International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Study of Mathematical Anxiety, Motivational Beliefs, and Metacognitive Skills in Relation to Academic Achievement and Mathematical Creativity

Tanmoy Kumar Maji[1], Dr. Vinita M Chaudhary[2]

[1]Research Scholar, [2]Supervisor, Assistant Professor
[1,2]Dept. of Education, Shri Venkateshwara University

Abstract:
The present study examines the relationship of mathematical anxiety, motivational beliefs, and metacognitive skills with academic achievement and mathematical creativity among students. The study aims to explore how psychological and cognitive factors influence students' performance and creative thinking in mathematics. A descriptive and correlational research design was adopted for the study. Data were collected from 400 secondary and senior secondary students using a structured questionnaire and academic achievement records. Statistical tools such as mean, standard deviation, correlation analysis, regression analysis, t-test, and ANOVA were used for data analysis. The findings revealed that mathematical anxiety negatively affects academic achievement and mathematical creativity, whereas motivational beliefs and metacognitive skills positively influence students' academic performance and creative mathematical thinking. The study highlights the importance of reducing mathematics anxiety and promoting motivation and metacognitive learning strategies in mathematics education.

Keywords: Mathematical Anxiety, Motivational Beliefs, Metacognitive Skills, Academic Achievement, Mathematical Creativity, Mathematics Education, Secondary School Students.

1. Introduction

Mathematics is widely recognized as one of the most essential subjects in modern education because it develops logical reasoning, analytical thinking, problem-solving ability, and cognitive skills among students. It plays a significant role in academic success as well as in scientific and technological advancement. Despite its importance, mathematics remains one of the most challenging subjects for many students due to psychological, emotional, and cognitive barriers associated with mathematics learning. Students often experience fear, stress, nervousness, and lack of confidence while solving mathematical problems, which negatively affects their academic achievement and creative thinking abilities. Consequently, educational researchers have increasingly focused on examining the psychological and metacognitive factors that influence students' mathematics learning outcomes (Shimizu et al., 2025).

One of the major psychological barriers affecting mathematics learning is mathematical anxiety. Mathematical anxiety refers to feelings of tension, fear, apprehension, and nervousness experienced by students while dealing with mathematical tasks, examinations, or classroom activities. Students suffering from mathematical anxiety often avoid mathematics-related activities and demonstrate low confidence in solving mathematical problems. High levels of anxiety reduce concentration, cognitive processing, and problem-solving efficiency, ultimately affecting academic achievement negatively. Mathematical anxiety has become a major concern in educational psychology because it significantly influences students' attitudes toward mathematics and their willingness to participate actively in learning activities (Lazarra, 2025).

Research studies have shown that mathematical anxiety not only affects academic achievement but also influences students' mathematical creativity and motivation. Students experiencing high levels of anxiety often hesitate to explore innovative problem-solving approaches due to fear of failure or making mistakes. Anxiety creates psychological pressure that limits students' flexibility, originality, and confidence during mathematical reasoning processes. As a result, anxious learners tend to rely on memorization instead of conceptual understanding and creative thinking (Morales-Navarro et al., 2023). Therefore, understanding the role of mathematical anxiety is essential for improving students' mathematics learning experiences and academic outcomes.

Another important factor influencing academic success in mathematics is motivational beliefs. Motivational beliefs refer to students' perceptions, attitudes, self-confidence, and beliefs regarding their ability to succeed academically. Motivation plays a critical role in determining students' learning behavior, persistence, effort, and academic engagement. Students with positive motivational beliefs demonstrate greater interest in mathematics, higher academic confidence, and stronger commitment toward learning tasks. Such students are more likely to participate actively in classroom discussions, solve challenging mathematical problems, and maintain persistence during difficult learning situations (Constantin, 2025). Self-efficacy, intrinsic motivation, task value, and achievement orientation are major dimensions of motivational beliefs that influence mathematics learning. Students with high self-efficacy believe in their capability to solve mathematical problems successfully and therefore show greater academic resilience. Motivated students are more willing to adopt effective learning strategies, seek conceptual understanding, and engage in independent learning practices. Conversely, students with weak motivational beliefs often exhibit low academic engagement, poor concentration, and reduced academic performance (Mega et al., 2024). Thus, motivational beliefs serve as an important predictor of academic achievement and mathematical creativity among students.

