Environment and Social Psychology (2025) Volume 10 Issue 10 ISSN: 2424-8975 (O)
doi: 10.59429/esp.v10i10.3364 2424-7979 (P)

RESEARCH ARTICLE

Busting fear and enhancing comprehension of learners in mathematics and science-oriented courses

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ABSTRACT

This research examined approaches to reducing fear and enhancing comprehension among learners in mathematics and science oriented courses. The study highlighted the perspectives of instructors, whose narratives provided insights into students' engagement, classroom behaviors, and attitudes toward these subjects. The study involved twenty-five (25) mathematics and science instructors from basic and higher education institutions in Dumaguete City and Zamboanga City, Philippines. Using a qualitative approach, data were gathered through in-depth interviews to capture teachers' insights of their students' experiences and challenges in mathematics and science learning. The findings revealed that students, as described by their instructors, exhibited improved comprehension and greater confidence when guided through supportive and adaptive teaching strategies, while fear and anxiety were substantially reduced. This study underscored the importance of effective instructional practices in fostering positive learning environments and enhancing student outcomes in mathematics and science education.

Keywords: Mathematics and science education; fear and anxiety; comprehension; instructional strategies

1. Introduction

In light of their widespread use in the majority of disciplines, mathematical and scientific knowledge and abilities have long been acknowledged as necessary qualifications for admission to universities and other higher education establishments. In order to improve their analytical, computational, and investigative abilities, all students essentially need to understand both mathematics and science [1]. Mathematics, the study of arrangement, order, and relationships that has developed from basic activities of counting, measuring, and depicting the forms of objects [2], and science, the systematic pursuit of knowledge about the natural and physical world through observation and experimentation, are disciplines frequently linked with fear and unease. Such fear can considerably obstruct students' educational experiences and overall scholastic

ARTICLE INFO
Received: 7 January 2025 | Accepted: 20 October 2025 | Available online: 29 October 2025

CITATION
Batucan NA, Inoferio HV, Quisay ARC, et al. Busting fear and enhancing comprehension of learners in mathematics and science-oriented courses. *Environment and Social Psychology* 2025; 10(10): 3364 doi:10.59429/esp.v10i10.3364

achievement [3].

The fields of mathematics and science education have long suffered from a constant disparity between students' capabilities and their actual performance, especially in STEM-focused courses. This divide is illustrated by the prevalent anxiety related to both mathematical tasks and science-related experiments, which can impede understanding and involvement, ultimately obstructing academic achievement. Research shows that roughly 20% to 30% of students face considerable math anxiety, while similar levels of apprehension are reported in challenging science subjects such as physics and chemistry [4]. These anxieties not only impact learning results but also shape students' long-term perceptions of the disciplines.

This research intended to reveal the approaches to tackle this important challenge by investigating the transformative influence of firsthand experiences in mathematics and science education, suggesting that experiential learning can greatly lessen anxiety and improve understanding among students. By analyzing particular activities and teaching strategies, this research aimed to offer insights into practices that have proven effective in alleviating fear for learners with previous anxiety about STEM subjects [5,6]. Furthermore, it offered advice on how educators can efficiently address comprehension challenges, fostering a deeper understanding and increased confidence in students as they engage with mathematical and scientific ideas [7].

Fear in mathematics and science is commonly acknowledged as a major obstacle to successful learning. Research has indicated that subject-related anxiety can result in avoidance behaviors, reduced performance, and a disinterest in problem-solving tasks [8-9]. Worldwide, the emphasis placed on mathematics and science as crucial skills for problem-solving and critical thinking highlights the necessity of effective teaching methods. Nations with robust curricula, such as Finland and Singapore, have shown success in creating positive learning environments that emphasize active engagement [10]. This research explored the learner's anxiety and comprehension levels in mathematics and science oriented courses. Analyzing qualitative data from various educational contexts, this study aimed to reveal the connection between hands-on learning activities and students' understanding of these disciplines.

Ultimately, this research sought to illustrate that employing effective instructional strategies in both mathematics and science curricula can reduce anxiety while enhancing student understanding. Offering empirical evidence and practical suggestions, this study intended to contribute to the ongoing discussion on effective STEM education, promoting pedagogical changes that prioritize supportive and adaptive teaching methods to empower learners in their academic pursuits. The setting concentrated on urban schools, particularly in the secondary and tertiary levels in well-resourced areas such as Dumaguete City and Zamboanga City, where varied student populations frequently encounter distinct challenges in mathematics and science education. The expected result was a clearer insight into how effective instructional strategies can serve as drivers of change, fostering a more inclusive and effective learning atmosphere.

2. Literature review

The belief in one's abilities is an essential element in overcoming fear and anxiety in education [11], Bandura's research indicates that when learners perceive themselves as capable and receive support, their fears lessen, which results in enhanced educational outcomes. Furthermore, the tenets of constructivist teaching, as described by Vygotsky [12], emphasized the significance of social interaction and collaborative learning in fostering a nurturing classroom atmosphere that can ease fear. In addition to these initial concepts, math anxiety often involves negative experiences, suggesting that a positive educational environment might help students overcome this sentiment. Similarly, science anxiety has been reported as a distinct phenomenon, manifesting as crippling panic during science examinations when the true investigative nature

of science is not made clear to learners [13]. These parallel findings reinforce the urgency of addressing subject-specific anxieties across STEM disciplines.

Research by Ramirez et al. [14] shows that certain activities, such as collaborative learning and finding application problems to solve, can significantly reduce anxiety in students who have previously had negative experiences with mathematics. In science education, inquiry-based learning offers students opportunities to engage with phenomena, develop inquiry skills, and enhance their epistemological awareness of the nature of science, which fosters both deeper understanding and more positive attitudes towards the subject [15]. In addition, there are studies by Maslow [16] on the hierarchy of needs that suggest that dealing with emotional barriers, such as fear and anxiety, is an essential requirement for effective learning. Studies by Ashcraft [17] have shown that math anxiety can be a major obstacle to performance and comprehension. This calls for techniques that reduce fear and create a more supportive learning environment. Traditional methods tend to emphasize rote memorization and procedural skills, which can increase anxiety [18]. In contrast, constructivist approaches that involve problem-solving and inquiry have been shown to increase interest and reduce anxiety in both mathematics and science education.

The Encourager and the Accessible Educator. For mathematics and science teachers, the educator role is most critical in shaping learners' attitudes and knowledge. As studies suggest, an educator who shows confidence toward their students works wonders with the students' self-efficacy and intrinsic motivation. The Accessible Instructor, on the other hand, emphasizes the need to make a learning environment welcoming and approachable. In such an environment, learners are comfortable asking questions or seeking help. This is particularly important in mathematics and science as learners are frequently faced with intricate concepts and may be reluctant to voice their problems. A study by Fong et al. [19] shows that when instructors are warm and available to provide help, students are more likely to engage in active learning and ask questions about challenging topics. An Accessible Educator is concerned with building relationships with students, creating a sense of belonging in the classroom, and fostering collaborative learning opportunities. This encouraging atmosphere makes learners less likely to feel isolated while facing challenges and more eager to engage actively.

