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Influence of Mathematical Self Efficacy and Mathematical Test Anxiety on Mathematics Learning Behavior of Higher Secondary School Students

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ABSTRACT

Mathematics is a foundational academic subject that significantly influences students' cognitive development and future academic trajectories. The purpose of the study was to investigate how Mathematical Self Efficacy and Mathematical Test Anxiety influence the Mathematics Learning Behaviour of Higher Secondary School Students. Mathematical Self Efficacy refers to a student's belief in their ability to effectively perform mathematical tasks, whereas Mathematical Test Anxiety is characterized by feeling of tension and apprehension that hinders a person's ability to solve mathematics problems, both in academic as well as in real-life situations. Mathematics Learning Behaviour includes attitudes, study habits, engagement, and classroom interactions/engagement directly related to Mathematics learning. A quantitative survey method was employed for the study. The sample of the study consists of 150 Higher Secondary School Students from various government and aided schools in the Trivandrum district of Kerala, following the Kerala State Syllabus. Standardized tools were used to measure Mathematical Self Efficacy, Mathematical Test Anxiety and Mathematics Learning Behaviour. The collected data were analysed using Descriptive Statistics, Correlation

Analysis, Cooks' Distance and Regression Analysis. The findings of the study revealed that Mathematical Self Efficacy had a significant positive relationship on Mathematics Learning Behaviour of Higher Secondary School Students, whereas Mathematical Test Anxiety had a negative relationship with Mathematics Learning Behaviour of Higher Secondary School Students. Additionally, Simple regression analysis result showed that both the variables are significant predictors of Mathematics Learning Behaviour of Higher Secondary School Students, with self efficacy being a stronger predictor. The study offers insight in to the crucial role of affective factors in shaping students' Learning Behaviour and provides a foundation for interventions that can reduce anxiety and strengthen students' confidence. Implications for teachers, curriculum developers, and policymakers are also discussed in the study to enhance student performance and emotional well-being in mathematics classrooms

Introduction

Mathematics has long been considered as a foundational subject in education, critical to the development of analytical thinking and problem-solving abilities. As society increasingly depends on technology and data-driven decision-making, mathematics education has taken on even greater importance. Globally, mathematics education has been a major focus of educational policy due to its impact on scientific literacy, technological advancement, and workforce readiness (OEC, 2019). Despite significant curriculum reforms and pedagogical innovations, disparities in student performance and engagement persist—often influenced by non-cognitive factors. Among these non-cognitive factors, Mathematical Self Efficacy and Mathematical Test Anxiety have emerged as critical predictors of students' learning behaviour and academic outcomes in Mathematics.

According to Bandura (1997) Self Efficacy, refers to "belief in one's capabilities to organize and execute the courses of action required to manage prospective situations." Mathematical Self Efficacy specifically pertains to a student's belief in their competence to understand and solve mathematical tasks. Pajares and Miller (1994) described it as "a judgment of one's capability to accomplish a certain level of performance in Mathematics." Students with high Mathematical Self Efficacy are more likely to persist

in the face of difficulty, employ effective strategies, and display greater motivation and resilience. On the contrary, low self efficacy can lead to avoidance behaviours and poor academic outcomes. On the other hand, Mathematical Test Anxiety is a specific form of anxiety that arises in testing or evaluative situations involving Mathematics. According to Wigfield and Meece (1988), Mathematical Test Anxiety is defined as "a feeling of tension, apprehension, or fear that interferes with mathematics performance in test situations." It is a subtype of general test anxiety and mathematics anxiety, focusing particularly on students' emotional responses to mathematics assessments.

Research indicates that Mathematical Test Anxiety can negatively affect students' cognitive functioning—especially working memory—and consequently impair performance during examinations (Ashcraft & Krause, 2007). Symptoms of Mathematical Test Anxiety often manifest as mental blocks, avoidance behaviors, procrastination, and physiological reactions such as sweating, rapid heartbeat, or nausea. It usually stems from repeated negative experiences during mathematics tests, poor academic performance, fear of being judged, and conventional teaching or testing practices that emphasize on speed and accuracy over understanding. The interaction between Mathematical Self Efficacy and Mathematical Test Anxiety directly influences students' Mathematics Learning Behaviors—a construct that encompasses their observable efforts and engagement with mathematical tasks. These behaviors reflect students' visible engagement in mathematical tasks, including active class participation, consistent homework completion, help-seeking when facing difficulties, attentiveness during instruction, and resilience in problem-solving. While high self efficacy tends to promote positive learning behaviors, elevated levels of mathematical test anxiety can undermine them by inducing fear of failure, reducing persistence, and limiting students' willingness to engage in challenging mathematical tasks.

Students who demonstrate higher levels of Mathematical Self Efficacy and lower levels of Mathematical Test Anxiety are generally more engaged, persistent, and intrinsically motivated in their mathematical learning processes. Although the growing recognition of these variables are increasingly recognized, there is only a limited empirical work within the context of India, particularly in Kerala's state syllabus schools, where academic pressures and diverse learner backgrounds contribute to varying experiences in mathematics classrooms. In the contemporary educational context, Mathematics Education is no longer limited to the development of computational skills alone but extends to the nurturing of cognitive, emotional, and behavioural competencies. This comprehensive view of mathematics learning is especially vital at the higher secondary level, where foundational attitudes and

behaviour towards mathematics become entrenched and significantly influence future academic and career choices.

