Mathematical Anxiety's Mediating Significance in the Relationship between Self-Efficacy and Mathematical Efficiency

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ABSTRACT

This study investigated the mediating significance of Mathematical Anxiety in the relationship between Self-efficacy and Mathematical Efficiency among senior high school students at Lorenzo S. Sarmiento Sr. National High School. This quantitative study involved 270 students and utilized a descriptive-correlational research design with mediation analysis. The findings revealed that self-efficacy has a strong positive relationship with mathematical efficiency, while mathematical anxiety has a strong negative relationship with both variables. Furthermore, all self-efficacy indicators: mastery experience, vicarious learning, social persuasion, and affective state has significantly influenced students' mathematical efficiency. Multiple regression analysis confirmed that both self-efficacy and mathematical anxiety significantly contribute to mathematical efficiency. Sobel's Test established that mathematical anxiety significantly mediates the relationship between self-efficacy and mathematical efficiency. These results underscore the crucial role of emotional and cognitive factors in enhancing students' mathematical performance. The findings suggest the need for intervention programs that promote confidence and reduce anxiety to boost mathematical success.

Keywords: Mathematics Teaching, Self-efficacy, Mathematical Anxiety, Mathematical Efficiency, Mediation, Descriptive-Correlational Study

INTRODUCTION

Mathematical efficiency is essential for learners as it influences their academic performance and opens doors to future careers, especially in science and technology. However, many students struggled with mathematics, not just because of the subject itself but also due to mental and emotional challenges. Believing in their ability to succeed played a significant role in how motivated and persistent they are in mathematics. Nevertheless, high mathematical anxiety can lower their confidence and become a roadblock to success. When students are anxious, it interrupts the balance between their skills and self-belief, affecting the desired progress. Therefore, self-efficacy and mathematical anxiety influence mathematical efficiency (Chan et al., 2022).

According to a study conducted in Spain, mathematical anxiety played a mediating role in the relationship between perceived self-efficacy and mathematical efficiency, highlighting concerns on mathematics related task (Pérez Fuentes et al., 2020). Similarly, in Norway, the same concern regarding the decline in students' mathematical efficiency had intensified, as evidenced by results from internationally recognized examinations (Nilsen et al., 2022). In fact, according to Luttenberger (2018), regardless of the level of advancement, many nations claimed that students consistently struggled to get favorable scores in mathematics, with some of these difficulties being attributed to high levels of mathematical anxiety.

Furthermore, a study in Cavite revealed that many students find mathematics challenging not because of lack in ability, but because of the common belief that being good at math was an inborn talent rather than a skill that could be developed though in reality, mathematical understanding grows through consistent practice, effort, and a positive attitude toward learning demonstrating the impact of mathematical anxiety on both mathematical efficiency and self-efficacy, highlighting an overall problem faced by the country, the mathematical efficiency

(Ilano and Raqueno, 2023). Filipino students' mathematical efficiency in national and international assessments fell behind compared to the neighboring countries like Singapore, South Korea, Hongkong, and Japan (Guinocor et al., 2020).

In Lorenzo S. Sarmiento Sr. National High School, the same concern on mathematical efficiency had been observed. Also, teachers in the same school had detected that students' mathematical efficiency was deteriorating. Students' interests and study habits had become increasingly drowned out. Also, this issue was apparent in the subject matter evaluation, where the researcher undertook multiple retakes of tests, summative assessments, and quizzes just to demonstrate proficiency in the assessment. According to the data taken in the same school, there was a steady decrease in average mathematical proficiency, totaling a 4.44% drop over three years. This indicated a potential area of concern that might have reflected increasing academic challenges, heightened anxiety, or decreased self-efficacy in mathematics among students. Furthermore, this study aimed to examine the mediating function of mathematical anxiety in the connection between self-efficacy and mathematical anxiety, given the crucial impact that both had on students' mathematical efficiency. Understanding this mediation could have helped educators create focused interventions that enhanced students' mathematical abilities and tackled the psychological and emotional obstacles that prevented them from realizing their entire mathematical efficiency.

Research Objectives

1. What is the level of self-efficacy Senior High School students demonstrating in terms of:

    1.1 mastery Experience,
    1.2 vicarious Learning,
    1.3 social Persuasion, and
    1.4 affective State?

