IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⋇ Peer-reviewed & Refereed journal ⋇ Vol. 12, Issue 6, June 2025

DOI: 10.17148/IARJSET.2025.12654

Mathematics Anxiety and Academic Motivation among Adolescents: A Gender-Based Study

Sukanta Koner[1]& Dr. Rumti Das[2]

Research Scholar, Department of Education, Swami Vivekananda University[1]

Assistant Professor, Department of Education, Swami Vivekananda University[2]

Abstract: Mathematics anxiety is a major psychological barrier that affects students' performance in Mathematics and has negative educational outcomes. Academic motivation refers to the mental processes that push goal-focused behavior in school settings. The present study examines the level of mathematics anxiety and academic motivation among adolescents and evaluates the association of mathematics anxiety and various subscales of academic motivation with an emphasis on gender. For this study descriptive survey research method was employed. 300 students selected for the study through purposive sampling technique as sample. Mathematics Anxiety Scale and Motivated Strategies for Learning Questionnaire were used to collect the required data. Collected data were analyzed through appropriate statistics. Mann-Whitney u tests confirm significant gender contrast in test anxiety scores, with no significant differences in other subscales, such as self-efficacy, cognitive strategy use, intrinsic value and self-regulation. Furthermore, spearman rank correlation shows significant negative correlations between mathematics anxiety and most of the academic motivation subscales, suggesting that as mathematics anxiety increases, academic motivation subscales decrease (r = -0.42, p< 0.05). In addition, linear regression reveals that total academic motivation scores for both genders significantly predict mathematics anxiety (R^2 = 0.20, p< 0.05), The results highlight the need to consider gender in educational settings and suggest the necessity of targeted interventions to address mathematics anxiety, especially among female students. This research helps to shed light on how gender impacts educational experiences and outcomes in mathematics. Consequently, the findings have implications for curriculum development and psychological interventions to improve student performance in mathematics.

Keywords: Mathematics Anxiety, Academic Motivation, Gender difference and Adolescents

I. INTRODUCTION

Mathematics anxiety is a major barrier to learning across the globe. People with Mathematics anxiety have 'feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of Mathematics problems in a wide variety of ordinary life and academic situations' (Richardson &Suinn, 1972). This anxiety also impacts students' cognitive processing, academic performance and career decisions (Ashcraft & Krause, 2007). It is a common psychological issue that causes tension, worry or fear hurting how well someone does in Mathematics problem solving (Ashcraft & Krause, 2007). This worry isn't just in head but it can make heart beat faster and cause sweating, which makes it harder to think and proceed in tackling problems (Maloney &Beilock, 2012). People think Mathematics anxiety comes from bad learning experiences, society's ideas about Mathematics, too much pressure to do well in Mathematics or a mix of these things. This leads to giving up and not wanting to study Mathematics (Beilock& Willingham, 2014). The problem is that there's a clear link between feeling anxious about Mathematics and doing well in it, the more anxious one is the worse one does (Ramirez et al., 2018). To fix this, there is a need to focus on changing how people think about Mathematics, helping them calm down and teaching Mathematics in better ways (Boaler, 2016).

Academic motivation plays a key role in shaping learning outcomes. It refers to the mental processes that push goal-focused behavior in school settings (Pintrich et al.,1993). This concept has its roots in theories like Self-Determination Theory (Deci & Ryan, 2000) and Expectancy-Value Theory (Eccles & Wigfield, 2002). It includes learning for fun (intrinsic motivation) learning for rewards (extrinsic motivation) and belief in one's skills (self-efficacy). Students who are motivated tend to stick with tasks longer, think more and manage their learning better (Zimmerman, 2000). What's more, motivation helps protect against school-related stress, including Mathematics anxiety, by building resilience and a growth mindset (Linnenbrink & Pintrich, 2002). Teaching methods that boost motivation, such as giving students more freedom focusing on progress and showing how lessons relate to real life, have been proven to increase both involvement and success in school (Hattie & Timperley, 2007).

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 6, June 2025

DOI: 10.17148/IARJSET.2025.12654

Academic motivation, which refers to the willingness to participate in learning activities, also influences Mathematics performance (Pintrich & De Groot, 1990). Students who are motivated tend to be more tenacious, use more efficient learning techniques and do better academically (Zimmerman, 2000). Gender differences in Mathematics anxiety and academic motivation have been the subject of the study. Earlier work has indicated that women typically experience greater degrees of arithmetic anxiety than men (Hembree, 1990) but later studies have provided conflicting results (Goetz et al., 2013). Contradictory results have been found regarding gender variation in academic motivation (Meece et al., 2006). Looking at how Mathematics anxiety and academic motivation are connected, both issues can be addressed simultaneously. This approach can help create a better setting for learning. For example, mindfulness exercises (Brunyé et al., 2013) and showing the value of Mathematics (Hulleman & Harackiewicz, 2009) can lower anxiety and boost motivation. These methods can lead to better Mathematics performance and make students feel more capable in Mathematics.