Numerous studies have confirmed the influence of psychological factors such as self efficacy and anxiety on academic performance. However, the behavioural dimension—how students engage with mathematics both in and outside the classroom—has not been received adequate attention in the Indian context, particularly within Kerala's state education system. Mathematical Self Efficacy, as supported by Bandura (1997), shapes students' ability to select task, level of effort, perseverance, and resilience in challenging situations. Similarly, Mathematical Test Anxiety impairs academic performance, hinders classroom participation, and reduce students' motivation to learn (Ashcraft & Faust, 1994). Analysing both of these affective variables together, offers a powerful lens to understand students' learning behaviour in mathematics classrooms. Despite the availability of studies in international contexts, there remains a noticeable gap in Indian research literature addressing how these psychological variables collectively influence learning behaviour, especially in government and aided schools where academic diversity is high.

This study attempts to bridge that research gap by providing empirically grounded insights into how Mathematical Self Efficacy and Mathematical Test Anxiety shape observable learning behaviours. Moreover, while much research focuses on achievement or test scores, this study uniquely centres on learning behaviour—a variable closely tied to long-term academic success, persistence, and self-regulated learning. The study also holds considerable significance for mathematics education in India, as it examines the emotional and cognitive foundations of student behaviour. The findings of this research are expected to offer actionable insights for teachers seeking to foster more supportive, motivating, and inclusive classroom environments. Educators, policy makers and curriculum planners can benefit from evidence-based strategies that target both anxiety reduction and efficacy enhancement. Moreover, the outcomes of the study could inform policy decisions regarding counselling services, remedial instruction, and the integration of socio-emotional learning components into mathematics pedagogy. Eventually, this research has the potential to contribute meaningfully to both theoretical and practical domains by emphasizing the behavioural consequences of affective variables in Mathematics Learning and by proposing empirically grounded interventions that support students in developing healthy attitudes and sustained engagement with the subject.

Gaining a deeper understanding of the relationship between self efficacy, test anxiety, and learning behaviour can aid in the early identification of students who are at risk of academic

underperformance due to emotional or motivational challenges. This insight is especially crucial in Kerala, where the higher secondary curriculum demands a high level of mathematical competence and sustained engagement. By focusing on students' internal belief systems and emotional responses, the study emphasizes a shift from purely cognitive metrics to a more holistic view of academic success. Furthermore, the study can serve as a foundation for developing teacher training modules that emphasize socio-emotional competencies in mathematics instruction. School counsellors and educational psychologists may also benefit from the findings to design targeted interventions. In the long run, fostering a positive mathematical mindset among students can lead to greater confidence, improved academic outcomes, and broader career aspirations in STEM-related fields.

In light of the above, the study is guided by the following research questions:

1. Does there exist any relationship between Mathematical Self Efficacy and Mathematics Learning Behaviour of Higher Secondary School Students?

2. Does there exist any relationship between Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students?

3. Is Mathematical Self Efficacy a significant predictor of Mathematics Learning Behaviour of Higher Secondary School Students?

4. Is Mathematical Test Anxiety a significant predictor of Mathematics Learning Behaviour of Higher Secondary School Students?

Statement of the Problem

Despite widespread emphasis on academic performance in mathematics, limited attention has been given to how students' emotional and cognitive dispositions influence their actual learning behaviour. Mathematical Self Efficacy and Mathematical Test Anxiety are two critical affective variables that can significantly shape how students engage with mathematical tasks. However, in the Indian context—particularly in Kerala's higher secondary schools—research on the influence of Mathematical Self Efficacy and Mathematical Test Anxiety on Mathematics Learning Behaviour remains scarce. To address this gap, the present study is entitled as:

"Influence of Mathematical Self Efficacy and Mathematical Test Anxiety on Mathematics Learning Behaviour of Higher Secondary School Students".

Objectives of the Study

1. To find out the relationship between Mathematical Self Efficacy and Mathematics Learning Behaviour of Higher Secondary School Students.

2. To find out the relationship between Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students.

3. To find out whether Mathematical Self Efficacy is a significant predictor of Mathematics Learning Behaviour of Higher Secondary School Students.

4. To find out whether Mathematical Test Anxiety is a significant predictor of Mathematics Learning Behaviour of Higher Secondary School Students.

Hypotheses of the Study

1. There exists a significant relationship between Mathematical Self Efficacy and Mathematics Learning Behaviour of Higher Secondary School Students.
2. There exists a significant relationship between Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students.

3. Mathematical Self Efficacy is a significant predictor of Mathematics Learning Behaviour of Higher Secondary School Students.

4. Mathematical Test Anxiety is a significant predictor of Mathematics Learning Behaviour of Higher Secondary School Students.

Review of Related Literature

Sari and Lutfi (2024) examined the impact of self-efficacy and mathematical anxiety on student performance in Economic Statistics courses. The study involved 50 students from the Economics and Sharia Banking program at STES Manna Wa Salwa. Using tests and questionnaires (20 items each on self-efficacy and math anxiety), data were collected after the final lecture and analyzed through multiple linear regression. Results showed that self-efficacy significantly influenced learning outcomes, while mathematics anxiety did not have a direct effect. However, together, self-efficacy and mathematics anxiety explained 22.7% of the variance in achievement. Interestingly, some students with high mathematics anxiety still achieved high scores, indicating a complex relationship.

Akorede and Chinaka (2024) conducted a study" Students' Self-Efficacy in Senior Secondary School Mathematics: Academic Engagement as Predictor Variable". The study aimed at determining the degree to which several aspects of students' academic engagement (behavioural, emotional and cognitive) predict Senior Secondary School students' self-efficacy in Mathematics. This study used a descriptive survey research approach, sample of the study comprises of a thousand six hundred and eighty students (1680) which were selected from twenty-one (21) public senior secondary schools in Ogun East Senatorial District (Remo Division) of Ogun state, using multi-stage sampling technique. The results of the analysis revealed **significant relationships** between all three forms of engagement and students' mathematics self-efficacy. Specifically, students who actively **participated in classroom activities** and those with **positive emotional connections** to peers and school exhibited **higher levels of self-efficacy** in mathematics. These findings underscore the importance of fostering **holistic academic engagement** to strengthen students' confidence and belief in their mathematical abilities.

