
Influence of Demographic Variables on Reasoning Ability, Academic Stress and Achievement in Mathematics

G. Sathishkumar¹, Dr. R. Sengamalam ²

¹ Research Scholar in Education,

Madurai Kamaraj University, Madurai, India.

² Assistant Professor, Department of Education, DDE,

Madurai Kamaraj University, Madurai, India.

Abstract

The present study investigates the influence of demographic variables on reasoning ability, academic stress and achievement in mathematics among higher secondary school students. Mathematics achievement is considered as one of the most important indicators of academic success because it reflects students' logical thinking, analytical skills and problem-solving capacity. However, several demographic and psychological factors influence students' mathematical performance. This study specifically examines how gender, locality, type of school, parental educational qualification and family income affect reasoning ability, academic stress and mathematics achievement. This study adopts a quantitative research approach using the descriptive survey method. A sample of 310 higher secondary students were selected using stratified random sampling techniques. Standardized tools were used to measure reasoning ability, academic stress and mathematics achievement. Statistical techniques such as mean, standard deviation, t-test, ANOVA, correlation analysis and regression analysis were employed for data analysis. The findings revealed that demographic variables significantly influenced students' reasoning ability, academic stress and mathematics achievement. Male students demonstrated comparatively higher reasoning ability and mathematics achievement, whereas female students experienced greater academic stress. Urban and private school students exhibited higher mathematics achievement than rural and government school students. Parental educational qualification and family income also significantly influenced the study variables. The study concluded that demographic and environmental factors play an important role in shaping students' cognitive abilities, stress levels and academic achievement. Educational institutions should therefore develop supportive academic environments that address students' diverse demographic backgrounds.

Keywords: Reasoning ability, academic stress, mathematics achievement, demographic variables, higher secondary students, educational psychology

Introduction

Mathematics is universally recognized as one of the most fundamental disciplines in education because it develops logical thinking, analytical reasoning, critical judgment and problem-solving skills among students. Achievement in mathematics is considered a major indicator of academic success and intellectual competence. Mathematics not only supports scientific and technological advancement but also enhances students' cognitive flexibility and decision-making abilities in everyday life. Consequently, mathematics achievement has become an important area of investigation in educational psychology and pedagogy. In modern educational systems, mathematics plays a vital role in determining students' future academic and professional opportunities. Students who demonstrate higher achievement in mathematics are more likely to pursue careers in science, technology, engineering,



economics and data-oriented disciplines. However, despite the significance of mathematics education, many students experience difficulties in learning mathematics due to psychological, cognitive, environmental and demographic factors. Researchers increasingly emphasize that mathematics achievement cannot be explained solely through intelligence or classroom instruction because multiple interacting variables influence students' academic performance (Breit et al., 2025). Among the cognitive variables influencing mathematics achievement, reasoning ability is considered one of the most powerful predictors of mathematical success. Reasoning ability refers to the mental capacity to analyse information, identify relationships, interpret patterns, evaluate evidence and draw logical conclusions. Mathematical learning fundamentally depends on reasoning processes such as inductive reasoning, deductive reasoning, abstract thinking and analytical problem solving. Students with strong reasoning ability generally demonstrate superior understanding of mathematical concepts and perform effectively in mathematical problem-solving situations (Kurdal, 2025).

Educational psychologists argue that reasoning ability facilitates conceptual understanding and enhances students' capacity to apply mathematical knowledge in unfamiliar situations. Piaget's cognitive developmental theory explains that formal operational thinking enables adolescents to engage in abstract reasoning and hypothetical problem solving, which are essential for mathematics learning. Similarly, Vygotsky emphasized the importance of social and cognitive interactions in intellectual development, suggesting that reasoning skills can be strengthened through guided educational experiences and collaborative learning environments (Schunk, 2020). In recent years, academic stress has emerged as another major factor affecting students' academic achievement. Academic stress refers to the psychological strain experienced by students due to examination pressure, excessive workload, fear of failure, parental expectations, competition and academic demands. Moderate levels of stress may motivate students toward better performance; however, excessive stress negatively affects emotional well-being, concentration, memory retention and academic engagement. Students experiencing high levels of academic stress often struggle with mathematical problem solving because stress interferes with working memory and cognitive processing abilities (Almarzouki et al., 2024). Research studies consistently indicate that mathematics is one of the subjects most strongly associated with stress and anxiety among school students. Mathematics anxiety, examination fear and performance pressure reduce students' confidence and academic participation, thereby lowering mathematics achievement. Ma (2025) reported that students with high mathematics anxiety demonstrated significantly lower academic achievement in mathematics compared to students with lower stress levels. Academic stress therefore acts as a major barrier to effective learning and cognitive performance. Apart from cognitive and emotional variables, demographic characteristics also influence students' academic experiences and performance. Variables such as gender, locality, type of school, parental educational qualification, socioeconomic status and family environment shape students' educational opportunities and psychological development. Educational researchers increasingly acknowledge that demographic variables contribute significantly to variations in reasoning ability, academic stress and mathematics achievement among students.

