MATHEMATICS ANXIETY IN SECONDARY LEARNERS: FACTORS, INTERVENTIONS, AND RESILIENCE STRATEGIES

By

***Hem Prasad Sharma, & **Narender Singh**

**Research Scholar, Department of Education, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh, India.*

***Assistant Professor, Department of Education, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh, India.*

Abstract

Mathematics plays a vital role in the economic, scientific, and technological advancement of modern societies and, consequently, remains a central component of educational curricula worldwide. Despite its importance, mathematics anxiety has long been recognised as a significant barrier to student achievement, particularly during the secondary school years when learners face abstract reasoning, standardised assessments, and heightened societal expectations. Mathematics anxiety is often described as fear, avoidance, and aversion toward mathematics. It is frequently conceptualised as a phobia that triggers negative responses to learning or performing mathematical tasks, ultimately hindering academic performance. However, in the 21st century, this problem has become more pronounced due to technological integration, changing pedagogical practices, and global educational demands. Addressing this issue is crucial to helping students reach their maximum academic potential. The present study explores the multidimensional factors that contribute to mathematics anxiety among secondary learners. Moreover, it highlights evidence-based strategies for teachers to use to mitigate mathematics anxiety and foster mathematical resilience and positive attitudes towards the subject among secondary learners. Drawing on secondary sources, the paper synthesises existing research to identify contributing factors and propose evidence-based strategies to address mathematics anxiety. By focusing on strategies that reduce anxiety and strengthen learners' problem-solving abilities, the paper ultimately aims to improve mathematical outcomes and reduce educational gaps in secondary education.

Keywords: *mathematics anxiety, strategies, mathematical resilience, and secondary stage learners.*

Introduction

Mathematics has become an essential foundation for driving economic growth, advancing scientific research, and fostering technological progress in the 21st century.

Mathematics education has become an imperative element of secondary schooling worldwide due to its contribution to problem-solving, data analysis, and critical thinking. When students succeed in mathematics, it not only supports individual academic and career pathways but also strengthens their country's competitiveness in a rapidly changing world.

Despite its central role, many students still find mathematics intimidating and continue to perceive it as a challenging subject. Secondary-level schooling emphasises abstract reasoning, comparisons with peers, and various other crucial assessments, leading many students to experience negative feelings about mathematics. These emotions are often expressed as *mathematics anxiety*, which involves feelings of tension, fear, or apprehension that make it difficult for individuals to deal with numbers

and solve mathematical problems in their daily lives and academic settings (Richardson & Suinn, 1972). Over the years, research has repeatedly proven that mathematics anxiety is a persistent obstacle to students' academic achievement, and it also hampers both cognitive outcomes and their feelings toward math in the long run.

Mathematics anxiety has emerged as a serious educational challenge. It contributes to the avoidance of mathematical tasks by reducing students' confidence and persistence. In today's context, where mathematics literacy is essential, especially in Science, Technology, Engineering, and Mathematics (STEM) fields, failing to identify this anxiety will widen educational inequalities and restrict learners' potential. At the secondary level, learners are mainly dealing with intensified academic demands, increasing societal and parental expectations, and pressure to perform well in competitive examinations.

Although many studies have explored mathematics anxiety, there remain gaps in understanding its complex, interconnected nature in the 21st century. Most earlier studies have focused on how math anxiety affects learners' thinking and emotions. However, a few studies have focused on other variables, such as environment, technology, parental influence, and modern teaching methods, and on how these factors influence students' interactions with mathematics. Although there are various strategies to reduce anxiety, what we really need is a better understanding of approaches that will help students build lasting mathematical resilience rather than just simply addressing deficits.

In the 21st-century context, we must examine the multidimensional factors that lead to anxiety among secondary school learners. It also calls for identifying evidence-based strategies for teachers to alleviate mathematics anxiety and boost mathematical resilience among learners, and encourage them to develop a positive attitude towards the discipline.

Background and Significance

Mathematics provides the foundation for logical reasoning, problem-solving, and scientific thinking. In today's society, competence in mathematics is vital for academic achievement and for participation in fields such as science, technology, engineering, and mathematics (STEM). Many students, however, view mathematics as challenging and intimidating, especially during secondary education. A significant obstacle to successful mathematics learning is mathematics anxiety.