The Mindfulness Advocate and Supportive Group Facilitator. These roles not only help to alleviate the anxiety often associated with mathematics and science but also enhance students' overall comprehension and engagement with the subject. Mindfulness, defined as the psychological process of bringing one's attention to the present moment, has been shown to have significant benefits for students, particularly in high-pressure academic environments. Research indicates that mindfulness practices can reduce anxiety and improve concentration, which are vital for students engaging with complex concepts [20]. By incorporating mindfulness techniques, such as breathing exercises and focused attention activities, the Mindfulness Advocate helps students cultivate a sense of calm and presence. Students who practice mindfulness are better equipped to manage stress and maintain a positive attitude toward learning. This facilitator fosters a sense of community among students, encouraging them to work together and support one another in their STEM journeys.

The Confidence Builder and the Holistic Approach Enthusiast. These teachers are vital in altering the educational experience, allowing students to participate more fully in mathematics and science. The Confidence Builder is crucial in fostering self-confidence among students. Belief in one's academic skills is strongly connected to achievement and perseverance in learning [21]. This scaffolding not only assists students in developing competence but also reinforces their confidence in their capabilities [22]. By acknowledging and celebrating minor successes, educators can foster a supportive environment where

students feel appreciated and motivated to take risks in their education. Studies show that positive reinforcement and constructive criticism play a significant role in enhancing students' self-efficacy, which is essential for overcoming the anxiety frequently associated with mathematics and science. This educator champions a comprehensive perspective on student growth, acknowledging that emotional, social, and cognitive elements all influence the learning journey. By linking mathematical and scientific ideas to students' lives and interests, educators can enhance relevance and motivation, promoting a deeper understanding [23].

The Absence of Strategic Approach Advocate and the Motivation and Engagement Analyst are prominent figures in comprehending and enhancing the educational experience for students. Research shows that students who lack strategies for approaching mathematics or science problems are more likely to experience anxiety and perform worse [24-25]. Educators can enable learners to take charge of their education by instructing them on how to arrange, monitor, and assess their learning preferences. Since it enables students to connect with the material in ways that are pertinent to their personal experiences, differentiated instruction can enhance student involvement and understanding [26]. Furthermore, studies indicate that students are more inclined to deeply engage with mathematics and science when they see relevance to their everyday lives. The Motivation and Engagement Analyst supports project-based learning and collaborative problem-solving tasks that enable students to investigate STEM within contexts that connect with their interests and experiences. Students who believe that their skills can be enhanced through effort and learning are more likely to embrace challenges and persist despite obstacles.

The Growth Mindset Advocate Researchers point out that whenever students grasp how to relate the abstractness of mathematics or science to an application in life, their excitement to learn and participate in these fields intensifies. Students can apply STEM knowledge in meaningful ways, such as projects requiring them to analyze community data or conduct practical experiments. This hands-on learning deepens their comprehension and lessens the anxiety typically linked to abstract academic concepts [27]. According to Dweck [28], this perspective encourages students to look at challenges as opportunities for growth rather than insurmountable obstacles. Through the development of self-regulation skills, including evaluation of their own understanding and adaptation of strategies when necessary, teachers can assist students in becoming more independent learners [29].

The Step-by-Step Guide and The Collaborative Learner. In both mathematics and science education, structured guidance and collaborative learning environments help foster understanding and reduce anxiety. Reducing extraneous cognitive load allows students to focus on key elements, enabling deeper learning [30]. Step-by-step explanations of variables, operations, and equations or in science, the stages of a laboratory investigation are effective strategies for teaching complex concepts. Research has shown that students who participate in structured instructional strategies perform better on assessments and display higher motivation. In the process of testing students' understanding at each stage, teachers are able to identify misconceptions and clarify them immediately. On the other hand, cooperative learning settings encourage students to communicate with one another, share perspectives, and solve issues as a group. According to studies, such interactions lead to a better understanding and retention of concepts in both mathematics and science [31]. As students explain their reasoning and challenge each other's methods, they build stronger conceptual foundations.

The analysis of this literature indicated strong correlations among instructional methods, anxiety reduction, and understanding in problem-solving. Methods such as cooperative group activities, integrating practical applications, inquiry-based explorations, and offering constructive criticism have been evidenced to

minimize fear and improve understanding. The aim of this literature review is to consolidate current studies on effective strategies in mathematics and science education, specifically concentrating on how these approaches can reduce fear and improve understanding among students. By examining the relationship between teaching methods and subject-specific anxiety, teachers can develop more effective instructional practices that promote a supportive learning environment across STEM disciplines.

3. Methodology

This study highlighted the importance of effective instructional strategies in increasing understanding and reducing anxiety related to mathematics and science education. It reviews qualitative data collection and analysis methods to address two major goals: reducing fear among learners and improving comprehension in problem-solving contexts.

3.1. Research designs

This research utilized an exploratory research design, incorporating a qualitative approach. This design was appropriate for evaluating the impacts of actual experiences on learners' understanding and perspectives concerning mathematics and science instruction [32]. The qualitative component consisted of focus group interviews and open-ended surveys to gather the participants' viewpoints and experiences, offering a deeper insight into the qualitative outcomes [33].

Exploratory research aimed to uncover something novel and engaging by investigating a research topic and served as the essence of effective research. Exploratory studies, a category of exploratory research, typically fell into two groups: those that conducted a preliminary analysis of a new topic and those that introduced new ideas or formulated new hypotheses regarding an existing topic [34].

3.2. Sampling and participants

The research used a purposive sampling strategy to choose participants from a university offering mathematics- and science-related courses. Participants comprised mathematics and science instructors from selected universities in Dumaguete City and Zamboanga City. Representing a mix of educators who regularly teach in these fields. This sampling method guarantees that the participants are pertinent to the research focus and can provide valuable insights [35] These participants were chosen based on their direct teaching experiences and their ability to provide meaningful narratives about their students' learning behaviors and challenges in relation to mathematics and science.

Purposive sampling signified a calculated and deliberate method for selecting participants, which is employed in research studies to ensure that individuals with characteristics or experiences aligned with the research objectives are included in the sample [36]. Purposive sampling encompasses a set of non-probability sampling techniques wherein units are chosen because they possess attributes that are required in the sample. In other words, units are chosen "on purpose," also referred to as judgmental sampling; this sampling approach depends on the researcher's judgment while identifying and selecting the individuals, cases, or events that can offer the most pertinent information to fulfill the study's aims.

3.3. Research instruments

This research used a semi-structured interview format, with 25 mathematics and science educators participating in these interview sessions, which allowed for an in-depth examination of students' actual experiences and views on mathematics and science learning. Qualitative interviews yield detailed, contextual insights that can uncover the subtleties of learners' experiences [37]. Within this framework, group discussions, observations, and document analyses were conducted.

