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Improving Math Engagement: Understanding Student and Teacher Perspectives Through Daryl Bem's Self-Perception Theory

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ABSTRACT

The research investigates high school students' views on mathematics to understand factors behind negative attitudes and design specific interventions to enhance mathematical engagement and performance. The researchers applied a qualitative inquiry method to conduct in-depth interviews with 25 students and 8 mathematics teachers at JAPeR Memorial High School. This research follows Daryl Bem's Self-Perception Theory, which suggests students who perceive themselves poorly in math struggle with learning and motivation.

The research identified key themes that shape student perceptions about mathematics, which consist of the subject's perceived difficulty level and teaching approaches, along with gender learning gaps, math anxiety, and its perceived lack of relevance. Students who experienced complex and abstract teaching methods at high speeds found it difficult to understand, while students receiving family support and interactive teaching showed better engagement and attitudes. The study discovered that math anxiety interrupts cognitive processing, which results in increased disengagement. The study recommends educational interventions that improve teaching methods through real-world math applications and offer comprehensive emotional and academic support to boost student engagement.

The study highlights the importance of utilizing a comprehensive approach to address students' cognitive, emotional, and social experiences with mathematics to develop an educational environment that supports learning. The proposed interventions focus on altering student attitudes towards mathematics to connect mathematical concepts with their academic pursuits and daily experiences.

Keywords: Mathematics Attitudes, Math Anxiety, Teaching Methods, Daryl Bem's Self-Perception Theory, Educational Interventions, Mathematics Engagement.

INTRODUCTION

The study of mathematics serves as a critical foundation for developing cognitive abilities that students apply in both educational and professional environments throughout their lives (Geary, 2011). Most students maintain negative attitudes towards mathematics because they view the subject as an abstract and intimidating discipline that presents significant challenges (Boaler & Chen, 2016; Suárez-Pellicioni, Núñez-Peña, & Colomé, 2016). Students' negative perceptions about their education go beyond the classroom walls and have a significant impact on their academic involvement as well as their career trajectories.

Studies indicate that students' perspectives toward mathematics are influenced by internal elements, like confidence and anxiety, with external factors like family, peers, and teaching methods also playing a role (Garcia, Martinez, & Hernandez, 2020; Santos & Reyes, 2019). In the Philippines, the prevalence of students with mathematics anxiety is alarming, as a good percentage of learners indicate fear or dislike of the subject (DepEd, 2023). According to research conducted by the Department of Education, approximately 60% of students report they experience fear or aversion to any mathematics-related activities (DepEd, 2023).

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This study is set in the context of Daryl Bem's Self-Perception Theory (1967) which states that people form attitudes based on their own actions as well as the surrounding context. Students who struggle regularly with math or have difficulties understanding the subject may internalize their experiences such that they eventually consider themselves "poor at math" (Boaler & Chen, 2016). This self-perception can further lead to lack of motivation and effort in engagement which is then self-reinforcing.

As studies show, teaching methods and engagement activities are fundamental in designing the students' attitude to mathematics (Smith, Johnson, & Lee, 2017; Santos & Reyes, 2019). In fact, Meltzoff et al (2015) and Smith and Brown (2018) have noted that students' confidence can be boosted, and anxiety lessened through interactive teaching approaches, the use of real-life examples, and by placing students in a supportive learning atmosphere. Besides, Garcia et al. (2020) point out that family support and friends are very important external factors since pupils tend to adopt the behaviors of those who are close to them.

Statement of the Problem

The primary objective of this research is to explore students' perceptions of mathematics and identify the factors that influence these perceptions. By understanding these factors, this study aims to propose tailored interventions to improve students' engagement and performance in mathematics.

The following research questions guide the study:

a. What are students' perceptions of mathematics at JAPeR Memorial High School?
b. How do teachers perceive students' attitudes towards mathematics?
c. What are the key factors that influence students' perceptions of mathematics?
d. What interventions can be designed to address these factors and improve student outcomes?

METHODS

This study employed a qualitative inquiry approach, focusing on in-depth interviews to capture the nuanced experiences of students and teachers. Qualitative research is particularly effective for understanding deeply held beliefs and attitudes, allowing for a comprehensive analysis of the factors influencing students' perceptions (Marecek et al., 2020).

