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Examining the Influence of Mathematics Anxiety on Mathematics Achievement Among Undergraduate Students: Testing Bandura's Cognitive Theory

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ABSTRACT

Purpose: The advent of the 21st century and the advancement of instructional materials and methods played a prominent role in developing the innate potentialities of an individual. The contribution made through various theoretical frameworks by past research on math attitude, math anxiety, mathematics self-efficacy, and others in academic and non-academic arenas in the field of education is significant. This research paper aims to practically apply Bandura's social cognitive framework with its factors leading to mathematics achievements.

Methodology: This paper is quantitative, using mediation analysis to explore the impacts of factors on mathematics achievements. The undergraduate students were chosen via convenience sampling, with a sample of 157, and 20 items were present in the online survey questionnaire prepared.

Findings: The result suggests a strong relationship between students' attitudes towards mathematics and others for increasing their mathematical anxiety, affecting their mathematical achievement.

Originality/value: The findings will be helpful for educators, students, and policymakers to utilize novel information and to develop intervention plans and strategies to determine their learning methods. They will also boost systematic literature reviews for future researchers.

Keywords: Mathematics Self-concept, Mathematics Self-efficacy, Mathematics anxiety, Mathematics achievement, Attitude towards mathematics

1. INTRODUCTION

Mastery in mathematics paves the way for future career prospects in the science, technology, engineering, and mathematics (STEM) sectors, contributing to an advanced, highly technological, and well-compensated society. However, a certain few adolescents find mathematics to be enjoyable and try to excel in the subject, while others may ignore it completely. As pointed out, the capacity to reason rationally and abstractly is fostered by mathematics and is essential for success in school and the future. Similarly, an area that receives a lot of attention among academic engagement is math engagement. In particular, success in mathematics opens doors to further education, attracts more lucrative employment options, and increases one's capacity to meet global marketplace demands. Researchers have shown that several personal characteristics, such as motivational ideas and emotions, influence a person's success in

mathematics. As a result, knowledge of mathematics is a significant way to access the crucial aspects of our daily lives.

According to 21st-century demand, we use both cognitive and emotive talents. Despite this, our emotional aspects and the consequences of mental and emotional states influencing mathematics learning have not gathered our attention among the conventional research on mathematics learning and problem-solving as much as in cognitive studies. Numerous studies, such as the one showing that there is an association between math anxiety and math self-efficacy and between math anxiety and students' expected outcomes. Furthermore, anxiety and its adaptive variables, such as self-concept, were associated in different ways. and how the scores of children's arithmetic, math anxiety, and academic self-concept were affected by the aptitude monitoring. In mathematics-related courses, grades were predicted by mathematics self-efficacy, math self-concept, and attitude towards mathematics, which also resulted in math performance and math anxiety.

A study of undergraduate business students' math anxiety and math self-efficacy, with math as their core, in which self-efficacy was a mediator. In addition, it was found that students' grades in mathematics courses were found to be predicted by mathematics self-efficacy, instead of general study efficacy. As drawn, the study looked at the mediating influence of self-efficacy between learned helplessness and mathematics anxiety. Mathematical anxiety and subsequently mathematical learning interest were the serial mediators between problematic smartphone use and mathematical success. Another study looks at how self-efficacy and math anxiety function as moderators in the relationship between interest in mathematics and mathematical success.

However, there is a lack of previous investigations to find that mathematical anxiety acts as a mediating variable with self-efficacy and self-concept acting as an independent variable with an impact on mathematics achievement. Similarly, it also tends to find the influence of the attitude on mathematics achievement. This insufficiency needs to be conceptualized using Bandura's social learning theory, as it is not a tested perspective among undergraduate students, as most of the studies were conducted in Western parts, while in Eastern parts it is limited in numbers. Thus, this study provides novelty and the first attempt to address the query with all the variables integrated in this study. The present paper aims to answer the following: to examine the mediating influence of mathematics anxiety in relation to self-efficacy, self-concept, and mathematics achievement; and attitudes' influence on mathematics achievement, using structural equation modeling for mediation analysis in Jamovi software.