Table 1. Demographic profile of the participants

No. of Participants	Gender	Age	Age Group Participants
Participants 1-4	Female	24-29	Young Adult
Participants 5-10	Male	24-28	Young Adult
Participants 11-16	Female	30-32	Early Middle Age
Participants 17-21	Male	27-29	Young Adult
Female 22-25	Female	31-35	Early Middle Age

Table 2. Research Objectives and Corresponding Research Questions

Research Objectives	Research Questions
1. Determine teaching techniques which can bust fears of learners in mathematics and science oriented courses.	1. As mathematics and science teachers, how do you create an environment that prevents fear among learners? 2. Do you have specific ways or activities which can reduce the fear of learners who have prior anxiety when they face mathematics or science problems? 3. Why do you think the teaching techniques that you've mentioned work in terms of reducing the fear of learners in mathematics and scienceoriented courses?
2. Determine how reduction of fear can increase comprehension of learners in mathematics and science problem solving.	1. What do you think causes the comprehension issues learners encounter in mathematics and science problem solving? 2. How do you increase the interest of learners in comprehending mathematics and science problem solving? 3. How should teachers manage comprehension issues related to mathematics and science problem solving?

3.4. Data gathering

The researchers carried out qualitative data collection through one-on-one interviews with 25 mathematics and science teachers to investigate participants' genuine experiences and viewpoints, which were recorded and transcribed for examination. To guarantee reliability and validity, pilot testing of the tools was carried out before the primary study.

Organizing focus groups promoted discussions among participants, offering a platform for them to collectively share their experiences. This method produced rich qualitative data concerning their perceptions of fear and understanding in mathematics and science oriented courses [38]. Participants were required to provide consent to take part in the interview. Comprehensive instructions were given to the participants prior to the interview. The schedule for the individual interview was arranged based on convenience and timing [39]. Observation provided insights into participants' engagement and interactions with mathematical and scientific concepts. Field notes and video recordings documented behavioral changes during actual experiences [40]. The researchers arranged the interview sessions to occur over one week. Through these sessions, the study efficiently assessed how instructional strategies, as described by teachers, influence learners' fear and understanding in mathematics- and science-focused courses.

3.5. Data analysis

The collected information for qualitative examination from interviews was evaluated through thematic analysis to pinpoint significant themes and patterns related to students' experiences and perceptions [41]. Employing thematic analysis alongside focus groups, observations, and semi-structured interviews provided a strong framework for delving into the intricacies of learners' experiences in mathematics and science-focused courses. The combination of these methods allowed for triangulation, improving the trustworthiness and validity of the research results.

This analysis included the outcomes from interviews with twenty-five (25) mathematics and science educators by applying qualitative data analysis methods, emphasizing the role of instructional strategies in alleviating anxiety and improving understanding in mathematics and science education. Research has consistently indicated that many students experience anxiety when confronted with mathematics, often stemming from a lack of confidence or negative past experiences. This anxiety can present itself in several forms, resulting in avoidance behaviors and a reduced ability to engage with mathematical content. Parallel challenges are reported in science education, where inquiry-based tasks and problem-solving can similarly provoke anxiety unless supported by effective pedagogical approaches. Furthermore, the research highlighted the necessity of effective instructional strategies in mathematics and science education as a means to counteract fear and enhance comprehension among learners. Future studies may investigate the enduring impacts of these approaches on student attitudes and performance in STEM courses.

4. Results

Research Objectives 1. Determine teaching techniques which can bust fears of learners in mathematics and science oriented courses.

Question No. 1. As mathematics and science teachers, how do you create an environment that prevents fear among learners?

The Encourager

Fifteen (15) respondents emphasized that reducing fear in mathematics and science begins with creating a learning environment where students feel supported rather than pressured. They explained that encouragement plays a vital role in helping learners stay motivated, especially when faced with difficult concepts. Promoting perseverance and framing challenges as opportunities for growth, these teachers aim to shift students' perspective from fearing mistakes to embracing them as stepping stones. They also stressed the importance of gradually guiding learners through complex topics, reminding them that mastery develops over time. In this way, educators help transform classrooms into spaces where confidence is cultivated and curiosity is nurtured.

> "As a mathematics and science teacher, I believe that fostering a positive, supportive environment is key to eliminating fear. I make it a point to acknowledge students' progress, no matter how small. I celebrate their 'aha' moments and remind them that mistakes are a part of the learning process. I often say, 'If you're not making mistakes, you're not learning!' This helps reduce the pressure and builds confidence."
>
> "Another key approach is to reassure students that they are not expected to understand everything immediately. Mathematics and science are cumulative, and each step leads to the next, but it's okay if something doesn't click right away. I

> encourage them to revisit challenging topics and not to give up. I often tell them, 'The more you work at it, the easier it will get, and you'll start seeing patterns and connections you didn't notice before.' This reassurance helps students understand that learning math and science is a gradual process."

1.2 *The Accessible Educator*

Ten (10) respondents highlighted that accessibility and empathy are central to overcoming fear in mathematics and science. Instead of reinforcing the notion that success is tied to innate talent, they actively work to make learning more inclusive by addressing both the academic and emotional needs of students. They focus on making themselves approachable and ensuring that no learner feels left behind, regardless of their background or starting point. Valuing persistence over perfection, they foster an atmosphere where effort is recognized and small achievements are celebrated. This approach not only builds resilience but also creates a classroom culture where students view learning as a collaborative and supportive process rather than an isolating struggle.

> "I try to break down the idea of 'genius' in math and science and emphasize that everyone has the capacity to succeed. I make sure that I'm always approachable, offering office hours and open discussions. Additionally, I offer multiple forms of support, including practice worksheets, video tutorials, and study groups, so that students can access help in a way that suits their learning style."

> "I've found that one of the most important things I can do as a math and science instructor is to address the emotional and psychological aspects of learning. These subjects can feel isolating, especially when students believe they're not naturally good at them. So, I try to be very empathetic and create a welcoming space where they can ask questions without judgment. I also work on building their self-esteem by showing them that every student has unique strengths."

1.3 Teacher's Role in Fear

Eleven (11) respondents emphasized that students' fear is often directed more toward the teacher than the subject itself. Strictness, lack of empathy, or intimidating behavior can cause anxiety, while patience and encouragement can create comfort. When teachers acknowledge student inquiries without judgment and present mathematics as a helpful tool in daily life, learners feel less threatened. This shows that the teacher's approach strongly determines whether fear is reinforced or reduced in the classroom.

> "Students are fearful not of the subject but of the teacher. I explain that mathematics is not attacking them but rather helping them in their day-to-day real-life experiences."

> "If the teacher is strict, the students get scared. When I teach, I encourage students to ask questions and I acknowledge their inquiries by giving answers without making them feel embarrassed. I also smile to ease students' tension or fear."

1.4 Teacher Factor

Nine (9) participants highlighted that teachers' approaches and strategies play a central role in how students perceive mathematics. Integrating ICT tools, interactive activities, and quizzes, teachers help students feel included in the learning process. At the same time, creating a motivating classroom environment allows learners to become more comfortable and open to participation. This shows that the

teacher factor through both instructional design and classroom atmosphere directly influences whether students experience fear or develop confidence in learning.