2. What is the level of Mathematical Anxiety Senior High School students experience in terms of:

    2.1 appraisal,
    2.2 arousal,
    2.3 face expression, and
    2.4 action tendencies?

3. What is the level of Mathematical Efficiency Senior High School students exhibit in terms of:

    3.1 interest, and
    3.2 study habit?

4. Is there a significant relationship between Self-efficacy and Mathematical Efficiency in Senior High School students?
5. Is there a significant relationship between Self-efficacy and Mathematical Anxiety among senior high school students?
6. What specific indicators of Self-efficacy significantly influence Mathematical Efficiency?
7. Does mathematical anxiety mediate the relationship between self-efficacy and mathematical efficiency among senior high school students?

METHODOLOGY

This study employed quantitative, that used descriptive correlational techniques to describe the hypothetical existence of a relationship between two defined variables and to determine the direction and degree of that relationship if one existed. When the purpose was to describe the condition of the situation as it existed at the time of the study to investigate the causes of a particular phenomenon, the descriptive correlation method was considered appropriate. A correlational research design with mediation analysis investigated relationships

between variables without the researchers controlling or manipulating any of them. A correlation reflected the strength and direction of the relationship between two or more variables (Bhandari, 2021). In correlational research, data was collected to determine whether the degree of a relationship existed between two or more quantifiable variables (Gay et al., 2006).

This survey dealt with quantitative data about the phenomenon. The quantitative aspect included an appropriate schedule for gathering data, designed for the target respondents to answer the questions. The data collection process was based on the use of questionnaires. The focus of the study was to determine Mathematical Anxiety's mediating significance in the relationship between Self-efficacy and Mathematical Efficiency among Senior High School Students.

Population and Sample

Stratified random sampling was used in determining the respondents of the study, which was composed of randomly selected Grade 11 and 12 students who were enrolled in the first semester of SY: 2024-2025 at Lorenzo S. Sarmiento Sr. National High School. The researcher used the Raosoft sample size calculator to determine the total number of respondents. The researcher also utilized stratified random sampling, getting 53 percent of the respondents from the strata of Grade 11 and 47 percent of the respondents from the strata of Grade 12. Shown in the table below is the distribution of the population in the study.

Grade Level	Population	Respondents	Percentages
11	478	143	53
12	426	127	47
Total	904	270	100

Table 1. Population and Sample size of Respondents

Statistical Tool

The following statistical tools were utilized for the data analysis and interpretation.

Mean. This statistical tool was used to determine the levels of self-efficacy, mathematical anxiety, and mathematical efficiency among senior high school students.

Pearson (r). This statistical tool was employed to determine the significance of the relationships between self-efficacy, mathematical anxiety, and mathematical efficiency among senior high school students.

Multiple Regression Analysis. This statistical tool used to understand the relationship between one dependent variable and two or more independent variables. In this study, it was applied to examine how self-efficacy directly affects mathematical efficiency. By using this tool, researchers were able to determine the strength and significance of self-efficacy's impact on students' performance in mathematics.

Sobel's Test. This statistical tool was utilized to examine the significance of the mediating effect of Mathematical Anxiety in the relationship between Self-Efficacy and Mathematical Efficiency. As a statistical method for testing mediation, Sobel's Test determines whether the indirect effect of the independent variable on the dependent variable through the mediator is significantly different from zero. This is achieved by calculating a z-value based on the unstandardized regression coefficients and standard errors from the relevant paths in the mediation model.

RESULTS

Level of Self-efficacy of Senior High School Students

Shown in Table 2 the level of self-efficacy of senior high school students in terms of mastery experience,

vicarious learning, social persuasion, and affective state. The overall mean is 2.81, described as moderately agree. Mastery experience with a mean of 3.11 has the highest mean among the self-efficacy indicators, while affective state has the lowest with a mean of 2.01. This meant that students felt more confident in their math abilities when they relied on past successes or experiences. On the other hand, affective state, which related to emotions like stress or nervousness, showed the lowest level of agreement, suggesting that emotional challenges still made it harder to fully believe in their capabilities when doing math.

