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BEYOND THE FEAR OF MATH: UNDERSTANDING MATHEMATICS ANXIETY IN HIGHER EDUCATION ACROSS ASIA

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Abstract :

Mathematics anxiety is one of the major challenges faced by students in higher education in Asia, especially in education systems that emphasize high academic achievement. This problem can negatively impact students' conceptual understanding, motivation to learn, and career choices. This study aims to identify factors that contribute to mathematics anxiety in higher education in Asia and explore strategies that can be applied to overcome it. The method used in this study is a literature study with a descriptive analysis approach. Data were obtained from national and international journals published between 2018 and 2024, focusing on mathematics anxiety among Asian students. The results showed that mathematics anxiety is influenced by various factors, including academic pressure, social expectations, less interactive teaching methods, and negative experiences in previous learning. In addition, there are gender differences in the level of mathematics anxiety, where female students tend to be more susceptible to it. The discussion reveals that effective interventions include cognitive-behavioral therapy, self-efficacy enhancement, social support, and innovations in teaching methods such as problem-solving approaches and the use of technology. By understanding the causal factors and effective mitigation strategies, educational institutions can create a more conducive learning environment for students in facing academic challenges in mathematics.

Keywords : *math anxiety, higher education, academic stress, teaching methods*

INTRODUCTION

Mathematics is often considered a difficult and challenging subject, especially at the higher education level (Firdaus & Rozie, 2024). Many students have difficulty understanding complex mathematical concepts, especially when faced with a curriculum that is more demanding than their previous level of education (Mangarin & Caballes, 2024). Math anxiety can hinder students ability to understand concepts, reduce motivation to learn, and even affect students career choices (Eidlin-Levy, Avraham, Fares, & Rubinsten, 2023). This phenomenon is becoming increasingly significant in Asian countries, where education systems often emphasize high academic achievement, especially in the STEM (Science, Technology, Engineering, and Mathematics) fields (Idris & Bacotang, 2023; Wahono, Lin, & Chang, 2020).

Math anxiety not only impacts academic aspects, but also has serious psychological implications for students. Research by Wang et al., (2021) showed that college students in China experience high levels of math anxiety due to intense academic pressure and strong social expectations. Another study by Roy and Kumar (2023) in India also showed that traditional teaching methods that emphasize memorization rather than conceptual understanding can increase math anxiety among students. Other factors such as negative experiences in

previous learning and lack of academic support can also worsen math anxiety (Ahmmed, Saha, Tamal, Abdullah Al Mamun, & Islam, 2024).

In a social and cultural context, high academic pressure in Asia often stems from family and societal expectations that see success in education, especially in mathematics and science, as the primary indicator of one's success (Tan & Yates, 2011; Wang et al., 2021). Research by Jarvis et al., (2020) in South Korea showed that social norms linking academic achievement to social status cause students to feel burdened with high expectations, which contributes to increased math anxiety. This pressure can affect students' mental health and increase the risk of emotional disorders such as stress and depression (Mofatteh, 2021).

Furthermore, a study conducted by Jamaludin et al., (2024) in Singapore showed that math anxiety not only impacts academic achievement but also the overall psychological well-being of students. Students with high levels of anxiety tend to experience prolonged stress, lack self-confidence, and even avoid courses related to mathematics. This is in line with research from Ng et al., (2022) which shows that students in Taiwan who experience mathematics anxiety are more likely to experience academic burnout and emotional distress (Chang, Lee, & Yen, 2019).

In higher education, math anxiety can affect many aspects of learning, including class participation, effectiveness in completing assignments, and performance on exams (Khasawneh, Gosling, & Williams, 2021; Núñez-Peña, Suárez-Pellicioni, & Bono, 2013). Research conducted by Satake and Amato (1995) in Japan revealed that students with high math anxiety tend to avoid classroom interactions, are afraid to ask questions, and have more difficulty solving math problems than students who do not have such anxiety. As a result, students often get lower grades, which further reinforces the cycle of anxiety and low math confidence (Moses & Maat, 2021). In Indonesia, math anxiety is also a concern in higher education. Research conducted by Prahmana et al., (2019) found that students at several universities in Indonesia experience significant anxiety when facing mathematics courses, especially those related to calculus and statistics. Factors such as negative experiences in high school, less interactive teaching methods, and academic pressure contribute to the emergence of anxiety (Stromájer et al., 2023).

Apart from academic and social factors, the role of lecturers and teaching methods are also important aspects in overcoming math anxiety (Zhang, 2023). Study by Ahmad et al., (2022)highlights how a more interactive and problem-based teaching style can help students develop a better understanding of mathematical concepts. In contrast, teaching methods that focus solely on memorization and testing tend to increase academic pressure and trigger higher anxiety (Chakraborty, 2023). Therefore, innovation in mathematics teaching is very necessary to create a more inclusive learning environment and support students in dealing with anxiety (Atoyebi & Atoyebi, 2022).