Participants: The participants were 25 students and 8 mathematics teachers from JAPeR Memorial High School. The students were purposively sampled based on their struggles with mathematics, as identified by their teachers. Teachers involved in the study were selected for their experience teaching mathematics at both the junior and senior high school levels.

Data Collection: Data was collected through semi-structured interviews, allowing flexibility in exploring both anticipated and emergent themes. Interviews were conducted in a private setting to encourage honest and open communication. Thematic analysis was used to identify recurring patterns in the data, categorizing student and teacher perceptions into key themes.

Ethical Considerations: Informed consent was obtained from all participants and, in the case of students, from their parents. Confidentiality and anonymity were maintained throughout the study, in compliance with Holy Name University's Ethical Review Board guidelines.

RESULTS

The findings from the interviews were organized into key themes that reflect students' and teachers' perceptions of mathematics.

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Table 1. Students' perceptions towards Mathematics in terms of perceived difficulty

Codes	Category	Theme
Complicated subject, Difficulty passing the subject, Difficulty despite effort, Difficulty in reading and solving, Struggle subject, Difficulty performing independently, Frustration with complex formulas and solutions, Increasing class difficulty, Difficult concepts and topics, Difficult subject, Confusing methods, Extremely Difficult, Struggle due to consecutive failures, Confusion making the subject difficult, Exhausting study sessions, Complexity with much to memorize, Feelings of inadequacy and loss of self-confidence, Challenges due to various topics, Pressure-inducing tasks	Difficult	Perceived Difficulty of Math

Perceived Difficulty of Mathematics: This theme captures students' emotional and motivational difficulties, such as a lack of confidence and fatigue from extended study sessions, in addition to their cognitive challenges, such as understanding abstract ideas and resolving multi-step problems.

Daryl Bem's Self-Perception Theory, which holds that people develop attitudes and beliefs about themselves by observing their behavior and experiences, is consistent with this sense of difficulty. In this situation, students see their repeated difficulties, perplexity, and perceived mathematical failures as proof that they are "not good at math," which lowers engagement and reinforces a fixed mindset. For instance, one student said, "Math is a confusing subject; no matter how much I attempt to understand, I cannot figure it out." This internalization illustrates how academic difficulties are interpreted cognitively and lead to low self-esteem and a lack of motivation to persevere.

These perceptions are influenced by repeated experiences of failure or difficulty rather than being a true reflection of mathematical aptitude, particularly when no explicit methods for overcoming these are provided. Thus, the idea that mathematics is complex becomes a self-reinforcing belief that can significantly impact students' academic performance, learning habits, and attitudes.

This research highlights the need for teaching strategies that purposefully combat learned helplessness, demystify mathematical concepts, and offer consistent scaffolding. It is possible to change students' self-perceptions and promote more positive engagement with mathematics by attending to their emotional reactions and offering them chances for success. This aligns with research by Solso et al. (2007), which emphasizes the cognitive and affective difficulties that students must overcome when attempting to learn mathematical concepts.

Table 2. Students' perceptions towards Mathematics in terms of the Influence of Teaching Method on Learning

Codes	Category	Theme
Difficulty level depending on the teacher, Irritation from unclear teacher explanations, unproductive math class due to continuous discussion	Dependence on Teaching	Influence of Teaching Method on Learning

Teaching methods: The Dependency on Teaching category highlights students' perceived dependence on their teachers' clarity, pacing, and engagement techniques. Many people can only comprehend complex mathematical concepts when teachers use scaffolded instruction and step-by-step explanations. On the other hand, students become frustrated and disengaged when instruction is hurried, unstructured, or do not consider varying learning speeds.

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This pattern is consistent with Daryl Bem's Self-Perception Theory, which holds that students deduce their academic proficiency from the results of their learning activities in particular situations. They often perceive themselves as competent learners when they experience success with explicit, well-structured instruction. However, they internalize these difficulties as signs of inadequacy, reinforcing negative self-perceptions, when confusion and failure result from ineffective teaching.

The impact of teaching strategies goes beyond scholarly comprehension; it also molds students' perceptions of their mathematical skill. One student subtly expressed this by saying math was more complicated, "depending on the teacher." This comment highlights how the teacher's responsiveness, clarity, and teaching style can either boost or undermine students' confidence.