Table 2. Level of Self-efficacy of Senior High School Students

Indicators	**Mean**	**Descriptive Equivalent**
Mastery Experience	3.11	Moderately Agree
Vicarious Learning	3.09	Moderately Agree
Social Persuasion	3.03	Moderately Agree
Affective State	2.01	Disagree
Overall	**2.81**	**Moderately Agree**

Level of Mathematical Anxiety

Presented on the Table 3 is the mean scores for the indicators of mathematical anxiety, with an overall mean of 3.02, described as moderately agree. This indicates that most students moderately experienced anxiety when dealing with mathematics. Among the indicators, appraisal receives the highest mean score of 3.36, suggesting that many students tended to perceive math tasks as difficult or stressful. In contrast, face expression has the lowest mean of 2.80, showing that fewer students outwardly displayed their anxiety through visible expressions. This signifies that even when students were feeling nervous, they often keep it to themselves.

Table 3. Level of Mathematical Anxiety

Indicators	**Mean**	**Descriptive Equivalent**
Appraisal	3.36	Moderately Agree
Arousal	2.92	Moderately Agree
Face Expression	2.80	Moderately Agree
Action Tendencies	3	Moderately Agree
Overall	**3.02**	**Moderately Agree**

Level of Mathematical Efficiency

Shown in Table 4 the mean scores of the indicators of mathematical efficiency, with an overall mean of 2.98, described as moderately agree. This rating reflects the respondents' moderate agreement on most items related to interest and study habits. Specifically, the indicator for interest has a mean of 3.07, while the study habits indicator has a mean of 2.89, both suggesting a moderate level of mathematical efficiency among the students.

Table 4. Level of Mathematical Efficiency

Indicators	**Mean**	**Descriptive Equivalent**
Interest	3.07	Moderately Agree

Study Habits	2.89	Moderately Agree
Overall	**2.98**	**Moderately Agree**

Significance of the Relationship between Self-efficacy and Mathematical Efficiency

One crucial purpose of this study is to determine whether self-efficacy has a significant relationship with senior high school students' mathematical efficiency. Table 5 shows that self-efficacy and mathematical efficiency had a Pearson's R-value of 0.908*, indicating a strong positive relationship. Moreover, a p-value of,.001, less than the 0.05 p-value, means a significant relationship between self-efficacy and mathematical efficiency. Thus, the null hypothesis, which states no significant relationship between self-efficacy and mathematical efficiency, is rejected. This further implies that the students' mathematical efficiency tends to be observed when the self-efficacy is observed.

Table 5: Significance on the Relationship Self-Efficacy and Mathematical Efficiency in Senior High School Students

	Mean	Pearson's r	**p-value**	**Remarks**
Self-Efficacy	2.81	-0.868	<.001	Significant
Mathematical Anxiety	3.02			

Significance of the Relationship Self-Efficacy and Mathematical Anxiety in Senior High School Students

Shown on Table 6 that self-efficacy and mathematical anxiety has a Pearsons' r-value of -0.868*, indicating a strong inverse relationship. Moreover, a p-value of <.001, less than the 0.05 p-value, means a significant relationship between self-efficacy and mathematical anxiety. Thus, null hypothesis, which states no significant relationship between self-efficacy and mathematical anxiety, is rejected. This further indicates that mathematical anxiety tends to be observed when self-efficacy is not observed.

Table 6: Significance on the Relationship Self-Efficacy and Mathematical Anxiety in Senior High School Students

	Mean	Pearson's r	**p-value**	**Remarks**
Self-Efficacy	2.81	0.908	<.001	Significant
Mathematical Efficiency	2.98			

Multiple Regression Analysis on the Influence of Self-Efficacy on Mathematical Efficiency

Presented in Table 7 is the regression analysis on the influence of self-efficacy on mathematical efficiency. The indicator mastery experience has a coefficient of 0.227, a t-value of 4.177, and a p-value of <.001, less than the significance level 0.05, indicating that mastery experience significantly influences the mathematical efficiency of senior high school students in a singular capacity. Further, the coefficient of 0.227 indicates that a one-unit increase in mastery experience results in a corresponding rise of 0.227 in mathematical efficiency of the senior high school students.

Succeeding, vicarious learning has a coefficient of 0.225, a t-value of 5.079, and a p-value of <.001, less than the significance level 0.05, indicating that vicarious learning significantly influences the mathematical efficiency of senior high school students in a singular capacity. Further, the coefficient of 0.225 indicates that a one-unit increase in vicarious learning results in a corresponding rise of 0.225 in mathematical efficiency of the senior high school students.