From a psychological perspective, various cognitive and emotional factors play a role in math anxiety. Information processing theory suggests that individuals with math anxiety often have difficulty processing numerical

information, leading to difficulties in understanding and remembering mathematical concepts (Jiang et al., 2021; Pizzie, 2022). In addition, the expectancy-value theory of motivation developed by Eccles and Wigfield (2002) emphasizes that a person's perception of their ability in mathematics can influence their level of anxiety. Students who have low self-efficacy in mathematics tend to be more prone to anxiety and are more likely to avoid mathematics-related subjects (Guo et al., 2015; Mayerhofer et al., 2024).

When dealing with math anxiety, various strategies can be applied to help students overcome this challenge. One approach that has proven effective is cognitive-behavioral therapy, which aims to help individuals identify and change their negative thought patterns toward math (Ojo, Oginni, Akinrinola, & Oginni, 2023). Another approach involves strengthening self-efficacy through practice and positive learning experiences, such as using step-by-step problem-solving techniques and providing constructive feedback to students (Bakar & Ismail, 2019). In addition, social support also has an important role in helping students manage math anxiety (Bai, Chao, & Wang, 2019). A study by Chen et al. (2021) showed that students who have strong social support from family, friends, and lecturers tend to be better able to face academic challenges and have lower levels of math anxiety (Sureen & Kandemir, 2020).

Although mathematics anxiety in higher education in Asia has been widely studied, previous studies have been limited in integrating multidisciplinary perspectives that comprehensively link academic pressure, social expectations, teaching methods, and cognitive and emotional factors. Most studies have focused on specific individual or contextual aspects without providing a systematic mapping of the factors that collectively contribute to mathematics anxiety. Therefore, a literature review is needed that can identify research gaps, evaluate the effectiveness of existing approaches, and offer new insights into innovative strategies in teaching, psychosocial support, and psychology-based interventions. Given the increasing demands for mathematical competence in higher education and the negative impacts of mathematics anxiety on students' academic performance and well-being, this study is expected to make significant contributions in designing more effective interventions to address mathematics anxiety in higher education in Asia.

RESEARCH METHOD

This study uses qualitative research with descriptive analysis techniques through literature studies, where this study attempts to describe the existing phenomena related to mathematics anxiety in the context of higher education in Asia. Literature studies are a research method that discusses existing problems by reviewing relevant literature to provide answers or solutions to these problems (Ramadhanti, Nurhayati, Putra, & Ali, 2023). The literature used in this study consists of national and international journals. This study presents arguments from a literature review and researchers' perspectives on mathematics anxiety, its causal factors, and strategies to reduce its impact on students in

college. The literature in this study was reviewed systematically to discuss the topic being discussed comprehensively.

To ensure the quality of this review, a study selection method was applied to select relevant studies for inclusion in this review. Inclusion and exclusion criteria were used to identify potential primary studies. The criteria were set to ensure the selection of relevant articles and to exclude irrelevant studies. The selected studies had to meet the following inclusion criteria:

1. Studies published from 2018-2024
2. A study analyzing mathematics anxiety in the context of higher education in Asia
3. Research evaluating interventions or strategies to reduce mathematics anxiety among college students.
4. Research that addresses the psychological, pedagogical, or sociocultural aspects of mathematics anxiety in higher education.

In addition, exclusion criteria were applied to identify irrelevant articles that should not be included in this study. The exclusion criteria were as follows:

1. Research that does not focus on mathematics anxiety in higher education
2. Research that does not evaluate interventions, causal factors, or theoretical frameworks related to math anxiety

These criteria are very important because they determine the scope and validity of the systematic review. The selection process follows these criteria, from the initial evaluation to the final stage of study classification, to ensure the reliability and relevance of the reviewed literature.

FINDINGS AND DISCUSSION

Table 1. Research Results

No	Author	Source	Mathematics Anxiety in Asian Higher Education
1.	Al Muharraqi and Toworfe (2018)	Google Scholar	Impact of mathematics anxiety on undergraduate mathematics students in a Gulf Country
2.	The Skaalvik (2018)	Springer	Mathematics anxiety and coping strategies among middle school students: relations with students' achievement goal orientations and level of performance
3.	Istikomah and Wahyuni (2018)	Sinta (Science and Technology Index)	Student's mathematics anxiety on the use of technology in mathematics learning
4.	Ahmed (2018)	ScienceDirect	Developmental trajectories of math anxiety during adolescence: Associations with STEM career choice

