International Journal of Sustainable and Integrated Studies
Volume 1, Issue 2 | ISSN: 3155-6361
DOI: https://doi.org/10.65339/ijsis.V1.I2.106

Addressing Math Anxiety: Strategies for Building Confidence and Competence

Mary Grace A. Caliwan
Osmeña Colleges Graduate School, Masbate City, Masbate, Philippines

Email of Corresponding Author: adraomarygrace08@gmail.com

Publication history:
Received: August 14, 2026 Accepted: September 19, 2026
Revised: September 15, 2026 Published: September 20, 2026
International Journal of Sustainable and Integrated Studies, Vol. 1, No. 2, pp. 493–498, September 2026.

Abstract

This study examined strategies for addressing mathematics anxiety and strengthening confidence and competence among college mathematics students at Immaculada Concepcion College. It was anchored in Self-Efficacy Theory (Bandura, 1977), Social Constructivist Theory (Vygotsky, 1978), Cognitive Load Theory (Sweller, 1988), and Growth Mindset Theory (Dweck, 2006), and further adopted the proposed Confidence-Cultivation and Anxiety-Reduction Model (CCARM). A mixed-methods research design was employed among 99 college mathematics students recruited through convenience sampling. Data were gathered using a survey questionnaire and semi-structured interviews and were analyzed through weighted mean, percentage, and thematic analysis. Instructional strategies were rated somewhat effective, with an overall weighted mean of 3.98, while growth mindset interventions produced a moderate impact on mathematics anxiety with a weighted mean of 3.08. Technology-based tools were rated somewhat effective in reducing anxiety with a weighted mean of 3.72, whereas collaborative learning produced a moderate reduction with a weighted mean of 3.21. Teacher feedback and encouragement received a weighted mean of 4.23 and were considered important in mathematics learning. Students emphasized interactive activities, real-world applications, personalized support, collaboration, accessible technology, and constructive feedback, although distraction and excessive dependence on applications were identified as limitations. The study concluded that reducing mathematics anxiety requires a combination of interactive instruction, growth mindset interventions, supportive environments, collaborative learning, appropriate technology use, and positive teacher feedback. It recommended integrating these approaches and conducting longitudinal research to examine their long-term effects. The study aligns with SDG 4, Quality Education, and SDG 3, Good Health and Well-Being by addressing barriers to mathematics learning and students' emotional experiences. Its sustainability impact lies in supporting educational, institutional, social, and technological practices that promote sustained participation, confidence, and success in mathematics.

Keywords: Collaborative Learning, Growth Mindset, Instructional Strategies, Mathematics Anxiety, Mathematical Competence, Self-Efficacy, Teacher Feedback, Technology-Based Tools

1. Introduction

Mathematics anxiety can negatively affect students' confidence, engagement, and academic performance. Recent studies consistently identify an inverse relationship between mathematics anxiety and achievement, including among university students (Barroso et al., 2021; Khasawneh et al., 2021; Caviola et al., 2022; Demedts et al., 2022). The present study, Addressing Math Anxiety: Strategies for Building Confidence and Competence, examines instructional strategies, growth mindset interventions, technology-based tools, collaborative learning, and teacher feedback among college students at Immaculada Concepcion College.

Mathematics anxiety involves tension and apprehension associated with mathematical tasks and may influence students' confidence, participation, and performance. Recent Philippine studies show that mathematics anxiety remains evident among secondary and higher education students and is associated with self-perceptions,

assessment experiences, preparation, and academic performance (Mamolo, 2022; Libre & Gulo, 2024; Nolasco, 2025; Viray-Ariola, 2025). These findings emphasize the need for interventions that strengthen both mathematical competence and confidence.