These results highlight how vital pedagogical strategies are for developing content mastery and positive mathematical self-concepts. Instructors can reduce perceived difficulty and encourage participation, perseverance, and eventually better performance by tailoring their teaching strategies to the needs of their students. Boaler and Chen (2016) argue that engaging and student-centered teaching can significantly increase engagement and reduce students' anxiety towards mathematics.

Table 3. Students' perceptions towards Mathematics in terms of Learning Disparities

Codes	Category	Theme
Easy for achievers but difficult for slow learners, Greater math excellence among females, Easier for girls than boys to solve, Struggle with weak memory, Easy for bright students, Incredible quickness of brighter classmates, Ease for boys due to analytical skills, Easy for bright ones, Struggles with weak memory, Quicker and more adept reasoning by boys	Variability in Learning	Learning Disparities

Gender and Learning Disparities: Students' subtle perceptions of mathematical ability are often tainted with gender stereotypes. In contrast, some of the students described learning variability in terms of general ability, speaking of "achievers" or "bright students" versus "slow learners," whereas others tended to use gendered references. Some comments were made by respondents to the effect that boys have "natural analytical" or "quicker reasoning." In contrast, the girls prosper through "diligence" or "effort," proposing an idea of inherent superiority of boys over girls in mathematics as opposed to an intrinsic downside or lack of competence on the part of girls in mathematics.

Instead of outright dismissing these perceptions with a single citation, these findings demand an in-depth consideration of how images such as these are internalized and reproduced in the school setting. They influence the dynamics within the classroom itself, one's self-efficacy, and participation in activities. Some boys may call themselves analytical and thus feel confident approaching complex problems. On the other hand, high-achieving girls might remark on their success being due to their hard work rather than ability, a pattern foreseen in Dweck's mindset theory and Bem's self-perception theory. With this internal out-attribution, such girls might resist risk in problem-solving and taking advanced mathematics courses, reinforcing the gender gap in other classical pathways within STEM.

The evidence that suggests that students negotiate those narratives in their social and academic context is further corroborated by their contradictory student views, for example, pointing to both males and females excelling in mathematics. Thus, schools need to bring down and destroy such gender expectations actively. Class discussions, teacher feedback, and curriculum content should intentionally infuse messages demonstrating a growth mindset and a gender-equitable view of mathematical ability.

Analyzing the data through the study's theoretical lens sheds light on how student self-perceptions can be influenced by ability, instruction, and sociocultural narratives. Thus, these narratives must be addressed through inclusive pedagogical strategies to create equitable math learning environments. Research by Kane

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and Mertz (2012) dispels the notion of inherent gender differences in mathematical ability, attributing these disparities to cultural stereotypes rather than cognitive differences.

Table 4. Students' perceptions towards Mathematics in terms of Math Anxiety

Codes	Category	Theme
Depressing subject, Constant worry, Source of extreme worry and fear, most feared subject, Pressure and anxiety, Fear of making mistakes in solving, Fearful subject due to low pass rate	Fear and Anxiety in Learning	Math Anxiety

Math Anxiety: Students often referred to mathematics as the "most dreaded" or "most stressful" subject, and their reactions to tests ranged from anxiety to paralysis. As an example of how anxiety directly impairs cognitive functioning and problem-solving skills, one student said, "I get so nervous during math tests that I just freeze and can't think properly."

Daryl Bem's Self-Perception Theory aligns with this pattern, which contends that people develop opinions about themselves by examining their actions and feelings. Students internalize these experiences as proof that they are naturally bad at mathematics when they frequently experience fear, confusion, or failure. This eventually results in a low academic self-efficacy, avoidance, and helplessness-based self-concept. The cycle of anxiety and disengagement may worsen if students start to see themselves as the cause of the issue rather than as a reaction to hardship.

Furthermore, high-stakes testing, performance pressure, fear of making mistakes in front of others, and peer comparison are some examples of external factors that frequently reinforce math anxiety. Students cannot fully participate in the learning process because these factors create a learning environment where emotional stress takes precedence over conceptual understanding.