> "When I teach math, in order for the students not to fear mathematics or me as their teacher, I include engaging activities, ICT tools, and quizzes. This way, they realize that they are part of the class and the level of learning and comprehension."

> "The majority of the students said that the teacher factor is also important. Some say they are more comfortable with certain teachers because of the classroom environment, so they learn more. Some students don't see the importance of mathematics. For me, teachers must motivate students by creating a positive environment in class to prevent fear and encourage learning in mathematics."

Question No. 2. Do you have specific ways or activities which can reduce the fear of learners who have prior anxiety when they face mathematics or science problems?

2.1 *The Mindfulness Advocate*

Fifteen (15) respondents noted that addressing anxiety before tackling academic tasks can greatly influence how students engage with mathematics and science. They explained that incorporating mindfulness strategies provides learners with tools to manage stress and refocus their attention. These teachers emphasized that practices such as guided breathing, short reflective pauses, and grounding activities help students regulate their emotions, reduce distractions, and prepare their minds for problem-solving. Embedding these exercises into the routine, instructors not only promote calmness but also cultivate habits that learners can carry beyond the classroom, equipping them with lifelong coping skills for academic and personal challenges.

> "One technique I've found particularly helpful is incorporating mindfulness exercises at the start of each class. Before diving into mathematics or science problems, I guide my students through a brief, calming exercise such as deep breathing or a short meditation designed to reduce anxiety and bring their focus to the present moment. This helps students let go of negative thoughts and approach the material with a clear mind. I also encourage them to take breaks during longer problem-solving sessions to avoid feeling overwhelmed."

> "I incorporate short, focused breathing exercises before starting each lesson. For example, we take a few minutes to breathe deeply, focus on inhaling and exhaling, and release tension. I also introduce 'grounding' techniques, where students focus on their senses such as noticing five things they can see, four they can touch, three they can hear, and so on. This helps students center themselves before diving into math and science problem-solving, reducing the mental overload that comes with anxiety."

2.2 *The Supportive Group Facilitator*

Ten (10) respondents underscored the importance of building community in the classroom to reduce fear in mathematics and science. They shared that collaborative activities foster a sense of belonging, as students recognize that learning is a shared journey rather than a solitary struggle. This setup also highlights the value of diverse thinking, where multiple perspectives and problem-solving strategies are welcomed. Emphasizing teamwork, teachers aim to replace competition with cooperation, helping students gain confidence through

peer support. In this way, mistakes become opportunities for collective growth rather than sources of embarrassment, making the classroom a safer and more encouraging space for learning.

> "I find that creating a collaborative, low-pressure environment helps alleviate anxiety in mathematics and science. I often use group work, where students solve problems together and help each other. In this setup, students can share their thought processes and strategies without the fear of being judged. When they see that everyone has different approaches and that it's okay to make mistakes, it normalizes the experience and reduces the feeling of isolation."

> "I try to keep the environment relaxed during group work by setting clear expectations that the goal is not to get everything right immediately, but to explore ideas and learn together. I give students math and science problems that allow for multiple approaches, so they can see how different strategies can lead to the same solution. This reduces the fear of making mistakes, as they understand that there are often many valid ways to approach a problem. I make sure to circulate and provide guidance, but my focus is more on process than on getting a 'correct' answer every time."

2.3 Peer Learning Support

Twelve (12) respondents noted that group activities play a vital role in reducing student anxiety by showing learners that they are not alone in their struggles with mathematics. When students work together, they share ideas, explain solutions to one another, and realize that others also face difficulties. This process helps normalize mistakes and encourages learners to see challenges as part of the learning journey. Peer support fosters collaboration and a sense of belonging, which is especially important for students who feel left behind or lack confidence in their abilities. Through collective discussions and cooperative tasks, learners build both understanding and courage to participate more actively.

> "I believe that by having group activities are a big help to students because they will learn from their peers and will not feel alone, especially those who are having a hard time understanding and keeping up with mathematics lessons."

> "I build confidence so that they will not be fearful to answer. I apply group activity where each group has to discuss a specific topic and act out the scenario. The other groups will then distinguish what they are trying to act out."

2.4 Creative and Interactive Strategies

Fourteen (14) participants shared that reducing fear in mathematics also depends on how teachers make lessons more dynamic and relatable. Creative methods such as role plays, interactive games, and contextualized activities transform abstract concepts into concrete experiences. Tying lessons to situations and incorporating playfulness, teachers can shift students' focus from fear of failure to active participation. These approaches make learning less intimidating because students are immersed in meaningful and enjoyable activities. When learners are engaged in this way, they are more likely to take risks, voice their answers, and persist even when problems become challenging.

> "I integrate or apply roleplay of a real-life explanation connected to the math lesson I discuss to keep them interested in class and engaged in active participation."

> "I encourage them to participate in group activities. We do the "Keep the Box or Give the Box" activity where I present a question and the answer. I let them work

with each other and learn from one another while staying engaged in the activity. I also apply trending topics to our discussion to keep them intrigued and interested in my class."

Question No. 3. Why do you think the teaching techniques that you've mentioned work in terms of reducing the fear of learners in mathematics and science oriented courses?

3.1 *The Confidence Builder*

Fifteen (15) respondents emphasized that cultivating confidence is one of the most effective ways to counter fear in mathematics and science. They explained that when students are given opportunities to succeed incrementally, they begin to replace hesitation with self-assurance. Activities that emphasize gradual skill-building help learners see progress over time, which encourages them to take on more difficult challenges without feeling overwhelmed. Respondents also pointed out that shifting the emphasis from flawless answers to the problem-solving journey itself encourages resilience. Normalizing mistakes as natural checkpoints in learning, teachers create an atmosphere where students are more willing to experiment, reflect, and persist, ultimately reinforcing the belief that they are capable of growth and achievement.

" I believe that the techniques I use work because they focus on reducing the fear of failure. When students experience success, even in small ways, it helps build their confidence. Starting with easy 'warm-up' problems or games allows students to feel successful before tackling more complex concepts. By emphasizing the process of learning rather than focusing solely on the outcome, we give students the space to make mistakes and learn from them, which is a crucial part of building confidence."

" I focus on the process of solving problems rather than just the correct answer. This allows students to see that mathematics and science are not about finding the right solution immediately, but about thinking through problems and figuring out ways to approach them. When students realize that there are multiple ways to solve a problem and that mistakes can be part of that process, they feel less pressure."

3.2 *The Holistic Approach Enthusiast*

Seven (7) respondents stressed that teaching effectiveness goes beyond addressing academic skills alone. They highlighted that mathematics and science anxiety often stems from emotional and social factors, not just content difficulty. Adopting a holistic perspective, teachers integrate strategies that nurture students' emotional well-being and sense of belonging alongside intellectual development. This means fostering a classroom environment where learners feel valued, connected, and safe to take risks. Respondents noted that such an approach not only reduces stress but also enhances motivation, making the learning process more engaging. When students perceive that their overall growth cognitive, emotional, and social is being supported, they are more likely to approach mathematics and science with openness rather than fear.