Sangral and Kumar (2023) investigated the Mathematical Test Anxiety among Secondary School Students in relation to their Gender, Locality and Types of Schools. The purpose of the study was to compare the level of mathematical test anxiety and numerical anxiety of Secondary School Students of samba block with regard to their gender, locality and types of school. The major findings of the study indicated that there is no significant difference in the mathematical test anxiety of Secondary School Students with regard to their gender, locality and types of school. However, the study found a significant difference in the numerical anxiety of Secondary School Students with regard to gender and locality, while no significant difference was observed with regard to the types of school.

Ablian and Parangat et.al (2022) conducted a study "Mathematics Anxiety and Mathematics Self Efficacy among Senior High School Students in Public Secondary Schools". The study aimed at exploring mathematics anxiety and mathematics self-efficacy of senior high school students in Botolan District of Zambales during the academic year 2020-2021. The study used descriptive design and statistical techniques like ANOVA, t-test, and Pearson r for analysis of the data collected. The result of the analysis revealed that there exist a high level of anxiety and self-efficacy in students, with significant differences based on demographics like age, sex, and school. Anxiety negatively influenced motivation, while self-efficacy varied by affective factors. The findings of the study also highlighted the impact of both variables on students' mathematical performance.

Yurt (2022) examined the mediating role of mathematics self-efficacy between task value and mathematics anxiety among 203 secondary school students. Using the Motivated Strategies for Learning

Questionnaire and Mathematics Anxiety Scale, the study found that higher task value was associated with increased self-efficacy and reduced mathematics anxiety. Structural equation modelling revealed that self-efficacy partially mediated the relationship between task value and mathematics anxiety. The findings suggest that emphasizing the usefulness of mathematics and promoting success experiences can help reduce students' everyday mathematics anxiety.

Çağırgan, and Soytürk, (2021) studied "The relationship between math anxiety, student engagement in mathematics and responsibilities towards learning among middle school students.". The primary objective was to examine whether mathematics anxiety and engagement in mathematics could predict students' sense of responsibility towards learning, beyond the effects of variables such as gender, grade level, interest in mathematics, liking their mathematics teacher, having a personal study room, and parental involvement. Using Hierarchical Regression Analysis, data were gathered from 568 middle school students. The findings indicated that students' social, emotional, and cognitive engagement in mathematics positively influenced their responsibility towards learning. Conversely, mathematics anxiety emerged as a significant negative predictor. The study concluded that students' responsibilities towards learning are closely linked to their mathematical experiences and behaviors.

Pérez-Fuentes et al. (2020) conducted a study titled *"The Role of Anxiety in the Relationship between Self efficacy and Mathematics Achievement". The purpose of the study was* to examine how **mathematics anxiety** influences the relationship between **perceived competence (self efficacy)** and **mathematics achievement**, considering variables such as **intellectual abilities, gender, and school year**. The study involved **2,245 Spanish students** from **7th to 10th grade.** The tools used are Fennema-Sherman Mathematics Attitudes Scales and the Sternberg Triarchic Abilities Test. The findings of the study revealed that perceived competence strongly predicts mathematics performance. Mathematics anxiety was also found to mediate this relationship, though the effect was small. Additionally, anxiety moderated the relationship, with the effect of self efficacy on achievement being stronger at higher anxiety levels. The study highlighted the complex interaction between emotional and cognitive factors in student learning outcomes.

Theoretical Framework

The present study is anchored in the Social Cognitive Theory proposed by Albert Bandura (1997), which emphasizes that human behavior is shaped through a continuous reciprocal interaction among personal factors, behaviors, and environmental influences. A fundamental component of this theory is

self-efficacy, defined as an individual's belief in their ability to successfully carry out actions required to manage prospective situations. In the academic context, particularly in mathematics education, self-efficacy plays a critical role in determining students' motivation, engagement, persistence, and achievement.

Within this theoretical orientation, Mathematical Self Efficacy is considered as a central cognitive-affective factor. It reflects students' beliefs about their capability to comprehend and solve mathematical problems and is developed through prior experiences, vicarious learning, verbal persuasion, and emotional states. In the present study, Mathematical Self Efficacy is viewed as a multidimensional construct, encompassing two key components:

(i) **confidence in performing specific mathematical tasks (task-based efficacy)** and

(ii) **confidence in succeeding in mathematics-related academic courses (course-based efficacy)**.

The task dimension involves self-perception of competence in arithmetic operations, algebra, geometry, and problem-solving, while the course dimension refers to beliefs about succeeding in classroom tests, mathematics examinations, and overall subject mastery. The stronger the students' belief in their ability to succeed in these areas, the more likely they are to approach difficult tasks as challenges rather than threats, employ adaptive learning strategies, and persist in the face of failure. This internal confidence, shaped by self-perceptions of competence, does not operate in isolation but actively influences how students behave in the mathematics classroom. Behaviors such as attentiveness, timely completion of assignments, seeking help when needed, participating in discussions, and demonstrating cognitive flexibility are all outward manifestations of high self efficacy. Consequently, Mathematical Self Efficacy is theorized to contribute positively to mathematics learning behaviour, the outcome variable in the present study.