Gender differences in mathematics achievement have been widely examined in educational research. Some studies indicate that male students exhibit higher confidence and reasoning performance in mathematics, whereas female students often experience greater mathematics anxiety and academic stress due to societal expectations and emotional sensitivity (Putwain, 2019). However, contemporary researchers argue that such differences are influenced more by socialization and educational opportunities than by biological factors. Similarly, locality plays an important role in shaping academic achievement. Urban students generally receive better educational resources, access to technology, coaching facilities and academic support systems compared to rural students. Rural students may face challenges such as limited educational infrastructure, lack of qualified teachers and restricted access to digital learning resources. These disparities significantly affect reasoning development and mathematics achievement. The type of school also influences students' cognitive and academic development. Private schools often provide advanced instructional strategies, technological integration, individualized attention and enriched



learning environments, whereas government schools may experience limitations related to infrastructure and resource availability. Consequently, students studying in different school systems may differ in reasoning ability, stress levels and mathematics achievement.

Parental educational qualification and family income are additional demographic variables that strongly influence academic performance. Parents with higher educational backgrounds are generally more capable of providing academic guidance, intellectual stimulation, emotional support and educational resources to their children. Similarly, economically stable families can provide better learning environments, educational materials and technological support, which positively contribute to academic achievement and reasoning development (Bandura, 1986). Recent educational research emphasizes the interaction between cognitive, emotional and demographic factors in determining academic achievement. Contemporary educational theories argue that academic success is multidimensional and influenced by both internal psychological characteristics and external environmental conditions. Therefore, understanding the influence of demographic variables on reasoning ability, academic stress and mathematics achievement is essential for developing equitable educational policies and effective teaching practices.

The present study attempts to examine the influence of demographic variables on reasoning ability, academic stress and mathematics achievement among higher secondary students. The study is expected to provide valuable insights into how students' background characteristics shape their cognitive abilities, emotional well-being and academic outcomes. The findings may help teachers, parents, counsellors and policymakers create supportive educational environments that promote both academic excellence and psychological well-being among students.

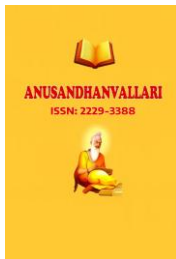
Need for the Study

The increasing academic competition in schools has created considerable stress among students, especially in mathematics learning. Many students perceive mathematics as a difficult and stressful subject due to its abstract concepts, formulas and problem-solving requirements. At the same time, reasoning ability plays a crucial role in mathematical understanding and achievement. Students with stronger reasoning skills are generally expected to perform better in mathematics. However, students' cognitive abilities and stress levels are significantly shaped by demographic conditions. Educational opportunities differ across gender, locality, school type, parental education and economic status. Students from urban areas may receive better educational resources and technological support than rural students. Similarly, parental educational qualification and family income may influence students' learning environments and academic aspirations.

The significance of the present study lies in its attempt to examine how demographic variables influence reasoning ability, academic stress and mathematics achievement simultaneously. The study is important for teachers because it helps identify demographic disparities in academic performance and stress experiences. It is also useful for school administrators and policymakers in designing educational interventions that support students from disadvantaged backgrounds. Further, the study contributes to educational psychology literature by integrating demographic, cognitive and emotional variables within a single framework. The findings may help educators develop stress-free learning environments and equitable educational opportunities for all students.