5.	Huang et al., (2019)	Springer	Impact of math self-efficacy, math anxiety, and growth mindset on math and science career interest for middle school students: the gender moderating effect
6.	Xie et al., (2019)	Springer	Gender differences of Chinese high school students' math anxiety: The effects of self-esteem, test anxiety and general anxiety
7.	Ali and Hassan (2019)	Google Scholar	Mathematics anxiety and mathematics motivation among students in the faculty of science of a public university in Malaysia
8.	Zhang et al., (2019)	PubMed	The relationship between math anxiety and math performance: A meta-analytic investigation
9.	Winarso and Haqq (2019)	Sinta (Science and Technology Index)	Psychological disposition of students: Mathematics anxiety vesus happiness learning at the educational level
10.	Al-Abdul (2020)	Ebsco	Creativity enhanced program for twice exceptionally gifted: effects of mathematics anxiety level
11.	Zhou et al., (2020)	Taylor & Francis	Teacher-student relationship and mathematical problem-solving ability: mediating roles of self-efficacy and mathematical anxiety
12.	Yi and Na (2020)	Taylor & Francis	How are maths-anxious students identified and what are the key predictors of maths anxiety? Insights gained from PISA results for Korean adolescents
13.	Saha et al., (2020)	Ebsco	ICT based mathematics skill development program: An initiative to overcome mathematics anxiety
14.	Rozgonjuk et al., (2020)	Springer	Mathematics anxiety among STEM and social sciences students: the role of mathematics self-efficacy, and deep and surface approaches to learning
15.	Marticion (2021)	Sinta (Science and Technology Index)	Mathematical anxiety as a predictor of learning motivation strategies

16.	Khasawneh et al., (2021)	PubMed	What impact does maths anxiety have on university students?
17.	Samuel and Warner (2021)	Taylor & Francis	"I can math!": Reducing math anxiety and increasing math self-efficacy using a mindfulness and growth mindset-based intervention in first-year students
18.	Luu-Thi et al., (2021)	Web of Science	An investigation of mathematics anxiety and academic coping strategies among high school students in Vietnam: A cross-sectional study
19.	Li et al., (2021)	Springer	Relations between mathematics students' anxiety and motivation to learn mathematics: A meta-analysis
20.	Barroso et al., (2021)	PubMed	A meta-analysis of the relationship between math anxiety and math achievement
21.	Lailiyah et al., (2021)	ScienceDirect	Levels of students' mathematics anxiety and the impacts on online mathematics learning
22.	Ghasemzadeh et al., (2021)	Semantic Scholar	The effect of interactive management style on academic adjustment, math anxiety and academic engagement of students
23.	Gholami et al., (2021)	ScienceDirect	Impact of lesson study on mathematics anxiety and mathematics achievement of Malaysian foundation program students
24.	Cho (2022)	Sage	Measuring math anxiety among predominantly underrepresented minority undergraduates using the abbreviated math anxiety scale
25.	Ng et al., (2022)	Wiley Online Library	Evaluation of math anxiety and its remediation through a digital training program in mathematics for first and second graders
26.	Guo and Liao (2022)	PubMed	The role of opportunity to learn on student mathematics anxiety, problem-solving performance, and mathematics performance
27.	Daches and Rubinsten (2022)	PubMed	Math anxiety and deficient executive control: does reappraisal

			modulate this link?
28.	Kusmaryono et al., (2022)	ScienceDirect	It doesn't mean that students don't have mathematics anxiety: A case study of mathematics learning with path analysis
29.	Yaftian and Barghamadi (2022)	Sinta (Science and Technology Index)	The effect of teaching using multimedia on mathematical anxiety and motivation
30.	Cahyawati et al., (2023)	Sinta (Science and Technology Index)	The impact of undergraduate students' mathematics anxiety and self-concept on their self-regulated learning and academic achievement
31.	Eidlin-Levy et al., (2023)	Springer	Math anxiety influences career choices during development
32.	Yuan et al., (2023)	Springer	A Cross-national study of mathematics anxiety
33.	Gonzalez-DeHass et al., (2024)	Springer	Undergraduate students' math anxiety: The role of mindset, achievement goals, and parents
34.	Delima et al., (2024)	Sinta (Science and Technology Index)	The students' mathematics self-regulated learning and mathematics anxiety based on the use of chat GPT, music, study program, and academic achievement
35.	Diponegoro et al., (2024)	Sinta (Science and Technology Index)	When religion meets mathematics: From mathematical anxiety to mathematical well-being for minority group students

Math anxiety in Asia is influenced by a highly competitive education system. Several studies have shown that high academic pressure and social expectations from family and society can increase students' anxiety levels (Eidlin-Levy et al., 2023; Tan & Yates, 2011). Students often feel pressured to achieve high academic results in mathematics, which is considered an indicator of intelligence and success in STEM fields (Idris & Bacotang, 2023). In addition to social and cultural factors, less interactive teaching methods also contribute to math anxiety. In some Asian countries, math learning methods still focus on memorization and repetitive practice problems without providing deep conceptual understanding (Roy & Kumar, 2023). Lack of problem-based approach can hinder students' confidence in dealing with mathematics problems (Suryani, Maidiyah, Salasi, & Mardhiah, 2020). Another factor that contributes to math anxiety is negative experiences in previous learning. Students who have had bad experiences with math teachers or have failed math exams tend to have higher levels of anxiety (Ahmmed et al., 2024). In addition, a less supportive learning environment, such

as a lack of academic support from lecturers, is also a major cause of this anxiety (Jamaludin et al., 2024).