II. REVIEW OF RELATED LITERATURE

Participation and performance in Mathematics is greatly hampered by Mathematics anxiety. According to recent studies, between 25% and 80% of college students have some degree of Mathematics anxiety (Ramirez et al., 2018; Dowker et al., 2016). Foley et al. (2017) stated that Mathematics anxiety directly affects ‘working memory’ resources and decrease the cognitive capacity which is essential component for Mathematical problem-solving. Mathematics anxiety has been connected to a variety of environmental variables, like classroom experiences, teacher attitudes and parental influences (Maloney et al., 2021). Zakaria's (2018) Mathematics Anxiety Scale, which shows good psychometric qualities across different demographics (Ching, 2019), is becoming an increasingly used tool for assessing this concept. Mathematics anxiety interferes with cognitive processing, particularly in working memory, leading to decreased performance even among those with strong Mathematical competence (Ashcraft & Kirk, 2017). Suárez-Pellicioni et al. (2016) used neuro-imaging methods to demonstrate that Mathematics anxiety activates brain areas associated with pain and threat perception, thus causing substantial cognitive disruption during Mathematical activities. Classroom encounters greatly influence the evolution of Mathematics anxiety. Based on the research by Ramirez et al. (2018), Mathematics-anxious teachers often transmit arithmetic anxiety to their pupils. In addition, parental views on Mathematics might drastically affect a child's anxiety levels (Maloney et al., 2021). New meta-analyses have shed light on how math nervousness affects men and women differently. When Barroso et al. (2021) looked at 49 studies from 2018 to 2020, they discovered that women consistently reported more Mathematics anxiety than men and this was true at all levels of schooling. The effect sizes were small to moderate. However, Sokolowski et al. (2019) argued that these differences vary considerably across educational systems and cultures. According to Goetz et al. (2020), women reported higher trait Mathematics anxiety (general tendency) but there were no differences between men and women in state Mathematics anxiety (situational experience). This shows that gender stereotypes and societal expectations may affect how people remember the past. Zakaria's Mathematics Anxiety Scale was used in several recent research examining gender differences. Nordin et al. (2019) found the scale to be successful in capturing both the cognitive and physical aspects of Mathematical anxiety, with women scoring higher on the physiological aspect.

Self-determination theory has been used in modern studies of academic motivation in Mathematics. León et al. (2018) argued that the fulfillment of fundamental psychological needs—autonomy, competence and relatedness—greatly predicts intrinsic motivation in Mathematics. Researchers have also highlighted Mindset. Burnette et al. (2020) found that interventions promoting a growth mindset boosted motivation, particularly for students with severe Mathematics anxiety. “The Motivated Strategies for Learning Questionnaire”(MSLQ) has recently been administered in Mathematics education, where it has proven to be a valuable instrument in capturing several aspects of motivation. Sun et al. (2022) used the MSLQ to identify motivational profiles among Mathematics students, which displayed distinct variations in intrinsic/extrinsic motivation, self-efficacy and task value, and forecasted different learning outcomes. More and more subtle trends have been found in research about how gender affects desire to do well in school. Lazarides and Lauermann (2019) found that gender differences in interest and utility value for Mathematics favoured males, but self-concept and teacher expectations offset these differences. Hampton and Mason (2017) found that women tended to have higher mastery objectives but lower Mathematics self-efficacy than men. In Mathematical settings, Liou and Bulut (2020) found that gender differences were primarily observed in task value and test anxiety components, and few differences in intrinsic goal orientation. Interestingly, they found that classroom goal structures influenced these variations, suggesting contextual factors on gendered motivational tendencies.