Current evidence supports a multidimensional approach to mathematics anxiety. Cognitive, emotional, therapeutic, and mathematics-skill interventions can reduce anxiety and improve mathematics outcomes, although effectiveness varies according to intervention type and context (Codding et al., 2023; Sammallahti et al., 2023). Mindfulness and growth mindset interventions have also demonstrated potential for reducing mathematics anxiety among college students (Samuel et al., 2023). Technology and structured instruction provide additional approaches. Digital resources may support mathematics learning and anxiety reduction when effectively integrated into instruction (Ersozlu, 2024), while structured teaching using real-world applications, guided discussion, and scaffolded problem solving may strengthen learning and reduce anxiety (Aujero & Fuentebilla, 2025).

Recent Philippine research identifies mathematics anxiety as a continuing educational concern influenced by learner, teacher, classroom, and contextual factors (Cullano, 2024). Studies involving Filipino learners further demonstrate the importance of confidence, preparation, emotional support, and appropriate instructional practices in mathematics learning (Mamolo, 2022; Libre & Gulo, 2024; Nolasco, 2025; Viray-Ariola, 2025). The present study focuses on undergraduate mathematics students at Immaculada Concepcion College and examines instructional strategies, growth mindset interventions, selected technology-based tools, collaborative learning, and teacher feedback during one academic term.

The study is anchored in Self-Efficacy Theory (Bandura, 1977), Social Constructivist Theory (Vygotsky, 1978), Cognitive Load Theory (Sweller, 1988), and Growth Mindset Theory (Dweck, 2006). These original theoretical sources explain how beliefs about ability, social interaction, cognitive demands, and responses to challenges influence mathematics learning. Recent evidence also supports the relevance of competence and growth mindset in understanding mathematics anxiety (Huang, 2025). The study further adopts the proposed Confidence-Cultivation and Anxiety-Reduction Model (CCARM), which integrates positive reinforcement, peer support, scaffolded instruction, mindfulness, and cognitive restructuring. Teacher support and learning engagement are also associated with mathematics anxiety, supporting the inclusion of instructional and interpersonal factors (Li et al., 2023; Luo et al., 2024).

Although recent studies have examined psychological, technological, and instructional interventions, findings indicate that intervention outcomes vary and that no single strategy consistently addresses both mathematics anxiety and academic performance (Codding et al., 2023; Sammallahti et al., 2023; Ersozlu, 2024). The present study addresses this gap by examining instructional strategies, growth mindset interventions, technology-based tools, collaborative learning, and teacher feedback within a single college setting to determine how these complementary approaches may reduce anxiety while strengthening confidence and competence.

The study primarily aligns with SDG 4, Quality Education, by addressing barriers to effective mathematics learning and promoting supportive instructional practices. It also relates to SDG 3, Good Health and Well-Being, through its consideration of mathematics anxiety, emotional experiences, and supportive learning conditions (United Nations Department of Economic and Social Affairs [UN DESA], 2024).

The study contributes to educational, institutional, social, and technological sustainability by examining approaches that may promote sustained participation and success in mathematics. Supportive teaching, student engagement, appropriate technology, confidence-building, and responsive learning environments provide a multidimensional basis for addressing mathematics anxiety (Li et al., 2023; Ersozlu, 2024; Huang, 2025).

2. Material and methods

2.1 Research Design

The study employed a mixed-methods research design, integrating quantitative and qualitative approaches to provide a comprehensive understanding of the research problem (Creswell & Creswell, 2023). Quantitative data on mathematics anxiety, confidence, and competence were gathered through a survey questionnaire, while semi-structured interviews provided qualitative information regarding participants' experiences and perceptions. The integration of both forms of data allowed the study to obtain broader quantitative patterns and more detailed qualitative insights (Creswell & Creswell, 2023). SAGE identifies the sixth edition as covering contemporary qualitative, quantitative, and mixed-methods research procedures.

2.2 Locale of the Study

The study was conducted at Immaculada Concepcion College in Caloocan City, where college mathematics students participated in the research.

2.3 Respondents of the Study

The respondents consisted of 99 college mathematics students from Immaculada Concepcion College. Their responses provided information on mathematics anxiety, confidence, competence, and experiences with the instructional strategies examined in the study.