" These strategies work because they take a holistic approach to learning. They don't just focus on solving problems; they focus on creating a positive, supportive learning environment. Students are more likely to succeed when they feel emotionally supported, socially connected, and confident in their abilities. The combination of group work, positive reinforcement, gradual progression, and mindfulness exercises addresses both the cognitive and emotional aspects of learning. This helps students manage their anxiety and focus on engaging with the material rather than fearing it."

3.3 Active Participation

Nine (9) respondents highlighted a fact that one of the most effective ways to address comprehension issues in mathematics is by promoting active participation while building learners' confidence. When students are engaged in collaborative tasks, rewarded for their performance, and encouraged to share ideas, they begin to overcome their fear of making mistakes. Teachers who foster an environment where everyone can contribute create opportunities for learners to view problem-solving as a shared process rather than an individual struggle. Combining peer support, incentives, and open communication, students become more motivated, less afraid of reciting, and more confident in applying their knowledge. This confidence not only reduces fear but also leads to stronger comprehension and more positive attitudes toward mathematics.

> "Nowadays, students are scared to take the risk of learning mathematics, so what I did is to pair students by solving mathematical problems where they exchange ideas and share their learnings with each other about how they were able to answer it."

> "If they answer correctly, they gain individual or group points so that they become active in participation, performance tasks, or even oral recitation. Especially points for students is a big help to their grades."

> "Group activities or quizzes keep students engaged, especially when they are given opportunities to actively participate in the lesson. Activities that allow them to contribute ideas or answer questions make the discussion more lively and relatable."

Research Objectives 2. Determine how reduction of fear can increase comprehension of learners in mathematics and science problem solving.

Question No. 1. What do you think causes the comprehension issues learners encounter in mathematics and science problem solving?

The Lack of Strategy Proponent

Fifteen (15) respondents emphasized that poor comprehension in mathematics and science often stems from students' tendency to approach problems without structure. Instead of analyzing the situation and planning their steps, many learners rush into calculations or random trial-and-error methods, which leads to confusion. Respondents noted that cultivating systematic habits such as organizing known information, identifying what is being asked, and breaking problems into manageable components can greatly improve outcomes. Consistent reinforcement of these habits helps students move away from guesswork and toward reflective problem-solving. A structured approach not only clarifies complex tasks but also builds confidence, which allows learners to progress from uncertainty to greater understanding and success in STEM subjects.

> "Many students struggle with problem-solving because they lack effective strategies. Mathematics and science problems often require a systematic approach, such as breaking a problem into smaller parts, identifying patterns, or choosing the right method. However, students often try to solve problems haphazardly without a clear strategy, jumping from one approach to another without giving each one a fair chance. This can lead to confusion and frustration. Teaching problem-solving strategies and fostering a structured approach can significantly improve comprehension."

> " One of the primary reasons students struggle with mathematics and science problems is that they don't always have a structured approach to tackle them. Many

> students try to start solving without really analyzing the problem first. They jump straight into calculations or guesses, often missing the chance to break the problem down into smaller, more manageable parts. This haphazard approach can result in confusion and incorrect answers. I encourage my students to spend a few moments at the start of each problem thinking about the problem as a whole asking questions like, 'What do I know?' and 'What am I trying to find?' This helps them organize their thoughts before diving into the solution process."

1.2 *The Motivation and Engagement Observer*

Ten (10) respondents highlighted that comprehension difficulties are often connected to students' attitudes and level of interest. When learners view mathematics and science as irrelevant or disconnected from their lives, they tend to disengage, which limits their persistence in solving problems. Respondents explained that increasing relevance is essential since concepts become more engaging when tied to real-world applications or aligned with students' personal experiences. They also stressed the importance of designing tasks that give students a sense of steady progress, where smaller achievements encourage continued effort. Confidence-building, curiosity, and a growth mindset create conditions where students are more willing to explore, experiment, and push through challenges rather than withdraw from them.

> " Motivation can be a significant factor in comprehension. Students who are not motivated or who see mathematics or science as irrelevant may disengage from the problem-solving process. This lack of motivation can prevent them from fully focusing on the problem or trying multiple approaches to reach a solution. Building connections between the material and students' interests, providing them with a sense of purpose, and showing them the value of what they're learning can increase engagement and improve comprehension."

> " I often see a lack of motivation in students when the task at hand feels too daunting. When a problem seems overwhelmingly complicated, it's easy for students to disengage. One way I combat this is by breaking larger problems into smaller, more manageable tasks. I also create problem-solving activities that build upon prior knowledge, so that students experience steady progress. Motivating students through small, achievable steps helps them see that they are making progress and keeps them engaged in the process, instead of feeling overwhelmed by the final solution."

1.3 Teacher Influence

Eleven (11) participants shared that students' previous negative experiences with teachers can heavily affect their comprehension in mathematics. When learners recall being embarrassed or laughed at for making mistakes, they develop lasting fear that discourages them from participating. This fear of judgment can also be amplified by language barriers, as students who struggle with English may hesitate to explain answers in front of their peers. Such factors highlight that comprehension problems are not always about ability alone but also about emotional and psychological barriers created by teacher-student interactions.

> "Maybe fear of the teacher, like students who have past traumas with their previous teachers. Thinking that if they answer wrong again, they will get embarrassed and be laughed at. That's why students fear how to explain, also

because of the language barrier, as many students are not fluent or do not have advanced vocabulary in English."

"The common problem I observed is that students have difficulties in understanding simple words, what more if it is a word problem? One of the issues causing students' comprehension problems is the limited or lack of vocabulary, which serves as a hindrance to to efficiently learn mathematics."

1.4 Lack of Interest in Mathematics

Thirteen (13) respondents noted a major barrier to comprehension in mathematics is the general lack of student interest in the subject. Many learners come into the classroom already convinced that mathematics is difficult, boring, or irrelevant to their lives. This negative mindset creates a cycle where students pay little attention, make minimal effort, and easily lose focus during lessons. Low interest also leads to short attention spans, as students quickly get distracted and fail to sustain concentration on problem-solving tasks. When learners do not value mathematics or see its importance, they are less motivated to engage deeply, and as a result, their comprehension suffers. This demonstrates that attitude and motivation are as crucial as cognitive skills in determining how well students learn mathematics.

"A lot of students honestly say that mathematics is their least favorite subject. Students don't want to learn mathematics, so it serves as a factor in why they have issues in comprehension, because from the beginning there's no interest to learn at all."

"Attention span is one of the issues causing comprehension problems in mathematics. Because math is their least favorite subject, they easily get distracted and do not give attention at all, and this shows in their efforts and performance in class."

Question No. 2. How do you increase the interest of learners in comprehending mathematics and science problem solving?

2.1 The Connector

Fifteen (15) respondents emphasized that making mathematics and science meaningful requires showing students how these subjects link to their daily lives and future opportunities. They shared that engagement increases when abstract ideas are tied to relevant themes such as technology, environment, health, or culture. Teachers design lessons that highlight how concepts shape decisions in various fields, from innovation to community problem-solving. This approach helps students recognize that what they learn in class extends beyond academic exercises and can be applied to practical challenges. As learners discover connections between schoolwork and their personal interests, they become more motivated and begin to view mathematics and science as valuable tools for navigating the world.