Several research has been drawn to the interaction between Mathematics anxiety and academic motivation. Van Beek et al. (2017) demonstrated a reciprocal relationship in which Mathematics anxiety predicted future intrinsic motivation negatively, which in turn predicted more anxiety. Dowker et al. (2019) found that Mathematics self-concept partly

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mediated this link. Several recent researches have also investigated whether there might be gender differences in these associations. Skaalvik (2018) found that women were more likely to be predicted to avoid motivation by arithmetic fear more than men. However, Chang and Beilock (2020) found that men were more adversely affected by the link of Mathematics anxiety and self-efficacy, perhaps Mathematics achievement is more strongly tied to masculine identity. In particular, Hill et al. (2018) found that Mathematics anxiety predicted the value component of motivation differently by gender, with more negative correlations for women than men. In contrast, Klee and Miller (2019) found that gender did not moderate the correlation between Mathematical anxiety and effort control, a behavioral component of motivation. Linear regression models have been used to study how Mathematics anxiety predicts different academic outcomes. Mathematics anxiety explained more than 18% of the variance in Mathematics avoidance behaviors (Hwang & Ham, 2021). Similarly, Luttenberger et al. (2018) demonstrated that, even after controlling for prior performance, Mathematics anxiety was a robust predictor of lower participation in advanced Mathematics courses. Previous studies have shown that Mathematics anxiety can reduce engagement and performance (Ashcraft & Ridley, 2005; Foley et al, 2017). In contrast to other factors, academic motivation, including qualities like self-efficacy and intrinsic value, has been shown to provide a buffer against anxiety. Moreover, studies on gender have yielded conflicting results. Some research indicates that females are more math anxious than males (Devine et al, 2012), but others argue that these differences are diminishing as a result of changes in educational paradigms. This research contributes to the literature by examining contemporary adolescent experiences in terms of gender.

While there has been research on Mathematics anxiety and academic motivation independently, and especially in relation to gender, there has been less research on the relationship between these two concepts. This gap is noteworthy as knowing how academic ambition affects Mathematics anxiety differently across genders should inform focused therapies.

III. RESEARCH OBJECTIVES

- To assess the levels of Mathematics Anxiety and Academic Motivation among adolescents.
- To compare Mathematics Anxiety and Academic Motivation between male and female adolescents.
- To examine the relationship between Mathematics Anxiety and Academic Motivation with respect to gender.
- To determine whether facets of Academic Motivation predict Mathematics Anxiety.

IV. HYPOTHESES

$H_0$1 There is no significant difference of Mathematics anxiety between male and female adolescents.

$H_0$2 There is no significant difference of academic motivation between male and female adolescents.

$H_0$2.1 There is no significant difference of Self-Efficacy between male and female adolescents.
$H_0$2.2 There is no significant difference of Intrinsic Value between male and female adolescents.
$H_0$2.3 There is no significant difference of Test Anxiety between male and female adolescents.
$H_0$2.4 There is no significant difference of Cognitive Strategy Use between male and female adolescents.
$H_0$2.5 There is no significant difference of Self-Regulation between male and female adolescents.

$H_0$3 There is no significant relationship between Mathematics anxiety and academic motivation of adolescents.

$H_0$3.1 There is no significant relationship between Mathematics anxiety and academic motivation of male adolescents in Anglo Indian schools.
$H_0$3.2 There is no significant relationship between Mathematics anxiety and academic motivation of female adolescents in Anglo Indian schools.
$H_0$3.3 There is no significant relationship between Mathematics anxiety and self- efficacy of adolescents in Anglo Indian schools.
$H_0$3.4 There is no significant relationship between Mathematics anxiety and self- efficacy of male adolescents in Anglo Indian schools.
$H_0$3.5 There is no significant relationship between Mathematics anxiety and self- efficacy of female adolescents in Anglo Indian schools.
$H_0$3.6 There is no significant relationship between Mathematics anxiety and intrinsic value of adolescents in Anglo Indian schools.
$H_0$3.7 There is no significant relationship between Mathematics anxiety and intrinsic value of male adolescents in Anglo Indian schools.
$H_0$3.8 There is no significant relationship between Mathematics anxiety and intrinsic value of female adolescents in Anglo Indian schools.

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$H_0$3.9 There is no significant relationship between Mathematics anxiety and test anxiety of adolescents in Anglo Indian schools.

$H_0$5.10 There is no significant relationship between Mathematics anxiety and test anxiety of male adolescents in Anglo Indian schools.

$H_0$5.11 There is no significant relationship between Mathematics anxiety and test anxiety of female adolescents in Anglo Indian schools.

$H_0$3.12 There is no significant relationship between Mathematics anxiety and cognitive strategy use of adolescents in Anglo Indian schools.

$H_0$3.13 There is no significant relationship between Mathematics anxiety and cognitive strategy use of male adolescents in Anglo Indian schools.