Next, the social persuasion has a coefficient of 0.348, a t-value of 8.102, and a p-value of <.001, less than the

significance level of 0.05, indicating that social persuasion significantly influences the mathematical efficiency of senior high school students in a singular capacity. Moreover, the coefficient of 0.348 indicates that a one-unit increase in social persuasion resulted in a corresponding rise of 0.348 in mathematical efficiency of the senior high school students.

The affective state has a coefficient of 0.220, a t-value of 5.641, and a p-value of <.001, less than the significance level of 0.05, indicating that affective state significantly influences the mathematical efficiency of senior high school students in a singular capacity. Additionally, the coefficient of 0.220 indicates that a one-unit increase in affective state resulted in a corresponding rise of 0.220 in mathematical efficiency of the senior high school students.

Therefore, as presented in the table, all the indicators of self-efficacy significantly influenced the mathematical efficiency of senior high school students.

Table 7: Multiple Regression Analysis of the influence Between Teachers' Attitude on Students' Motivation

Self-efficacy	**Unstandardized B**	**Coefficient Standard Error**	**Coefficient**	**t-value**	**p-value**	**Remarks**
Mastery Experience	0.203	0.049	0.227	4.177	<.001	Significant
Vicarious Learning	0.237	0.047	0.225	5.079	<.001	Significant
Social Persuasion	0.334	0.041	0.348	8.102	<.001	Significant
Affective State	0.248	0.044	0.220	5.641	<.001	Significant
Dependent Variable: Mathematical Efficiency						

Mediation Analysis of Mathematical Anxiety on the Relationship Between Self-Efficacy and Mathematical Efficiency

Presented in table 8 is the multiple regression analysis of mathematical anxiety (mediating variable), self-Efficacy (independent variable) and mathematical efficiency (dependent variable) to present if mathematical anxiety and self-efficacy influences mathematical efficiency.

Mathematical anxiety has a coefficient of 0.358, a t-value of 9.262, and a p-value of <.001, less than the significance level of 0.05, indicating that mathematical anxiety significantly influences the senior high school students' mathematical efficiency. Also, self-efficacy significantly influences the mathematical efficiency of senior high school students, having a coefficient of 1.201, a t-value of 31.060, and a p-value of <.001, which is less than the significance level of 0.05, making it significant.

Table 8: Multiple Regression analysis of Mathematical Anxiety (mediating variable), Self-Efficacy (independent variable) and Mathematical Efficiency (dependent variable)

	Unstandardized B	**Coefficient Standard Error**	**Coefficient**	**t-value**	**p-value**	**Remarks**
Mathematical Anxiety	0.002	.000	0.358	9.262	<.001	Significant
Self-efficacy	1.346	0.043	1.201	31.060	<.001	Significant
Dependent Variable: Mathematical Efficiency						

Since the results of multiple regression analysis ensures that both the mediating variable and independent variable influences the mathematical efficiency, the Sobel's Test in Table 9 will confirm or not if the mathematical anxiety act as mediating variable in the relationship between self-efficacy and mathematical efficiency.

Table 9 unveils that mathematical anxiety has an indirect effect of -0.000 and a z-score of -4.98, indicating a negative indirect effect. The negative z-score implies that as self-efficacy increased, it reduced mathematical anxiety, which in turn increased mathematical efficiency. The p-value was <.001, less than the significance level of 0.05, indicating that mathematical anxiety significantly mediates the relationship between self-efficacy and mathematical efficiency. Thus, the null hypothesis, which stated that mathematical anxiety does not mediate the relationship between self-efficacy and mathematical efficiency among senior high school students, is rejected.

Table 9: Mediating Analysis of Mathematical Anxiety on the Relationship Between Self-Efficacy and Mathematical Efficiency (Sobel's Test)

	Indirect Effect (a x b)	**z-score**	**p-value**
Sobel Test	-0.000	-4.98	<.001

DISCUSSIONS

Level of Self-Efficacy of Senior High School Students

The respondents' level of self-efficacy among senior high school students at Lorenzo S. Sarmiento Sr. National High School revealed that senior high school students were described as moderately agree, suggesting a significant presence of different factors of self-efficacy in mathematics.