In contrast to self efficacy, the construct of Mathematical Test Anxiety represents a negative emotional response that adversely affects learning and performance. While anxiety in general can be facilitative in certain low-intensity forms, high levels of mathematics-related anxiety—especially in evaluative contexts—can be debilitating. Research in educational psychology indicates that test anxiety disrupts working memory, reduces processing speed, and impairs concentration, all of which are essential cognitive functions for effective mathematics performance. In the context of this study, Mathematical Test Anxiety is conceptualized as having two key dimensions:

(i) **evaluation anxiety**, which involves fear of negative judgments and performance failure during assessments, and

(ii) **learning mathematics anxiety**, which refers to discomfort, worry, or panic when exposed to mathematics tasks during instruction and practice.

Evaluation anxiety tends to peak during high-stakes tests and oral questioning, whereas learning anxiety can affect students even during regular classes and homework. The effects of test anxiety extend beyond test performance to influence day-to-day classroom behaviors. Students experiencing high levels of anxiety often avoid participation, hesitate to ask questions, procrastinate on assignments, and display reduced motivation and interest. Thus, Mathematical Test Anxiety has a strong negative association with productive mathematics learning behaviour. It is not merely an emotional state but a behavioural inhibitor that constrains the student's ability to engage fully with the subject matter.

In the context of Bandura's theory, both self-efficacy and test anxiety are personal factors that interact with behavior (learning behaviour) and environment (classroom dynamics, peer influence, instructional methods). Their interaction is often reciprocal. For example, students with low self efficacy may experience heightened anxiety when faced with complex problems or high-stakes evaluations. Conversely, students who repeatedly experience anxiety and failure in mathematics may develop chronic low self efficacy, leading to disengagement. This bidirectional influence reinforces the need to study these constructs together rather than in isolation. It also highlights the importance of addressing students' emotional and cognitive experiences as part of any attempt to improve learning behaviors and educational outcomes.

A particularly relevant aspect of Social Cognitive Theory is the emphasis on self-regulation, which includes goal setting, self-monitoring, and strategic behavior. Self efficacy is a precursor to self-regulation. Students who believe their mathematics ability are more likely to monitor their progress, regulate their learning environment, and choose appropriate strategies when difficulties arise. On the other hand, high anxiety can undermine self-regulation by creating distractions, reducing cognitive control, and leading students to focus on avoiding failure rather than achieving success. The combined effects of self efficacy and anxiety directly shape how students behave in the classroom, particularly in mathematics where challenges are frequent, cumulative, and often socially evaluated.

Empirical research supports these theoretical assumptions. For instance, studies by Pajares and Miller (1994) demonstrated that self efficacy is a better predictor of mathematics performance than prior

achievement or self concept. Similarly, Ashcraft and Faust (1994) showed that mathematics anxiety reduces working memory capacity, which negatively affects problem-solving ability. Pérez-Fuentes et al. (2020) found that mathematics anxiety mediates the relationship between perceived self efficacy and achievement, suggesting a complex interaction between cognitive beliefs and emotional states. More recently, Yurt (2022) illustrated that self efficacy plays a mediating role between task value and mathematics anxiety, highlighting how beliefs about the utility of mathematics can reinforce confidence and reduce emotional stress. These findings underscore the need for an integrated model that accounts for both positive and negative affective influences on student learning behaviour.

In the present study, Mathematics Learning Behaviour is conceptualized as an observable outcome that reflects students' active engagement, persistence, attention, and adaptability in mathematics learning. Drawing on the framework proposed by McDermott et al. (1999), Mathematics Learning Behaviour is treated as a **multi-dimensional construct comprising four components:**

(i) **competence motivation**, which reflects a student's internal drive to master mathematical tasks;

(ii) **attitude towards learning**, which encompasses students' emotional disposition towards mathematics;

(iii) **attention/persistence**, which includes the ability to concentrate and maintain effort in the face of difficulty; and

(iv) **strategy/flexibility**, which indicates the use of varied approaches and adaptability in problem-solving.

These behaviors are shaped by students' internal belief systems and emotional states, particularly their levels of self efficacy and anxiety. Therefore, learning behaviour is not merely a reflection of students' ability but also a result of their emotional readiness and psychological orientation towards the subject.

The theoretical model proposed in this study integrates these components into a coherent framework. It posits that Mathematical Self Efficacy and Mathematical Test Anxiety are significant predictors of Mathematics Learning Behaviour among Higher Secondary School Students. While self efficacy is expected to exert a positive influence by enhancing motivation, focus, and resilience, test anxiety is hypothesized to exert a negative influence by reducing cognitive efficiency and engagement. Together,

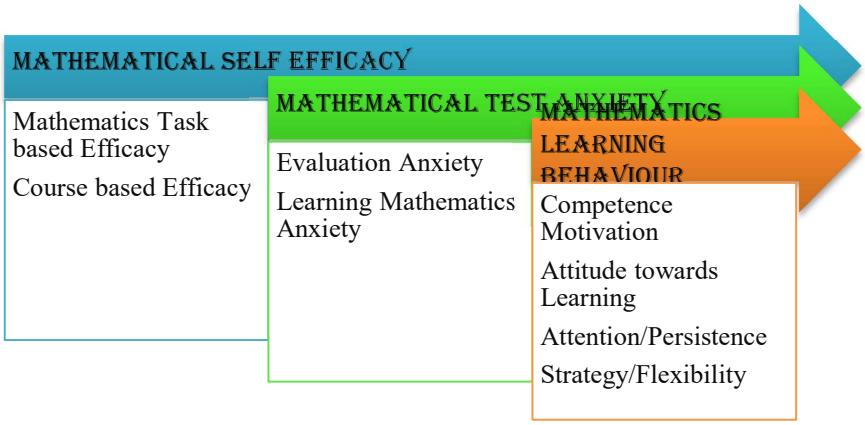
these constructs provide a comprehensive explanation for the variability in how students behave in mathematics classrooms, beyond what can be explained by intellectual or demographic factors alone.