This research highlights how important it is for teachers to establish psychologically secure classrooms where making mistakes is accepted as a natural part of learning. The goal of interventions should be to help students reframe their self-perception from fear to growth and capability by attending to their cognitive and emotional needs. This is consistent with findings by Suárez-Pellicioni, Núñez-Peña, and Colomé (2016), who demonstrated that math anxiety can interfere with working memory, further impairing performance.

Table 5. Students' perceptions towards Mathematics in terms of Lacking Real-world Relevance

Codes	Categories	Theme
Hassle subject due to lack of real-life application, not useful beyond academic schooling, Question the relevance of topics in real-life situations, Don’t understand the practical use of math topics in real life, Don’t recognize the relevance of lessons	Perceived Irrelevance	Perception of Mathematics as Lacking Real-world Relevance

Perceived Irrelevance: Many students find mathematics theoretical, abstract, and detached from real-world applications. "I don't see why we need to learn these things; they don't help in real life," said one student. This disconnect erodes students' intrinsic motivation and leads to disengagement because they don't see the value or purpose of the material they are being asked to learn.

According to Daryl Bem's Self-Perception Theory, students interpret these classroom experiences to develop attitudes toward math and themselves as math learners. Students may conclude that mathematics is not for them or that they are not the type of people who "use math" meaningfully if they are constantly exposed to material that seems unrelated or unapplicable. This conclusion may lead to a vicious cycle in which students' perceptions of math's value reduce their desire to use it, further solidifying their sense that it is irrelevant.

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Due to this perception, students may also start to doubt the importance of effort in math learning. They are less inclined to devote time and effort to comprehending the subject matter if they fail to perceive a link between what is taught and their future roles or real-world goals. This undermines the development of positive math identities and impacts engagement.

These results highlight how crucial it is to contextualize math education in ways that demonstrate its tangible and obvious relevance. Students can be assisted in changing their perspectives and realizing the usefulness of mathematics in both social and personal contexts by lessons that integrate real-world issues, interdisciplinary connections, and authentic applications. As students start to see themselves as capable of using math in meaningful ways, this may also help them develop more positive self-perceptions. Tanaka and Smith (2019) argue that students are more likely to engage in mathematics when they perceive it as relevant to real-world applications.

Table 6. Students' perceptions towards Mathematics in terms of Disengagement and Inefficiency in Learning.

Codes	Categories	Theme
Boring subject, Dullness from repetitive tasks, most boring subject, Lack of engagement causing dizziness, Dullness due to repetitive tasks, Tiring subject, Daunting bulky questions, Overwhelming and draining subject, Disinterest in studying math Tedious subject leading to a lack of interest	Lack of Engagement and Interest	Disengagement in Learning Mathematics
Time wasting subject, time-consuming subject leading to disappointment	Time Constraints	Inefficiency in Learning Mathematics

External Influences: Disengagement in Learning and Inefficiency in Learning Mathematics are two related but separate themes that the data shows influence students' unfavorable opinions of mathematics. According to students, math is a monotonous and repetitive subject that is "boring," "tiring," and "overwhelming" (e.g., "dullness from repetitive tasks," "most boring subject," and "disinterest in studying math"). This lack of emotional and cognitive stimulation exacerbates the general theme of Lack of Engagement and Interest. Many people's disengagement stems from what they perceive to be a disconnect between meaningful learning experiences and teaching methods, rather than a lack of ability.

Students' dissatisfaction with the perceived inefficiency of math learning is addressed in the second category, Time Constraints. Codes such as "time-wasting subject," "time-consuming," and "bulky and daunting questions" imply that students believe their efforts are not very worthwhile, which deters them and makes them less motivated.

Daryl Bem's Self-Perception Theory, which holds that people form attitudes and self-belief by observing their actions and the results of those actions, is strongly supported by these patterns. Students who frequently feel bored, exhausted, or ineffective in math classes start to internalize these feelings as a sign of their incapacity or disinterest. Instead of considering disengagement as a response to poor curriculum design or instruction, students may conclude that "math is not for me" or "I'm not good at math," which would further diminish effort and participation and reinforce negative self-perceptions.