In addition to motivation and anxiety, metacognitive skills have gained increasing importance in mathematics education and cognitive learning research. Metacognition refers to an individual's awareness and regulation of his or her own thinking and learning processes. Metacognitive skills involve planning, monitoring, evaluating, and controlling cognitive activities during learning tasks. Students possessing strong metacognitive skills are able to identify effective learning strategies, monitor their understanding, detect errors, and make necessary adjustments during problem-solving activities (Baguin & Janiola, 2024). Such students become more independent, organized, and reflective learners capable of achieving higher academic success.

Metacognitive skills are especially important in mathematics because mathematical learning requires logical analysis, strategic thinking, and continuous self-monitoring. Students who effectively apply metacognitive strategies are better able to solve mathematical problems systematically and creatively. They can identify mistakes, evaluate alternative solutions, and regulate their learning behaviors according to task requirements. Research has indicated that metacognitive awareness significantly improves students' mathematics achievement and conceptual understanding (Hidayat et al., 2021). Furthermore, metacognitive skills encourage deeper cognitive engagement, thereby enhancing students' mathematical creativity and innovative thinking abilities.

Mathematical creativity is another important educational outcome that has gained considerable attention in recent years. Mathematical creativity refers to the ability to generate original, flexible, and innovative solutions to mathematical problems. It involves divergent thinking, imagination, analytical reasoning, and cognitive flexibility. Creative mathematical thinking allows students to approach problems from multiple perspectives and apply mathematical concepts effectively in real-life situations. Educational researchers emphasize that creativity in mathematics is not limited to highly gifted learners but can be developed

through supportive learning environments, effective teaching practices, and positive motivational conditions (Asare, Dissou, & Obeng, 2025).

Several studies have highlighted the interrelationship among mathematical anxiety, motivational beliefs, metacognitive skills, academic achievement, and mathematical creativity. Students with high motivation and strong metacognitive skills generally demonstrate lower anxiety levels and higher academic performance. They are more capable of managing academic stress and adapting learning strategies effectively during mathematical tasks. Conversely, students with poor metacognitive awareness and low motivation often experience greater anxiety and reduced creative performance in mathematics learning (Youssef et al., 2024). Therefore, these psychological and cognitive variables collectively influence students' academic behavior and mathematics achievement.

The secondary school stage is a critical period for the development of academic confidence, learning strategies, and cognitive skills among students. During this phase, students encounter increasingly complex mathematical concepts and examination pressure, which may increase anxiety and reduce academic confidence. Therefore, understanding the relationship among mathematical anxiety, motivational beliefs, metacognitive skills, academic achievement, and mathematical creativity becomes highly important for improving mathematics education. Educational institutions and teachers need to develop supportive classroom environments that reduce anxiety, enhance motivation, and promote metacognitive learning strategies among students (Panadero & Broadbent, 2024).

2. Literature Review

Mathematics education has increasingly become an important area of educational research because of its direct relationship with cognitive development, academic achievement, and problem-solving abilities among students. Researchers have emphasized that students' performance in mathematics is not determined solely by intellectual ability, but also by several psychological and cognitive factors such as mathematical anxiety, motivational beliefs, and metacognitive skills. These factors significantly influence students' attitudes toward mathematics, learning behavior, academic engagement, and creative thinking abilities. In recent years, educational psychologists have shown growing interest in understanding how these variables interact with one another to influence mathematics achievement and mathematical creativity among learners (Mega, Ronconi, & De Beni, 2024).

One of the most widely studied psychological constructs in mathematics education is mathematical anxiety. Mathematical anxiety refers to feelings of tension, fear, stress, and nervousness experienced by students while engaging in mathematical activities. High levels of anxiety often reduce students' confidence and negatively affect their academic performance in mathematics. Lazarra (2025) found that mathematics anxiety significantly predicts mathematics achievement among students. The study revealed that students experiencing higher levels of anxiety performed poorly in mathematical tasks due to reduced concentration, low confidence, and fear of failure. Similarly, Shimizu et al. (2025) reported a strong negative relationship between mathematics anxiety and academic achievement. Their findings indicated that students with greater anxiety levels demonstrated lower classroom engagement and weaker mathematical performance.