Objectives of the Study

1. To examine the influence of gender on reasoning ability, academic stress and mathematics achievement among the select sample of the study



2. To study the influence of type of school on reasoning ability, academic stress and mathematics achievement among the select sample of the study
3. To investigate the influence of locality on reasoning ability, academic stress and mathematics achievement among the select sample of the study
4. To analyze the influence of parental educational qualification on reasoning ability, academic stress and mathematics achievement among the select sample of the study
5. To determine the influence of family income on reasoning ability, academic stress and mathematics achievement among the select sample of the study
6. To identify the relationship among reasoning ability, academic stress and mathematics achievement among the higher secondary students of the study.

Hypotheses of the Study

1. There is no significant difference in reasoning ability, academic stress and mathematics achievement of select sample based on gender.
2. There is no significant difference in reasoning ability, academic stress and mathematics achievement of select sample based on type of school.
3. There is no significant difference in reasoning ability, academic stress and mathematics achievement of select sample based on locality.
4. There is no significant difference in reasoning ability, academic stress and mathematics achievement of select sample based on parental educational qualification.
5. There is no significant difference in reasoning ability, academic stress and mathematics achievement of select sample based on family income.
6. There is a significant relationship among reasoning ability, academic stress and mathematics achievement of higher secondary students of the study.

Review of Related Literature

Reasoning Ability and Mathematics Achievement

Reasoning ability is considered as one of the strongest predictors of mathematics achievement because mathematical learning fundamentally depends on logical thinking and analytical processing. Students with higher reasoning ability generally demonstrate better conceptual understanding, problem-solving skills and academic performance in mathematics. Breit, Schneider and Preckel (2025) reported that reasoning ability and intelligence significantly predict mathematics achievement across educational levels. Their systematic review emphasized that cognitive abilities contribute positively to mathematical understanding and performance. Similarly, Kurdal (2025) found that students with higher mathematical reasoning skills perform better in mathematical problem-solving tasks. The study highlighted that reasoning ability enables students to identify mathematical relationships and solve complex problems effectively. Educational psychologists argue that reasoning ability supports abstract thinking, hypothesis formulation and logical interpretation, all of which are essential for mathematics achievement.



Academic Stress and Academic Achievement

Academic stress has become increasingly prevalent among school students due to examination pressure, academic competition, parental expectations and workload burden. Excessive academic stress negatively affects students' emotional well-being, concentration and academic engagement. Almarzouki et al. (2024) reported that stress interferes with working memory functioning and reduces students' academic performance. Students experiencing high academic stress often struggle with concentration and problem-solving tasks. Ma (2025) observed that mathematics anxiety and academic stress exhibit significant negative relationships with mathematics achievement. Students with higher stress levels showed reduced confidence and lower performance in mathematics examinations.

Demographic Variables and Academic Achievement

Demographic factors significantly influence students' educational experiences and academic performance. Gender differences in mathematics achievement have been widely discussed in educational research. Some studies report that male students demonstrate higher mathematics achievement, whereas female students experience greater academic stress and mathematics anxiety. School type also influences academic outcomes. Private school students generally receive better educational resources, academic support and technological facilities compared to government school students. Similarly, locality influences educational opportunities. Urban students often have greater access to coaching centers, digital learning resources and academic support systems than rural students. Parental educational qualification and family income significantly shape students' learning environments. Educated parents provide better academic guidance, emotional support and educational motivation for their children.

Methodology

Research Method

The present study adopted the descriptive survey method because it facilitates systematic collection and analysis of data related to reasoning ability, academic stress and mathematics achievement.

Population

The population of the study consisted of higher secondary students studying in government and private schools.

Sample

A sample of 310 higher secondary students was selected using stratified random sampling techniques.

Tools Used for Data Collection

Reasoning Ability Test

A standardized reasoning ability test was used to assess students' logical reasoning, analytical reasoning and abstract reasoning abilities.

Academic Stress Scale

Academic stress was measured using a standardized Academic Stress Scale that assessed examination stress, workload pressure, parental expectations and classroom stress.

Mathematics Achievement Test

Mathematics achievement was considered using last appeared mathematics examination scores.