In addition, gender differences also play a role in math anxiety in Asia. Several studies have shown that female students tend to experience higher levels of anxiety than male students, mainly due to social stereotypes that assume men are superior in STEM fields (Mayerhofer et al., 2024). This stereotype can start to develop at an early age through the influence of family, school, and media, which indirectly forms the perception that mathematical ability is innate and more suitable for boys (Huang et al., 2019). This makes female students more vulnerable to experiencing doubts about their own abilities, even when they have the same or better academic achievements than their male peers (Xie et al., 2019). In addition, the lack of representation of women in STEM fields can also reinforce the perception that mathematics is not a suitable field for them, which ultimately further exacerbates the anxiety felt (Marticion, 2021; Núñez-Peña et al., 2013). The lack of female role models in math and science can leave female students feeling isolated and less motivated to pursue those fields. Not only that, but social expectations that place women in more traditional roles can also affect their level of confidence in facing academic challenges, including in math (González-Pérez, Mateos de Cabo, & Sáinz, 2020). As a result, many female students experience double pressure, on the one hand, they are expected to succeed academically, but on the other hand, they face psychological and social barriers that reduce their confidence in their own mathematical abilities (Van Mier, Schleepen, & Van den Berg, 2019). To address this issue, a more inclusive approach to mathematics teaching is needed, such as providing female role models in STEM, as well as a learning environment that supports and builds female students' self-confidence so they can overcome mathematics anxiety (Fernandez, Froschl, Lorenzetti, & Stimmer, 2024).

Math anxiety has a wide impact, both in academic and psychological aspects of students. Academically, students with high anxiety tend to have difficulty in understanding mathematical concepts, avoid courses related to mathematics, and show lower academic results than students who do not have such anxiety (Ng et al., 2022). This can reinforce the cycle of anxiety, where academic failure further increases the fear of mathematics. From a psychological perspective, math anxiety can lead to prolonged stress, lower self-confidence, and increase the risk of depression among students (Mofatteh, 2021). Students with high anxiety often experience emotional tension when facing math assignments or exams, which ultimately has a negative impact on their overall well-being (Chang et al., 2019). Math anxiety can also affect students' career choices. Research by Eidlin-Levy et al., (2023) showed that students with high math anxiety are more likely to avoid majors and professions related to math, even though they have good academic potential in the field. This has an impact on student representation in STEM fields, especially in Asian countries that are highly dependent on the development of science and technology (Idris & Bacotang, 2023).

Several strategies have been identified as effective in reducing math

anxiety among college students. One widely used approach is cognitive-behavioral therapy, which helps students change negative thinking patterns toward math and develop more adaptive coping strategies (Ojo et al., 2023). Another approach is to increase students' self-efficacy through positive learning experiences. A study by Bakar and Ismail (2019) showed that students who were given the opportunity to learn with a more problem-solving and group discussion-based approach tended to have lower levels of anxiety compared to those who studied individually. Social support is also an important factor in overcoming math anxiety. Students who have a supportive learning environment, including support from lecturers, friends, and family, are better able to manage their anxiety and show better academic performance (Gonzalez-DeHass et al., 2024). Therefore, higher education institutions need to create an inclusive learning environment and provide more personalized academic guidance. In addition to individual strategies, innovation in mathematics teaching methods is also needed. Study by Ahmad et al., (2022) highlighting the importance of more interactive teaching methods, such as the use of technology in learning, project-based approaches, and gamification in mathematics materials. This method not only makes learning more interesting but also helps students develop a deeper understanding of mathematical concepts.

From the various studies reviewed, it is clear that mathematics anxiety in higher education in Asia is a serious problem that requires special attention. The main contributing factors include academic pressure, ineffective teaching methods, and negative experiences in previous learning. This anxiety not only impacts students' academic performance but also their psychological well-being and career choices. Therefore, it is important for educational institutions to implement more effective strategies to reduce mathematics anxiety. Psychological-based interventions, self-efficacy enhancement, social support, and innovation in teaching methods can be effective solutions. With a more inclusive and well-being-oriented approach, mathematics anxiety can be minimized so that students can reach their full academic potential. Overall, this study provides valuable insights into the dynamics of mathematics anxiety in higher education in Asia. The findings can form the basis for further research and the development of educational policies that are more responsive to students' needs in facing challenges in learning mathematics.