Studies show that mathematics anxiety results from a combination of factors. Cognitive factors such as low self-confidence, weak foundational understanding, limited working memory, and negative beliefs about one's abilities are influential. Inadequate teaching methods, including rote learning, insufficient focus on concepts, excessive exam pressure, and limited use of student-centred or technology-based approaches, can increase students' fear of mathematics. Environmental factors such as classroom

atmosphere, parental attitudes, socio-economic circumstances, and stereotypes also shape students' feelings about mathematics. Additionally, learner characteristics and parental expectations contribute to the continuation of mathematics anxiety. There is increasing awareness that mathematics anxiety is a widespread educational issue requiring broad and well-informed interventions. Various strategies—including collaborative learning, fostering a growth mindset, cognitive restructuring, retesting, expressive writing, and supportive classroom environments—have proven effective in reducing anxiety and building mathematical resilience.

This study aims to bring together current research on mathematics anxiety among secondary students, examine its various causes, and highlight ways to address it. By integrating perspectives from cognitive, instructional, environmental, learner, and parental viewpoints, the study seeks to deepen understanding of mathematics anxiety in modern education and offer practical recommendations for teachers and policymakers.

This study is important because it offers a thorough and integrated view of mathematics anxiety among secondary school students. By considering cognitive, instructional, environmental, learner, and parental factors, the research presents mathematics anxiety as a complex issue. Such a comprehensive understanding is necessary for creating interventions that address both the academic and emotional aspects of learning mathematics.

For teachers, this research offers practical strategies for the classroom. By focusing on teaching methods such as cooperative learning, mastery-based assessment, self-paced instruction, and technology integration, the study provides educators with tools to reduce anxiety, build confidence, and foster more profound understanding. Emphasising supportive teaching and avoiding punitive practices highlights the key role teachers play in shaping students' experiences with mathematics.

The research also benefits students by focusing on psychological and student-driven techniques that help manage anxiety. Strategies such as developing a growth mindset, expressive writing, cognitive restructuring, relaxation exercises, and reflective discussions encourage students to build self-regulation, resilience, and a positive outlook toward mathematical challenges. These approaches support both academic improvement and emotional well-being, encouraging long-term engagement with mathematics.

On a larger scale, the study is relevant for education planners and policymakers by stressing the need to address mathematics anxiety to close learning gaps and increase participation in STEM fields. By compiling research-driven solutions, the study offers a basis for developing teacher training, curriculum changes, and culturally responsive strategies that promote positive experiences in mathematics.

Overall, this research contributes to current understanding by offering a straightforward, practical approach to recognising and addressing mathematics anxiety. By helping shift mathematics from something to be feared to an area of confidence, the study's findings can improve educational results and prepare secondary students with vital skills for future academic and career success.

Objectives of the Paper

1. To examine the multidimensional factors contributing to mathematics anxiety among secondary stage learners.
2. To present evidence-based strategies for teachers to mitigate mathematics anxiety and foster mathematical resilience and positive attitudes towards the subject.

Literature Review

Recent studies suggest that mathematics anxiety should be understood as a condition shaped by classroom experiences, teaching practices, and students' emotional responses, rather than as an inherent weakness of learners. Researchers have noted that anxiety tends to increase when mathematics instruction places excessive emphasis on speed, accuracy, and examination performance, often discouraging deep understanding and reflective thinking (Carey et al., 2017). Such learning environments can foster a fear of failure, hindering students' ability to engage meaningfully with mathematical concepts.

Evidence from cognitive research further indicates that anxiety can disrupt students' working memory, making it difficult for them to process numerical information effectively during problem-solving tasks (Lyons & Beilock, 2012). This explains why capable students may underperform in mathematics under pressure.

More recent educational research highlights the importance of assessment practices in shaping students' emotional responses to mathematics. Formative assessment approaches that focus on feedback and improvement, rather than grades alone, have been found to reduce anxiety and promote confidence among learners (Black & Wiliam, 2018). Similarly, classrooms that encourage discussion, allow mistakes, and treat errors as part of learning contribute to a more supportive mathematical environment (Boaler, 2016).

The integration of digital technologies has also gained attention in recent years. Adaptive learning tools and online platforms offer students opportunities to practise mathematics at their own pace, which can help reduce fear and build confidence (Attard et al., 2020). In addition, studies emphasise the role of teachers in addressing mathematics anxiety, noting that emotional support, encouragement, and autonomy-supportive teaching can significantly influence students' attitudes toward mathematics (Lazarides & Buchholz, 2019). Overall, contemporary literature stresses that reducing mathematics anxiety requires sustained changes in teaching methods, assessment strategies, and classroom culture

Methodology

To highlight both challenges and solutions while contributing to a comprehensive understanding of mathematics anxiety in the 21st century. The researcher conducted a literature review by synthesising existing research from databases**,** including ResearchGate, Google Scholar, ScienceDirect, ERIC, and Academia, using the keywords' *math*' and *'mathematics anxiety*'. Subsequently, to provide practical insights for educators, teachers and policymakers, which will help them to foster resilience, reduce anxiety, and improve mathematical outcomes for secondary learners.