This theoretical framework serves multiple purposes within the study. First, it guides the formulation of the research objectives and hypotheses, which seek to explore the nature and strength of the relationships among the three core variables. Second, it informs the design of the research tools used to measure self efficacy, anxiety, and learning behaviour, ensuring each tool captures the appropriate subdimensions. Third, it provides a conceptual basis for interpreting the findings and deriving implications for pedagogy, curriculum design, and educational policy. Finally, it underscores the importance of addressing affective dimensions in mathematics education—a field traditionally dominated by cognitive and performance-based metrics.

To sum up, the theoretical framework of this study reflects a holistic understanding of mathematics education, one that incorporates both cognitive beliefs and emotional experiences as central to learning. By integrating concepts from social cognitive theory with empirical insights from educational psychology, and by clearly outlining the subdimensions of the study variables, the framework provides a robust basis for analyzing how mathematical self efficacy and test anxiety influence the observable learning behaviours of students. It emphasizes that improving mathematics outcomes requires not only effective instructional strategies and curricular alignment but also a deliberate effort to strengthen students' belief in their capabilities and to reduce the emotional and psychological barriers that hinder meaningful engagement with mathematics.

Figure 1

Diagrammatic representation of Conceptual Framework illustrating Mathematical Self-Efficacy, Mathematical Test Anxiety, and Mathematics Learning Behaviour



Methodology

Normative Survey Method was employed to investigate the influence of Mathematical Self Efficacy and Mathematical Test Anxiety on Mathematics Learning Behaviour of Higher Secondary School Students. The Population of the study is Higher Secondary School Students of Kerala, following Kerala State Syllabus and the sample of the study consists of 150 Higher Secondary School Students of class XI, from three higher secondary schools in Trivandrum District, selected through simple random sampling to ensure representation across the population. Data were collected using three instruments including a Mathematical Self Efficacy Scale, a Mathematical Test Anxiety Scale, and a Mathematics Learning Behaviour Scale. The Mathematical Self Efficacy Scale was developed using two subscales: Mathematics Tasks Subscale and Mathematics Courses Subscale, based on the framework provided by Bertz and Hackett (1993). The draft tool consisted of 40 items (20 items based on Mathematics Tasks Subscale and 20 items based on Mathematics Course Subscale), which was refined to 34 items after item analysis. Items were rated using a 5-point Likert scale ranging from *Not at all Sure* to *Absolutely Sure.* The reliability of the test was established using test-retest method, yielding a reliability coefficient of 0.85 and content validity index (Lawshe, 1975) was 0.902. The Mathematical Test Anxiety Scale was constructed using the domains: Evaluation Anxiety and Learning Mathematics Anxiety, based on the framework of Richardson and Suinn (1972). Items were rated using a 5-point Likert scale ranging from *Not at all Anxious* to *Extremely Anxious.* The draft tool consists of 36 items, which were reduced to 30 items in the final version. The reliability of the scale was established using test-retest method, with a reliability coefficient of 0.83 and the content validity index (Lawshe, 1975) is 0.92. The Mathematics Learning Behaviour Scale was constructed using components: Competence Motivation, Attitude towards Learning, Attention/Persistence, and Strategy/Flexibility, based on the framework of McDermott et al (1999). The draft tool consists of 40 items, which were reduced to 31 items in the final version. Items were rated using a 5-point Likert scale ranging from Never to Always. The reliability of the test was established using test-retest method, yielding a reliability coefficient of 0.81 and the content validity index (Lawshe, 1975) is 0.901.

Statistical Techniques Used

- Karl Pearson's Coefficient of Correlation
- Cook's Distance
- Simple Regression Analysis

Analysis and Interpretation of Data Collected

Descriptive statistics of Mathematical Self Efficacy, Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students

The descriptive statistics for Mathematical Self Efficacy, Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students are presented in the following table:

Table 1

Descriptive Statistics of Mathematical Self Efficacy, Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students

Variables	Mean	Standard Deviation	Skewness	Kurtosis	Shapiro-Wilk W
Mathematical Self Efficacy	115.37	15.13	-0.427	-0.516	0.958
Mathematical Test Anxiety	82.4	16.1	0.720	-0.387	0.924
Mathematics Learning Behaviour	120.24	12.41	-1.09	0.935	0.906

The table given above presents the **descriptive statistics** and **normality test results** for three variables: *Mathematical Self Efficacy, Mathematical Test Anxiety,* and *Mathematics Learning Behaviour*. These statistics provide important insights into the nature and distribution of the collected data and are crucial for determining the suitability of subsequent statistical analyses.

For **Mathematical Self Efficacy**, the mean of the scores is **115.37** with a standard deviation of **15.13**, indicating that the scores are moderately spread around the average. The **skewness** value of **-0.427** indicates a slight **leftward (negative) skew**, meaning that more students scored above the mean than below. The **kurtosis** value of **-0.516** shows that the distribution is **platykurtic**, or flatter than a normal distribution. The **Shapiro-Wilk W value** of **0.958**, which is relatively close to 1, suggests that the distribution is approximately normal, with only a mild deviation from normality.

In the case of **Mathematical Test Anxiety**, the mean of the scores is **82.40** with a standard deviation of **16.10**, indicating that the scores are slightly more spread out. The **skewness** is **0.720**, indicating a **rightward (positive) skew**, meaning more students reported lower anxiety levels, with fewer students exhibiting higher anxiety. The **kurtosis** value of **-0.387** again indicates a **platykurtic** distribution. The **Shapiro-Wilk W value** of **0.924** which is relatively close to 1, suggests that the distribution is approximately normal, with only a mild deviation from normality.

