which have been identified as a significant barrier to learning (Ashcraft & Krause, 2007). The relationship between emotions and academic success in mathematics and how these emotions can affect the student's academic achievement. Solving this existing problem can help provide learners with cognitive and emotional needs.

The study of emotional dynamics has become an interest in educational research. Studies have shown that negative emotions can significantly impair students' ability to process mathematical concepts. In contrast, positive emotions like curiosity and confidence can improve learning outcomes (Pekrun et al., 2017). In the Philippine context, the 2018 PISA results revealed that Filipino students ranked among the lowest in mathematical literacy, with only 19% achieving the minimum proficiency level (OECD, 2019). This alarming result underscores the necessity to study the emotional factors influencing students' performance in mathematics.

At Laak, Davao de Oro, the situation mirrors the broader national and global challenges in mathematics education. Teacher reports and observations showed possible causes of disengagement in learning mathematics. This research will explore the correlation between achievement emotions and learners' academic performance. By examining how emotions influence learning outcomes, this study aims to provide insights that can help create possible interventions for learners. Lastly, the researcher hopes to contribute to the existing knowledge on the importance of emotional dynamics in education, offering valuable recommendations that can enhance student well-being and mathematical attainment.

LITERATURE REVIEW

Achievement emotions are defined as affective reactions tied to academic activities and outcomes that will play an important role in creating strategies and activities suitable for learners. Pekrun's (2006) control-value theory indicates that emotions ranging from enjoyment and pride to anxiety and boredom are affected by individuals' perceived control over tasks and the subjective value they assign to outcomes. Recent empirical work highlights the bidirectional relationship between achievement emotions and success in the academic field. For instance, Loderer et al. (2020) conducted a meta-analysis that demonstrated that positive emotions like enjoyment are known to enhance cognitive engagement and achievement, while negative emotions such as boredom can impair the self-regulation and performance of students. Similarly, Putwain et al. (2022) found that lower intrinsic motivation can be predicted by anticipatory. These results showed the importance of suitable interventions to improve emotional profile.

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Emerging research also explores the role of social and environmental factors in modulating achievement emotions. Frenzel et al. (2021) revealed the direct impact of teachers' emotional expressions on students' emotional responses, which recommends that the solution for maladaptive emotion mitigation is to create a supportive classroom environment. In addition, the advancement of the learning environment brought by digital learning has introduced new difficulties; a longitudinal study by Pekrun and Marsh (2023) found that online education amplifies emotional variability due to less face-to-face feedback. Cognitive appraisals from interventions shape control and value belief, yielding positive emotions. (Pekrun & Marsh, 2023). Ultimately, this work shows the importance of emotional achievement in educational fields and calls for the best integration method to address individual and contextual determinants.

ENJOYMENT

Enjoyment is a positive emotional achievement associated with improved academic performance across various educational settings. According to Pekrun's (2006) control-value theory, enjoyment arises when students view academic tasks as manageable and worthwhile, boosting intrinsic motivation and cognitive involvement. This connection has been supported by recent research indicating that enjoyment is a positive predictor of academic success through factors like increased task attention, perseverance, and the application of effective learning strategies. For example, a study by Goetz et al. (2021) found that students who experienced higher enjoyment in mathematics showed more substantial improvements in their performance over time based on their reports. These students were more inclined to engage in discussions about their complex problems. Additionally, Pekrun et al. (2022) emphasized that enjoyment in science classes correlated with deeper comprehension of concepts and superior achievement scores, highlighting how positive emotions can enhance meaningful learning experiences for students. These results imply that enjoyment has the potential to boost academic success.

Factors related to both context and the individual also play a role in how enjoyment affects academic success. Research conducted by Frenzel et al. (2021) indicated that fostering enjoyment relies on teachers' enthusiasm and a supportive classroom atmosphere, which are indicators of improved academic outcomes. Additionally, the rise of new dynamics in digital learning contexts has been illustrated by a study by Loderer et al. (2020), which found that students who found enjoyment in online learning, even without direct interaction with teachers, were more inclined to engage in self-regulated learning and observe improvements in academic performance. Nevertheless, a student's prior knowledge and self-efficacy can influence the connection between enjoyment and performance. For instance, students who report higher levels of self-efficacy are more likely to feel enjoyment and successfully convert it into academic achievements (Putwain et al., 2022). Ultimately, these studies underscore the significance of enjoyment as a predictor of academic performance.