Mathematical anxiety has also been associated with reduced creativity and problem-solving ability. Morales-Navarro et al. (2023) explored the relationship among beliefs, anxiety, self-efficacy, and learning outcomes and found that anxiety negatively affects students' willingness to explore innovative problem-solving methods. Students with high anxiety levels often avoid challenging mathematical tasks and rely heavily on memorization rather than conceptual understanding. Such behavior limits cognitive flexibility

and reduces mathematical creativity. Therefore, reducing mathematical anxiety is considered essential for improving both academic achievement and creative mathematical thinking among students.

Another important variable influencing mathematics learning is motivational beliefs. Motivational beliefs include self-efficacy, intrinsic motivation, task value, and achievement orientation that shape students' attitudes and commitment toward academic activities. Students possessing strong motivational beliefs are more likely to demonstrate persistence, confidence, and active participation in mathematics learning. Constantin (2025) emphasized that motivational beliefs play a central role in promoting effective learning behavior and academic success. The study suggested that motivated students are more willing to apply learning strategies, solve complex problems, and engage in reflective thinking processes.
Several researchers have highlighted the positive relationship between motivational beliefs and academic achievement. Abdala and Alemu (2023) examined the relationship between motivational beliefs, self-regulated learning strategies, and academic performance among university students. Their findings revealed that students with strong motivational beliefs achieved higher academic performance because they invested greater effort and persistence in learning tasks. Similarly, Mega et al. (2024) found that motivational beliefs positively influence academic achievement by encouraging students to adopt effective learning strategies and maintain consistent academic engagement. The study further concluded that motivated learners exhibit higher levels of confidence and cognitive involvement during academic tasks.

Educational research has also focused extensively on metacognitive skills as a major determinant of academic success in mathematics education. Metacognition refers to awareness and regulation of one's own thinking and learning processes. Metacognitive skills involve planning, monitoring, controlling, and evaluating cognitive activities during learning situations. Students with strong metacognitive skills are capable of selecting appropriate learning strategies, identifying errors, and adapting their thinking processes according to task requirements. Such learners become more independent and effective problem solvers (Baguin & Janiola, 2024).

The relationship between metacognitive skills and mathematics achievement has been confirmed by several empirical studies. Hidayat et al. (2021) investigated the interrelationship between metacognition and mathematical modeling competency and found that metacognitive awareness significantly improves mathematical reasoning and conceptual understanding. Their findings indicated that students with strong metacognitive abilities demonstrated better performance in mathematical problem-solving tasks. Similarly, Koyuncuoglu (2023) reported that metacognition positively influences academic success through self-efficacy and cognitive regulation. Students who effectively monitor and evaluate their learning processes tend to achieve better academic outcomes and demonstrate higher confidence in their abilities.

Research studies have also explored the combined role of motivation and metacognition in mathematics learning. Choi and Choi (2024) examined the influence of computational thinking, motivation, attitude, and achievement in educational settings and found that motivated students with strong metacognitive skills demonstrated higher academic achievement and learning efficiency. Their findings suggested that metacognitive regulation enables students to manage learning challenges effectively while motivation encourages persistence and active engagement in academic tasks. Similarly, Panadero and Broadbent (2024) emphasized the importance of integrating metacognitive and self-regulated learning strategies into secondary education to improve mathematics achievement and independent learning behavior.

Mathematical creativity has emerged as another important educational outcome associated with motivation and metacognition. Mathematical creativity refers to the ability to generate original, flexible, and innovative mathematical solutions. Students with higher creativity levels tend to approach

mathematical problems from multiple perspectives and apply analytical reasoning effectively. Asare, Dissou, and Obeng (2025) found that mathematics self-belief and problem-solving ability significantly influence mathematical creativity among university students. The study concluded that students who possess confidence in their mathematical abilities demonstrate greater originality and flexibility during mathematical reasoning tasks.

Research has also shown that metacognitive skills contribute significantly to mathematical creativity. Kholid et al. (2025) examined self-regulated learning in mathematical problem-solving and found that students with strong metacognitive awareness demonstrated greater creativity and cognitive flexibility in solving mathematical tasks. Their study emphasized that planning, monitoring, and reflective thinking encourage innovative problem-solving behavior and conceptual understanding. Hallarte et al. (2024) similarly reported that teacher support and parental involvement positively influence students' self-regulation and motivation in mathematics learning, thereby enhancing creative mathematical thinking.