Statistical Techniques

The following statistical techniques were employed:

- Mean and Standard Deviation
- Independent Sample t-test
- One-way ANOVA
- Pearson Correlation Analysis
- Multiple Regression Analysis

Data Analysis and Interpretation

Table 1: Descriptive Statistics of Reasoning Ability, Academic Stress and Mathematics Achievement

Variables	N	Mean	Standard Deviation
Reasoning Ability	310	72.48	8.56
Academic Stress	310	64.27	9.14
Mathematics Achievement	310	78.35	10.22

The mean score of reasoning ability was 72.48, indicating moderate to high reasoning skills among students. The mean academic stress score was 64.27, suggesting moderate levels of stress among students. Mathematics achievement showed a satisfactory mean score of 78.35.

Table 2: Difference in Reasoning Ability, Academic Stress and Mathematics Achievement based on Gender

Variables	Gender	N	Mean	SD	t-value	p-value
Reasoning Ability	Male	158	74.12	8.21	2.84**	0.005
	Female	152	71.03	8.67		
Academic Stress	Male	158	61.45	8.54	3.27**	0.001
	Female	152	66.89	9.21		
Mathematics Achievement	Male	158	79.84	9.86	2.16*	0.031
	Female	152	76.92	10.41		

* $p < .01$, $p < .05$

Male students demonstrated higher reasoning ability and mathematics achievement than female students. Female students experienced comparatively higher academic stress.

Table 3: Difference in Reasoning Ability, Academic Stress and Mathematics Achievement based on Type of School

Variables	Type of School	N	Mean	SD	t-value	p-value
Reasoning Ability	Government	169	69.87	8.42	4.91**	0.000
	Private	141	75.09	7.96		
Academic Stress	Government	169	67.31	8.87	4.12**	0.000
	Private	141	61.22	8.76		
Mathematics Achievement	Government	169	73.48	9.76	6.03**	0.000
	Private	141	82.54	8.91		

$p < .01$

Private school students showed significantly higher reasoning ability and mathematics achievement than government school students. Government school students experienced higher academic stress.

Table 4: Difference in Reasoning Ability, Academic Stress and Mathematics Achievement based on Locality

Variables	Locality	N	Mean	SD	t-value	p-value
Reasoning Ability	Urban	174	74.85	8.03	3.95**	0.000
	Rural	136	69.76	8.71		
Academic Stress	Urban	174	65.82	8.92	2.11*	0.036
	Rural	136	62.49	9.13		
Mathematics Achievement	Urban	174	81.26	9.35	4.74**	0.000
	Rural	136	74.98	10.58		

* $p < .01$, $p < .05$

Urban students demonstrated higher reasoning ability and mathematics achievement than rural students. Urban students also experienced comparatively higher academic stress.

Table 5: One-Way ANOVA for Reasoning Ability, Academic Stress and Mathematics Achievement based on Parental Educational Qualification

Variables	Source of Variation	Sum of Squares	df	Mean Square	F-value	p-value
Reasoning Ability	Between Groups	1248.36	3	416.12	5.84**	0.001
	Within Groups	21084.45	306	71.23		
Academic Stress	Between Groups	1395.52	3	465.17	6.29**	0.000

	Within Groups	21890.14	306	73.95		
Mathematics Achievement	Between Groups	1826.73	3	608.91	7.12**	0.000
	Within Groups	25312.28	306	85.51		

$p < .01$

Students whose parents possessed higher educational qualifications demonstrated better reasoning ability and mathematics achievement with comparatively lower academic stress.

Table 6: Correlation between Reasoning Ability, Academic Stress and Mathematics Achievement

Variables	Reasoning Ability	Academic Stress	Mathematics Achievement
Reasoning Ability	1.00	-0.34**	0.68**
Academic Stress	-0.34**	1.00	-0.52**
Mathematics Achievement	0.68**	-0.52**	1.00

$p < .01$

Reasoning ability exhibited a strong positive relationship with mathematics achievement, whereas academic stress showed a negative relationship with mathematics achievement.

Discussion of the Study

The findings of the present study revealed that demographic variables significantly influence reasoning ability, academic stress and mathematics achievement among higher secondary students. Male students demonstrated comparatively higher reasoning ability and mathematics achievement, whereas female students experienced greater academic stress. These findings may be associated with differences in confidence, societal expectations and emotional responses toward academic competition.