PRIDE

Pride is recognized as a self-aware emotional achievement, playing a crucial role in influencing students' academic performance and motivation. As outlined in Pekrun's (2006) control-value theory, pride emerges when students appreciate their successes and credit their achievements to their own efforts. This favorable emotion can enhance academic results by boosting self-efficacy, persistence, and goal-oriented behavior. Recent findings from Pekrun et al. (2022) indicated that students who felt pride after completing exams were more inclined to set more ambitious academic objectives and adopt more profound learning strategies in their future assignments. Moreover, Goetz et al. (2021) showed that pride in mathematics correlates positively with long-term performance improvements, driven by motivation and effort. These results underscore the significance of pride in achieving academic success.

However, contextual and cultural factors can influence the relationship between pride and academic performance. Research by Tracy and Robins (2020) distinguishes between authentic and hubristic pride. Authentic pride leads to positive academic outcomes, while hubristic pride can lead to maladaptive behaviors. In addition, the cultural difference in the interpretation of pride can moderate its impact on academic performance. For example, a cross-cultural study by Williams et al. (2021) found that students from collectivist cultures were more likely to experience pride when their achievements benefited their social group, whereas individualist cultures emphasized personal success. These studies highlight the crucial role of fostering authentic pride in the educational landscape while considering cultural and contextual influences to maximize its positive effects on academic performance.

ANGER

Anger is a negative achievement emotion; it has been shown to have detrimental effects on students' academic performance and learning processes. According to Pekrun's (2006) control-value theory, anger occurs when students perceive obstacles to their goals or feel that their efforts are never evaluated relatively, leading to frustration and disengagement. Research by Pekrun et al. (2022) observed that anger while doing academic tasks is linked with reduced cognitive resources, impaired problem-solving skills, and lower achievement results. For instance, a study by Goetz et al. (2021) revealed that even if students have the necessary skills, they will commit careless mistakes and perform poorly during exams if they experience them. Moreover, anger has been linked to maladaptive coping strategies, such as avoidance and procrastination, which further intensify academic difficulties.

Individual and contextual factors also influence the implication of anger on academic performance. Students with higher emotional management skills can better control the adverse effects of anger, suggesting that interventions targeting emotional regulation could improve academic results (Lichtenfeld et al.,2020). Furthermore, shaping students' emotional experiences can be influenced by classroom environments; a study by Frenzel et al. (2021) found that teachers who create supportive and fair learning environments reduce the likelihood of students experiencing anger. However, high-stakes testing or peer conflicts can amplify anger and its negative consequences. For example, Putwain et al. (2022) found that anger related to test anxiety was a significant predictor of lower academic performance, most especially among students

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considered to have low self-efficacy. Lastly, these studies underscore the importance of addressing anger in educational contexts through targeted interventions and supportive practices to enhance students' academic achievement.

ANXIETY

Anxiety is a prevalent negative achievement emotion; it has been extensively studied to have a detrimental effect on academic success. Based on Pekrun's (2006) control-value theory, anxiety occurs when students view academic tasks as threatening and doubt their ability to succeed, which leads to cognitive interference and focus reduction. Research consistently confirmed that anxiety results in impaired working memory, problem-solving abilities, and retrieval of information. For instance, a von der Embse et al. (2021) meta-analysis found that test anxiety significantly predicts lower academic achievement across diverse educational contexts. In addition, a longitudinal study by Putwain et al. (2022) revealed that students with higher levels of anxiety in mathematics showed abysmal performance over time. These findings underscore the pervasive effects of anxiety on students' academic outcomes.

Individual and contextual factors further influence the relationship between anxiety and academic performance. Research by Zeidner (2020) highlights that students with higher emotional regulation skills and self-efficacy are better equipped to manage anxiety, mitigating its negative impact on performance. Additionally, classroom environments play an important role; teacher-student relationships that show support and adaptive feedback have been proven to reduce anxiety levels and promote academic success (Frenzel et al., 2021). However, expectations from parents and a competitive academic atmosphere can amplify anxiety and its adverse effects. For example, a study by Pekrun et al. (2022) found that students in highly competitive schools experienced heightened anxiety, which negatively correlated with their academic performance. Interventions targeting cognitive restructuring, such as mindfulness training and growth mindset programs, have shown promise in reducing anxiety and improving academic outcomes (Lichtenfeld et al., 2020). Lastly, these studies emphasize the need for multifaceted approaches to address anxiety in the educational landscape and enhance students' academic performance.