Furthermore, Youssef et al. (2024) highlighted the relationship between anxiety and self-regulated learning strategies among graduate students. The study found that students who effectively regulate their learning activities experience lower anxiety and higher academic confidence. Such students are more capable of maintaining concentration, managing stress, and engaging in meaningful learning activities. These findings support the view that psychological and cognitive variables collectively influence academic achievement and creativity in mathematics education.

3. Research Methodology

This study explains the research methodology adopted for the study. The methodology provides a systematic framework for collecting, analyzing, and interpreting the data related to the selected variables. The study used quantitative research methods to examine the relationship among mathematical anxiety, motivational beliefs, metacognitive skills, academic achievement, and mathematical creativity among students.

3.1 Research Design

The present study adopted a descriptive and correlational research design. The descriptive research design was used to study the existing levels of mathematical anxiety, motivational beliefs, metacognitive skills, academic achievement, and mathematical creativity among students. The correlational design helped in identifying the relationships among the study variables. In addition, regression analysis was used to determine the predictive influence of motivational beliefs and metacognitive skills on academic achievement and mathematical creativity.

3.2 Population of the Study

The population of the study consisted of secondary and senior secondary school students studying in selected educational institutions. Students from both government and private schools were included in the population. The target population was selected because students at this educational stage often experience academic pressure, mathematics anxiety, and cognitive challenges that influence their learning outcomes and creative thinking abilities.

3.3 Sample and Sampling Technique

A total sample of 400 students was selected for the study using the stratified random sampling technique. The sample included male and female students from different class levels, school types, and residential backgrounds. Stratified sampling was used to ensure equal representation of different categories of respondents and to improve the reliability and validity of the study findings.

3.4 Sources of Data Collection

The study used both primary and secondary sources of data collection. Primary data were collected directly from students through a structured questionnaire and academic achievement records. Secondary data were collected from books, journals, research articles, educational reports, and previous studies related to mathematical anxiety, motivation, metacognition, academic achievement, and mathematical creativity.

3.5 Tools for Data Collection

The main research instrument used for the study was a structured questionnaire based on a five-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree." The questionnaire included statements related to mathematical anxiety, motivational beliefs, metacognitive skills, and mathematical creativity. Academic achievement data were collected from students' mathematics examination scores and school records. The instrument was designed to measure dimensions such as fear of mathematics, self-efficacy, intrinsic motivation, planning, monitoring, self-evaluation, originality, and creative problem-solving ability.

3.6 Variables of the Study

The study included both independent and dependent variables. Mathematical anxiety, motivational beliefs, and metacognitive skills were treated as independent variables. Academic achievement and mathematical creativity were considered dependent variables. The study examined how psychological and cognitive factors influence students' academic performance and creative mathematical thinking.

3.7 Data Collection Procedure

The researcher personally visited selected schools after obtaining permission from school authorities. Students were informed about the purpose and importance of the study, and confidentiality of responses was assured. The questionnaires were distributed and collected after completion. Proper instructions were provided to respondents to ensure accurate and unbiased responses during the data collection process.

4. RESULTS AND DATA ANALYSIS

This Study presents the analysis and interpretation of data collected for the study. The purpose of this Study is to examine the relationships among mathematical anxiety, motivational beliefs, metacognitive skills, academic achievement, and mathematical creativity among students. Statistical tools such as percentage analysis, mean, standard deviation, reliability analysis, correlation analysis, regression analysis, independent sample t-test, and one-way ANOVA were used for data interpretation. The findings are presented systematically in tabular form followed by detailed discussions and interpretations.

4.2 Demographic Profile of Respondents

Table 4.1 Demographic Characteristics of Respondents (N = 400)

Variable	Category	Frequency	Percentage
Gender	Male	214	53.5%
	Female	186	46.5%
Class Level	9th Standard	196	49.0%
	10th Standard	204	51.0%
School Type	Government School	218	54.5%
	Private School	182	45.5%
Residence	Urban	236	59.0%
	Rural	164	41.0%
Medium of Instruction	English Medium	228	57.0%
	Hindi Medium	172	43.0%

Table 1 presents the demographic distribution of respondents included in the study. The findings indicate that 53.5% of the respondents were male students, while 46.5% were female students. Regarding class level, 51.0% students belonged to 10th standard and 49.0% were from 9th standard. Government school students constituted 54.5% of the sample, whereas private school students represented 45.5%. In terms of residential background, 59.0% of respondents belonged to urban areas while 41.0% were from rural regions. The majority of students (57.0%) studied in English-medium schools. The demographic composition reflects a balanced representation of different educational and social backgrounds, thereby increasing the reliability and validity of the study findings.