CONCLUSION

The results showed that mathematics anxiety in Asia is influenced by various factors, including high academic pressure, social expectations, less interactive teaching methods, and negative experiences in previous learning. In addition, gender differences also play a role in increasing mathematics anxiety, where female students are more vulnerable due to social stereotypes and underrepresentation of women in STEM fields. The discussion revealed that mathematics anxiety negatively impacts students' academic achievement, psychological well-being, and career choices, which contributes to low representation in STEM fields. To address this issue, interventions are needed

that include cognitive-behavioral therapy, increasing self-efficacy through positive learning experiences, and social support from lecturers, friends, and family. In addition, innovations in teaching methods, such as problem-solving approaches and the use of technology, can help reduce mathematics anxiety. Therefore, educational institutions in Asia need to develop more inclusive and supportive strategies to create a more conducive learning environment for students to face academic challenges in mathematics. For future research, it is recommended to explore specific interventions that are most effective in reducing mathematics anxiety across educational contexts in Asia, including technology-based approaches, gamification, or collaborative learning methods. Additionally, further research could examine how cultural factors and educational policies in each country influence levels of math anxiety as well as how gender-based approaches can be applied to increase female participation in STEM fields.

REFERENCES

Ahmad, M., Khalid, M. N., & Shafiq, F. (2022). Effect of problem solving teaching method in mathematics on the performance of 7th grade students. *Global Educational Studies Review*, *VII*(II), 28–40. https://doi.org/10.31703/gesr.2022(VII-II).03

Ahmed, W. (2018). Developmental trajectories of math anxiety during adolescence: Associations with STEM career choice. *Journal of Adolescence*, *67*(1), 158–166. https://doi.org/10.1016/j.adolescence.2018.06.010

Ahmmed, S., Saha, J., Tamal, M. A., Abdullah Al Mamun, K., & Islam, S. (2024). Factors predicting the mathematics anxiety of adolescents: a structural equation modeling approach. *Frontiers in Psychiatry*, *15*, 1–14. https://doi.org/10.3389/fpsyt.2024.1484381

Al-Abdul, A. M. (2020). Creativity enhanced program for twice exceptionally gifted: effects of mathematics anxiety level. *Journal for the Education of Gifted Young Scientists*, *8*(3), 1185–1199. https://doi.org/10.17478/jegys.738223

Ali, N. A. M., & Hassan, N. C. (2019). Mathematics anxiety and mathematics motivation among students in the faculty of science of a public university in malaysia. *International Journal of Academic Research in Progressive Education and Development*, *8*(4), 952–963. https://doi.org/10.6007/IJARPED/v8-i4/6786

AlMuharraqi, M., & Toworfe, G. (2018). Impact of mathematics anxiety on undergraduate mathematics students in a Gulf Country. *International Journal of Engineering and Management Research*, *8*(3). https://doi.org/10.31033/ijemr.8.3.28

Atoyebi, O. M., & Atoyebi, S. B. (2022). The link between mathematics teaching strategies and students' anxiety. *Asian Journal of Education and Social Studies*, *33*(4), 48–57. https://doi.org/10.9734/ajess/2022/v33i4716

Bai, B., Chao, G. C. N., & Wang, C. (2019). The Relationship between social support, self-efficacy, and english language learning achievement in Hong Kong. *TESOL Quarterly*, *53*(1), 208–221. https://doi.org/10.1002/tesq.439

Bakar, M. A. A., & Ismail, N. (2019). Metacognitive learning strategies in mathematics classroom intervention: A review of implementation and operational design aspect. *International Electronic Journal of Mathematics Education*, *15*(1), 1–9. https://doi.org/10.29333/iejme/5937

Barroso, C., Ganley, C. M., McGraw, A. L., Geer, E. A., Hart, S. A., & Daucourt, M. C. (2021). A meta-analysis of the relation between math anxiety and math achievement. *Psychological Bulletin*, *147*(2), 134–168. https://doi.org/10.1037/bul0000307

Cahyawati, D., Delima, N., & Gunarto, M. (2023). The impact of undergraduate students' mathematics anxiety and self-concept on their self-regulated learning and academic achievement. *Jurnal Elemen*, *9*(1), 183–196. https://doi.org/10.29408/jel.v9i1.6898

Chakraborty, A. (2023). Exploring the root causes of examination anxiety: Effective solutions and recommendations. *International Journal of Science and Research (IJSR)*, *12*(2), 1096–1102. https://doi.org/10.21275/SR23220002911

Chang, T.-T., Lee, J. R., & Yen, N.-S. (2019). Mathematical learning and Its difficulties in Taiwan: Insights from educational practice. In *International Handbook of Mathematical Learning Difficulties* (pp. 265–278). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-97148-3_17

Cho, K. W. (2022). Measuring math anxiety among predominantly underrepresented minority undergraduates using the abbreviated math anxiety scale. *Journal of Psychoeducational Assessment*, *40*(3), 416–429. https://doi.org/10.1177/07342829211063286

Daches Cohen, L., & Rubinsten, O. (2022). Math anxiety and deficient executive control: does reappraisal modulate this link? *Annals of the New York Academy of Sciences*, *1513*(1), 108–120. https://doi.org/10.1111/nyas.14772

Delima, N., Kusuma, D. A., & Paulus, E. (2024). The students' mathematics self-regulated learning and mathematics anxiety based on the use of chat GPT, music, study program, and academic achievement. *Infinity Journal*, *13*(2), 349–362. https://doi.org/10.22460/infinity.v13i2.p349-362