The study highlighted that mathematical efficiency was affected by self-efficacy, affirming the study of Zhang et al., (2020), which stated that self-efficacy had a significant relationship with Mathematical Efficiency. Among the four indicators, Mastery Experience recorded the highest mean, suggesting that students' confidence in their ability to succeed in Mathematics primarily came from their own personal academic accomplishments. This aligned with the findings of Kurniawati et al., (2019), who emphasized that students with strong mastery experiences tended to persist and perform better in solving mathematical problems. The data showed that students agreed most strongly with the statement "I do well in Mathematics if I study hard," indicating that they recognized the connection between effort and success. As supported by Sides and Cuevas (2020), students who achieved their goals through persistence developed stronger self-efficacy beliefs.

Vicarious Learning came in second, still falling under moderately agree. This reflected students' tendencies to draw motivations and strategies from observing peers and teachers succeed in Mathematics. Statements like "Seeing adults and kids do well in Mathematics pushes me to do better" highlighted the influence of role models on students' belief in their own capabilities. This echoed the views of Putnam (2021) and Rozgonjuk et al., (2020), who argued that observing others could significantly impact learners' self-confidence, particularly when the models appeared relatable. However, this process could be undermined when students perceived themselves as significantly different from those they observed, limiting the influence of modeling (Yildiz et al., 2019).

Social Persuasion, with the third highest mean, fell within the moderately agree range and reflected the supportive impact of teachers, family, and peers on students' confidence in Mathematics. Students responded positively to affirmations such as "My teacher appreciates me if I solve mathematics problems correctly." These results were similar to Echeverría-Castro et al., (2020), who noted that verbal encouragement and recognition of progress enhanced students' self-belief and perseverance. However, feedback had to be constructive—negative reinforcement, as warned by Calhoun (2021), could foster self-doubt and aversion to difficult subjects like Mathematics. Hence, while praise and recognition were important, they had to be paired with specific guidance and opportunities for growth.

In contrast, affective state gained the lowest mean, which was under the disagree range, indicating that many students did not feel emotionally comfortable or confident while engaging in Mathematics. Statements such as "I feel relaxed and calm by just being in Mathematics class" received low favor, emphasizing students' anxiety and emotional strain when tackling mathematical tasks. This observation supports Gao's (2020) and Yeager and Dweck's (2020) findings that students with low self-efficacy often experienced stress, frustration, and a lack of motivation, especially when facing failure. Emotional discomfort during mathematics not only impaired performance but could also damage self-efficacy beliefs over time. As Zakariya (2022) pointed out, fostering a positive emotional environment could enhance both motivation and mathematical achievement, suggesting that interventions targeting emotional regulation might be beneficial for students struggling in this area.

Level of Mathematical Anxiety

In the previous chapter, the findings of mathematical anxiety among senior high school students at Lorenzo S. Sarmiento Sr. National High School were presented. It revealed that the level of mathematical anxiety among senior high school students was reported as moderately agree, suggesting a significant presence of different factors of anxiety in mathematics.

The level of mathematical anxiety among senior high school students revealed an overall mean that fell under the moderately agree range. This suggested that students experienced a moderate level of discomfort, fear, or worry when engaging in mathematical activities. Among the four dimensions, appraisal received the highest mean, indicating that students often felt anxious when confronted with unfamiliar math problems or when asked to solve problems publicly, like Süren and Kandemir's (2020) claim that nervousness and concern impaired students' mathematical functioning. These appraisal-based worries, often cognitive in nature, aligned with Ablian and Parangat's (2022) view that exams and problem-solving tasks in mathematics could trigger significant apprehension and feelings of inadequacy among students.

Action tendencies, obtaining the second highest mean among the four indicators, showed that students sometimes exhibited avoidant behaviors in math classes, such as remaining silent, avoiding eye contact, or even skipping classes. This finding affirms the claims of Choe et al., (2019) and Estonanto et al., (2019), who noted that students with heightened mathematical anxiety often displayed avoidance behaviors and low motivation toward math tasks. These behavioral manifestations, which were often visible to teachers, reflected attempts by students to escape stressful math-related experiences and served as a coping mechanism against feelings of helplessness or embarrassment in class. The tendency to retreat or disengage from class participation underscored how anxiety not only affected cognition but also shaped classroom behavior and academic engagement.