4.3 Descriptive Statistics of Study Variables

Table 2 Descriptive Statistics of Major Variables

Variables	Mean	Std. Deviation	Minimum	Maximum
Mathematical Anxiety	3.62	0.744	1.72	5.00
Motivational Beliefs	4.05	0.628	2.15	5.00
Metacognitive Skills	4.12	0.593	2.28	5.00
Academic Achievement	3.96	0.671	2.01	5.00
Mathematical Creativity	3.89	0.702	1.94	5.00

The descriptive statistics presented in Table 2 reveal that students demonstrated relatively high levels of metacognitive skills and motivational beliefs, with mean scores of 4.12 and 4.05 respectively. Academic achievement also showed a satisfactory mean score of 3.96, indicating good academic performance among students. Mathematical creativity recorded a mean score of 3.89, suggesting moderate to high levels of creative mathematical thinking. However, mathematical anxiety showed a mean score of 3.62, indicating that a considerable number of students experience anxiety while dealing with mathematics-related tasks. The standard deviation values indicate moderate variability among students' responses across the study variables.

4.4 Reliability Analysis

Table 4.3 Reliability Statistics of Study Variables

Variables	Number of Items	Cronbach's Alpha
Mathematical Anxiety	8	0.864
Motivational Beliefs	8	0.881
Metacognitive Skills	10	0.892
Academic Achievement	6	0.846
Mathematical Creativity	8	0.857
Overall Scale	40	0.921

Table 3 presents the reliability analysis of the research instrument using Cronbach's Alpha coefficient. The obtained reliability values for all variables exceeded the acceptable threshold value of 0.70, indicating strong internal consistency and reliability of the questionnaire items. Metacognitive skills reported the highest reliability coefficient of 0.892, followed by motivational beliefs (0.881) and mathematical anxiety (0.864). The overall reliability value of 0.921 confirms that the instrument was highly reliable and suitable for measuring the selected variables in the study.

4.5 Correlation Analysis

Table 4.4 Correlation Matrix of Study Variables

Variables	MAx	MB	MS	AA	MC
Mathematical Anxiety (MAx)	1	-0.628**	-0.671**	-0.724**	-0.689**
Motivational Beliefs (MB)	-0.628**	1	0.712**	0.746**	0.701**
Metacognitive Skills (MS)	-0.671**	0.712**	1	0.781**	0.754**

Academic Achievement (AA)	-0.724**	0.746**	0.781**	1	0.718**
Mathematical Creativity (MC)	-0.689**	0.701**	0.754**	0.718**	1

Correlation significant at 0.01 level

The correlation analysis shown in Table 4 reveals significant relationships among all study variables at the 0.01 significance level. Mathematical anxiety demonstrated strong negative correlations with academic achievement (r = -0.724), metacognitive skills (r = -0.671), motivational beliefs (r = -0.628), and mathematical creativity (r = -0.689). These findings suggest that higher levels of mathematical anxiety reduce students' academic performance, confidence, and creative mathematical thinking abilities. Conversely, motivational beliefs and metacognitive skills showed strong positive relationships with academic achievement and mathematical creativity. Students possessing strong motivational beliefs and effective metacognitive skills were found to perform better academically and exhibit greater creativity in mathematics learning.

4.6 Regression Analysis

Table 5 Effect of Metacognitive Skills on Academic Achievement

Model Summary

R	R Square	Adjusted R Square	Std. Error
0.781	0.610	0.607	0.394

ANOVA

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	96.514	1	96.514	621.804	0.000
Residual	61.812	398	0.155		
Total	158.326	399			

Coefficients

Variables	B	Std. Error	Beta	t	Sig.
Constant	0.732	0.108		6.778	0.000
Metacognitive Skills	0.784	0.031	0.781	24.936	0.000

The regression analysis presented in Table 5 indicates that metacognitive skills significantly predict academic achievement among students. The R-square value of 0.610 reveals that approximately 61.0% of the variation in academic achievement is explained by metacognitive skills. The ANOVA result was statistically significant ($F = 621.804$, $p < 0.001$), confirming the fitness of the regression model. The standardized beta coefficient ($\beta = 0.781$) indicates a strong positive influence of metacognitive skills on academic achievement. The findings suggest that students who effectively plan, monitor, and evaluate their learning processes achieve better academic performance in mathematics.