Diponegoro, A. M., Khalil, I. A., & Prahmana, R. C. I. (2024). When religion meets mathematics: From mathematical anxiety to mathematical well-being for minority group student. *Infinity Journal*, *13*(2), 413–440. https://doi.org/10.22460/infinity.v13i2.p413-440

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology*, *53*(1), 109–132. https://doi.org/10.1146/annurev.psych.53.100901.135153

Eidlin-Levy, H., Avraham, E., Fares, L., & Rubinsten, O. (2023). Math anxiety affects career choices during development. *International Journal of STEM Education*, *10*(1), 49. https://doi.org/10.1186/s40594-023-00441-8

Fernandez, F., Froschl, M., Lorenzetti, L., & Stimmer, M. (2024). Investigating the importance of girls' mathematical identity within United States STEM programmes: a systematic review. *International Journal of Mathematical Education in Science and Technology*, *55*(3), 650–690. https://doi.org/10.1080/0020739X.2021.2022229

Firdaus, M. G., & Rozie, F. (2024). Analisis permasalahan belajar matematika siswa kelas vii SMP Asrol Ulum. *Indo-MathEdu Intellectuals Journal*, *5*(3), 3598–3609. https://doi.org/http://doi.org/10.54373/imeij.v5i3.

Ghasemzadeh Alishahi, A., Panahi, M., & Samadi, M. (2021). The effect of interactive management style on academic adjustment, math anxiety and academic engagement of students. *Iranian Journal of Educational Sociology*, *4*(4), 127–140. https://doi.org/10.52547/ijes.4.4.127

Gholami, H., Ayub, A. F. M., Yunus, A. S. M., & Kamarudin, N. (2021). Impact of lesson study on mathematics anxiety and mathematics achievement of malaysian foundation programme students. *International Journal of Evaluation and Research in Education (IJERE)*, *10*(3), 912. https://doi.org/10.11591/ijere.v10i3.20502

Gonzalez-DeHass, A. R., Furner, J. M., Vásquez-Colina, M. D., & Morris, J. D. (2024). Undergraduate students' math anxiety: The role of mindset, achievement goals, and parents. *International Journal of Science and Mathematics Education*, *22*(5), 1037–1056. https://doi.org/10.1007/s10763-023-10416-4

González-Pérez, S., Mateos de Cabo, R., & Sáinz, M. (2020). Girls in STEM: Is it a female role-model thing? *Frontiers in Psychology*, *11*, 1–21. https://doi.org/10.3389/fpsyg.2020.02204

Guo, J., Marsh, H. W., Parker, P. D., Morin, A. J. S., & Yeung, A. S. (2015). Expectancy-value in mathematics, gender and socioeconomic background as predictors of achievement and aspirations: A multi-cohort study. *Learning and Individual Differences*, *37*, 161–168. https://doi.org/10.1016/j.lindif.2015.01.008

Guo, S., & Liao, S. (2022). The role of opportunity to learn on student mathematics anxiety, problem-solving performance, and mathematics performance. *Frontiers in Psychology*, *13*, 1–15. https://doi.org/10.3389/fpsyg.2022.829032

Huang, X., Zhang, J., & Hudson, L. (2019). Impact of math self-efficacy, math anxiety, and growth mindset on math and science career interest for middle school students: the gender moderating effect. *European Journal of Psychology of Education*, *34*(3), 621–640. https://doi.org/10.1007/s10212-018-0403-z

Idris, R., & Bacotang, J. (2023). Exploring STEM education trends in Malaysia: Building a talent pool for industrial revolution 4.0 and society 5.0. *International Journal of Academic Research in Progressive Education and Development*, *12*(2), 381–393. https://doi.org/10.6007/IJARPED/v12-i2/16825

Istikomah, E., & Wahyuni, A. (2018). Student's mathematics anxiety on the use of technology in mathematics learning. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, *3*(2), 69–77. https://doi.org/10.23917/jramathedu.v3i2.6364

Jamaludin, A., Jabir, A. I., Wang, F., & Tan, A. L. (2024). Low-progress math in a high-performing system: the role of math anxiety in Singapore's elementary learners. *The Asia-Pacific Education Researcher*, *33*(5), 1071–1082. https://doi.org/10.1007/s40299-023-00773-7

Jarvis, J. A., Corbett, A. W., Thorpe, J. D., & Dufur, M. J. (2020). Too much of a good thing: Social capital and academic stress in south korea. *Social Sciences*, *9*(11), 187. https://doi.org/10.3390/socsci9110187

Jiang, R., Liu, R., Star, J., Zhen, R., Wang, J., Hong, W., … Fu, X. (2021). How mathematics anxiety affects students' inflexible perseverance in mathematics problem-solving: Examining the mediating role of cognitive reflection. *British Journal of Educational Psychology*, *91*(1), 237–260. https://doi.org/10.1111/bjep.12364