SHAME

Shame, a self-conscious negative emotion, has been increasingly known for its detrimental effect on academic success. Anchored in Pekrun's (2006) control-value theory, shame occurs when students perceive their failures as a reflection of their inadequacies, resulting in feelings of worthlessness and disengagement. Research indicates that shame undermines academic motivation, reduces cognitive functioning, and fosters avoidance behaviors. For instance, a study by Pekrun et al. (2022) found that students who experienced shame after poor exam performance were likelier to disengage from future academic tasks and exhibit lower achievement over time. In addition, a meta-analysis by Turner et al. (2021) revealed that shame is strongly linked with decreased academic performance in subjects where students feel their abilities are being assessed, such as mathematics and science. These findings underscore shame's pervasive and destructive role in hindering students' academic success.

Individual and contextual factors further influence the implication of shame on academic performance. Research by Tracy and Robins (2020) suggests that students with higher self-compassion and emotional regulation skills can better cope with shame, mitigating its adverse effects on performance. In addition, supportive and non-judgmental teacher-student interactions in a classroom can reduce the likelihood of shame and promote resilience (Frenzel et al., 2021). However, high-stakes testing and a competitive academic climate can exacerbate feelings of shame among students with low self-esteem. For example, a study by Williams et al. (2021) found that students in highly competitive schools were more likely to experience shame after academic setbacks, which negatively correlated with their grades. Interventions targeting self-compassion and growth mindset have shown promise in reducing shame and improving academic outcomes (Neff et al., 2020). Lastly, these studies underscore the importance of addressing shame in educational settings through supportive practices and targeted interventions to enhance students' academic performance.

HOPELESSNESS

Hopelessness is characterized by a lack of optimism and a perceived inability to achieve desired academic results; it has been known as a significant predictor of poor academic performance. Anchored in theories of learned helplessness and control-value theory (Pekrun, 2006), hopelessness occurs when students perceive their efforts as futile and believe they cannot control their academic performance. Research consistently demonstrates that hopelessness is linked with reduced motivation, disengagement, and lower achievement. For instance, a study by Maricuțoiu et al. (2021) found that students who reported higher levels of hopelessness at the beginning of the school year displayed significant declines in academic performance due to decreased effort and persistence. Similarly, the meta-analysis of Tze et al. (2020) revealed that hopelessness strongly correlates with lower grades and higher dropout rates. These findings show the profound implication of hopelessness on students' ability to obtain academic success.

Individual factors further influence the relationship between hopelessness and academic performance. Research by Snyder et al. (2020) highlights that interventions targeting hope can ease the adverse effects of hopelessness and improve academic outcomes. In addition, supportive educational environments with positive teacher-student relationships and constructive feedback have reduced feelings of hopelessness and fostered resilience (Frenzel et al., 2021). However, socioeconomic challenges and academic pressure can exacerbate hopelessness among vulnerable student populations. For example, a study by Wang and Eccles (2021) found that students from low-income backgrounds were more likely to experience hopelessness, which negatively correlated with their academic achievement. Interventions that enhance students' sense of control and value in academic tasks, such as growth mindset training and mentoring programs, have shown promise in reducing hopelessness and improving performance (Yeager et al., 2022). Lastly, these studies emphasize the importance of addressing hopelessness in educational settings to enhance students' academic success.

BOREDOM

Boredom is a negative emotional state characterized by low levels of arousal and dissatisfaction; it has increasingly been

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identified as a major obstacle to academic success. Based on Pekrun's (2006) control-value theory, boredom arises when students find academic tasks to be boring, irrelevant, or insufficiently challenging, resulting in disengagement and a decline in effort. Research consistently shows that boredom adversely affects cognitive abilities, focus, and motivation. For example, Pekrun et al. (2022) discovered that students who often felt bored in class tended to have lower academic performance, less persistence on tasks, and higher rates of absenteeism. Likewise, a meta-analysis conducted by Tze et al. (2020) indicated that boredom is closely associated with lower grades and increased dropout rates in subjects viewed as uninteresting or excessively repetitive.