2.4 Sample and Sampling Procedure

Convenience sampling was used to recruit respondents who were readily available and accessible to the researchers (Stratton, 2021). This non-probability sampling approach facilitated data collection within the available resources and study period. However, findings derived from convenience samples are primarily applicable to the participant group and have limited generalizability to a broader population (Stratton, 2021). Stratton describes convenience sampling as a non-probability approach based on accessible participants and specifically notes its limitations for population-level generalization.

2.5 Research Instrument

The study used a survey questionnaire and a semi-structured interview guide. The questionnaire gathered demographic information and measured mathematics anxiety and confidence, as well as perceptions regarding instructional strategies, growth mindset interventions, technology-based tools, and collaborative learning environments. It contained Likert-scale items and open-ended questions to obtain quantitative ratings and qualitative feedback. Responses from 4.50-5.00 represented effective or significant impact; 3.50-4.49, somewhat effective or considerable impact; 2.50-3.49, neutral or moderate impact; 1.50-2.49, somewhat ineffective or minimal impact; and 1.00-1.49, not effective or no impact. For frequency, reduction, and importance, the corresponding interpretations ranged from always, significant reduction, or very important at 4.50-5.00 to never, no impact, or not important at 1.00-1.49. The semi-structured interview guide used open-ended questions to explore participants' experiences with instructional strategies, growth mindset interventions, technology-based tools, collaborative learning, and teacher feedback and encouragement.

2.6 Data Gathering Procedure

Following institutional ethical approval, participants were recruited from college mathematics courses using convenience sampling. The purpose of the study, voluntary nature of participation, and confidentiality provisions were explained before informed consent was obtained. The questionnaire was administered either in person or online, with adequate time and clarification provided when necessary. A subset of participants representing varied experiences with mathematics anxiety was subsequently selected for individual semi-structured interviews. Interviews were conducted either face-to-face or through video conferencing according to participants' availability and preferences. With their consent, interviews were audio-recorded and transcribed for analysis.

2.7 Data Analysis Techniques

Quantitative survey data were analyzed using descriptive statistics, specifically weighted mean and percentage, to summarize response patterns. Qualitative interview data were transcribed and analyzed through thematic analysis to identify recurring patterns, themes, experiences, and insights concerning mathematics anxiety and confidence (Braun & Clarke, 2021). Braun and Clarke's 2021 methodological guide provides a contemporary framework for developing and interpreting themes in qualitative data.

2.8 Ethical Considerations

Ethical approval was obtained from the appropriate institutional review board before data collection. Participants were informed of the study's purpose, voluntary participation, and confidentiality provisions. Informed consent was obtained before participation, and permission was secured before audio-recording the interviews.

3. Results and Discussion

3.1 Instructional Strategies for Reducing Mathematics Anxiety and Improving Confidence

3.1.1 Effectiveness of Instructional Strategies

The instructional strategies obtained an overall weighted mean of 3.98, interpreted as "Somewhat Effective." Interactive activities such as games and discussions received the highest weighted mean of 4.19, followed by real-world applications at 4.00, while lecture-based teaching obtained the lowest mean of 3.74. Qualitative responses further emphasized scaffolding, frequent practice and feedback, relevant examples, supportive learning environments, individual assistance, and technology as helpful strategies. The findings indicate that interactive, contextualized, and supportive instruction was perceived as more effective than predominantly lecture-based approaches. Recent literature similarly emphasizes experiential activities, real-world applications, cooperation, and structured instructional approaches in addressing mathematics anxiety (Ma, 2025). Current meta-analytic

evidence also indicates that interventions combining mathematics skill development with anxiety-reduction strategies may be particularly effective (Liu et al., 2026).