For **Mathematics Learning Behaviour**, the mean of the scores is **120.24** with a standard deviation of **12.41**, indicating less variability around the mean. The **skewness** value of **-1.09** shows a **strong negative skew**, indicating that a large number of students scored high on learning behaviour, with fewer low scorers. The **kurtosis** of **0.935** suggests a **leptokurtic distribution**, meaning the data are more peaked and concentrated around the mean. The **Shapiro-Wilk W value** of **0.906** which is relatively close to 1, suggests that the distribution is approximately normal, with only a mild deviation from normality.

Relationship between Mathematical Self Efficacy and Mathematics Learning Behaviour of Higher Secondary School students

In order to find out the nature of relationship between Mathematical Self Efficacy and Mathematics Learning Behaviour of Higher Secondary School Students, the investigator used Karl Pearson's Product Moment Correlation and the details of r, t, SE and level of significance for total sample is given in the table.

Table 2

Relationship between Mathematical Self Efficacy and Mathematics Learning Behaviour of Higher Secondary School Students

					99%Confidence Interval	
Group	**N**	**r**	**t**	SE_r	Upper Level	Lower level
Total	150	0.753	13.92	0.054	0.645	0.831

From the above table coefficient of correlation for total sample is 0.753. The 'r' lies between the confidence interval 0.645-0.831 at 0.01 levels. Hence it is significant at 0.01 levels. The significant 'r' indicates that there exists a true relationship between the Mathematical Self Efficacy and Mathematics

Learning Behaviour of Higher Secondary School Students. The magnitude of 'r' reveals that the relationship between Mathematical Self Efficacy and Mathematics Learning Behaviour is high and positive. This indicates that the students having high Mathematical Self Efficacy possess high Mathematics Learning Behaviour.

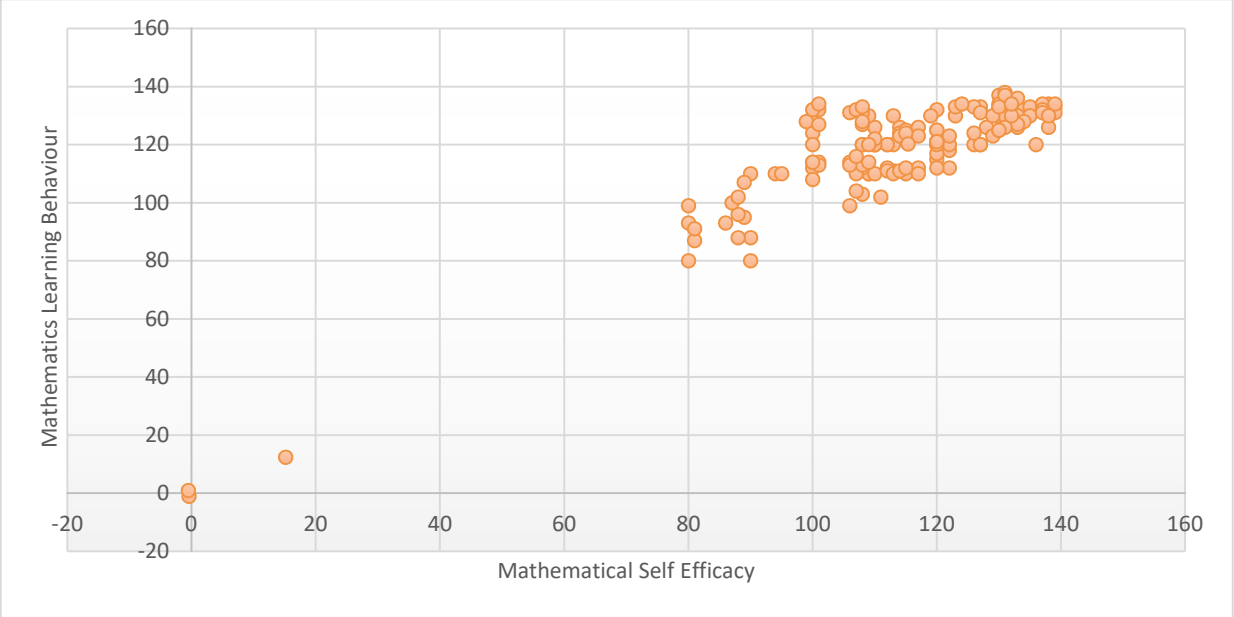
The obtained Fischer's t-value is 13.92 which is greater than the table value at 0.01 level. Hence it can be considered that there is a significance relationship between the two variables. Therefore, it can be concluded that the relationship exist between the variables is a high positive relationship.

Scatterplot showing Relationship between Mathematical Self Efficacy and Mathematics Learning Behaviour of Higher Secondary School Students

A Scatter Diagram showing the relationship between Mathematical Self Efficacy and Mathematics Learning Behaviour for total sample is given below.

Figure 2

Scatterplot showing between Mathematical Self Efficacy and Mathematics Learning Behaviour of Higher Secondary School Students



In the figure the points are clustered round a line and also the increase in one variable is associated with an increase in the other variable, which shows that there is a direct, positive and high

relationship exists between Mathematical Self Efficacy and Mathematics Learning Behaviour of Higher Secondary School Students.

Relationship between Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School students

In order to find out the nature of relationship between Problem Solving Ability and Achievement in Applied Mathematics, the investigator used Karl Pearson's Product Moment Coefficient of Correlation and the details of r, t, SE and level of significance for total sample is given in the table.

Table 3

Relationship between Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students

					99%Confience Interval	
Group	**N**	**r**	**t**	SE_r	Upper Level	Lower level
Total	150	-0.705	-12.09	0.058	-0.797	-0.581

From the above table coefficient of correlation for total sample is -0.705. The 'r' lies between the confidence interval -0.797 to -0.581 at 0.01 levels. Hence it is significant at 0.01 levels. The significant 'r' indicates that there exists true relationship between the Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students. The magnitude of 'r' reveals that the relationship between Mathematical Test Anxiety and Mathematics Learning Behaviour is high and negative. This indicates that the students having high Mathematical Test Anxiety possess low Mathematics Learning Behaviour.