Khasawneh, E., Gosling, C., & Williams, B. (2021). What impact does maths anxiety have on university students? *BMC Psychology*, *9*(1), 1–9. https://doi.org/10.1186/s40359-021-00537-2

Kusmaryono, I., Ubaidah, N., & Basir, M. A. (2022). It doesn't mean that students don't have mathematics anxiety: A case study of mathematics learning with path analysis. *European Journal of Educational Research*, *11*(3), 1683–1697. https://doi.org/10.12973/eu-jer.11.3.1683

Lailiyah, S., Hayat, S., Urifah, S., & Setyawati, M. (2021). Levels of students' mathematics anxieties and the impacts on online mathematics learning. *Jurnal Cakrawala Pendidikan*, *40*(1), 107–119. https://doi.org/10.21831/cp.v40i1.36437

Li, Q., Cho, H., Cosso, J., & Maeda, Y. (2021). Relations between students' mathematics anxiety and motivation to learn mathematics: A meta-analysis. *Educational Psychology Review*, *33*(3), 1017–1049. https://doi.org/10.1007/s10648-020-09589-z

Luu-Thi, H.-T., Ngo-Thi, T.-T., Nguyen-Thi, M.-T., Thao-Ly, T., Nguyen-Duong, B.-T., & Tran-Chi, V.-L. (2021). An investigation of mathematics anxiety and academic coping strategies among high school students in Vietnam: A cross-sectional study. *Frontiers in Education*, *6*. https://doi.org/10.3389/feduc.2021.742130

Mangarin, R. A., & Caballes, D. O. (2024). Difficulties in learning mathematics: A systematic review. *International Journal of Research and Scientific Innovation*, *XI*(IX), 401–405. https://doi.org/10.51244/IJRSI.2024.1109037

Marticion, J. A. (2021). Mathematical anxiety as predictor of learning motivation strategies. *Southeast Asian Mathematics Education Journal*, *11*(1), 13–24. https://doi.org/10.46517/seamej.v11i1.123

Mayerhofer, M., Lüftenegger, M., & Eichmair, M. (2024). The development of mathematics expectancy-value profiles during the secondary–tertiary transition into STEM fields. *International Journal of STEM Education*, *11*(1), 31. https://doi.org/10.1186/s40594-024-00491-6

Mofatteh, M. (2021). Risk factors associated with stress, anxiety, and depression among university undergraduate students. *AIMS Public Health*, *8*(1), 36–65. https://doi.org/10.3934/publichealth.2021004

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), 932–956. https://doi.org/10.6007/IJARBSS/v11-i3/8992

Ng, C., Chen, Y., Wu, C., & Chang, T. (2022). Evaluation of math anxiety and its remediation through a digital training program in mathematics for first and second graders. *Brain and Behavior*, *12*(5), 1–17. https://doi.org/10.1002/brb3.2557

Núñez-Peña, M. I., Suárez-Pellicioni, M., & Bono, R. (2013). Effects of math anxiety on student success in higher education. *International Journal of Educational Research*, *58*, 36–43. https://doi.org/10.1016/j.ijer.2012.12.004

Ojo, A., Oginni, O. G., Akinrinola, O. E., & Oginni, R. I. (2023). Impact of cognitive-behavioral intervention on alleviating depression and anxiety in mathematics: Enhancing students' learning experience and academic performance. *Voice of the Publisher*, *09*(04), 257–271. https://doi.org/10.4236/vp.2023.94020

Pizzie, R. (2022). Mind, brain, and math anxiety. In *Handbook of Cognitive Mathematics* (pp. 349–383). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-03945-4_29

Prahmana, R. C. I., Sutanti, T., Wibawa, A. P., & Diponegoro, A. M. (2019). Mathematical anxiety among engineering students. *Infinity Journal*, *8*(2), 179–188. https://doi.org/10.22460/infinity.v8i2.p179-188

Ramadhanti, A., Nurhayati, S. R., Putra, R. P., & Ali, S. M. S. (2023). Role of positive psychology to education in indonesia: Positive education in physics. *EduFisika: Jurnal Pendidikan Fisika*, *8*(2), 174–182. https://doi.org/10.59052/edufisika.v8i2.23508

Roy, A., & Kumar, A. (2023). Mathematics anxiety among Indian children and its preventive measures. *Bharatiya Vaigyanik Evam Audyogik Anusandhan Patrika*, *31*(2), 142–151. https://doi.org/10.56042/bvaap.v31i2.6390

Rozgonjuk, D., Kraav, T., Mikkor, K., Orav-Puurand, 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*, *7*(1), 1–11. https://doi.org/10.1186/s40594-020-00246-z

Saha, J., Ahmmed, S., Ali, M., Tamal, M., & Rezaul, K. (2020). ICT based mathematics skill development program: An initiative to overcome mathematics anxiety. *International Journal of Emerging Technologies in Learning (IJET)*, *15*(14), 252–261. Retrieved from https://www.learntechlib.org/p/217583/