Result and Discussion

Though it is a review paper based upon the findings of the earlier studies, their findings have been discussed from other relevant works and researchers' own point of view.

Factors Contributing to mathematics anxiety among secondary learners

Cognitive factors

Mathematics anxiety often develops when students overuse cognitive resources. The cognitive dimension of math anxiety (MA) hinders learning abilities by influencing an individual's thoughts, perceptions, and expectations about mathematics (Beilock & Maloney, 2015). In support, Haase et al. (2019) reported that mathematical anxiety disrupts cognitive processes, math self-concept, and shapes attitudes and self-efficacy. Low self-confidence and weak skills hinder critical thinking and increase anxiety (Pletzer et al., 2015; Batchelor et al., 2017; Haase et al., 2019; Ramirez et al., 2018). Working memory (WM) is crucial for processing and storing short-term information. However, this function is often impaired in math-anxious individuals, leading to disruptions in working memory, reduced capacity, weaker responses, and poor math achievement (Foley et al., 2017; Namkung et al., 2019). Consequently, students may panic, feel discomfort, and avoid math-related tasks (Haase et al., 2019; Ersozlu & Karakus, 2019). Moreover, self-efficacy, i.e. belief in one's ability to perform tasks, is negatively associated with MA, as low confidence fosters fear, doubt, and low motivation, especially in test situations (Andrews & Brown, 2015; Gunderson et al., 2018; Kahramanoğlu & Deniz, 2017; Rozgonjuk et al., 2020).

Odiri (2023) found, through interviews and questionnaires, that cognitive, contextual, and behavioural factors determine students' math anxiety. Similarly, Prahamana et al. (2020) reported that fear of solving complex mathematical problems, confusion, and concentration difficulties are key cognitive triggers, while home and classroom environments also contribute to mathematical anxiety. Anxiety in mathematics arises from multiple factors, and cognitive factors are one of the strongest (Rubinstein et al., 2018). Yeasmin (2017) examined multiple dimensions of mathematical anxiety using several secondary sources and concluded that low performance in mathematics is related to cognitive components. Cognitive, psychological, physiological and

environmental factors also contribute to maths anxiety (Shaikh, 2013).

Inappropriate Teaching Methods

Teaching style has a significant impact on math anxiety. Inappropriate and unproductive use of methods for teaching mathematics can also contribute to developing mathematical anxiety. Zanabazar et al. (2023) conducted a study with a sample of 916 students, which found that poor teaching methods, such as rote memorisation, lack of communication between teacher and students, limited use of ICT tools, outdated resources and lack of conceptual understanding are responsible for causing mathematical anxiety as students feel bored and anxious, often leading to avoidance of mathematics. Mehmet and Hulya (2021) added that insufficient knowledge of teaching strategies, teachers' indifferent attitudes towards students at the elementary stage, and comparisons made by teachers with successful peers increase the risk of anxiety. Likewise, Estonanto and Dio (2019) emphasised that the use of inadequate teaching methods raises anxiety, especially when teaching abstract mathematical concepts and Calculus. Yuliana et al. (2018) reported that students who mechanically complete their math assignments without really understanding the underlying concepts become most anxious during assessments. The main reason behind this gap in students' understanding is greatly linked to ineffective teaching strategies that failed to foster deep understanding. Finlayson (2014), highlighted many significant factors that lead to mathematical anxiety, including fear of failure, lack of knowledge, low engagement, a shortage of self-confidence, and poor teaching strategies.