3.2 Growth Mindset Interventions and Mathematical Competence

3.2.1 Exposure and Influence of Growth Mindset Interventions

Among the 99 respondents, 72 or 72.73% reported exposure to growth mindset interventions, while 27 or 27.27% had not experienced them. The interventions obtained a weighted mean of 3.08, indicating a "Moderate Impact" on mathematics anxiety. Students also reported gradual improvements in problem-solving, persistence, practical understanding, and competence through targeted tutoring, small-group instruction, and personalized support. The moderate result suggests that growth mindset interventions may be more effective when combined with other forms of academic and emotional support. Samuel et al. (2023) found that a combined mindfulness and growth mindset approach reduced self-perceived mathematics anxiety among community college students, while Liu et al. (2026) similarly emphasized the effectiveness of interventions that integrate skills development and anxiety management.

3.3 Technology-Based Tools for Mitigating Mathematics Anxiety

3.3.1 Technology Use and Perceived Effectiveness

Technology-based tools were used frequently, with a weighted mean of 3.66, while their effectiveness in reducing mathematics anxiety received a weighted mean of 3.72, interpreted as "Somewhat Effective." Students reported that videos, applications, and online resources made concepts more accessible, allowed repeated explanations, and supported self-paced learning. However, respondents also identified distraction and excessive dependence on applications as potential limitations. These findings demonstrate that technology can facilitate engagement and understanding but does not automatically reduce mathematics anxiety. Ersozlu (2024) similarly reported mixed evidence regarding technological interventions, with some digital tools supporting anxiety reduction while other technology-mediated environments may increase anxiety. Dondio et al. (2023) also found only a small overall effect of game-based interventions, emphasizing that effectiveness depends on design, duration, and social interaction.

3.4 Collaborative Learning and Mathematical Competence

3.4.1 Influence of Collaborative Learning on Anxiety and Competence

Students frequently participated in collaborative learning activities, reflected by a weighted mean of 3.45. Collaborative learning produced a weighted mean of 3.21 for its influence on mathematics anxiety, interpreted as a "Moderate Reduction." Students reported that teamwork allowed them to correct mistakes, exchange ideas, obtain different solutions, improve understanding, and solve mathematical problems more confidently. The findings suggest that collaboration supported mathematical competence and confidence but produced only a moderate reduction in anxiety. Awofala et al. (2025) similarly found that smartphone-assisted cooperative learning showed a reduction in mathematics anxiety, although the decrease was not statistically significant. Dondio et al. (2023) further reported that interventions involving collaborative and social interaction tended to produce stronger anxiety-reduction effects than individual digital game activities.

3.5 Teacher Feedback and Mathematical Confidence

3.5.1 Importance of Teacher Feedback and Encouragement

Teacher feedback and encouragement obtained a weighted mean of 4.23 and were interpreted as "Important" in mathematics learning. Students particularly valued positive and specific reinforcement, acknowledgment of progress, explanations of mistakes, and timely personalized guidance. The findings indicate that constructive and supportive teacher interactions can strengthen students' confidence and encourage continued participation in mathematics. Li et al. (2023) identified dynamic relationships among teacher support, mathematics engagement, and mathematics anxiety, while Wang et al. (2024) found that perceived teacher support was associated with mathematics anxiety through teacher-student relationships and mathematics self-efficacy. More recent evidence likewise shows that mathematics anxiety and learning engagement can mediate the relationship between teacher support and mathematics achievement (Zhang et al., 2026).

4. Conclusion & Recommendations

The study concluded that addressing mathematics anxiety among college students requires a combination of interactive instruction, real-world applications, growth mindset interventions, supportive learning environments, collaborative activities, appropriate technology use, and positive teacher feedback. Interactive and relatable strategies were perceived as more effective than traditional lectures, while growth mindset and collaborative learning produced moderate reductions in anxiety but contributed to confidence and competence. Technology supported accessibility and self-paced learning but presented risks of distraction and overreliance. Overall, supportive teacher-student interactions, personalized guidance, and encouraging feedback were important in creating a positive mathematics learning environment.