$H_0$3.14 There is no significant relationship between Mathematics anxiety and cognitive strategy use of female adolescents in Anglo Indian schools.

$H_0$3.15 There is no significant relationship between Mathematics anxiety and self-regulation of adolescents in Anglo Indian schools.

$H_0$3.16 There is no significant relationship between Mathematics anxiety and self-regulation of male adolescents in Anglo Indian schools.

$H_0$3.17 There is no significant relationship between Mathematics anxiety and self-regulation of female adolescents in Anglo Indian schools.

$H_0$4 Academic motivation does not predict Mathematics anxiety of adolescents in Anglo Indian schools.

$H_0$4.1 Academic motivation does not predict Mathematics anxiety of male adolescents in Anglo Indian schools.

$H_0$4.2 Academic motivation does not predict Mathematics anxiety of female adolescents in Anglo Indian schools.

V. METHODOLOGY

Using a quantitative Correlational study design, descriptive survey method was employed for the present study. Given that the study is concerned with assessing relationships among variable, this design is appropriate. The study follows a systematic procedure for data collection and analysis, being careful with sampling, instrumentation and statistical approaches.

VARIABLES

Major variable: Academic motivation and Mathematics anxiety
Categorical variable: Gender

POPULATION

The target population for this present study is the adolescents aged 15-16 years, both boys and girls studying in Anglo-Indian schools in the district Hooghly of West Bengal, India.

SAMPLE AND SAMPLING STRATEGY

The sample for the study was 300 students of Anglo-Indian schools inHooghly district of West Bengal. Purposive sampling technique is used to select the sample.

RESEARCH TOOLS

- Mathematics Anxiety Scale (MAS; Zakaria, 2018):

The instrument consists of 21 items measuring Mathematics anxiety across two dimensions: 'learning Mathematics anxiety (LMA)' (11 items) and 'perception of difficulty and motivation (PDM)' (10 items). Each item was rated on a 5-point Likert scale, with 1 denoting "strongly disagree" and 5 denoting "strongly agree." The Mathematics Anxiety Scale has shown strong construct validity by correlating significantly with other measures of anxiety and fear, especially in academic settings and the scale has demonstrated strong reliability (Cronbach's alpha = 0.88 for the overall scale). Items can be summed within each dimension and can also be summed to provide an overall Mathematics anxiety score. Scores on Mathematics anxiety are higher, indicating greater Mathematics anxiety.

- "Motivated Strategies for Learning Questionnaire" (MSLQ):

Academic motivation was assessed using the MSLQ (Pintrich et al., 1991; adapted version). The motivation section has 44 items spread across five subscales: 'Self-Efficacy' (9 items), 'Intrinsic Value' (9 items), 'Test Anxiety' (4 items), 'Cognitive Strategy Use' (13 items), and 'Self-Regulation' (9 items).Items are rated on a 7-point Likert scale from 1

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(not at all true of me) to 7 (very true of me). The MSLQ has been widely validated in educational contexts (Credé & Phillips, 2011), including strong reliability coefficients for the motivation subscales (α = 0.62–0.93).

Response format: 7-point Likert scale (1 = not at all true of me to 7 = very true of me). Scores across the 'Self-Efficacy', 'Intrinsic Value', 'Test Anxiety', 'Cognitive Strategy Use' and 'Self-Regulation' subscales were averaged to calculate an overall academic motivation score.

VI. DATA ANALYSIS AND INTERPRETATION

Table I Tests of normality

Variable		Shapiro-Wilk		
		Statistic	df	Sig.
MA	Whole	.977	300	.000
	Male	.966	111	.000
	Female	.979	189	.000
AM	Whole	.946	300	.000
	Male	.946	111	.000
	Female	.958	189	.000

The normality tests shows that Mathematics Anxiety (MA) scores and Academic Motivation (AM) scores deviate from normality for almost all the groups ($p < .05$), indicating non-normal distributions. These results justify using non-parametric tests for analysis of data.

To fulfill **objective 1**, Descriptive statistics were computed for Mathematics Anxiety (M.A.) and Academic Motivation (A.M.) of Adolescents of Anglo-Indian schools with regard to their gender.