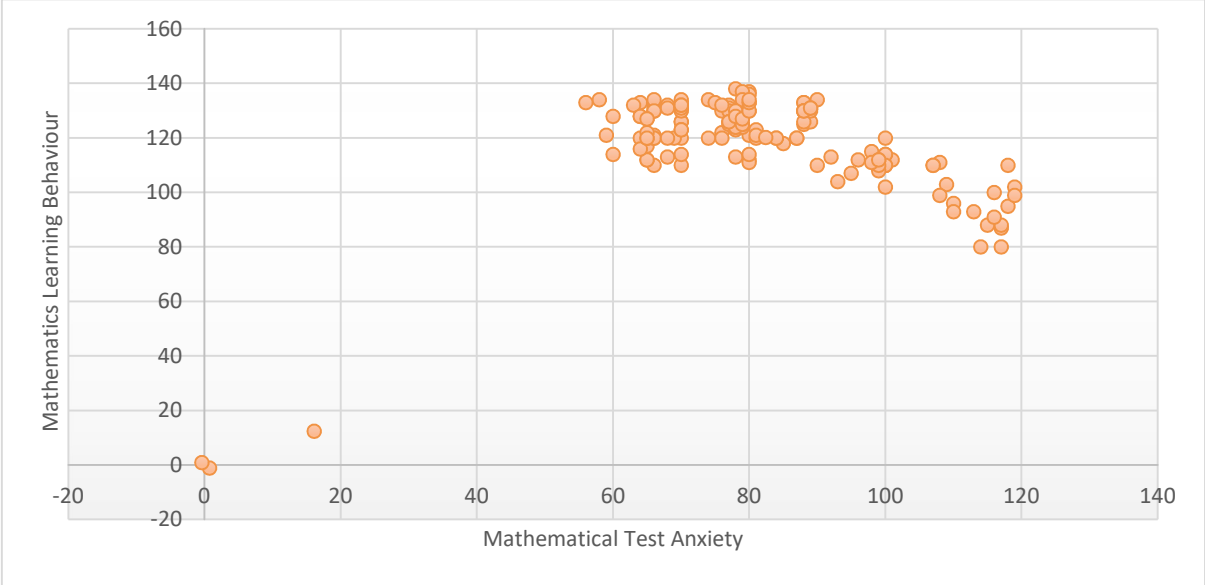
The obtained Fischer's t-value is -12.09 which is greater than the table value at 0.01 level. Hence it can be considered that there is a significance relationship between the two variables. Therefore, it can be concluded that the relationship exist between the variables is a high negative relationship.

Scatterplot showing Relationship between Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students

A Scatter Diagram showing the relationship between the variables Mathematical Test Anxiety and Mathematics Learning Behaviour for total sample is given below.

Figure 2

Scatterplot showing Relationship between Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students



In the figure the points are clustered round a line and also the increase in one variable is associated with an increase in the other variable, which shows that there is a direct, negative and high relationship exists between Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students.

Summary of Cooks' Distance Analysis for Detecting Influential Data Points

Cook's D values obtained while performing simple regression between the scores of Mathematical Self Efficacy and Mathematics Learning Behaviour falls well below the commonly accepted threshold of 0.5—most ranging between near zero and 0.12—it can be concluded that no single observation significantly distorts the regression coefficients. The highest Cook's D value observed is approximately 0.1207, which is still far from the critical value of 1.0, suggesting that the data points are relatively uniform in their impact. This implies that the regression model based on this dataset is stable and robust, and the results derived from it are not overly affected by any particular data point. Therefore,

the dataset can be considered statistically sound for further analysis and interpretation, and there is no immediate need to remove or adjust for influential observations.

Similarly, Cook's D values obtained while performing simple regression between the scores of Mathematical Test Anxiety and Mathematics Learning Behaviour again indicates that **no data point exerts an unduly high influence** on the regression model. All values are substantially **below the conservative threshold of 0.5,** with the **maximum Cook's D value being approximately 0.1196,** and the vast majority clustered between near-zero and 0.03. This distribution confirms that **none of the observations individually distort the model's parameter estimates**, ensuring the **robustness and reliability of the regression results**. A few values, such as 0.1196, 0.1183, 0.0542, and 0.0494, are relatively higher and may be flagged for closer inspection in sensitivity analyses, but they still do not cross the danger threshold. Therefore, the dataset can be considered **free from influential outliers**, and the model derived from this data is **statistically sound and stable**, suitable for further analysis, interpretation, or reporting without adjustment or exclusion of cases.

Simple Regression Analysis of Predictors of Mathematics Learning Behaviour of Higher Secondary School Students

To determine whether Mathematical Self Efficacy and Mathematical Test Anxiety are significant predictors of Mathematics Learning Behaviour of Higher Secondary School Students, the investigator conducted simple regression analysis for each predictor variable and the result of the analysis is summarized below:

Table 4

Summary of Simple Regression Analysis

Predictor Variables	SE	t	p	R	R^2
Mathematical Self Efficacy	0.044	13.92	< .01	0.753	0.567
Mathematical Test Anxiety	0.045	-12.09	< .01	-0.705	0.497

The results of the simple regression analysis indicate that both Mathematical Self Efficacy and Mathematical Test Anxiety are significant predictors of Mathematics Learning Behaviour of Higher