Third on the list was action tendencies. This related to the physical symptoms experienced by students, such as increased heart rate, trembling hands, and headaches when confronted with mathematics-related situations. These bodily responses were well-documented in the literature, with Hunkin et al., (2019) and Mononen et al. (2022) describing similar stress responses such as sweating, nausea, and rapid heartbeat in anxious students. These physical symptoms indicated that mathematical anxiety went beyond mental discomfort and triggered a fight-or-flight-like response in the body, which could hinder students' ability to focus, retrieve learned information, and perform during tests or recitations. This aligned with the conclusions of Widjajanti et al., (2020), who emphasized that both psychological and physiological symptoms contributed to diminished math performance.

Lastly, face expression got the lowest mean, still falling under the moderately agree level. This suggested that students were somewhat conscious of their facial expressions, such as frowning, sweating, or blushing during math activities, which might have involuntarily revealed their anxiety to peers and teachers. As Foley et al., (2017) and Pizzie et al., (2021) mentioned, such non-verbal cues were valid indicators of internal emotional states and could affect how students were perceived and treated in learning environments. The subtlety of these facial reactions may have explained why this category ranked lowest; students might not have always been fully aware of these involuntary responses. Nevertheless, as discussed by Khan (2019) and Budhathoki et al., (2022) these were part of a wider emotional and behavioral profile that characterized mathematical anxiety, which could have implications for students' academic self-concept, classroom behavior, and long-term mathematical achievement.

Level of Mathematical Efficiency

The respondents' level of mathematical Efficiency among the respondents was interpreted as moderately agree. This meant that while students generally exhibited Mathematical Efficiency, there was still room for improvement in how they engaged with math-related tasks. The results aligned with the claims of Throndsen et al., (2022), who noted that Mathematical Efficiency was essential in ensuring long-term success, not just academically but also in life. The relatively moderate scores in both indicators, interest and study habits, supported the idea that Mathematical Efficiency was shaped not only by innate ability but also by students' motivation and consistent academic routines (Saputro and Herman, 2021).

Among the two indicators, interest scored slightly higher, indicating that students were somewhat motivated to engage in mathematics. The highest individual item mean was seen in the desire to achieve good grades, which reflected students' intrinsic motivation to succeed academically. However, some responses, like the one concerning frustration when a class was interrupted, showed inconsistency in emotional responses, which could have affected consistency in learning. These findings reinforced the claim by Aras & Zahrawati (2021) that interest played a crucial role in students' motivation and ultimately affected their Mathematical Efficiency. A genuine interest not only motivated students to put in the effort but also helped protect against the negative effects of interruptions and challenges (Harefa, 2023).

On the other hand, study habits had a slightly lower overall mean but still within the moderately agree range. While students showed signs of persistence, such as studying hard after getting low grades and preparing for quizzes and tests, the scores were particularly lower in areas related to self-discipline and time management. For instance, items like "preferring to finish assignments and studying before using cellphones" showed lower ratings. These habits were crucial to Mathematical Efficiency, as supported by Capuno et al., (2019), who emphasized that consistent and effective study routines improved learning outcomes. The lower ratings in this area suggested that while students may have understood the importance of studying, they may have struggled with distractions or balancing academics with social activities.

The overall result of the level of mathematical efficiency showed that both interest and study habits were moderately present among the respondents and played critical roles in fostering Mathematical Efficiency. As confirmed by the claims of Kaur and Singh (2020), factors such as student engagement, persistence, and a conducive study environment significantly impacted how efficiently students performed in mathematics. The results highlighted the need for interventions that enhanced both motivational and behavioral aspects of learning math. Encouraging practices like self-regulation, time management, and goal setting, combined with fostering a deeper interest in mathematics, could have served as effective strategies to boost Mathematical Efficiency among senior high school students.

Significance of the between Relationship Self-Efficacy and Mathematical Efficiency

The results reveals a very strong positive correlation between the two variables. In addition, the p-value was far below the standard significance level confirming that the relationship was statistically significant. This meant that students who exhibited higher self-efficacy also tended to demonstrate higher levels of mathematical efficiency.

This significant result supported existing literature that highlighted the important role of self-efficacy in students' academic performance, mainly in mathematics. Zakariya (2021) emphasized that mathematical efficiency was positively correlated with strong math self-efficacy, while students with low self-efficacy tended to struggle more in math tasks. Students who believed in their ability to succeed were more likely to put in effort, persist through challenges, and use effective strategies, which in turn enhanced their mathematical performance (Wakhata et al., 2022). This study's findings affirmed that self-efficacy was not just a feeling but rather, it directly impacted a student's ability to perform efficiently in math.