Table II Descriptive Statistics

Variable	Gender	Mean	Median	SD	Skewness	Kurtosis	Q_1	Q_3
M.A.	Total	58.04	57.00	20.61	0.17	-0.79	43	74
	Male	55.72	54.0	21.27	0.16	-0.81	40.0	72
	Female	59.40	58	20.14	0.18	-0.78	43	74
A.M.	Total	5.17	5.23	0.68	-1.07	2.37	4.84	5.64
	Male	5.07	5.09	0.79	-1.10	2.73	4.59	5.55
	Female	5.24	5.25	0.60	-0.86	1.60	4.95	5.64

Women (M = 59.40) indicate slightly more Mathematics Anxiety than men (M = 55.72), but the difference is small in comparison to the standard deviations for both groups. In case of Academic Motivation, women (M = 5.24) also scored slightly higher than men (M = 5.07). Mathematics anxiety is distributed broadly, somewhat right skewed, and mildly platykurtic, indicating variability but no major outliers. The Kurtosis of Male Academic Motivation is 2.73, indicating that it is more peaked and left-skewed, suggesting clustering around the mean with a few higher-end outliers. Gender differences are small, with women being more motivated and anxious.

Table III Level of Mathematics anxiety

level	Range	No. of students	Percentage of students
low	≤49	104	34.7
Medium	50-77	112	37.3
High	>78	84	28.0

From the above table it can be depicted that a majority of students (37.3 %) experience medium levels of Mathematics anxiety (scores 50-77), 34.7 % have low anxiety (<49) and 28% have high anxiety (>78).

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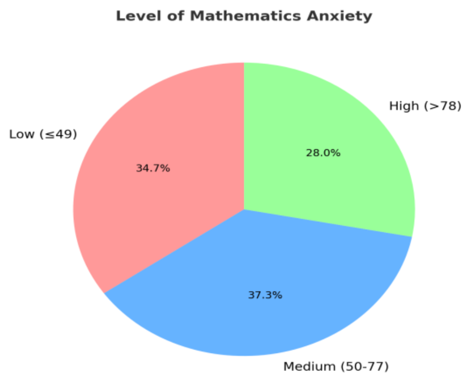

Figure 1 percentage level of Mathematics anxiety

Table IV Level of Academic Motivation

level	Range	No. of students	Percentage of students
low	<4.5	40	13
Medium	4.6-5.8	218	73
High	>5.8	42	14

For academic motivation, the majority (73%) of students score in the medium range (scores 4.6–5.8), with smaller proportions having low (<4.5, 13%) and high (>5.8, 14%) motivation.

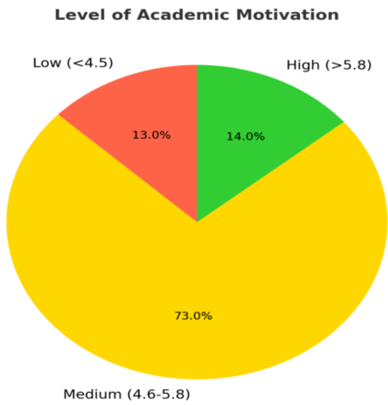

Figure 2 percentage level of Academic motivation

This means that Mathematics anxiety is fairly common at the moderate level, but students tend to have medium academic motivation, and extreme levels (low or high) are relatively rare in both categories.

Objective 2 was fulfilled through Mann-Whitney u test. Gender Differences in Mathematics Anxiety and Academic Motivation is depicted in the below table:

Table V Gender difference in Mathematics Anxiety and Academic Motivation

Hypotheses	Subscale	U Statistic	p-Value	Status
$H_0$1	Mathematics Anxiety	9456.5	0.155	Retained
$H_0$2	Academic Motivation	9078.0	0.052	Retained
$H_0$2.1	Self-Efficacy	105735	0.908	Retained
$H_0$2.2	Intrinsic Value	9466.5	0.158	Retained

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Hypotheses	Subscale	U Statistic	p-Value	Status
$H_0 2.3$	Test Anxiety	8250.5	0.002	Rejected
$H_0 2.4$	Cognitive Strategy Use	9347.5	0.115	Retained
$H_0 2.5$	Self-Regulation	9432.5	0.145	Retained

Results from the Mann-Whitney U test showed that there were no statistically significant gender differences in Mathematics anxiety and academic motivation. Across most subscales of academic motivation, including self-efficacy, intrinsic value, cognitive strategy use and self-regulation, as all p-values are greater than 0.05. Therefore, $H_0 1$ remain retained, therefore Mathematics anxiety between male and female adolescents is not significantly different. $H_0 2$, $H_0 2.1$, $H_0 2.2$, $H_0 2.4$ and $H_0 2.5$ also remain retained. There is also no significant difference found between male and female adolescents with regard to academic motivation, self-efficacy, intrinsic value, cognitive strategy use and self-regulation. However statistical analysis of test anxiety scores revealed a significant difference ($U = 8250.5$, $p = 0.002$), suggesting that male and female students experience different levels of test anxiety.