Regression Equation:

$$Y = 0.732 + 0.784X$$

Where:

Y=Academic Achievement
X = Metacognitive Skills

4.7 Independent Sample t-Test

Table 4.6 Gender-wise Difference in Mathematical Anxiety

Gender	N	Mean	Std. Deviation	t-value	Sig.
Male	214	3.48	0.714	2.862	0.005
Female	186	3.79	0.736		

The independent sample t-test results presented in Table 6 indicate a statistically significant difference between male and female students regarding mathematical anxiety ($t = 2.862$, $p < 0.05$). Female students reported higher mathematical anxiety levels compared to male students. The findings suggest that female learners may experience greater nervousness, fear, and stress during mathematics learning and examinations. Such anxiety may negatively influence academic confidence and mathematical performance.

4.8 One-Way ANOVA

Table 4.7 ANOVA for School Type-wise Difference in Mathematical Creativity

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9.417	2	4.708	7.124	0.001
Within Groups	262.394	397	0.661		
Total	271.811	399			

The ANOVA analysis reveals a significant difference in mathematical creativity among students based on school type ($F = 7.124$, $p < 0.05$). The findings indicate that students studying in private schools demonstrated comparatively higher levels of mathematical creativity than government school students. Better educational resources, technological exposure, and innovative teaching practices may contribute toward the development of creative mathematical thinking among students in private educational institutions.

4.9 Hypothesis Testing Summary

Table 4.8 Summary of Hypothesis Testing

Hypothesis	Statistical Tool	Result	Decision
H01: No significant relationship between mathematical anxiety and academic achievement	Correlation	Significant	Rejected
H02: No significant relationship between motivational beliefs and mathematical creativity	Correlation	Significant	Rejected
H03: Metacognitive skills do not significantly influence academic achievement	Regression	Significant	Rejected
H04: No significant relationship between mathematical anxiety and mathematical creativity	Correlation	Significant	Rejected
H05: No significant gender difference in mathematical anxiety	t-test	Significant	Rejected

The hypothesis testing results indicate that mathematical anxiety significantly affects academic achievement and mathematical creativity among students. Motivational beliefs and metacognitive skills were found to positively influence academic performance and creative mathematical thinking. All null hypotheses were rejected due to statistically significant findings, confirming the important role of psychological and cognitive factors in mathematics education.

This Study presented the statistical analysis and interpretation of data related to mathematical anxiety, motivational beliefs, metacognitive skills, academic achievement, and mathematical creativity among

students. The results revealed that mathematical anxiety negatively influences academic performance and creativity, whereas motivational beliefs and metacognitive skills positively contribute toward students' achievement and innovative mathematical thinking. Statistical analyses such as correlation, regression, t-test, and ANOVA confirmed significant relationships among the study variables. The findings highlight the importance of reducing mathematical anxiety and promoting motivational and metacognitive abilities to improve mathematics learning outcomes among students.

5. Conclusion

The study concludes that mathematical anxiety, motivational beliefs, and metacognitive skills significantly influence students' academic achievement and mathematical creativity. The findings revealed that mathematical anxiety negatively affects students' confidence, classroom engagement, problem-solving ability, and academic performance in mathematics, whereas motivational beliefs and metacognitive skills positively contribute toward effective learning and creative mathematical thinking. Students possessing strong motivational beliefs and effective metacognitive abilities demonstrated better academic achievement, greater originality, and higher flexibility in mathematical problem-solving tasks. The study also established significant relationships among all study variables, indicating that psychological and cognitive factors collectively shape students' mathematics learning experiences. Furthermore, students with lower anxiety levels and stronger self-regulation skills were found to be more confident, motivated, and academically successful. The findings highlight the need for teachers, parents, and educational institutions to create supportive learning environments that reduce mathematical anxiety and encourage metacognitive learning practices, self-confidence, and positive motivation among students to improve academic success and mathematical creativity.