Environmental Factors

Research revealed that environmental factors and demographic factors significantly influence math anxiety. Vargas (2021) reviewed various studies and found that a variety of environmental factors, including parents' educational qualifications, family background, parenting style, socioeconomic status, and teachers' education level, can contribute to mathematical anxiety. Prahanama et al. (2020, 2019) found that classroom culture and social stereotypes are important environmental factors that contribute to mathematical anxiety. Several studies have found that the anxiety level of students is often increased by negative classroom experiences, inappropriate teaching methods, crowded classrooms, and gender stereotypes (Rubinstein et al., 2018; Faujadpour et al., 2018). Batchelor et al. (2017) found that Children's math anxiety is also influenced by their parents' attitudes, shaped by societal pressures and high expectations, which often lead to excessive control over children's academic achievement. However, this situation varies across families based on their background, parenting style and parents' level of MA (Haase et al., 2019). Similarly, Mollah (2017) emphasised that stressful home and school environments, along with the psychological teaching methods, lead to mathematical anxiety. Shaikh (2013) argued that, beyond

cognitive and emotional causes, environmental factors are among the strongest predictors of math anxiety. Supporting these findings, Bekdemir (2010) proved that preservice teachers with unpleasant classroom experiences reported higher math anxiety. Ashcraft (2002) noted that public embarrassment in math classes can have a lasting adverse effect, playing a significant role in the development of math anxiety.

Learner Factors

Student-related factors significantly influence the emergence of mathematics anxiety. Odiri (2023) found that learners' inability to grasp certain maths concepts and their lack of mathematics skills often contribute to math anxiety. Similarly, Zanabazar et al. (2023) identified several factors, including poor mathematical skills, nervousness, and negative emotions, that contribute to math anxiety. A study by Hunt et al. (2021) found that low self-awareness, exceptionally low self-efficacy, and low confidence in one's math skills tend to increase math anxiety. Azizah et al. (2019), Siswanti and Djalal (2018), and Yeasmin (2017) also collectively identified factors such as low self-confidence, low problem-solving skills, lack of self-belief, and avoidance behaviour as key contributors to mathematics anxiety among students. Beilock and Maloney (2015) collectively found that math anxiety is developed from both cognitive predispositions and learners' negative mindset. Similarly, Finlayson (2014) revealed that a rigid curriculum, excessive focus on memorisation, fear of failure, and low engagement also intensify students' anxiety towards mathematics.

Parental Factors

Parents often play a significant role in shaping how students perceive and experience mathematics. When Parents themselves fear mathematics and put pressure on their child for high performance, parents' hesitation about their child's poor mathematical performance and lack of confidence in their child's abilities can unintentionally increase students' math anxiety (Zanabazar et al., 2023; Rubinstein et al., 2018). Similarly, a review-based study revealed that parental pressure on children, parents' limited mathematical knowledge, and societal expectations are significant contributors to math anxiety (Marks, 2022). Prahamana et al. (2020) noted that when parents believe their child is not good at maths, they often discourage further engagement with the subject. Yeasmin (2017) further pointed out that parental factors like lack of family support, negative parental attitude towards mathematics and family stress can increase mathematics anxiety among children.

Research also shows that family structure and socio-economic background are crucial contributors to students' learning. Children whose parents are actively involved in their upbringing often have higher socio-economic status and better access to educational resources. In contrast, children from single-parent families may face significant challenges, including limited resources, limited academic support, childcare difficulties, and may receive less

parental attention (Lareau, 2002). Moreover, children from separated families may experience emotional strain, which can lower academic motivation and performance, particularly in difficult subjects like mathematics (Lareau, 2002; Chiu & Xihua, 2008).

Stratergies

Pedagogical Strategies

Effective pedagogical approaches to reducing mathematical anxiety emphasise moving from rote memorisation to fostering deeper conceptual understanding. Rather than relying entirely on rote memorisation, it enables learners to engage meaningfully with the subject (Puteh, 2002).

Cooperative learning is one of the most effective and widely supported strategies for reducing math anxiety. When teachers create opportunities for collaborative and peer-assisted learning, students begin to see that struggling with academic challenges is completely normal. This shared learning fosters peer support and encouragement (Casinillo et al., 2022). In addition, when teachers provide scaffolding and constructive feedback, it helps reduce the fear of mistakes and gradually builds learners' confidence and resilience in the learning process (Kaziya, 2025).

Incorporating approaches like retesting or mastery-based learning models that allow students to have multiple chances to demonstrate their comprehension and improve over time. Retesting can serve as an emotional safety net, reducing the fear of failure among secondary learners (Iossi, 2007). For instance, permitting retakes after feedback normalizes mistakes and builds confidence, as students perceive assessments as opportunities for growth rather than judgment (Scheldorf, 2022). A study found that students viewed retesting as helpful, and approximately 90% improved their performance on the retest (Juhler, Rech, From, & Brogan, 1998).