Objective 3 was to examine the relationship between Mathematics Anxiety and Academic Motivation with respect to gender. To find out the relationship between these two variables spearman's rank correlation was employed.

Table VI Correlation between Mathematics Anxiety and Academic Motivation

Hypotheses	Variable	Categorical Variable	Correlation Coefficient	p value	Status
$H_0 3$	Mathematics Anxiety and Academic motivation	Total	-0.4190	.000	Rejected
$H_0 3.1$	Mathematics Anxiety and Academic motivation	Male	-0.4276	.000	Rejected
$H_0 3.2$	Mathematics Anxiety and Academic motivation	Female	-0.4493	.000	Rejected
$H_0 3.3$	Mathematics Anxiety Score and Self Efficacy	Total	-0.4976	.000	Rejected
$H_0 3.4$	Mathematics Anxiety Score and Self Efficacy	Male	-0.5150	.000	Rejected
$H_0 3.5$	Mathematics Anxiety Score and Self Efficacy	Female	-0.4922	.000	Rejected
$H_0 3.6$	Mathematics Anxiety Score and Intrinsic Value	Total	-0.3610	.000	Rejected
$H_0 3.7$	Mathematics Anxiety Score and Intrinsic Value	Male	-0.3134	.000	Rejected
$H_0 3.8$	Mathematics Anxiety Score and Intrinsic Value	Female	-0.4031	.000	Rejected
$H_0 3.9$	Mathematics Anxiety Score and Test Anxiety	Total	0.4246	.000	Rejected
$H_0 3.10$	Mathematics Anxiety Score and Test Anxiety	Male	0.3726	.000	Rejected
$H_0 3.11$	Mathematics Anxiety Score and Test Anxiety	Female	0.4339	.000	Rejected
$H_0 3.12$	Mathematics Anxiety Score and Cognitive Strategy Use	Total	-0.2924	.000	Rejected
$H_0 3.13$	Mathematics Anxiety Score and Cognitive Strategy Use	Male	-0.3324	.000	Rejected
$H_0 3.14$	Mathematics Anxiety Score and Cognitive Strategy Use	Female	-0.2919	.000	Rejected
$H_0 3.15$	Mathematics Anxiety Score and Self-Regulation	Total	-0.5320	.000	Rejected
$H_0 3.16$	Mathematics Anxiety Score and Self-Regulation	Male	-0.5568	.000	Rejected

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

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Hypotheses	Variable	Categorical Variable	Correlation Coefficient	p value	Status
$H_0$3.17	Mathematics Anxiety Score and Self-Regulation	Female	-0.5273	.000	Rejected

Spearman correlation analysis showed significant relationships between Mathematics anxiety, academic motivation and subscales of academic motivation across the total sample and both genders. In general, total academic motivation was negatively correlated with Mathematics anxiety (ρ = -0.419, p < .05), meaning that those with greater academic motivation will have lower Mathematics anxiety. All correlations were significant (p < .05), and this pattern was consistent for both males (ρ = -0.428) and females (ρ = -0.439). Therefore, there is no significant relationship between Mathematics anxiety, academic motivation and all the dimensions of academic motivation of adolescents (whole group and gender wise).The strongest negative correlations with Mathematics anxiety were observed for self-regulation (ρ = -0.532) and self-efficacy (ρ = -0.498), suggesting that students who are more self-regulated and confident tend to experience less Mathematics anxiety. Significant associations were also found for intrinsic value, cognitive strategy use and test anxiety, where test anxiety was positively related (ρ = 0.425), meaning that students with higher Mathematics anxiety also report higher general test anxiety. Females showed slightly stronger relationships with most of the variables, suggesting subtle gender differences in how motivation components are related to Mathematics anxiety. Overall, the results highlight the need for promoting self-regulated learning, intrinsic value, cognitive strategy use and self-efficacy to reduce Mathematics anxiety in students.

Objective 4 was fulfilled by using linear regression. Predictive Relationship Between Mathematics Anxiety and Academic Motivation of whole group presented below.