2. Theoretical Foundation

2.1 Social cognitive theory

The proposed framework was based on Bandura's social cognitive theory. According to reciprocal determinism, it is the opinionated view of causality in social cognitive theory. According to this reciprocal causation paradigm, environmental situations, behavior, cognition, and other personal traits function as interacting determinants that influence one another. The many influential sources are not all equivalent in power because not all the reciprocal impacts happen at once, so there is reciprocal causation, and for some people, it may be stronger than for others.

By integrating people in social contexts, social cognitive theory offers to analyze human motivation, thinking, and behavior in its framework. It focuses on the reciprocal triadic interaction between the three components—human actions, cognitive and other personal qualities, and environmental events. It is believed that these variables interact with one another to determine one another.

Our ideas about our aptitude can be predicted by our behavior because they influence how we use the knowledge and skills we have. Thus, it is critical to explore students' self-efficacy, self-concept, and anxiety concerning mathematics, as these factors influence their behavior and decision-making
Researchers have focused a lot of emphasis on one factor—mathematics self-efficacy—because of its potential impact on mathematics learning.

3. Literature Review

The systematic reviews are pivotal resources for researchers, policymakers, decision-makers, and students, providing invaluable assistance in navigating the vast landscape of research literature and aiding in the development of the "state of the art" section in academic works. Ensuring that these reviews are meticulously detailed is essential, as it allows users to assess the reliability and relevance of the findings presented. In the context of this, the authors adhered to the guidelines outlined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) when delineating the methods employed and the results obtained in their examination of how mathematical anxiety impacts the academic achievement of undergraduate students.

Research articles were compiled for their comprehensive coverage across various academic fields, such as from databases like Web of Science, Scopus, and Google Scholar, using manual exploration. They were selected, using specific keywords in the Scopus query string (math AND anxiety, AND mathematics AND achievement, AND students). Initially, only 186 articles were obtained. Following the application of exclusion criteria focusing on articles only and English as the language of publication, the number was reduced to 158 articles.

Under the same stringent conditions, systematic literature reviews were conducted using the Web of Science using the specific keywords (math AND anxiety, AND mathematics AND achievement, AND students), which yielded 531 results from the Web of Science Core Collection. After excluding non-article entries and filtering for the English language, 506 documents remained. Combined with the results from Scopus, a total of 664 articles were retained. Upon identifying and removing duplicate articles, the total was narrowed down to 625. Notably, a more stringent filter was applied to eliminate non-open-access articles, resulting in the removal of 71 entries. Following the examination of 558 papers seem to be relevant to the study's objectives, 2 articles were found to lack peer review, and applying a publication year limit of 2018-2024 led to the exclusion of 262 articles, leaving 290 relevant ones. Among these, 112 articles were directly pertinent to the topic. Further scrutiny excluded articles like editorials and conference papers based on their titles and abstracts.

A. Attitude towards mathematics(ATM) and Mathematics achievement

The attitude definition is somewhat tricky to describe as"A learned disposition or tendency on the part of an individual to respond positively or negatively to some object, situation, concept, or another person"(Aiken, 1970; The current study uses a rather simplistic definition of attitudes that nevertheless encompasses a variety of feelings toward mathematics and problem-solving, such as love, hate, anxiety, curiosity, and a perception of mathematics' usefulness in life.

ATM is an emotional state toward mathematics which is either favorable or unfavorable (McLeod, 1994;. Many children start school with positive views, according to some studies conducted so far; however, as children become older, their attitudes become less positive and often turn negative when they reach high school (Ma & Kishor, 1997; ; Azar and Mahmoudi,2014) have demonstrated that with an affirmative attitude in mathematics, or those who love the subject, strive harder and score higher in mathematics than

those with a negative attitude. Soleymani and Rekabdar (2016) studied the connection between the attitudes of undergraduate students toward mathematics and their achievement in the subject. The adoption of a realistic mathematics approach has the potential to influence students' attitudes towards mathematics(Zakaria et al.2017).Similarly more success in math-related programs at university and more positive attitudes concerning mathematics than students who had taken foundational math courses in high school (Óturai et al., 2023). The recent study focuses on finding out the proposed hypothesis:

H1: Attitude towards mathematics has a positive influence on mathematics achievement.