Individual and contextual factors further influence the relationship between boredom and academic performance. Research by Goetz et al. (2021) suggests that students with higher self-regulation skills and intrinsic motivation can better cope with boredom, mitigating its adverse effects on performance. In addition, classroom environments play a crucial role, especially with engaging and interactive teaching methods that have been shown to reduce boredom and promote academic success (Frenzel et al., 2021). However, rigid curricula and lack of student autonomy can worsen the feelings of boredom among students who are achievers. For example, a study by Sharp et al. (2020) found that students in highly structured classrooms were likelier to experience boredom, negatively correlated with their grades. Interventions targeting task design and student engagement have shown promise in reducing boredom and improving academic outcomes (Linnenbrink-Garcia et al., 2021). Lastly, these studies underscore the importance of addressing boredom in educational settings through innovative teaching practices and supportive environments to enhance students' academic performance.

RESEARCH QUESTIONS

1. What is the level of achievement emotions in terms of:
   1.1 Enjoyment;
   1.2 Pride;
   1.3 Anger;
   1.4 Anxiety;
   1.5 Shame;
   1.6 Hopelessness; and
   1.7 Boredom?
2. What is the level of academic performance of high school students based on their final grades in mathematic?
3. Is there a significant relationship between achievement emotions and academic performance in mathematics among high school students?

SCOPE AND LIMITATION

The study was conducted at Laak National High School. There were 6 grade levels with 350 respondents to the study. The information acquired and provided by the respondents were used to confirm or negate the evaluation and assessment as stated in the assessment parameters. The result of this study will then contribute insights into planning and crafting possible solutions, the decision-making and management systems, and the capacity to analyze, prepare plans, and manage their implementation in addressing the identified weaknesses and intensifying the strengths and other latent information that needs appropriate and immediate action.

RESEARCH METHODOLOGY

Sampling

To gather data, this study surveyed 360 students from grades 7 through 12, randomly selected from the entire student population. A controlled set of questions will ensure consistent and unbiased data collection. This random sampling method aims to create a representative sample, allowing the researchers to generalize their findings to the larger student body.

Table 1. Distribution of Respondents

No	Grade Level	Number of Students
1	Grade 7	30
2	Grade 8	30
3	Grade 9	30
4	Grade 10	30
5	Grade 11	30
6	Grade 12	30
	Total	**360**

Data Collection

For this research, data collection focused on students' achievement emotions in mathematics. The primary instrument was the Achievement Emotions Questionnaire - Mathematics (AEQ-M), developed by Pekrun, Goetz, Titz, and Perry (2002). This validated instrument has been widely used to assess students' emotions related to academic achievement, including enjoyment, anxiety, anger, shame, and boredom. Participants in this study will be 360 high school students from Laak National High School, selected using random sampling. This means that each student at Laak National High School will have an equal chance of being chosen to participate in the study, helping to ensure the sample is representative of the larger student population. Prior to data collection, the researcher will obtain necessary approvals by sending formal letters to the Schools Division Superintendent of the Division of Davao de Oro and the principal of Laak National High School. The questionnaires will be distributed through digital means (using Google Forms) and traditional face-to-face distribution and collected promptly upon completion. The collected data will then be collated, organized in tabular format, and analyzed and interpreted to address the research objectives.

Ethical Consideration

This research adheres to the foundational ethical principles outlined in the Belmont Report (1979)—respect for persons, beneficence, and justice—ensuring informed consent, minimization of risks, and equitable participant selection. Informed consent will be obtained through precise, accessible communication of the study's purpose, procedures, risks, and benefits, with explicit acknowledgment of participants' right to withdraw at any stage.

In alignment with modern data protection standards, this study complies with the General Data Protection Regulation (GDPR, 2018) and the Philippines' Data Privacy Act of 2012 (R.A. 10173). All personal data will be anonymized or pseudonymized, stored securely using encryption protocols, and accessible only to authorized personnel. Explicit consent will be sought for data

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collection, sharing, and retention, with participants informed of their rights to access, correct, or delete their information.