Secondary School Students. For Mathematical Self Efficacy, the regression analysis yielded a t-value of 13.92, which is statistically significant at 0.01 level. The correlation coefficient (R) is 0.753, indicating a high positive relationship between Mathematical Self Efficacy and Mathematics Learning Behaviour. The coefficient of determination (R^2) is 0.567, suggesting that 56.7% of the variance in students' Mathematics Learning Behaviour can be explained by their level of Mathematical Self Efficacy. Similarly, the analysis for Mathematical Test Anxiety revealed a significant t-value of -12.1 (at 0.01 level), with a correlation coefficient of -0.705, also indicating a high negative relationship. The R^2 value of 0.497 shows that 49.7 % of the variance in Mathematics Learning Behaviour is accounted for by students' Mathematical Test Anxiety. These findings demonstrate that both Mathematical Self Efficacy and Mathematical Test Anxiety are significant variables that contribute meaningfully to students' Mathematics Learning. Therefore, integrating activities that promote these skills into mathematics instruction could enhance students' performance and engagement with the subject.

Major Findings

1. There exists a significant and high positive relationship between Mathematical Self Efficacy and Mathematics Learning Behaviour of Higher Secondary School Students.
2. There exists a significant and high negative relationship between Mathematical Test Anxiety and Mathematics Learning Behaviour of Higher Secondary School Students.
3. Mathematical Self Efficacy is a significant predictor of Mathematics Learning Behaviour of Higher Secondary School Students.
4. Mathematical Test Anxiety is a significant predictor of Mathematics Learning Behaviour of Higher Secondary School Students.

Educational Implications

Based on the major findings of the study, several educational implications can be drawn for curriculum developers, educators, school administrators, counsellors, and policymakers:

- **Foster mathematical self-efficacy through confidence-building classroom practices:**

  Teachers should create a supportive learning environment with appropriately challenging tasks that help students experience success and build belief in their mathematical abilities.

- **Adopt teaching strategies that alleviate mathematical test anxiety:**

  Student-centered approaches such as collaborative problem-solving, real-life contextual learning, and a low-pressure classroom climate can significantly reduce test-related stress and encourage active participation.

- **Provide professional development to help teachers recognize self-efficacy and anxiety issues:**

  Training programs should equip teachers to identify signs of low mathematical self-efficacy and high-test anxiety, and implement targeted interventions to support students effectively.

- **Integrate school-based counselling to manage test anxiety:**

  Counsellors should be involved in helping students develop coping strategies for test anxiety, fostering emotional resilience, and promoting a growth mindset in mathematics.

- **Design curriculum activities that enhance self-efficacy and emotional well-being:**

  Mathematics curricula should include tasks that encourage problem-solving, reflective thinking, and incremental success to nurture self-confidence and reduce fear of failure.

- **Utilize formative assessments to build confidence and minimize evaluation anxiety:**

  Frequent, low-stakes assessments with constructive feedback help students learn from their mistakes without the pressure of high-stakes testing.

- **Engage parents in promoting positive attitudes towards mathematics:**

  Schools should involve parents in supporting their children's emotional and academic growth in mathematics, emphasizing encouragement over performance.

- **Revise teacher education programs to include emotional dimensions of learning:**

  Pre-service teacher training should address psychological factors such as self-efficacy and test anxiety to better prepare educators to support diverse learners.

- **Promote collaborative and real-world mathematical experiences:**

Incorporating peer-based and application-oriented activities can increase engagement, making mathematics more meaningful and less intimidating for students.

- **Encourage policies that support emotional and cognitive development in mathematics learning:**

Educational policy should recognize the importance of addressing emotional factors—like self-efficacy and test anxiety—alongside academic achievement for holistic student development.

Conclusion

The present study highlights the crucial roles of Mathematical Self Efficacy and Mathematical Test Anxiety in shaping the Mathematics Learning Behaviour of Higher Secondary School Students. The findings reveal that while self efficacy significantly enhances students' engagement and confidence in learning mathematics, anxiety poses a major barrier to their performance and interest. Both variables are significant predictors of learning behaviour, emphasizing the need to address emotional and psychological factors in Mathematics Education. By fostering a supportive and confidence-building learning environment, educators and stakeholders can help students develop a more positive and effective approach to learning mathematics.

Delimitation and Limitations of the Study

- The study is delimited to Higher Secondary School students (Class XI) following the Kerala State Syllabus.
- The sample comprises students from selected government and aided schools in the Trivandrum District only.
- The study investigates only three variables: Mathematical Self Efficacy, Mathematical Test Anxiety, and Mathematics Learning Behaviour.
- The study employs a cross-sectional survey method and does not include any intervention or experimental treatment.
- The findings are based on self-reported data, which may be influenced by personal biases and social desirability.

- The study is confined to a single district and may not reflect the diverse educational contexts of other regions.
- The cross-sectional nature of the study limits the ability to establish causality between the variables.
- The sample size, although statistically adequate, may not fully capture all demographic variations within the population.
- The study does not account for external factors such as parental involvement, teaching quality, peer influence, or socio-economic status that may affect learning behaviour.

Recommendations for further Research

- Future studies may adopt a longitudinal design to examine the causal influence of self-efficacy and anxiety on mathematics learning behaviour over time.
- A larger and more demographically diverse sample across different districts and educational boards can enhance generalizability.
- Qualitative methods such as interviews and focus group discussions can be employed to gain deeper insights into students' emotional experiences with mathematics.
- Experimental studies can be conducted to assess the effectiveness of intervention programs aimed at enhancing mathematical self-efficacy and reducing anxiety.
- Comparative studies exploring gender, locality (urban vs. rural), or school management (government vs. private) differences can provide nuanced understanding.
- Further research could incorporate additional affective and cognitive variables such as motivation, academic resilience, and classroom environment.

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