Private school students performed better in reasoning ability and mathematics achievement than government school students. Better infrastructure, instructional quality, academic support and technological facilities available in private schools may contribute to improved academic outcomes.

Urban students demonstrated higher reasoning ability and mathematics achievement than rural students. Urban educational environments often provide greater access to coaching centers, digital learning platforms, libraries and educational guidance.

The findings also revealed that parental educational qualification significantly influences students' academic outcomes. Students whose parents were highly educated demonstrated better reasoning ability and mathematics achievement because educated parents may provide effective academic guidance and supportive learning environments.

The correlation analysis confirmed that reasoning ability positively influences mathematics achievement, whereas academic stress negatively affects mathematics achievement. These findings support educational psychology theories emphasizing the interaction between cognitive and emotional factors in academic performance.



Major Findings of the Study

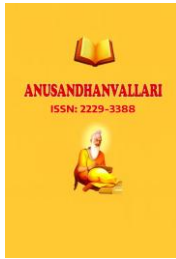
1. Higher secondary students possessed moderate to high levels of reasoning ability and mathematics achievement.
2. Male students have comparatively higher reasoning ability and mathematics achievement than female students.
3. Female students have greater academic stress than male students.
4. Private school students have significantly better reasoning ability and mathematics achievement than government school students.
5. Government school students have higher academic stress.
6. Urban students have higher reasoning ability and mathematics achievement than rural students.
7. Students from highly educated family backgrounds have better reasoning ability and mathematics achievement.
8. Reasoning ability positively correlated with mathematics achievement.
9. Academic stress negatively correlated with mathematics achievement.

Educational Implications

- The findings of the study have important implications for teachers, school administrators, parents and policymakers.
- Teachers should create supportive classroom environments that encourage logical thinking and reduce unnecessary academic pressure among students.
- Schools should organize counselling programs, stress management workshops and mindfulness activities to help students manage academic stress effectively.
- Government schools and rural educational institutions should receive additional educational resources and technological support to reduce academic disparities.
- Parents should avoid imposing unrealistic expectations on students because excessive pressure negatively affects academic performance and emotional well-being.
- Educational policymakers should formulate inclusive educational policies that support students from economically and educationally disadvantaged backgrounds.

Conclusion

This present study highlights the significant influence of demographic variables on reasoning ability, academic stress and mathematics achievement among higher secondary students. Gender, school type, locality, parental educational qualification and family income significantly shape students' educational experiences and academic outcomes. The findings emphasize that academic achievement is not determined solely by cognitive ability but is also influenced by emotional and environmental factors. Students from supportive educational and family backgrounds generally demonstrate better reasoning ability and mathematics achievement with lower academic stress. Educational institutions should therefore create equitable and stress-free learning environments that promote both cognitive development and emotional well-being. Reducing academic stress and improving



educational opportunities for disadvantaged students can significantly enhance mathematics achievement and overall academic success.

References

- [1] Almarzouki, A. F., et al. (2024). Stress, working memory and academic performance. *Stress*, 27(1), 1–15.
- [2] Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.
- [3] Breit, M., Schneider, M., & Preckel, F. (2025). Mathematics achievement and learner characteristics: A systematic review of meta-analyses. *Contemporary Educational Psychology*, 81, 102026.
- [4] Kurdal, C. (2025). Are students with high mathematical reasoning skills successful problem solvers? *Journal of Pedagogical Research*, 9(2), 55–71.
- [5] Ma, H. (2025). The relationship between mathematics anxiety and academic achievement. *Frontiers in Psychology*, 16, 112–129.
- [6] Martin, A. J., & Marsh, H. W. (2008). Academic buoyancy: Towards an understanding of students' everyday academic resilience. *Journal of School Psychology*, 46(1), 53–83.
- [7] Putwain, D. W. (2019). Examination stress and student achievement: Current research and future directions. *Educational Psychology*, 39(2), 123–135.
- [8] Schunk, D. H. (2020). *Learning theories: An educational perspective* (8th ed.). Pearson.
- [9] Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, 25(1), 82–91.