B. Self-efficacy, Mathematical Anxiety, Mathematics Achievement

Self-efficacy is a key concept that has been associated with math phobia. The major factor influencing a person's decision to do a given task is their self-efficacy, which is their view of their capacity to carry out a certain behavior or action. These expectations show how much work will be put in and how persistently the goal will be pursued when suffering setbacks(Akin et al 2011). By enabling the employment of cognitive techniques, boosting the belief in task completion, and motivating one to come up with alternate solutions for the current challenge, mathematics self-efficacy favorably improves academic accomplishment (Stevens, Olivarez, Lan, & Runnels, 2004) as cited by (Gürefe & Bakalım,.2018). As past studies had shown, positive findings in the relationship between math achievement and self-efficacy among Portuguese pupils ranging from fifth to ninth grade(Rosário et al., 2012; Perez-Fuentes et al., 2020) and with teenagers from Britain(Tosto et al., 2016; Perez-Fuentes et al., 2020). A study by showed that students who have a good mathematical self-concept had reduced anxiety and higher mathematics self-efficacy and self-concept, and b) pupils who have a poor mathematical self-perception, as evidenced by their decreased anxiety and greater levels of self-efficacy and self-concept.

According to (Pizzie & Kraemer, 2017; Perez-Fuentes et al., 2020), math anxiety is a form of dislike leading to avoiding math classes and disciplines requiring math proficiency. Likewise, the outcome is in line with other studies that have shown how self-efficacy, math anxiety, attitude, and gender affect the success in mathematics (Schunk & Mullen, 2012; Recber et al., 2018). Anxiety and mathematical self-efficacy were also shown to be mediated by the attitude toward mathematics variable, which was also thought to be a mediator of statistical advancement (Azar & Mahmoudi,2014). Studies by McMullan & Lea (2012) and Leppma & Darrah (2024) found that math anxiety and self-efficacy are inversely correlated. Additionally, such findings encourage the formation of a new hypothesis.

H2: Self-efficacy influences mathematical anxiety positively.

H3: Self-efficacy influences math achievement positively.

H4: Mathematical anxiety has a positive impact on math achievement.

C. Self-concept, Mathematical anxiety, Mathematics achievement.

A person's view that they can succeed in mathematics is known as their mathematics self-concept; it is their assurance that the subject can be studied (Reyes, 1984; One such study stated that self-concept is a complex and hierarchical construct that encompasses an individual's general and personal opinions of themselves (Marsh & Shavelson, 1985; Jameson & Fusco,2014).

There is a debate over whether self-efficacy or self-concept is better at predicting a person's level of math anxiety and performance, but both appear to complement each other, as several studies have shown that self-concept, especially in mathematics, includes a self-efficacy component (Jameson, 2013b; Jameson & Fusco, 2014). A recent study by Kaskens et al. (2020) provides support for the idea that children's perceptions of their mathematical abilities may affect how well they learn math and, more specifically,

how fluently they can perform arithmetic in the fourth grade. Additionally, these findings encourage the formation of a new hypothesis.

H5: Self-concept influences mathematical anxiety positively.

H6: Self-concept influences mathematics achievement positively.

4. Theoretical model and hypotheses development

The next subsections discuss the connections between the elements that are essential for the current investigation, so the proposed diagram, Figure 1, represents three independent variables, along with one mediating variable and one dependent variable.