Self-paced learning is another option, where students progress at their own rate, potentially alleviating anxiety by reducing pressure from rigid timelines. In secondary education, this could involve modular units with flexible deadlines, helping performance-oriented students who might otherwise feel overwhelmed (Iossi, 2007). However, it requires careful implementation to ensure mastery, as unstructured pacing might exacerbate avoidance behaviours in anxious learners.

Psychological Interventions

Growth mindset *training* is a psychological intervention that can effectively reduce mathematics anxiety by reshaping students' beliefs about learning and failure. This training emphasises that mathematical ability develops through perseverance and practice rather than being a fixed innate talent, and has proven particularly effective in lowering students' anxiety levels (Dweck, 2006; Kaziya, 2025). Growth mindset training helps students understand that struggling with math is entirely normal, and through practice, they can improve their performance. This intervention has shown significant benefits in building resilience and reducing negative emotional responses to

academic challenges, as it encourages learners to reframe failure as a crucial component of the learning process (Ramirez et al., 2018).

Expressing feelings through reflective group discussion is another strategy to reduce math anxiety. Allow students to openly share how they feel about math. This reflective process encourages students to talk about their feelings and enables them to become more self-aware about their potentialities and less anxious (Shodahl & Diers, 1984; Tobias, 1991)

Cognitive Restructuring is a key psychological intervention to reduce math anxiety. Tobias (1991) reported that activities such as the Divide Page Exercise are practices in which students write their negative self-statements on one side of the page and positive affirmations to counter the negative statements on the other. This reflective technique helps learners confront irrational beliefs. Swanson (2013) further supported this technique by encouraging learners to reflect on their emotional reactions when they face a math problem. Through consistent practice, cognitive restructuring enables learner to foster self-efficacy and turn their fear into an area of growth and confidence.

Classroom intervention

Reduce the use of physical punishments: as they increase students' fear and anxiety. Teachers should avoid practices such as caning, slapping, or forcing students. Instead, they should adopt positive reinforcement (Kinanda, Kyaruzi, & Fulgence, 2024).

Avoid embarrassment and intimidation: teachers should stop threatening, humiliating, and mocking students in classrooms. They should create a compassionate, supportive environment that helps students gain confidence in mathematics (Kinanda et al., 2024).

Use of rewards and reinforcement: Teachers should try to motivate students with rewards, smiles, laughter, or verbal encouragement to help reduce anxiety and build a positive attitude toward the subject.

Peer teaching: This practice enables students to teach each other, which gradually lowers the pressure of learning. Student interaction with peers builds confidence through peer support (Kinanda et al., 2024).

One-to-one support: Providing individual guidance helps teachers address specific learning difficulties and reduce the anxiety that comes from being left behind (Kinanda et al., 2024).

Integrating technology: By using videos, online platforms, reasoning games, and digital resources, teachers can simplify abstract mathematical concepts and make learning more engaging, thereby reducing anxiety (Kinanda et al., 2024).

Relating mathematics to real life: When teachers connect lessons with practical applications, such as money, distance, and time, to make mathematics meaningful and

less intimidating, it can gradually reduce maths anxiety.

Daily practice: Practice makes a man perfect. Many researchers recommend that practising mathematics problems daily can help students build confidence and reduce the fear of mathematics. Therefore, teachers should encourage students to solve problems regularly, which will help improve skills, build confidence, and overcome fear (Mandal & Saha, 2019).

Student-Led Positive Coping Techniques

Empowering students with self-regulation tools shifts control to the learner, making strategies sustainable beyond the classroom.

Expressive writing: where students write about their anxieties before tasks, reduces worry and improves focus. At the secondary level, a short 10-minute pre-test writing activity can reduce performance gaps between anxious and non-anxious students (Beilock & Willingham, 2014; Smith-Nelson, 2016).

Brain breaks: short pauses for stretching or walking refresh working memory. Studies have shown that these short breaks are the most effective study technique, especially at the secondary level (Smith-Nelson, 2016). Just as clearing a phone's cache or fixing a bug helps it run smoother and faster, these breaks similarly help our brains process more efficiently.

Relaxation techniques: *This* techniques, mindful breathing and meditative colouring are simple methods that help calm our mind and body during stress. Studies revealed that about 76% of students found deep breathing helpful for managing their anxiety (Smith-Nelson, 2016). Research found that when meditative colouring is paired with math problems, it systematically desensitises students to anxiety triggers.