Mathematics instruction should incorporate interactive activities, real-world applications, personalized feedback, and strategic use of technology to reduce anxiety and strengthen student confidence. Growth mindset interventions should be combined with skill development and practical applications, while teachers should provide consistent encouragement and support. Collaborative learning approaches should also be further developed to create supportive learning environments, and future longitudinal studies should examine how these strategies influence students over time.

The study did not examine the long-term effects of the identified strategies on mathematics anxiety, confidence, and competence. The findings were therefore limited in establishing how the observed outcomes might develop or persist over time, highlighting the need for longitudinal research to determine clearer connections between the interventions and subsequent student outcomes.

5. Compliance with ethical standards

Ethical approval was obtained from the appropriate institutional review board prior to data collection. Participants were informed of the purpose of the study, the voluntary nature of their participation, and the confidentiality of the information they provided. Informed consent was secured before participation, and additional permission was obtained before audio-recording the semi-structured interviews for transcription and analysis.

REFERENCES

Aujero, L. P., & Fuentebilla, R. S. (2025). Structured approach in critical thinking skills and mathematics anxiety of Grade 12 STEM students of Isulan National High School. International Journal of Research and Innovation in Social Science, 9(4), 260–269. https://doi.org/10.47772/IJRISS.2025.90400021

Awofala, A. O. A., Johnson, F. O., & Akinoso, S. O. (2025). Reducing mathematics anxiety through smartphone-assisted jigsaw cooperative learning among senior high school students. ASEAN Journal of Science and Engineering Education, 5(2), 75–90. https://doi.org/10.17509/ajsee.v5i2.82807

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

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

Braun, V., & Clarke, V. (2021). Thematic analysis: A practical guide. SAGE Publications Ltd. https://uk.sagepub.com/en-gb/eur/thematic-analysis/book248481

Caviola, S., Toffalini, E., Giofrè, D., Mercader Ruiz, J., Szűcs, D., & Mammarella, I. C. (2022). Math performance and academic anxiety forms, from sociodemographic to cognitive aspects: A meta-analysis on 906,311 participants. Educational Psychology Review, 34, 363–399. https://doi.org/10.1007/s10648-021-09618-5

Codding, R. S., Goodridge, A. E., Hill, E., Kromminga, K. R., Chehayeb, R., Volpe, R. J., & Scheman, N. (2023). Meta-analysis of skill-based and therapeutic interventions to address math anxiety. Journal of School Psychology, 100, 101229. https://doi.org/10.1016/j.jsp.2023.101229

Creswell, J. W., & Creswell, J. D. (2023). Research design: Qualitative, quantitative, and mixed methods approaches (6th ed.). SAGE Publications, Inc. https://www.sagepub.com/shop/buy-a-book/research-design-6-270550

Cullano, J. C. (2024). Factors influencing mathematics anxiety and mathematics performance: A scoping review towards learning optimization directives. International Journal of Research and Innovation in Social Science, 8(3S), 4544–4573. https://doi.org/10.47772/IJRISS.2024.803332S

Demedts, F., Reynvoet, B., Sasanguie, D., & Depaepe, F. (2022). Unraveling the role of math anxiety in students' math performance. Frontiers in Psychology, 13, 979113. https://doi.org/10.3389/fpsyg.2022.979113

Dondio, P., Gusev, V., & Rocha, M. (2023). Do games reduce maths anxiety? A meta-analysis. Computers & Education, 194, 104650. https://doi.org/10.1016/j.compedu.2022.104650

Dweck, C. S. (2006). Mindset: The new psychology of success. Random House. https://www.penguinrandomhouse.com/books/44330/mindset-by-carol-s-dweck-phd/

Ersozlu, Z. (2024). The role of technology in reducing mathematics anxiety in primary school students. Contemporary Educational Technology, 16(3), ep517. https://doi.org/10.30935/cedtech/14717

Huang, M. (2025). How growth mindset reduces math anxiety across cultures: Mediating roles of autonomy, competence, and relatedness in PISA 2022. Acta Psychologica, 261, 105902. https://doi.org/10.1016/j.actpsy.2025.105902