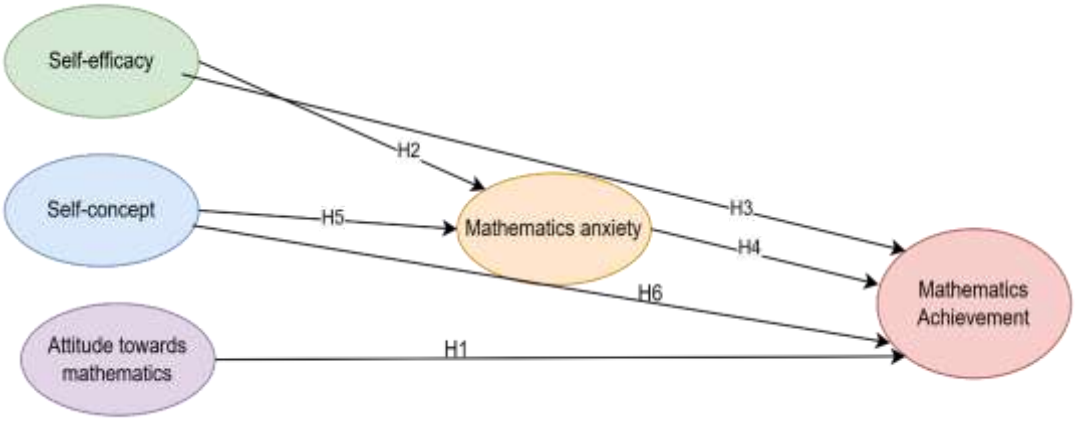


Figure 1: The proposed model.

5. Methodology

The methodology adopted by this study is quantitative. It employs a cross-sectional research design, as it is the most cost-effective method of gathering data from a large sample; this design was employed (Bryman, 2016). The study aims to develop a model for assessing mathematics achievement by identifying the factors that influence their achievement. It is useful for testing hypotheses by gathering quantitative data from the survey and performing statistical analysis. For a valid instrument for measuring the constructs presented in our study, we took help from the previously existing studies, as they had already developed validated measures to ensure their validity. The construct measuring mathematical self-efficacy by **(**Opstad & Årethun, 2019**;** Óturai, G., Riener, C., & Martiny, S. E,2023), while the other constructs like the mathematical self-concept by (Pintrich et al., 1991; Chen, X., Leung, F. K., & She, J., 2023; Timmerman et al., 2019).Mathematical anxiety by (PISA 2012; Gupta, S., Liu, C., Li, S., Chang, F., & Shi, Y.2023).Mathematical Achievement by (Yildirim, 2010; O'Neil & Abedi, 1996), and Attitude towards mathematics by(Martin et.al.,2020) as adopted scale.

For assessing the perspectives of Respondents, the 5-point Likert scale was adopted. Furthermore, the points revealed their agreement and their disagreements for each statement allotted (strongly disagree =1, disagree, neutral=3, agree = 4, and strongly agree=5) for Mathematics self-efficacy (SEF), mathematics self-concept(MSC), Attitude towards mathematics(ATT), and Mathematics Achievement (MA), while the negative was reversed only for mathematics anxiety (MAN). The online questionnaire was distributed to the target respondents via convenience sampling to realistically collect the samples available with minimal

effort. The online survey for the study was used. Students were then sent the link to the online survey, and the researchers gathered around 157 valid questionnaires. The data was analysed using Jamovi software.

6. Results

Table 2: Summary of the Descriptive and Normality of the sample

Statistic	Self-efficacy	Mathematics Self-concept	Mathematics Anxiety	Attitude towards Mathematics	Mathematics Achievement
Mean	3.14	3.18	2.83	3.21	3.30
SD	0.214	0.222	0.167	0.226	0.272
Skewness	-4.13	-4.11	-2.60	-4.34	-4.59
Kurtosis	18.4	17.7	10.2	20.5	23.9
Shapiro-Wilk W	0.503	0.464	0.761	0.472	0.479
Shapiro-Wilk p	< .001	< .001	< .001	< .001	< .001

The descriptive table shows a mean and Standard deviation score for the variables of Self-Efficacy (M = 3.14, SD = 0.214), Mathematics Self-Concept (M = 3.18, SD = 0.222), Attitude Towards Mathematics (M = 3.21, SD = 0.226), and Mathematics Achievement (M = 3.30, SD = 0.272), while Mathematics Anxiety showed a low mean score (M = 2.83, SD = 0.167).

The Shapiro-Wilk normality test shows negative skewness (-2.60 to -4.59) and high kurtosis (10.2 to 23.9) for all the above-mentioned variables. Also, the Shapiro–Wilk test was significant for all constructs ($p < .001$), indicating non-normality; thus, the data are not normally distributed. For the non- normal, the non-parametric statistics are to be analysed.

6.1 Reliability

For the consistency between the items, the reliability analysis using Fornell and Larcker (1981) criteria was conducted to get the Convergent Reliability (CR) for all the items. It should be higher than 0.70. The values of our study are 0.928 for all the items above the prescribed value.