Furthermore, the strong correlation observed could be tied to the five interrelated components of mathematical efficiency discussed by Rahman and Juniati (2023): conceptual knowledge, procedural fluency, strategic

competence, adaptive thinking, and productive attitudes. Students with high self-efficacy were more likely to engage in these areas because they felt capable and motivated. As Wang et al., (2020) noted, individuals who believed in their ability were more willing to apply strategies and modify their problem-solving approaches, leading to greater efficiency. This reinforced the idea that improving students' self-belief could be a practical strategy in raising their mathematical achievement.

Thus, the results indicated that a major emphasis in learning about mathematics, particularly at the senior high school level, should be on developing self-efficacy. The high correlation between mathematical efficiency and self-efficacy indicated that students who had confidence in their mathematical skills were more likely to perform well and use their knowledge efficiently. Consequently, educators and instructors ought to have employed strategies that boosted students' self-esteem, like giving encouraging remarks, providing chances for achievement, and fostering a pleasant learning environment in the classroom. Feeling competent made students more willing and equipped to handle mathematical problems, which eventually improved their performance in the classroom and beyond.

Significance of the Relationship between Self-Efficacy and Mathematical Anxiety

Studying the connection between senior high school students' self-efficacy and mathematical anxiety was another essential aspect of this study. As shown in Table 6, it indicated a strong negative correlation between the two variables. This suggested that as self-efficacy increased, mathematical anxiety decreased, and vice versa. Furthermore, the significance of the correlation was confirmed by the p-value, which was significantly lower than the standard limit. Therefore, the null hypothesis stating that there was no significant relationship between self-efficacy and mathematical anxiety was rejected.

This finding agreed with previous research showing that students who had greater levels of self-efficacy were less likely to suffer from mathematical anxiety. Zakariya (2021) emphasized that strong mathematics self-efficacy was negatively associated with mathematical anxiety. When students believed in their ability to succeed, they were more confident and less fearful of failure, which could significantly reduce anxiety. This was further supported by Morán-Soto et al. (2022), who found that students who were confident in their mathematical skills were less prone to experiencing feelings of tension, worry, or panic during math-related tasks.

Furthermore, the result emphasized the importance of the emotional and psychological dimensions in learning mathematics. According to Irvine (2020), affective factors such as anxiety could either boost or hinder mathematical efficiency. The study's result reinforced the idea that self-efficacy was not only a predictor of academic success but also a buffer against negative emotional experiences in the classroom. When students felt incapable or overwhelmed, their anxiety levels tended to rise, which then interfered with their cognitive functioning and performance in math (Di Leo and Muis, 2020).

The strong inverse relationship between self-efficacy and mathematical anxiety highlighted the importance of nurturing students' belief in their own abilities. By creating learning environments that fostered confidence and provided opportunities for success, educators could help reduce anxiety and create more positive experiences in mathematics. Strategies such as setting attainable goals, offering supportive feedback, and promoting a growth mindset could empower students to face mathematical challenges without fear. When self-efficacy was nurtured, students not only became more efficient learners but also experienced lower levels of anxiety, setting them up for greater academic success.

The Influence Self-efficacy on Mathematical efficiency Senior high school students' mathematical efficiency was significantly influenced by each of the four self-efficacy indicators: affective state, social persuasion, vicarious learning, and mastery experience. Among these, social persuasion was shown to be the most influential. This meant that students who regularly received support from their teachers, fellow students, or other adults in their surroundings were more likely to believe they could succeed in mathematics. Positive reinforcement from society was crucial in forming students' perceptions of their own talents, particularly in difficult disciplines like mathematics, as emphasized by Yildiz et al., (2019).

The students' current efficiency was also significantly influenced by their mastery experience, or prior

mathematical accomplishments. Students were more likely to think they could solve new problems successfully when they could recall their prior successes in math-related tasks. Repetitive exposure to positive experiences strengthened academic confidence, which in turn improved performance, according to Zakariya's (2021) study. This supported the idea that students who believed they had an established mathematical background were better prepared to tackle increasingly challenging subjects head-on.