Samuel, T. S., & Warner, J. (2021). "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*, *45*(3), 205–222. https://doi.org/10.1080/10668926.2019.1666063

Satake, E., & Amato, P. P. (1995). Mathematics anxiety and achievement among japanese elementary school students. *Educational and Psychological Measurement*, *55*(6), 1000–1007. https://doi.org/10.1177/0013164495055006009

Skaalvik, E. M. (2018). Mathematics anxiety and coping strategies among middle

school students: relations with students' achievement goal orientations and level of performance. *Social Psychology of Education*, *21*(3), 709–723. https://doi.org/10.1007/s11218-018-9433-2

Stromájer, G. P., Csima, M., Iváncsik, R., Varga, B., Takács, K., & Stromájer-Rácz, T. (2023). Stress and anxiety among high school adolescents: Correlations between physiological and psychological indicators in a longitudinal follow-up study. *Children*, *10*(9), 1548. https://doi.org/10.3390/children10091548

Süren, N., & Kandemir, M. A. (2020). The effects of mathematics anxiety and motivation on students' mathematics achievement. *International Journal of Education in Mathematics, Science and Technology*, *8*(3), 190. https://doi.org/10.46328/ijemst.v8i3.926

Suryani, I., Maidiyah, E., Salasi, & Mardhiah, M. (2020). Students' mathematics problem-solving skills through the application of Problem-Based Learning model. *Journal of Physics: Conference Series*, *1460*(1), 12–29. https://doi.org/10.1088/1742-6596/1460/1/012029

Tan, J. B., & Yates, S. (2011). Academic expectations as sources of stress in Asian students. *Social Psychology of Education*, *14*(3), 389–407. https://doi.org/10.1007/s11218-010-9146-7

Van Mier, H. I., Schleepen, T. M. J., & Van den Berg, F. C. G. (2019). Gender differences regarding the impact of math anxiety on arithmetic performance in second and fourth graders. *Frontiers in Psychology*, *9*, 1–13. https://doi.org/10.3389/fpsyg.2018.02690

Wahono, B., Lin, P.-L., & Chang, C.-Y. (2020). Evidence of STEM enactment effectiveness in Asian student learning outcomes. *International Journal of STEM Education*, *7*(1), 1–18. https://doi.org/10.1186/s40594-020-00236-1

Wang, Z., Borriello, G. A., Oh, W., Lukowski, S., & Malanchini, M. (2021). Co-development of math anxiety, math self-concept, and math value in adolescence: The roles of parents and math teachers. *Contemporary Educational Psychology*, *67*, 1–14. https://doi.org/10.1016/j.cedpsych.2021.102016

Winarso, W., & Haqq, A. A. (2019). Psichological disposition of student: Mathematics anxiety vesus happines learning on the level education. *International Journal of Trends in Mathematics Education Research*, *2*(1), 19–25. https://doi.org/10.33122/ijtmer.v2i1.32

Xie, F., Xin, Z., Chen, X., & Zhang, L. (2019). Gender difference of chinese high school students' math anxiety: The effects of self-esteem, test anxiety and general anxiety. *Sex Roles*, *81*(3–4), 235–244. https://doi.org/10.1007/s11199-018-0982-9

Yaftian, N., & Barghamadi, S. (2022). The effect of teaching using multimedia on mathematical anxiety and motivation. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, *7*(2), 55–63. https://doi.org/10.23917/jramathedu.v7i2.16141

Yi, H. S., & Na, W. (2020). How are maths-anxious students identified and what are the key predictors of maths anxiety? Insights gained from PISA results for Korean adolescents. *Asia Pacific Journal of Education*, *40*(2), 247–262.

https://doi.org/10.1080/02188791.2019.1692782

Yuan, Z., Tan, J., & Ye, R. (2023). A Cross-national study of mathematics anxiety. *The Asia-Pacific Education Researcher*, *32*(3), 295–306. https://doi.org/10.1007/s40299-022-00652-7

Zhang, J., Zhao, N., & Kong, Q. P. (2019). The relationship between math anxiety and math performance: A meta-analytic investigation. *Frontiers in Psychology*, *10*, 1–17. https://doi.org/10.3389/fpsyg.2019.01613

Zhang, S. (2023). Math anxiety: The influence of teaching strategies and teachers' attitude. In *Proceedings of the 2022 International Conference on Sport Science, Education and Social Development (SSESD 2022)* (pp. 202–208). Paris: Atlantis Press SARL. https://doi.org/10.2991/978-2-494069-13-8_27

Zhou, D., Du, X., Hau, K.-T., Luo, H., Feng, P., & Liu, J. (2020). Teacher-student relationship and mathematical problem-solving ability: mediating roles of self-efficacy and mathematical anxiety. *Educational Psychology*, *40*(4), 473–489. https://doi.org/10.1080/01443410.2019.1696947