6.2 Confirmatory Factor Analysis (CFA)

The purpose of CFA is to validate the measurement model; in this study, it comprises five latent constructs: mathematics self-efficacy (Efficacy), mathematics self-concept (Concept), mathematics anxiety (Anxiety), Attitude towards mathematics (Attitude), and mathematics achievement (Achievement). The results were considered for evaluation using their standardised factor loadings, Cronbach's alpha, Composite reliability, AVE, and model fit indices. It is recommended that in CFA analysis, the standardized loadings should be at least .50 and ideally .70 or higher (Hair et al., 2018).

Table 3: Construct measurements

Construct	Item	Standardized Factor Loading (λ)	Cronbach's Alpha (α)	Composite Reliability (CR)	AVE
Self-Efficacy	SEF1	0.554	0.836	0.879	0.652
	SEF2	0.879			
	SEF3	0.799			
	SEF4	0.785			

Mathematics Self-Concept	MSC1	0.624	0.872	0.914	0.728
	MSC2	0.862			
	MSC3	0.894			
	MSC4	0.824			
Mathematics Anxiety	Man1	0.746	0.906	0.936	0.786
	Man2	0.925			
	Man3	0.938			
	Man4	0.754			
Attitude toward Mathematics	A1	0.821	0.810	0.858	0.605
	A2	0.585			
	A3	0.502			
	A4	0.857			
Mathematics Achievement	MA1	0.659	0.809	0.855	0.599
	MA2	0.692			
	MA3	0.755			
	MA4	0.779			

For the standardized factor loading, mathematics self-efficacy, all four indicators had a positive and significant loading, that is, their p-value is less than 0.01. Among their indicators, SEF 2 shows the highest and strongest loading, while SEF 1 has the lowest loading of 0.554, but still it is above the threshold of 0.50. For the mathematics self-concept, all four indicators had a positive and significant loading, as their p-value is less than 0.01. The strongest indicator was MSC with 0.894, followed by MSC2 and MSC4, measuring their perception of abilities in mathematics. All mathematics anxiety indicators showed statistically significant factor loadings of less than $p < .001$. The highest loading was for MAN3, with a value of 0.938**,** followed by MAN2, which is 0.925. The attitude towards mathematics showed the strong factor loading with the item, such as A4 is 0.857, A1 is 0.821, A2 is 0.585, and A3 is 0.502, which was comparatively weaker but above the accepted threshold limit of 0.50. The construct of mathematics achievement showed that MA4 has the highest loading of 0.779, followed by MA3. All achievement indicators exceeded the recommended threshold of 0.50; all these indicate that the observed items represent the underlying latent variables adequately.

The internal consistency of a particular construct, which can be concluded by obtaining the Cronbach's alpha values ranging from 0.809 to 0.906, indicates good reliability across all constructs. Mathematics Anxiety has the highest reliability among all ($\alpha = 0.906$), while Mathematics Achievement showed the lowest but acceptable reliability ($\alpha = 0.809$).

The Average Variance Extracted (AVE) is used to assess the convergent validity—the degree to which a latent construct explains the variance of its observed variables. The variable Mathematics Anxiety has the highest AVE value of 0.786, followed by Mathematics Self-Concept, with an AVE value of 0.728. While the mathematics Achievement has the lowest among all, that is, an AVE value of 0.599, it is still an adequate variance extraction.

6.3 Model fit indices

Table 4: The obtained model fit indices values.

Fit Index	Obtained Value	Cut-off	Author(s) support	Decisions
χ^2/df	2.41	< 3.00	Kline (2016); Hair et al. (2019)	Acceptable Fit
p-value	< .001	> .05	Bollen (1989)	Not Supported
CFI	0.993	≥ 0.95	Hu & Bentler (1999)	Excellent Fit
TLI	0.992	≥ 0.95	Hu & Bentler (1999)	Excellent Fit
GFI	0.989	≥ 0.90	Jöreskog & Sörbom (1993)	Good Fit
AGFI	0.982	≥ 0.90	Jöreskog & Sörbom (1993)	Good Fit
SRMR	0.065	≤ 0.08	Hu & Bentler (1999)	Good Fit
RMSEA	0.095	≤ 0.08 (acceptable) ≤ 0.06 (good)	Browne & Cudeck (1993); Hu & Bentler (1999)	Marginal Fit