Additionally, noteworthy was the influence of vicarious learning. When students see others, especially their classmates, achieving in mathematics, they often think they could too. Aligned with the claims by Mamolo (2022), seeing someone with comparable traits overcome learning difficulties encouraged others to adopt the same mindset. This was particularly true when cooperative learning techniques were used in the classroom, enabling students to observe and absorb one another's approaches to problem-solving, thereby enhancing their competence and confidence.

Furthermore, students' mathematical efficiency was significantly influenced by their affective states. Students could participate in mathematics tasks with greater confidence when they were in a pleasant emotional environment that was free from worry, fear, and self-doubt. Emotional experiences, such as reduced stress and increased confidence, significantly influenced a student's academic performance, as highlighted by Ardi et al., (2019). Students were more likely to focus, process information efficiently, and persevere in solving mathematical problems when they were emotionally stable and at ease. All indicators of self-efficacy significantly enhanced mathematical efficiency, each through unique yet complementary approaches.

Mediation Analysis of Mathematical Anxiety on the Relationship Between Self-Efficacy and Mathematical Efficiency

Both self-efficacy and mathematical anxiety had significant effects on the mathematical efficiency of senior high school students. Specifically, self-efficacy was found to have a strong positive influence, while mathematical anxiety also played a significant role in predicting mathematical efficiency. These findings aligned with the conclusions of Wang et al., (2020), who emphasized that students with higher self-efficacy tended to approach mathematical tasks with confidence and persistence, which enhanced their efficiency. On the other hand, mathematical anxiety, even in small amounts, consumed cognitive resources and interfered with problem-solving, as pointed out by Skagerlund et al., (2019).

Further analysis through the Sobel Test (Table 9) demonstrated that mathematical anxiety significantly mediated the relationship between self-efficacy and mathematical efficiency. The negative indirect effect indicated that when self-efficacy increased, it helped lower mathematical anxiety, which in turn improved students' mathematical efficiency. This finding supported Perez-Fuentes et al., (2020), who acknowledged that self-efficacy and mathematical anxiety were intertwined, with one influencing the other in shaping a student's performance. The significant mediation effect also confirmed Szczygieł's (2021) assertion that individuals with low self-efficacy were more prone to anxiety, which then hampered their mathematical outcomes.

This suggested that fostering self-efficacy in the classroom was not just a matter of boosting confidence but rather, it was a critical strategy in reducing mathematical anxiety and enhancing performance. Pellizzoni et al., (2020) noted that targeted interventions which reduced math-related fear could simultaneously improve a student's enthusiasm and perceived capability in the subject. This chain reaction formed a positive feedback loop where reduced anxiety led to improved efficiency, which in turn strengthened self-efficacy. The implication was clear: addressing emotional barriers in learning mathematics could create long-term academic benefits.

Moreover, these findings highlighted the importance of rounded support systems in math education. Ablian and Parangat (2022) stressed that teachers should not only focus on cognitive strategies but also attend to the emotional and psychological aspects of math learning. Integrating adaptive teaching strategies, mindfulness, and metacognitive training could equip students with tools to manage anxiety while nurturing their belief in their capabilities. By creating a learning environment that supported both the emotional and academic development of students, educators could empower learners to break the cycle of math anxiety and unlock their full potential in mathematical efficiency.

CONCLUSION

Based on the findings of this study, it could be concluded that self-efficacy played a significant role in influencing the mathematical efficiency of senior high school students. A strong positive relationship was found between these two variables, suggesting that students who believed in their own mathematical abilities tended to perform more efficiently in math-related tasks. Moreover, each indicator of self-efficacy, including mastery experience, vicarious learning, social persuasion, and affective state, was shown to have a meaningful influence on mathematical efficiency, further emphasizing the importance of building students' confidence and motivation in the subject.

Additionally, the results revealed that mathematical anxiety negatively correlated with self-efficacy and significantly mediated the relationship between self-efficacy and mathematical efficiency. This meant that students with higher self-efficacy were more likely to experience lower levels of anxiety, which in turn contributed to better mathematical performance. The findings emphasized the idea that improving students' self-efficacy not only enhanced their academic outcomes directly but also helped them manage emotional barriers like anxiety. Creating a supportive learning environment that strengthened self-efficacy while addressing math-related anxiety was crucial for helping students reach their full potential in mathematics.

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