Peer pressure and family support are outside factors that exacerbate these internalized views. Students who receive strong academic support from their families are more likely to develop positive attitudes toward math, according to Mbugua et al. (2012). On the other hand, a lack of support or a hostile peer environment can exacerbate disengagement. Students' identities and willingness to stick with subjects seen as challenging or uncool are greatly influenced by their peers, particularly during adolescence.

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These results highlight the need for a more stimulating, pertinent, and encouraging learning environment that promotes emotional investment and meets cognitive needs. Students' perceptions of math and themselves as competent learners can be reframed with teaching strategies that incorporate real-life contexts, encourage collaborative learning, vary instruction, and provide visible progress markers.

DISCUSSION

Interpretation of Findings: This study reveals that students often develop negative feelings towards math due to both personal and external influences. On a personal level, factors like self-confidence, anxiety about math, and their perception of math's importance are significant. Externally, the way teachers instruct, the influence of family members, and pressure from peers also contribute. These results align with previous research, particularly Bem's Self-Perception Theory. This theory argues that when students face repeated challenges, they start believing they're not good at math, leading them to internalize these experiences and develop negative beliefs about their math abilities (Bem, 1967; Boaler & Chen, 2016).

The perceived difficulty of mathematics was a major theme in this study, with students feeling overwhelmed by the complexity of the subject. This echoes the findings of Geary (2011), who observed that many students perceive math as inherently difficult, which contributes to avoidance behaviors and poor academic performance. Addressing these perceptions requires targeted interventions that simplify mathematical concepts and make them more accessible.

How teachers teach has a big impact on how students feel about math. Teaching strategies that center on students and include real-life examples can make students more interested and less anxious about math (Smith et al., 2017; Tanaka & Smith, 2019). Teachers who use these strategies are more effective at helping students overcome challenges in math.

Math anxiety was identified as a major hurdle for student success. According to Suárez-Pellicioni and colleagues (2016), this type of anxiety can interfere with students' cognitive processes, leading to poorer academic performance and a stronger dislike for math. To effectively combat math anxiety, it's important to adopt a comprehensive approach that includes both academic and emotional support. Teachers can make a big difference by fostering a supportive classroom environment and providing opportunities for students to succeed in math. This approach can help build students' confidence and reduce their fear of the subject.

The perceived irrelevance of mathematics was a key factor in student disengagement. Tanaka and Smith (2019) suggest that incorporating real-world applications into the curriculum can help students see the value of mathematics, making the subject more relatable and engaging.

Implications for Teaching: This study highlights some important steps to make students more positive about math. First, teachers should get training that focuses on student-centered teaching and ways to ease math anxiety. This kind of training can equip teachers with fresh ideas to make math less intimidating and more fun. Second, integrating real-world applications of math into the curriculum can help demystify abstract concepts and demonstrate relevance. Effective examples include using budgeting exercises to teach percentages and decimals, applying geometry through architectural design challenges, or analyzing local weather data to understand statistics and probability. These activities not only make math more tangible but also show students how math is used in daily life and future careers. Lastly, providing emotional support is crucial. Schools can offer this through counseling services and peer mentoring programs. These resources help students tackle emotional challenges that might prevent them from fully participating in math classes (Santos & Reyes, 2019).

CONCLUSION

This study reveals that students’ negative attitudes toward math stem from both personal and external influences, including math anxiety, teaching methods, and how important they perceive math to be. This finding is consistent with Bem’s Self-Perception Theory from 1967, which suggests that students' beliefs about their math abilities are shaped by their past experiences and performance.

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The study underscores the need for ongoing teacher development, focusing on student-centered teaching strategies to alleviate math anxiety. Demonstrating real-world applications of math can enhance students' attitudes and interest in the subject. Schools should also prioritize emotional support programs, such as counseling and peer mentoring, to aid students in managing anxiety and boosting their confidence in math.

RECOMMENDATIONS:

Teacher Training: Schools should offer professional development workshops focused on differentiated instruction, student-centered learning, and strategies for reducing math anxiety.

Curriculum Development: Incorporating real-world applications of mathematics into the curriculum can help students understand the relevance of the subject, motivating them to engage more actively.

Student Support Systems: Schools should implement counseling services and peer mentoring programs to help students manage their anxiety and build confidence in math. Encouraging a growth mindset can also shift student attitudes toward learning.

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