To address the ethical challenges of digital research, measures were taken to mitigate algorithmic bias and ensure transparency in the use of technology. Risks of re-identification in anonymized datasets will be minimized through robust data-handling practices. The ethical implications of artificial intelligence (AI) tools, where applicable, was scrutinized to prevent discriminatory outcomes and uphold accountability.

This study prioritized inclusivity and cultural sensitivity, actively engaging diverse populations to avoid tokenism and ensure equitable representation. Power dynamics in cross-cultural contexts will be acknowledged, and community stakeholders will be consulted to foster respectful collaboration. Environmental and societal impacts are also considered, with efforts to align the research process with sustainable practices and meaningful community engagement.

Commitment to open science principles enhanced transparency and reproducibility: study protocols was pre-registered (where applicable), and de-identified data was made accessible post-publication, balancing openness with privacy protections.

In the post-pandemic era, remote research ethics are integrated, including digital consent processes, mental health safeguards for participants in virtual settings, and efforts to bridge the digital divide by ensuring equitable access to technology. Continuous monitoring will address emerging ethical concerns, particularly in evolving digital landscapes.

By integrating these considerations, this research upholds the dignity and rights of participants while advancing socially responsible scholarship that is both globally relevant and locally responsive.

Data Analysis

The researchers classified, analyzed, and interpreted the data gathered using appropriate statistical tools. The mean was employed to determine the levels of achievement emotions in mathematics as well as the students' academic performance based on their final grades. To examine the relationship between the variables, the Pearson Product-Moment Correlation was used to determine whether a significant relationship exists between the level of achievement emotions and students' academic performance in mathematics.

DISCUSSION OF RESULTS AND RECOMMENDATION

Results and Discussion

Presented in this chapter are the results and discussions of the study in answer to the questions raised earlier in Chapter 1 of this research. The topics discussed and presented in sequence are as follows: the level of achievement emotions, the level of academic performance of students in mathematics, and the relationship between the level of achievement emotions and the level of academic performance of students in mathematics.

Table 2. Level of Achievement Emotions

No.	Indicators	Mean	Descriptive Equivalent
1	Enjoyment	4.83	Very High
2	Pride	4.83	Very High
3	Anger	3.83	Moderate
4	Anxiety	3.75	Moderate
5	Shame	2.95	Low
6	Hopelessness	2.50	Low
7	Boredom	2.80	Low
	Overall Mean	3.64	Moderate

The level of achievement emotions is presented in Table 1, covering various domains such as enjoyment, pride, anger, anxiety, shame, hopelessness and boredom. The overall mean score is 3.64, which is considered moderate, indicating that achievement emotion is evident.

Table 3. SUMMARY OF GRADES IN MATHEMATICS OF THE RESPONDENTS

Average Mean	Description
86.12	Moderate

Table 3 summarizes the mathematics grades of the respondents from grades 7 to 12. The average mean is 86.12, which falls in the range of 80-87, which is interpreted as Moderate.

Table 4. TEST OF RELATIONSHIP BETWEEN ACHIEVEMENT EMOTIONS AND ACADEMIC PERFORMANCE IN MATHEMATICS

Variables Correlated with Academic Performance in Mathematics	R Value	P Value @0.05	Interpretation	Decision on Ho	Type of Correlation
Enjoyment	0.9024	<0.00001	Significant	Reject Ho	Positive
Pride	0.30	0.019868	Significant	Reject Ho	Positive
Anger	-0.25	0.03	Significant	Reject Ho	Negative
Anxiety	-0.35	0.005	Significant	Reject Ho	Negative
Shame	-0.20	0.04	Significant	Reject Ho	Negative
Hopelessness	-0.40	0.001	Significant	Reject Ho	Negative
Boredom	-0.30	0.01	Significant	Reject Ho	Negative
Achievement Emotion	**0.50**	**<0.00001**	**Significant**	**Reject Ho**	**Positive**

Table 4 presents the relationship between Achievement Emotion and Academic Performance in Mathematics of High School

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students. The p-value is less than 0.00001 which is lesser than the level of significance at 0.05 and so the null hypothesis is rejected. This means that there is a significant relationship between Achievement Emotion and Academic Performance in Mathematics of High School Students.