Table VII Model Summary of whole group (Academic Motivation and Mathematics Anxiety)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.42[a]	0.20	0.20	18.71

a. Predictors: (Constant): Academic Motivation, b. Dependent Variable: Mathematics Anxiety

Table VIII ANOVA of whole group

Model		Sum of Square	df	Mean Square	F	Sig.
1	Regression	22703.55	1	22703.55	64.88	.000[b]
	Residual	104277.05	298	349.92		
	Total	126980.60	299			

a. Dependent Variable: Mathematics Anxiety, b. Predictors: (Constant): Academic Motivation

Table IX Regression Coefficients of whole group

Model		Un-standardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	Constant	86.38	3.00		28.79	.000
	Academic Motivation	-5.98	0.74	-0.42	-8.05	.000

a. Dependent Variable: Mathematics Anxiety

Table 7 shows that the R Square = 0.20, which indicates that 20% variance in the Mathematics Anxiety is due to level of Academic Motivation. Table 8 reveals that the value of F (1, 298) = 64.88, p < 0.05, so, $H_0$4 is rejected at the 0.05 level of significance. This denotes that Academic Motivation of adolescents could significantly predict their Mathematics anxiety. From the table 9 it has been found that un-standardized coefficient B = -5.98, p <0.05, which indicates that academic motivation negatively and significantly contributes to the mathematics anxiety of adolescents. If the value of Academic Motivation increases by one unit, then the value of Mathematics Anxiety would expect to decreases by 5.98 units. This suggests that, as a function of the negative slope, there is lower Mathematics anxiety related to higher levels of academic motivation.

Regression Equation:

$Y = 86.38 - 5.98\, X_1$

Where, Y= Mathematics Anxiety (dependent variable), X_1= Academic Motivation (independent variable)

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Table X Model Summary of Male Adolescents (Academic Motivation and Mathematics Anxiety)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.43[a]	0.18	0.17	19.28

a. Predictors: (Constant): Academic Motivation, b. Dependent Variable: Mathematics Anxiety

Table XI ANOVA of Male Adolescents

Model		Sum of Square	df	Mean Square	F	Sig.
1	Regression	9,226.95	1	9,226.95	24.81	.000[b]
	Residual	40,531.39	109	371.85		
	Total	49,758.34	110			

a. Dependent Variable: Mathematics Anxiety, b. Predictors: (Constant): Academic Motivation

Table XII Regression Coefficients of Male Adolescents

Model		Un-standardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	Constant	82.79	4.70		17.61	.000
	Academic Motivation	-5.18	1.04	-0.43	-4.98	.000

a. Dependent Variable: Mathematics Anxiety

Table 10 shows that the R Square = 0.18, which indicates that 18% variance in the Mathematics Anxiety is due to level of Academic Motivation. Table 11 reveals that the value of F (1, 109) = 24.81, $p < 0.05$, so, $H_0$4.1 is rejected at the 0.05 level of significance. This denotes that Academic Motivation of male adolescents could significantly predict their Mathematics anxiety. From the table 12 it has been found that un-standardized coefficient B= -5.18, $p < 0.05$, which indicates that academic motivation negatively and significantly contributes to the mathematics anxiety of male adolescents. If the value of Academic Motivation increases by one unit, then the value of Mathematics Anxiety would expect to decreases by 5.18 units. This suggests that, as a function of the negative slope, there is lower Mathematics anxiety related to higher levels of academic motivation.

Regression Equation:
$Y= 82.79 - 5.18X_1$
Where, Y= Mathematics Anxiety (dependent variable), X_1= Academic Motivation (independent variable)

Table XIII Model Summary of Female Adolescents (Academic Motivation and Mathematics Anxiety)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.45	0.20	0.20	18.01

a. Predictors: (Constant): Academic Motivation, b. Dependent Variable: Mathematics Anxiety

Table XIV ANOVA of Female Adolescents

Model		Sum of Square	df	Mean Square	F	Sig.
1	Regression	15628.73	1	15628.73	48.19	.000[b]
	Residual	60648.50	187	324.32		
	Total	76277.24	188			

a. Dependent Variable: Mathematics Anxiety, b. Predictors: (Constant): Academic Motivation

Table XV Regression Coefficients of Female Adolescents

Model		Un-standardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	Constant	87.13	3.40		25.63	.000
	Academic Motivation	-5.80	0.83	-0.45	-6.94	.000

a. Dependent Variable: Mathematics Anxiety

DOI: 10.17148/IARJSET.2025.12654

Table 13 shows that the R Square = 0.20, which indicates that 20% variance in the Mathematics Anxiety is due to level of Academic Motivation. Table 14 reveals that the value of F (1, 187) = 48.19, $p < 0.05$, so, $H_0 4.2$ is rejected at the 0.05 level of significance. This denotes that Academic Motivation of female adolescents could significantly predict their Mathematics anxiety. From the table 15 it has been found that un-standardized coefficient B= -5.80, p <0.05, which indicates that academic motivation negatively and significantly contributes to the mathematics anxiety of female adolescents. If the value of Academic Motivation increases by one unit, then the value of Mathematics Anxiety would expect to decreases by 5.80 units. This suggests that, as a function of the negative slope, there is lower Mathematics anxiety related to higher levels of academic motivation in female adolescents.