The measurement model of the above table gathered that the chi-square statistic was significant, with the value of A χ^2/df value = 2.41, p < .001, below 3.0 as an acceptable model fit. It also indicates a discrepancy between the observed and the covariance-based matrix model. It can happen only if the chi-squared is sensitive to the size of the sample. So, we also need to see the other indices to reach the conclusion of considering fit or not. The other indices include the Comparative Fit Index (CFI = 0.993), Tucker-Lewis Index (TLI = 0.992), the Goodness-of-Fit Index (GFI = 0.989), and the Adjusted Goodness-of-Fit Index (AGFI = 0.982). The CFI and TLI are above the cut-off value of 0.95, showing an excellent fit. Also, GFI and AGFI are above the recommended value of 0.90, showing a good fit for the model. The Standardized Root Mean Square Residual (SRMR = 0.065) is below the value of 0.08, which indicates an acceptable residual fit. Furthermore, the Root Mean Square Error of Approximation (RMSEA = 0.0947) is slightly higher than the recommended value of 0.08, a marginal fit. Nevertheless, considering the above values for CFI, TLI, GFI, AGFI, and SRMR, it can be said that the overall model fit is acceptable to good.

6.4 Hypothesis Testing

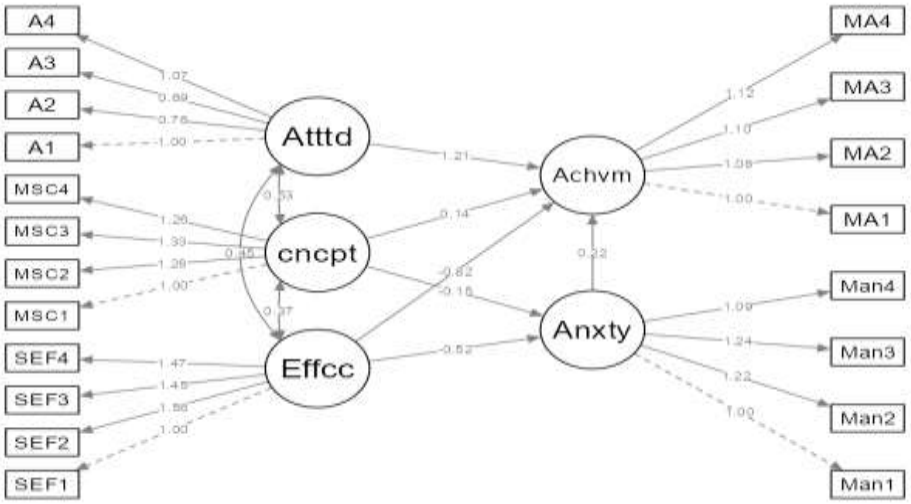
Table 5: Hypotheses Testing

Hypothesis	Paths	Estimate (β)	p-value	Result	Decision
H1	Attitude → Mathematics Achievement	1.466	< .001	Significantly Positive	Supported
H2	Self-Efficacy → Mathematics Anxiety	-0.392	.024	Significantly Negative	Supported
H3	Self-Efficacy → Mathematics Achievement	-0.662	.004	Significantly Negative	Supported
H4	Mathematics Anxiety → Mathematics Achievement	0.233	< .001	Significantly Positive	Supported
H5	Self-Concept → Mathematics Anxiety	-0.133	.444	Not Significant	Not supported

H6	Self-Concept → Mathematics Achievement	0.132	.397	Not Significant	Not supported

With the mathematics achievement, attitude toward mathematics showed a strong positive effect (β = 1.466, p < .001), and the construct of self-efficacy was significantly and positively influenced by the mathematics anxiety (β = -0.392, p = .024). Contrarily, mathematics self-concept did not influence mathematics anxiety significantly (β = -0.133, p = .444). While self-efficacy showed a significantly positive effect on mathematics achievement (β = -0.662, p = .004). Despite being significant, the direction of their relationship is opposite to the assumed effect. Similarly, mathematics self-concept did not influence mathematics achievement significantly (β = 0.132, p = .397).On the other hand, mathematics anxiety has been significantly and positively affected by mathematics achievement (β = 0.233, p < .001). Thus, all of the findings indicate that the higher level of mathematics anxiety was related to mathematics achievement in our study.