Conclusion

This paper underscores the multifaceted nature of mathematics anxiety among secondary learners by revealing the factors such as cognitive overload, ineffective teaching practices, uncooperative environments, individual learner characteristics, and parental influences. These factors not only make students uncomfortable but also impair working memory and self-efficacy. It perpetuates avoidance behaviours in learners, hindering their academic performance and long-term STEM engagement. However, many studies have shown that evidence-based strategies such as growth mindset training, cognitive restructuring, cooperative learning, retesting, and expressive writing offer promising pathways to mitigate maths anxiety, foster resilience, and cultivate positive attitudes toward mathematics.

By implementing strategies that research offers, we can transform math from a stressful subject to a gateway for empowerment. Educators should be empowered with creative teaching methods, psychological tools, and supportive classroom practices. When teachers adopt innovative and creative teaching strategies and inclusive classroom practices, students feel less anxious and become more resilient and confident toward mathematics.

Addressing mathematics anxiety not only strengthens their confidence but also equips them with vital skills they need to thrive in today's world, narrowing educational gaps and maximising opportunities. Future research should focus on tracking students over a more extended period and on providing culturally sensitive interventions to ensure lasting, meaningful outcomes.

References

Andrews, A., & Brown, J. (2015). The effects of math anxiety. *Education, 135*(3), 362–370.

Attard, C., Holmes, K., & Thomas, J. (2020). *Teaching mathematics with digital technologies*. Routledge.

Beilock, S. L., & Willingham, D. T. (2014). Math anxiety: Can teachers help students reduce it? *American Educator, 38*(2), 28–32. https://www.aft.org/sites/default/files/bilock.pdf

Black, P., & Wiliam, D. (2018). Classroom assessment and pedagogy. *Assessment in Education: Principles, Policy & Practice, 25*(6), 551–575. https://doi.org/10.1080/0969594X.2018.1441807

Boaler, J. (2016). *Mathematical mindsets*. Jossey-Bass.

Carey, E., Hill, F., Devine, A., & Szűcs, D. (2017). The modified abbreviated math anxiety scale: A valid and reliable instrument for use with children. *Frontiers in Psychology, 8*, 11. https://doi.org/10.3389/fpsyg.2017.00011

Casinillo, L. F., Casinillo, E. L., Lagumbay, C. T., Abad, H. R. F., & Dagongdong, M. L. (2022). Revisiting mathematical resilience and anxiety among senior high students. *International Journal of Indonesian Education and Teaching, 6*(2), 193–203. https://doi.org/10.24071/ijiet.v6i2.4661

Caviola, S., Carey, E., Mammarella, I. C., & Szűcs, D. (2017). Stress, time pressure, strategy selection and math anxiety in mathematics: A review of the literature. *Frontiers in Psychology, 8*, Article 1488. https://doi.org/10.3389/fpsyg.2017.01488

Ersozlu, Z., & Karakus, M. (2019). Mathematics anxiety: Mapping the literature by bibliometric analysis. *Eurasia Journal of Mathematics, Science and Technology Education, 15*(1), em1659. https://doi.org/10.29333/ejmste/99486

Finlayson, M. (2014). Addressing math anxiety in the classroom. *Improving Schools, 17*(1), 99-115

Gay, G. (2018). *Culturally responsive teaching: Theory, research, and practice* (3rd ed.). Teachers College Press.

Gunderson, E. A., Park, D., Maloney, E. A., Beilock, S. L., & Levine, S. C. (2018). Reciprocal relations among motivational frameworks, math anxiety, and math achievement in

early elementary school. *Journal of Cognition and Development, 19*(1), 21–46. https://doi.org/10.1080/15248372.2017.1421538

Haase, V. G., Guimarães, A. P. L., & Wood, G. (2019). Mathematics and emotions: The case of math anxiety. In A. Fritz, V. G. Haase, & O. Räsänen (Eds.). *International handbook of mathematical learning difficulties: From the laboratory to the classroom*. 177–194. Springer. https://doi.org/10.1007/978-3-319-97148-9_11

Hellum-Alexander, A. (2010). *Effective teaching strategies for alleviating math anxiety and increasing self-efficacy in secondary students* [Master's project, The Evergreen State College].