Regression Equation:
$Y = 87.13 - 5.80 X_1$
Where, Y= Mathematics Anxiety (dependent variable), X_1= Academic Motivation (independent variable).

VII. DISCUSSION

The latest findings support and expand the connection between mathematics anxiety (MA) and academic motivation (AM). As previous research by Ramirez et al., 2018 and Barroso et al., 2021, results show girls report higher MA levels (M = 59.40 compared to boys M = 55.72), but this difference lacks statistical significance (U = 9456.5, p = 0.155). This aligns with Goetz et al. (2020) observation that while gender differences in MA exist, they might be smaller than previously assumed. The full-scale gender difference in test anxiety (U = 8250.5 p = 0.002) backs up Skaalvik (2018) research indicating boys may experience more stress related to test in mathematical contexts. The strong negative link between MA and AM (ρ = - 0.42 $p < 0.05$) backs up Van Beek et al. (2017) two-way model showing how anxiety and motivation are related to each other. Self-regulation (ρ = - 0.53) and self-efficacy (ρ = - 0.50) both had the maximum negative correlation with MA. This supports León et al. (2018) focus on competence beliefs to reduce stress. But the findings clash with Hill et al. (2018) results. Similar correlation pattern across genders is found which points to cultural or growth differences in these connections.

The regression analysis (R^2 = 0.20 p <.05) backs up AM's ability to predict MA, which aligns with findings of Hwang & Ham, 2021. More research is required to explore this further. Interestingly, results support the general negative MA-AM relationship has also seen in Western contexts (Ashcraft & Krause, 2007). However, the small effect sizes hint that other cultural or situational factors might be at work in Anglo Indian schools.

These subtle results show why it's crucial to look at both standard approaches and specific differences based on context when studying MA. The results particularly emphasize the central role of self-regulatory and efficacy beliefs in managing MA, regardless of gender, while suggesting test anxiety may represent a distinct dimension requiring targeted intervention, especially for male students.

VIII. EDUCATIONAL IMPLICATIONS

The findings of this study highlight several critical implications for educators and policymakers. The significant gender difference in test anxiety suggests that male students may benefit from targeted interventions such as stress-management workshops and mindfulness training to reduce anxiety during assessments (Brunyé et al., 2013). The strong negative correlation between academic motivation (particularly self-efficacy and self-regulation) and mathematics anxiety underscores the importance of fostering these traits in the classroom. Teachers should integrate meta-cognitive strategies and growth mindset approaches (Boaler, 2016) to help students build confidence and resilience in Mathematics. Additionally, pedagogical practices that emphasize intrinsic motivation, such as connecting mathematical concepts to real-world applications (Hulleman & Harackiewicz, 2009) could reduce anxiety and enhance engagement. Professional development for teachers is also essential to ensure the unintended passing of anxiety (Ramirez et al., 2020) and to create supportive low-stress learning environments.

IX. CONCLUSION

This study gives valuable insights into the association among mathematics anxiety (MA) and academic motivation (AM) in adolescents. While no significant gender variations had been revealed in general MA and AM levels, females showed higher score in both variables, aside from test anxiety, wherein male revealed additional susceptibility. The consistent negative correlation among MA and AM (ρ = -0.42), in particular with self-regulation (ρ = -0.53) and self-efficacy (ρ = -0.50), highlights the protective role of motivational factors toward reducing of anxiety. Regression analysis revealed that AM accounts for 20% of MA variance, with a marginally extra influence among female students

DOI: 10.17148/IARJSET.2025.12654

(β = -5.80) compared to males (β = -5.18).These findings dynamics of cognitive and affective factors in mathematics learning, suggesting students' motivational resources significantly alternate their experience of mathematics-related anxiety. The results contribute to understanding of how psychological factors play in academic contexts, particularly in STEM discipline where anxiety hinders achievement and participation. The study will definitely strengthen its contribution to the literature on mathematics education and well-being of students.

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IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 6, June 2025

DOI: 10.17148/IARJSET.2025.12654

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