" I believe the key to increasing interest is showing students how mathematics and science apply to the real world. For example, I bring in examples from physics, economics, or engineering that use the concepts we're learning. When students see that these subjects aren't just abstract exercises, but tools used in careers and real-life scenarios, they become more engaged. I also try to relate problems to current events or their personal interests, whether it's through sports statistics, tech innovations, or social media trends. This connection makes the material more meaningful to them."

" Students are more interested when they can see how mathematics and science relate to their personal lives. I give them opportunities to choose problems that are relevant to their own interests. For example, they might use algebra to calculate the cost of a road trip, solve geometry problems related to the design of a product they're passionate about, or use basic physics concepts to explain everyday phenomena. When students can work with content in a way that feels personal and meaningful to them, it becomes less abstract and more engaging."

2.2 The Growth Mindset Advocate

Ten (10) respondents pointed out that student interest grows when classrooms emphasize the idea that ability develops through practice and persistence. They explained that encouraging learners to value effort over perfection transforms mistakes into learning opportunities instead of setbacks. Teachers also work to create a culture where challenges are welcomed, and progress is celebrated regardless of speed. In this way, students gain resilience and learn to appreciate problem-solving as a rewarding process. Respondents stressed that growth-oriented feedback and recognition of small successes help cultivate confidence and determination. When students believe improvement is always possible, they approach mathematics and science with curiosity rather than fear.

" I think increasing interest in mathematics and science is strongly tied to fostering a growth mindset. If students believe that their abilities in these subjects are not fixed and that they can improve with effort, they are more likely to engage with the material. I regularly remind my students that struggle is part of the learning process, and every mistake they make is an opportunity to learn. I also celebrate their persistence, which helps students develop a mindset where they enjoy the process of problem-solving, regardless of the outcome."

" I agree wholeheartedly. Creating an environment where students feel comfortable embracing challenges is key. I emphasize to my students that talent in mathematics and science isn't innate; it's built through practice and effort. I often tell them that success is more about persistence and grit than natural ability. When students understand that their brains can grow and adapt with effort, they become more willing to take risks in problem-solving and are less afraid to make mistakes."

2.3 Interest-Driven Strategies

Fifteen (15) participants emphasized that making mathematics engaging often requires connecting lessons to students' interests and practical experiences. When teachers design activities that reflect what captures learners' attention whether through creative tools, educational games, or relatable examples, students are more likely to stay focused and motivated. Gamified approaches not only make learning fun but also encourage active participation, while practical applications demonstrate the value of mathematics beyond the classroom. Combining these strategies helps transform mathematics from a subject many students fear into one that feels accessible and meaningful. By aligning lessons with learner preferences and contexts, teachers reduce anxiety while improving comprehension

"I observed my students by finding their likes and dislikes, or what interests them and what type of learners they are, since some are visual learners. Recently, in my ICT class I applied UBO cards instead of a standard deck of cards. In my UBO

cards, there are also mathematical problems related to our discussion so that I can get their attention and increase their interest in learning mathematics."

"I make relevant examples connected to real-life situations to gain their attention. Gamified or game-based activities are what I apply to keep them active and excited in every math discussion or performance. With this, it increases their interest."

Question No. 3. How should teachers manage comprehension issues related to mathematics and science problem solving?

3.1 The Step-by-Step Guide

Fifteen (15) respondents explained that students often attempt to solve problems all at once without first breaking them into smaller, manageable parts. They stressed the importance of teaching learners to approach mathematics and science problems step after step. Teachers further encourage learners to write down their thoughts as they break the problem apart, allowing them to organize their reasoning systematically. These insights emphasize the value of stepwise learning in preventing confusion and building deeper comprehension. Through modeling, structured reflection, scaffolding, and group interaction, instructors strengthen students' ability to approach complex problems in a logical and effective manner.

" One common issue is that students try to tackle a problem all at once without breaking it down into manageable parts. I emphasize the importance of breaking mathematics and science problems down into steps. I model how to approach problems step-by-step, showing them how to extract the key information, identify patterns, and then determine which mathematical or scientific tools are needed."

" I often ask my students to pause and reflect on the problem after reading it through. Before jumping into solving, I guide them to ask questions: What do we know? What do we need to find? What formulas, rules, or principles apply here? This reflective practice helps them separate the key components of the problem and approach it with a clearer strategy. I also encourage students to jot down thoughts and ideas as they break down the problem, which helps them organize their thinking."

3.2 The Collaborative Learner

Ten (10) respondents emphasized that collaborative learning serves as an effective method to address comprehension difficulties. They design group activities where students work together to solve mathematics and science problems, exchange strategies, and share insights. Teachers observe and listen to discussions, providing guidance when misconceptions arise. This interaction fosters collective processing of information and reduces the feeling of isolation. During group tasks, instructors listen closely to student conversations, which allows them to identify misunderstandings and address them through targeted questions. Learners also gain confidence when they explain ideas to their peers, since teaching others reinforces their own understanding. Working in groups encourages exploration of multiple methods, often resulting in deeper comprehension. If necessary, teachers redirect the group through guiding questions or by presenting alternative approaches that strengthen clarity. These practices demonstrate how collaborative learning enhances comprehension. Through peer teaching, group problem-solving, structured reviews, and interdisciplinary tasks, students become more engaged and willing to learn. Collaboration creates a

supportive environment where learners feel comfortable asking questions, sharing challenges, and learning from each other, which ultimately leads to stronger understanding.

> " One effective way to manage comprehension issues is through collaborative learning. I use group activities where students work together to solve mathematics and science problems, discuss strategies, and share insights. Often, students are more willing to ask questions in a peer setting, and explaining a concept to others helps reinforce their own understanding. I also circulate and listen to their discussions, offering guidance where needed. This peer-to-peer interaction reduces isolation and helps them process the material collectively."

> " During group work, I don't just circulate, but also listen actively to the students' discussions. By overhearing their conversations, I can identify misconceptions and guide them with targeted questions. When students work together, they're more comfortable exploring different methods, and this often leads to better understanding. If needed, I gently steer the group back on track by asking leading questions or offering alternative strategies to help them gain clarity."

3.3 Collaboration Among Teachers

Twelve (12) participants highlighted that collaboration between teachers is seen as an effective way to improve students' comprehension in mathematics. Working together, teachers can align strategies, share approaches, and create activities that strengthen learning across different subjects. This collective effort ensures that students encounter consistent language, explanations, and methods, reducing confusion and reinforcing understanding. Collaboration also helps teachers address the challenges students face by analyzing performance together and designing more effective interventions. When teachers support one another, the burden of addressing comprehension problems does not fall on a single individual but becomes a shared responsibility that benefits learners in the long run.

> "The sad reality is that even college students have difficulty in understanding or understanding mathematics or comprehending it. What we can do as teachers is to talk and collaborate with other teachers so students may understand terms used. We should also create activities for students to observe or analyze their performance and level of learning. In this way, we help each other as teachers by solving our problem with it and also helping students to increase their comprehension level in mathematics."