Iossi, L. (2007). *Strategies for reducing math anxiety in post-secondary students*. In S. M. Nielsen & M. S. Plakhotnik (Eds.), Proceedings of the Sixth Annual College of Education Research Conference: Urban and International Education Section, 30–35. Florida International University. http://coeweb.fiu.edu/research_conference/

Ishak, N. H. F. B., Mat Yusoff, N. F. B., & Madihie, A. (2020). Resilience in mathematics, academic resilience, or mathematical resilience? An overview. *Universal Journal of Educational Research, 8* (5A), 34–39. https://doi.org/10.13189/ujer.2020.081905

Kahramanoğlu, R., & Deniz, T. (2017). An investigation of the relationship between middle school students' metacognitive skills, mathematics self-efficacy and mathematics achievement. *İnönü University Journal of the Faculty of Education, 18*(3), 189–200. https://doi.org/10.17679/inuefd.334285

Kaziya, K. (2025). Developing mathematical resilience: Effective strategies to alleviate mathematics anxiety among secondary school students in Kalomo District, Zambia. *International Journal of Research and Innovation in Social Science, 9*(6), 1630–1666. https://doi.org/10.47772/IJRISS.2025.906000131

Kinanda, J. J., Kyaruzi, F., & Fulgence, K. (2024). Strategies for reducing mathematics anxiety among students in secondary schools Tanzania. *Journal of Instructional Psychology, 37*(1), 24–31.

Kour, S. J., & Rafaqi, M. Z. ul H. (2024). Factors affecting mathematical anxiety: A systematic review of related literature. *Rajasthali Journal, 3*(2), 103.

Lazarides, R., & Buchholz, J. (2019). Student-perceived classroom support and mathematics anxiety: A multilevel analysis. *Learning and Instruction, 63*, 101–108. https://doi.org/10.1016/j.learninstruc.2019.05.003

Lyons, I. M., & Beilock, S. L. (2012). Mathematics anxiety: Separating the math from the anxiety. *Cerebral Cortex, 22*(9), 2102–2110. https://doi.org/10.1093/cercor/bhr289

Mandal, A. K., & Saha, B. (2019). Mathematics anxiety and prevention strategies: An attempt to improvement of mathematics performance of secondary school students in West Bengal. *NSOU-OPEN Journal, 2*(1), 1–7.

Marshall, E., Mann, V., & Wilson, D. (2016). Maths anxiety: A collaboration [Conference handout]. Higher Education Academy (HEA) STEM Conference, Nottingham, United Kingdom.

Mazana, M. Y., Montero, C. S., & Casmir, R. O. (2019). Investigating students' attitude towards learning mathematics. *International Electronic Journal of Mathematics Education, 14*(1), 207–231. https://doi.org/10.29333/iejme/3997

Musa, N. H., & Maat, S. M. (2021). Mathematics anxiety: A case study of students' learning experiences through cognitive, environment and behaviour. *International Journal of Academic Research in Business and Social Sciences, 11*(3), 833–845. https://doi.org/10.6007/IJARBSS/v11-i3/8992

Omar, S. H., Syed Aris, S. R., & Teoh, S. H. (2022). Mathematics anxiety and its relationship with mathematics achievement among secondary school students. *Asian Journal of University Education, 18*(4), 863–878. https://doi.org/10.24191/ajue.v18i4.19992

Onoshakpokaiye, O. E. (2023). Students' Learning Experiences: A case study of Cognitive, Environmental and Behavioural predispositions towards Math Anxiety. *St. Theresa Journal of Humanities and Social Sciences*, *9*(1), 24-45

Park, D., Ramirez, G., & Beilock, S. L. (2014). The role of expressive writing in math anxiety. *Journal of Experimental Psychology Applied*, *20*(2), 103–111. https://doi.org/10.1037/xap0000013

Prahmana, R. C. et al. (2019). Mathematical anxiety among engineering students. *Infinity Journal*, *8*(2), 179-188.

Puteh, M. (2002). *Techniques for developing positive attitudes towards mathematics.* [Conference session]. Persidangan Kebangsaan Pendidikan Matematik 2002, Universiti Pendidikan Sultan Idris, Tanjong Malim, Malaysia.

Rada, E., & Lucietto, A. M. (2022). Math anxiety — A literature review on confounding factors. *Journal of Research in Science, Mathematics and Technology Education*. Advance online publication. https://doi.org/10.31756/jrsmte.12040

Radišić, J., Videnović, M., & Baucal, A. (2015). Math anxiety—contributing school and individual level factors. *European Journal of Psychology of Education, 30*(1), 1–20. https://doi.org/10.1007/s10212-014-0224-7

Ramirez, G., Shaw, S. T., & Maloney, E. A. (2018). Math anxiety: Past research,

promising interventions, and a new interpretation framework. *Educational Psychologist, 53*(3), 145–164. https://doi.org/10.1080/00461520.2018.1447384