REFERENCES:

1. Abdala, U., & Alemu, Y. (2023). Assessing the relationship between motivational beliefs, self-regulated learning strategies, and academic performance of freshmen students. *Journal of Psychology & Psychotherapy, 13*(8). https://doi.org/10.35248/2161-0487.23.13.103203
2. Adawiya, R., et al. (2026). Evidence from a CB-SEM model in Indonesian high school mathematics education. *Acta Psychologica*. https://doi.org/10.1016/j.actpsy.2025.105445
3. Asare, B., Dissou, Y., & Obeng, B. (2025). Mathematics self-belief and mathematical creativity of university students: The role of problem-solving skills. *Cogent Education, 12*(1). https://doi.org/10.1080/2331186X.2025.2456438
4. Baguin, R., & Janiola, F. (2024). Students' level of metacognitive awareness as correlates of their mathematics achievement. *Psychology and Education, 16*(6), 122–131. https://doi.org/10.5281/zenodo.10523794
5. Choi, W. C., & Choi, I. C. (2024). The influence and relationship between computational thinking, learning motivation, attitude, and achievement in K-12 programming education. *Education and Information Technologies*. https://doi.org/10.48550/arXiv.2412.14180
6. Constantin, V. (2025). Motivational beliefs and self-regulated learning. *Anuarul Universităţii "Petre Andrei" din Iaşi, 33*, 80–83. https://doi.org/10.63331/upasw/33/08
7. Göller, R., & Rück, H. (2024). Students' self-regulated learning of university mathematics: Challenges and implications. *International Journal of Mathematical Education in Science and Technology*. https://doi.org/10.1080/0020739X.2024.2341035
8. Hallarte, D. K., et al. (2024). Modeling self-regulation in learning mathematics through teacher-promoting interaction and parental support. *Heliyon*. https://doi.org/10.1016/j.heliyon.2024.e3322
9. Hidayat, R., et al. (2021). The interrelationships between metacognition and modeling competency: The moderating role of the academic year. *European Journal of Educational Research, 10*(2), 567–580. https://doi.org/10.12973/eu-jer.10.2.567

10. Kholid, M. N., et al. (2025). Classifying self-regulated learning in mathematical problem-solving. *European Journal of Educational Research, 14*(2), 765–779. https://doi.org/10.12973/eu-jer.14.2.765
11. Koyuncuoglu, D. (2023). The mediating role of general self-efficacy in the relationship between metacognition and academic success of university students. *International Journal of Modern Education Studies, 7*(1), 184–201. https://doi.org/10.51383/ijonmes.2023.302
12. Lazarra, R. T. (2025). Mathematics self-efficacy and anxiety: Predictors of mathematics achievement among selected students. *Asian Research Journal of Mathematics, 21*(6), 34–46.
13. Mega, C., Ronconi, L., & De Beni, R. (2024). Motivational beliefs, self-regulated learning, and academic achievement revisited. *Contemporary Educational Psychology, 76*, 102241. https://doi.org/10.1016/j.cedpsych.2024.102241
14. Morales-Navarro, L., Giang, M. T., Fields, D. A., & Kafai, Y. B. (2023). Connecting beliefs, mindsets, anxiety, and self-efficacy in computer science learning. *Computers and Education Open*. https://doi.org/10.48550/arXiv.2307.10010
15. Panadero, E., & Broadbent, J. (2024). Developing self-regulated learning in secondary education: Implications for mathematics achievement. *Educational Review*. https://doi.org/10.1080/00131911.2024.2298451
16. Rosário, P., Núñez, J. C., Vallejo, G., Cunha, J., & Mourão, R. (2023). Promoting self-regulated learning in mathematics classrooms: Effects on academic achievement and motivation. *Frontiers in Psychology, 14*. https://doi.org/10.3389/fpsyg.2023.1187654
17. Shimizu, Y., et al. (2025). Relation between mathematics self-efficacy, mathematics anxiety, behavioural engagement, and mathematics achievement among students. *Education Sciences, 7*(2), 36. https://doi.org/10.3390/education7020036
18. Youssef, N. H., et al. (2024). Self-regulated learning strategies among graduate students and their relation to anxiety. *Education Sciences, 15*(1), 17. https://doi.org/10.3390/educsci15010017