> "Collaborating with other teachers is an effective way to address math comprehension by creating methods, strategies, and diverse learning or teaching. It also exercises students' thinking as they share with the class, while helping them build confidence by talking in front of the class and reflecting on what they have learned to more easily catch up with the discussion."

3.4 Individualized and Peer Support

Eleven (11) participants emphasized that addressing comprehension difficulties in mathematics requires both individualized teacher support and structured peer collaboration. They explained that complex topics should be broken down into smaller, more manageable parts so that learners are not overwhelmed when introduced to advanced concepts. Individualized monitoring, coupled with timely feedback, was seen as an effective strategy to keep students on track. Importantly, this feedback must be given in a respectful and

private manner, as public correction may cause embarrassment and further discourage participation. Alongside individualized guidance, peer-to-peer learning provides additional support by allowing students to work with classmates of similar age or background, creating a space where they feel more comfortable expressing themselves. Through these combined strategies, teachers not only help students gradually build comprehension but also foster an inclusive and encouraging environment where learners can confidently share their understanding and key takeaways from each lesson.

> "To manage my students' comprehension as a teacher, I make complex topics or concepts into small, manageable parts before we proceed to extreme or advanced topics. I also monitor my students closely and give feedback to keep them on track. As teachers, we should be the first ones to understand them and talk to them personally, not give the feedback in front of the class so they won't feel embarrassed. I also use peer-to-peer study because some are more comfortable with their same age or gender. After discussion, they share their key takeaways or understanding from the lesson we tackled."

> "What I usually do is get their interest first to help them develop and connect their comprehension through quizzes, since some are visual learners. I also create strategies for that so no one will be left behind."

5. Discussion

Research Objective 1. Determine teaching techniques which can bust fears of learners in mathematics and science oriented courses.

The primary goal of this research is to examine the transformative influence of experiential learning on students' perceptions and comprehension of mathematics and science. Conventional teaching methods frequently lead to anxiety and create a disconnection from the subject, resulting in a cycle where fear hampers understanding. . These are some questions during an interview: "As math and science teachers how do you create an environment that prevents fear among learners?", "Do you have specific ways or activities which can reduce the fear of learners who have prior anxiety when they face mathematical or scientific problems?" and "Why do you think, the teaching techniques that you've mentioned work in terms of reducing the fear of learners on mathematics and science oriented courses?" provide meaningful insights into the participants' understanding and preferences.

Tackling this objective includes investigating several essential questions linked to the classroom atmosphere, distinct activities that diminish anxiety, and the reasoning behind the success of these methods. It is vital for mathematics and science educators to create an atmosphere that mitigates fear among learners. This entails building a classroom culture that prioritizes growth, curiosity, and collaboration. Approaches such as promoting a supportive environment where errors are seen as chances for learning can greatly lessen anxiety. Educators can establish norms that promote open communication and peer assistance, enabling students to discuss their difficulties without the fear of being judged. Research indicates that a positive emotional environment can boost cognitive involvement and lessen performance anxiety [42]. By applying collaborative strategies, such as cooperative learning and peer tutoring, teachers can nurture a sense of community that reinforces the concept that learning STEM subjects is a shared experience.

Another key finding highlighted the importance of classroom climate in shaping students' perception of mathematics. In mathematics education, the incorporation of suitable software to create visualizations and mathematical representations amplifies students' creativity and problem-solving skills [43]. When teachers

establish an environment that encourages inquiry, minimizes embarrassment, and promotes positive teacher–student relationships, students are more likely to participate without fear. This confirms that anxiety is not only linked to the subject itself but also to interpersonal dynamics within the learning space [44]. A supportive classroom atmosphere has been shown to reduce avoidance behaviors and increase learners' willingness to take risks in problem solving [45].

The findings further revealed that reward-based systems, such as group points or recognition of correct answers, help sustain active participation in mathematics classes. Incentives give students a sense of accomplishment and reinforce the value of effort, particularly for those who struggle with confidence. While external rewards alone cannot fully resolve comprehension issues, they act as effective short-term motivators that encourage learners to participate more consistently [46]. This aligns with research showing that performance incentives can increase student effort and engagement when combined with meaningful instructional strategies [47].

Specific activities aimed at alleviating fear among students who have previously experienced anxiety regarding mathematics and science can manifest in various ways. For instance, studies in biology note that fear can be triggered not only by abstract concepts but also by practical activities, such as touching preserved specimens or seeing blood during dissection [48]. This suggests that fear in science is both cognitive and sensory, requiring targeted strategies to address different triggers. One effective approach involves utilizing practical applications of principles, which can assist students in recognizing the significance of mathematics and science in their daily lives. For example, project-based learning, during which students tackle real problems or carry out investigations, can furnish context and purpose to mathematical and scientific principles [49]. When students acknowledge the importance of STEM in their lives, their motivation and involvement substantially increase [50]. Moreover, integrating games and interactive technology can render learning enjoyable and captivating. Studies suggest that gamification in education can alleviate anxiety and bolster motivation by offering a low-pressure setting where students can practice without the stress of conventional assessments [51]. The efficacy of these instructional methods in mitigating fear is grounded in numerous psychological and educational theories. Firstly, linking theory to practice aids in clarifying abstract concepts, rendering them more approachable and less daunting. When students grasp how mathematics and science relate to practical contexts, they are more inclined to engage positively with the subject matter.

The results also emphasized the role of confidence-building activities in addressing fear and comprehension issues. Structured tasks such as roleplays, scenario-based group work, and peer discussions provide learners with manageable challenges where success is possible. These activities allow students to gradually overcome hesitation while reinforcing understanding through active engagement [52]. Self-efficacy is an integral part of personal factors that contributes substantially to students' success in mathematics [53], this suggests that repeated small successes build self-efficacy, which is essential in reducing mathematics anxiety and sustaining motivation.

Furthermore, nurturing a collaborative learning atmosphere permits students to learn from each other, diminishing individual pressure and fostering a sense of community. This aspect is especially crucial in STEM subjects, where learners frequently feel alone in their challenges or intimidated by laboratory activities. In addition, promoting a growth mindset, it motivates students to perceive challenges as chances for development rather than as threats to their skills. This shift in mindset can significantly lower anxiety, as students come to embrace difficulties and view effort as a means to improvement. Mehta et al. [54], emphasized that in teaching science, tapping into student emotions by demonstrating care, equity, and weaving content into stories can powerfully reduce fear and foster engagement. The participants' emphasis

on confidence-building, encouragement, and mastery experiences reflects the process of strengthening efficacy beliefs that reduce fear and foster persistence. In conclusion, addressing students' fears in STEM-focused courses necessitates a multifaceted strategy that encompasses fostering a supportive environment, incorporating practical applications, and implementing collaborative activities. The strategies outlined not only alleviate anxiety but also improve overall understanding, setting the stage for a more favorable and productive learning experience.

Research Objective 2. Determine how reduction of fear can increase comprehension of learners in mathematics and science problem solving.