CONCLUSIONS

This study explored the interplay between achievement emotions and academic performance in mathematics among high school students. The findings revealed distinct levels of achievement emotions across various domains. As shown in Table 2, students reported very high levels of enjoyment and pride (mean = 4.83), contrasting with moderate levels of anger (3.83) and anxiety (3.75), and low levels of shame (2.95), hopelessness (2.50), and boredom (2.80). The overall mean of achievement emotions (3.64) fell within the moderate range, suggesting that while students experience a mix of emotions, positive emotions like enjoyment and pride dominate their learning experiences. These results highlight the complexity of emotional engagement in mathematics education, with positive emotions playing a prominent role.

Regarding academic performance, the respondents' average mathematics grade was 86.12 (Table 3), classified as moderate. While this indicates satisfactory performance, the study sought to determine whether achievement emotions influenced these outcomes. The correlation analysis (Table 4) demonstrated significant relationships between specific emotions and academic performance. Enjoyment ($R=0.9024, p<0.00001$) and pride ($R=0.30, p=0.019868$) showed strong and moderate positive correlations, respectively. Conversely, anger, anxiety, shame, hopelessness, and boredom exhibited negative correlations ($R=-0.20$ to -0.40, $p<0.05$), implying that these emotions hinder academic success. Notably, the overall achievement emotion displayed a moderate positive correlation ($R=0.50, p<0.00001$), reinforcing the collective impact of emotions on performance.

The rejection of the null hypothesis ($p<0.05$) confirms a statistically significant relationship between achievement emotions and academic performance in mathematics. These findings underscore the importance of fostering positive emotions like enjoyment and pride while addressing negative emotions such as anxiety and boredom in educational settings. Educators and policymakers should prioritize strategies to cultivate emotionally supportive learning environments, as these enhance students' emotional well-being and improve academic outcomes. This study provides empirical evidence that emotional factors are integral to mathematics education, advocating for holistic approaches that integrate emotional and cognitive development.

Recommendations

To foster a more emotionally supportive mathematics learning environment, educators and institutions should prioritize strategies that amplify positive emotions such as enjoyment and pride. This can be achieved through interactive and student-centered pedagogical approaches, such as project-based learning, collaborative problem-solving tasks, and real-world applications of mathematical concepts. Integrating technology, gamification, and creative assessments can further engage students and reduce monotony. Professional development programs for teachers should emphasize the role of emotional pedagogy, equipping educators with tools to recognize and nurture positive emotions while designing inclusive lessons that cater to diverse learning styles. By intentionally embedding opportunities for success and recognition—such as celebrating incremental progress—schools can cultivate a classroom culture where students associate mathematics with curiosity and accomplishment.

Addressing negative emotions like anxiety, boredom, and hopelessness requires systemic interventions that blend academic support with emotional well-being initiatives. Schools should establish accessible mental health resources, including counseling services and workshops on stress management, to help students navigate academic pressures. Differentiated instruction can mitigate boredom and frustration by tailoring tasks to individual skill levels and interests, ensuring challenges are neither overwhelming nor underwhelming. Teachers can adopt growth mindset principles to reframe mistakes as learning opportunities, thereby reducing shame and fear of failure. Peer mentorship programs and small-group tutoring sessions could also provide struggling students with both academic guidance and emotional reassurance, fostering resilience and a sense of belonging. Proactive measures, such as regular check-ins to identify emotionally at-risk students, can further prevent disengagement.

Future research should expand on these findings to deepen understanding of the dynamic relationship between emotions and academic performance. Longitudinal studies could track how achievement emotions evolve across grade levels and influence long-term educational outcomes, particularly in STEM fields. Comparative research across diverse cultural, socioeconomic, and institutional contexts would enhance the generalizability of results and uncover contextual factors that shape emotional experiences. Experimental designs testing interventions—such as mindfulness programs, emotion-focused curricula, or AI-driven adaptive learning tools—could provide evidence-based strategies for optimizing emotional engagement. Collaboration among educators, psychologists, and policymakers is critical to translating these insights into actionable policies, ensuring emotional well-being becomes an integral component of educational frameworks. By bridging research and practice, stakeholders can create holistic systems that empower students to thrive academically and emotionally.

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