Rozgonjuk, D., Saal, K., & Täht, K. (2020). Mathematics anxiety among STEM and social sciences students: The roles of mathematics self-efficacy, and deep and surface approach to learning. *International Journal of STEM Education.* https://doi.org/10.1186/s40594-020-00246-z

Rubinsten, O., Daches Cohen, L., Henik, A., & Drori, R. (2018). A framework for studying the heterogeneity of risk factors in math anxiety. *Frontiers in Behavioral Neuroscience, 12*, Article 291. https://doi.org/10.3389/fnbeh.2018.00291

Salahot, D. (2022). The Effect of Mathematical Anxiety on Mathematical Performance among Secondary School Students in Tanzaniz: A case of Arusha City Council. *International Journal of Scientific Research and Management, 12*(10), 425-436.

Samuel, T. S., & Warner, J. (2019). "I can math!": Reducing math anxiety and increasing math self-efficacy using a mindfulness and growth mindset-based intervention in first-year students. *Community College Journal of Research and Practice*. Advance online publication. https://doi.org/10.1080/10668926.2019.1666063

Scheldorf, H. M. (n.d.). *Reducing math anxiety in the secondary classroom*. [Unpublished manuscript]. Bemidji State University.

Shodahl, S. & Diers, C. (1984). Math Anxiety in College Students: Sources and Solutions. *Community College Review, 12*(2), 32-36.

Smith-Nelson, C. K. (2016). *Practicing positive coping strategies for managing math anxiety in a secondary mathematics classroom*. [Master's thesis, Missouri State University]. BearWorks. https://bearworks.missouristate.edu/theses/2977

Suárez-Pellicioni, M., Núñez-Peña, M. I., & Colomé, À. (2016). Math anxiety: A review of its cognitive consequences, psychophysiological correlates, and brain bases. *Cognitive, Affective, & Behavioral Neuroscience, 16*(1), 3–22. https://doi.org/10.3758/s13415-015-0370-7

Swanson, P. (2013). Over Prahmana, R. C et al. (2021). Mathematics Anxiety and the Influencing Factors among Junior High School Students in Yogyakarta, Indonesia. *Croatian Journal Educational*, *23*(2).343-369.

Tobias, S. (1991). Math mental health. *College Teaching, 39*(3), 91.

Xolocotzin Eligio, U. (Ed.). (2017). *Understanding emotions in mathematical thinking and learning*. Academic Press.

Yaesmin, M. (2017). Consequences of Mathematical Anxiety on Students

Achievements in Mathematics. What does Research Say? *International Journal of Academic Research and Development, 2*(6), 707-712.

Zakaria, E., Mohd Zain, N., Ahmad, N. A., & Erlina, A. (2012). Mathematics anxiety and achievement among secondary school students. *American Journal of Applied Sciences, 9(*11), 1761–1765. https://doi.org/10.3844/ajassp.2012.1828.1832

Zanabazar, A., Deleg, A., & Ravdan, M. (2023). A study of factors causing math anxiety among undergraduate students. *International Journal of Innovative Research and Scientific Studies, 6(*3), 578–585. https://doi.org/10.53894/ijirss.v6i3.1609

To cite this article

****

Hem Prasad Sharma, & Narender Singh. (2025). Mathematics Anxiety in Secondary Learners: Factors, Interventions, and Resilience Strategies. *Sparkling International Journal of Multidisciplinary Research Studies, 8*(4), 16-30.

****

ABOUT THE AUTHORS

Mr. Hem Prasad Sharma *is a Research Scholar, Department of Education Rajiv Gandhi (A Central) University, Rono Hills, Doimukh, Arunachal Pradesh, India. He is pursuing his Ph.D. in Education, (RGU). Mr. Sharma academic credential includes M.Sc. in Mathematics, M.Ed., and NET (Education). He is conducting Quantitative research on the topic "Mathematics Anxiety in Relation to Achievement, Problem Solving Ability and Academic Stress among the Secondary School Students in Arunachal Pradesh".*

Dr Narender Singh *is working as Assistant Professor in the department of Education, Rajiv Gandhi (A Central) University, Rono Hills Doimukh, Arunachal Pradesh, India. His academic credential includes M.A. (English), M.A. (Sociology), M.Ed., and M.Sc. (Chemistry), NET (Education & English). Dr Singh has published 30 research papers in National and international journals and published one (1) reference book on Research Methodology and six (6) edited books. He is the program coordinator for ITEP and members of various committees of the university. His Specialization is Language Education, Research Methodology, and Educational Administration and Leadership.*

****