Fig 2: The testing of Hypotheses and mediation analyses in Jamovi



6.5 Mediation analysis

Table 6: The mediation analyses

Mediation Path	Direct Effect (β)	Indirect Effect (β)	p-value (Indirect)	Type of Mediation
Self-Efficacy → Mathematics Anxiety → Mathematics Achievement	-0.662**	-0.092*	.032	**Partial Mediation**
Self-Concept → Mathematics Anxiety → Mathematics Achievement	0.132	-0.031	.459	**No Mediation**

Note: p < .05 significant at 0.05 level, p < .01*** Significant at the 0.1% level.

The mediation analysis showed that Mathematics Anxiety partially mediates the relationship between Self-Efficacy and Mathematics Achievement, as the indirect effect was significant (β = -0.092, p = .032),

and the direct effect of Self-Efficacy on Mathematics Achievement was also significant (β = -0.662, p = .004). Therefore, partial mediation was seen between them. In contrast, Mathematics Anxiety did not mediate the relationship between Mathematics Self-Concept and Mathematics Achievement because the indirect effect was not significant (β = -0.031, p = .459). Thus, no mediation effect was found for the variable Mathematics Self-Concept.

7. Discussion

There is scarce literature present with all the variables integrating for the two said objectives: firstly, to find that mathematical anxiety acts as a mediating variable with self-efficacy and self-concept, which acts as an independent variable with an impact directly on the mathematics achievement, and similarly, it also tends to find the impact of attitude towards mathematics on mathematics achievement. The findings of this study show that the direct path connecting Attitude towards mathematics with mathematics achievement is positively significant, indicating that students with a favorable attitude toward mathematics are often associated with higher achievement, supported by Ural (2015) that positive attitudes towards mathematics can enhance self-efficacy, while negative attitudes may lead to an increment in anxiety and hinder students' achievement.

showed a positive association between math anxiety and math self-efficacy, but our result showed that the construct self-efficacy is positively significant with respect to mathematics anxiety and mathematics achievement as in contrast with Leppma & Darrah (2024) which states math anxiety and self-efficacy are negatively correlated, accepting its aforementioned hypotheses and suggesting that students with higher levels of self-efficacy tend to experience lower levels of mathematics anxiety because students' perceptions of their mathematical abilities did not significantly predict their anxiety levels. But the relation between mathematics anxiety and mathematics achievement was significantly positive. The self-concept was found to be not significant with respect to mathematics anxiety and mathematics achievement, contrary to the study of Akin & Güzeller (2017), which found that self-efficacy influences the self-concept of students by mediating the anxiety effect on achievement.

Our study is not free from several limitations, such as the fact that this study adopted convenience sampling and focused on a particular quantitative methodology with the analysis through structural equation modelling for mediation analysis, specified only for the undergraduate students. Future researchers are welcome to integrate other variables along with moderation for their study, adopt the qualitative or mixed methods for a longitudinal approach for in-depth insights, use probability samplings, and with a different target sample of a large size, along with different educational levels, which could be generalizable along with other theoretical frameworks.

8. Conclusion

Our study aims to examine how self-efficacy, self-concept, and attitude towards mathematics influence mathematics achievement, mediated by mathematics anxiety. Our results showed a positive influence of attitude towards mathematics, mathematics self-efficacy on mathematics achievement, and with mathematics anxiety, whereas with self-concept, mathematics anxiety, and mathematics achievement had negative relations. The partial mediation was seen between self-efficacy and mathematics achievement, with mathematics anxiety as a mediating construct. To the best of our knowledge, this is one of the most comprehensive studies focusing on different aspects influencing mathematics achievement. Therefore, these findings have an important implication for students, teachers, and policymakers to take initiative,

such as introducing an intervention program to enhance their self-efficacy and reduce mathematics anxiety. Also, teachers need to be equipped with a range of strategies to reduce mathematics anxiety among students by promoting their self-concept and other relevant factors for mathematics learning.

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