The second goal of this study emphasized an important area in STEM education, where the interaction among anxiety, experience, and understanding can greatly influence learners' achievements. This goal focuses on a vital element of mathematics and science education, especially the connection between alleviating fear and understanding in problem-solving scenarios. The interview questions are: "What do you think causes the comprehension issues learners on mathematics and science problem solving", "How do you increase the interest of learners in comprehending math and science problem solving" and "How should teachers manage comprehension issues related to mathematics and science problem solving?" These questions offer valuable insights into the participants' expertise and preferences.

Mathematics and science anxiety is a widespread problem that many students encounter, frequently obstructing their capability to engage with problem-solving activities. Comprehension difficulties in problem-solving usually arise from numerous factors. A significant reason is the innate anxiety linked to mathematics and science, commonly known as STEM anxiety. This anxiety may result in a mental block, where students become so apprehensive about making errors that they find it hard to interact with the material. Studies indicate that learners who undergo high amounts of anxiety tend to perform poorly since their emotional distress consumes their cognitive resources. Moreover, a deficiency in foundational knowledge can impede students' ability to address complex problems, leading to frustration and disengagement [55].

Another emerging factor is the significant role of language and vocabulary in shaping comprehension. Students who lack fluency in English or have limited mathematical vocabulary often struggle to understand word problems and instructions. This barrier compounds their fear of making mistakes in front of others, which limits participation. Addressing these issues requires teachers to simplify explanations, scaffold terminology, and use learners' native language when appropriate to ensure inclusivity and improved comprehension.

The findings also underscored the value of designing lessons that align with students' learning styles and interests. Integrating digital game-based learning (DGBL) into mathematics teaching has gained significant attention for its potential to improve learning outcomes. Creative integration of visual aids, interactive materials, and game-based tasks keeps students attentive and less intimidated by mathematics [56]. Connecting mathematical concepts to familiar contexts, teachers make learning more relevant and accessible. This demonstrates that comprehension improves when lessons are presented in ways that resonate with learners' experiences and preferences [57].

The study further highlighted the effectiveness of breaking down complex topics into smaller, manageable parts while providing individualized monitoring. This scaffolding process ensures that students gradually build understanding rather than being overwhelmed by advanced material. Moreover, combining teacher guidance with peer-to-peer support enables learners to clarify concepts in a less intimidating setting

[58]. There is strong evidence that prompting learners to explain leads to greater conceptual knowledge, procedural knowledge and procedural transfer when knowledge is assessed immediately after the learning session; there is limited evidence for greater procedural transfer after a delay. Such dual strategies provide both the structure and encouragement necessary for students to progress in mathematics comprehension [59].

Additionally, the instructional methods utilized can significantly affect comprehension; conventional, rote memorization methods typically do not promote a profound understanding of mathematical or scientific principles [60]. To enhance students' interest in understanding problem-solving, educators might adopt various strategies that link STEM to practical situations. Implementing project-based learning, where learners utilize concepts in practical scenarios, can ignite interest and illustrate the significance of mathematics and science in daily life. In science, assessment methods should also be aligned with active learning and laboratory-based inquiry, focusing on students' ability to apply their knowledge and skills to solve problems and conduct investigations [61]. Furthermore, employing technology, like interactive software or online simulations, can captivate students by offering them instant feedback and a hands-on learning experience [62]. Moreover, nurturing a supportive classroom atmosphere where errors are regarded as learning opportunities can motivate students to take risks and engage more actively in problem-solving tasks. Educators should address comprehension challenges related to mathematics and science problem-solving by using a differentiated instruction approach [63]. This entails acknowledging the varied learning styles and requirements of students and modifying instruction accordingly. Teachers can cultivate such an environment by fostering a growth mindset, enabling students to view challenges as opportunities for development rather than threats.

Professional development programs ought to concentrate on methods for establishing inclusive classrooms that emphasize emotional well-being along with academic success [64]. Offering scaffolding, such as guided practice and collaborative learning experiences, can assist students in developing confidence and gradually tackling more intricate challenges [65]. Furthermore, consistent formative assessments can enable teachers to pinpoint comprehension deficits and remedy them promptly, ensuring that students stay aligned with their educational progress. Educators who grasp the psychological components of learning can execute effective strategies to alleviate anxiety and foster positive learning environments. Koray and Çetinkılıç [66] add that reading and critical reasoning are essential for developing problem-solving skills, suggesting that teachers should integrate structured reading and reasoning tasks into STEM classrooms. These results both support and extend prior models of mathematics and science anxiety. Participants confirmed that anxiety undermines working-memory resources. However, unlike earlier deficit-focused models, this study highlights teachers' agency in transforming classroom climates, thereby extending Dweck's growth-mindset and Bandura's efficacy principles into the context of Filipino STEM classrooms. Moreover, the emphasis on mindfulness and emotional regulation introduces an affective-pedagogical layer less explored in prior Western studies, suggesting a culturally responsive expansion of existing frameworks.

6. Conclusion

This study underscores that addressing learners' fear and strengthening comprehension in mathematics- and science-oriented courses require systematic and supportive instructional approaches. Findings indicate that strategies such as mindfulness exercises, collaborative learning, step-by-step scaffolding, and interactive methods effectively reduce anxiety while fostering engagement and confidence. Minimizing intimidation and emphasizing encouragement, teachers can create an environment where learners are more willing to take risks, participate actively, and develop deeper conceptual understanding.

Equally significant is the recognition that comprehension is shaped not only by cognitive skills but also by emotional and social dynamics within the classroom. Normalizing mistakes, reinforcing incremental successes, and providing empathetic feedback enable learners to overcome psychological barriers that hinder their performance. Such approaches shift perceptions of mathematics and science from intimidating disciplines to fields of inquiry that value persistence, exploration, and growth.

The results also underscore that comprehension improves when instruction is contextualized, engaging, and learner-centered. Approaches that incorporate inquiry-based activities, gamified tasks, and collaborative problem-solving enhance both mastery of content and the resilience needed to persist in challenging tasks. These methods help move students beyond rote memorization toward analytical thinking and practical application, preparing them to meet the increasing demands of STEM education.

Ultimately, the role of the teacher is central. Learners' fear often arises not from the subjects themselves but from teacher attitudes and classroom climate. Instructors who demonstrate empathy, accessibility, and encouragement foster trust and motivation, while rigid or punitive approaches reinforce anxiety. Effective pedagogy, therefore, must combine methodological clarity with relational responsiveness to fully support students in overcoming fear and enhancing comprehension.

In summary, busting fear and enhancing comprehension in mathematics and science require a multifaceted strategy that balances emotional support, structured guidance, and interactive engagement. Embedding these practices into instruction can transform classrooms into spaces where confidence replaces anxiety, and where comprehension leads to genuine problem-solving competence. While this study offers valuable insights, its findings are limited to participants from two urban centers (Dumaguete and Zamboanga Cities). Contextual factors such as institutional culture, resource availability, and regional language differences may influence the transferability of the results. Therefore, future research should replicate the study across different Philippine regions and other countries to validate the framework in more diverse educational settings.

Conflict of interest

The authors declare no conflict of interest

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