Khasawneh, E., Gosling, C., & Williams, B. (2021). What impact does maths anxiety have on university students? BMC Psychology, 9(1), Article 37. https://doi.org/10.1186/s40359-021-00537-2

Li, H., Zhang, M., Hou, S., Huang, B., Xu, C., Li, Z., & Si, J. (2023). Examining the dynamic links among perceived teacher support, mathematics learning engagement, and dimensions of mathematics anxiety in elementary school students: A four-wave longitudinal study. Contemporary Educational Psychology, 75, 102211. https://doi.org/10.1016/j.cedpsych.2023.102211

Libre, A., & Gulo, J. (2024). A survey on the mathematics anxiety of students: A convergent study. Psychology and Education: A Multidisciplinary Journal, 29(1), 51–72. https://doi.org/10.5281/zenodo.14524254

Liu, Y., Peng, P., & Li, S. (2026). How to reduce mathematics anxiety: A systematic review and meta-analysis on intervention studies. Journal of Educational Psychology, 118(3), 299–324. https://doi.org/10.1037/edu0000992

Luo, R., Zhang, A., Wang, Y., Li, H., Xu, Y., Guo, K., & Si, J. (2024). Math attitudes and math anxiety predict students' perception of teacher support in primary school, but not vice versa. British Journal of Educational Psychology, 94(1), 6–21. https://doi.org/10.1111/bjep.12628

Ma, Y. F. (2025). The effect of teaching approaches and curriculum designs in reducing mathematics anxiety: A literature review. Frontiers in Education, 10, 1656419. https://doi.org/10.3389/feduc.2025.1656419

Mamolo, L. A. (2022). Online learning and students' mathematics motivation, self-efficacy, and anxiety in the "new normal." Education Research International, 2022, Article 9439634. https://doi.org/10.1155/2022/9439634

Nolasco, D. (2025). Unearthing mathematics anxiety: A qualitative exploration of student experiences. Journal of Technology and Science Education, 15(2), 223–239. https://doi.org/10.3926/jotse.2950

Sammallahti, E., Finell, J., Jonsson, B., & Korhonen, J. (2023). A meta-analysis of math anxiety interventions. Journal of Numerical Cognition, 9(2), 346–362. https://doi.org/10.5964/jnc.8401

Samuel, T. S., Buttet, S., & Warner, J. (2023). "I can math, too!": Reducing math anxiety in STEM-related courses using a combined mindfulness and growth mindset approach (MAGMA) in the classroom. Community College Journal of Research and Practice, 47(10), 613–626. https://doi.org/10.1080/10668926.2022.2050843

Stratton, S. J. (2021). Population research: Convenience sampling strategies. Prehospital and Disaster Medicine, 36(4), 373–374. https://doi.org/10.1017/S1049023X21000649

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. Cognitive Science, 12(2), 257–285. https://doi.org/10.1207/s15516709cog1202_4

United Nations Department of Economic and Social Affairs. (2024). The Sustainable Development Goals Report 2024. United Nations. https://unstats.un.org/sdgs/report/2024/

Viray-Ariola, C. A. (2025). College students' level of mathematics anxiety and academic performance: A basis for a proposed intervention program. International Journal of Multidisciplinary: Applied Business and Education Research, 6(11), 5421–5433. https://doi.org/10.11594/ijmaber.06.11.03

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Harvard University Press.

Wang, C., Xu, Q., & Fei, W. (2024). The effect of student-perceived teacher support on math anxiety: Chain mediation of teacher-student relationship and math self-efficacy. Frontiers in Psychology, 15, 1333012. https://doi.org/10.3389/fpsyg.2024.1333012

Zhang, Z., Gao, C., Wu, H., & Ren, D. (2026). The impact of teacher support on high school students' mathematics achievement: The mediating roles of mathematics anxiety and learning engagement. BMC Psychology, 14, 1013. https://doi.org/10.1186/s40359-026-04776-z