*Wah Academia Journal of International Law and Policy*
***Volume 1, Issue 1, Mar 2026, pp. 59-78***
***https://doi.org/10.63954/e2ax4939***

Article Information

**Received**: 7 Jan 2026

**Revised**: 21 Feb 2026

**Accepted**: 13 Mar 2026

**Published**: 30 Mar 2026

Original Article

# *Factors Influencing Mathematical Anxiety among Undergraduate Students in the Faculty of Arts (Special Reference to Higher Education Institutes Sri Lanka)*

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**Keywords**: Mathematical anxiety, Causal factors, Arts undergraduates, Academic performance, STEM

## Abstract

This study examines the influence of factors on mathematical anxiety among undergraduates in Arts Faculties, focusing on higher education institutions in Sri Lanka. In a technologically advanced society, proficiency in mathematics is crucial for success in the Science, Technology, Engineering and Mathematics (STEM) employment sector. Mathematical anxiety negatively affects an individual's physical and cognitive functioning, leading to low achievement in mathematics. The consequences of low mathematics achievement can have devastating consequences for an individual's career in STEM fields that require high levels of mathematics. This article will provide a review of the prevalence of mathematics anxiety, its historical development, as well as the etiological factors such as cognitive and affective, genetics and missed opportunities. This study was conducted using a quantitative approach, collecting data from 99 undergraduate students from three Sri Lankan universities using a simple random sampling method through a structured questionnaire. Structural equation modeling, a statistical analysis technique, was used to explore the relationship between mathematical anxiety and influencing factors. The study concludes that targeted interventions such as anxiety management workshops and curriculum reforms are essential to reduce these influencing factors and expand students' academic and career opportunities.

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## Introduction

Mathematical anxiety is defined as a feeling of tension, fear, or nervousness when engaging in math-related activities. It affects students' daily routines when attempting to solve math problems and often leads to significant difficulties in handling any math related task. This anxiety is not simply an emotional response but a significant barrier to math achievement, and is influenced by a variety of factors[2]. When faced with math challenges, some people experience mathematical anxiety, which is defined by feelings of fear, helplessness, and mental confusion. Mathematics is a core component of many competitive exams, and often serves as a gateway to higher education and career opportunities. Research has shown that mathematical anxiety and attitudes among university students significantly affect their academic performance[3].

Emotional factors are closely related to mathematical anxiety and can interfere with math performance. Students with high levels of mathematical anxiety may struggle to excel in assessments and may face limitations when entering competitive fields[4]. Addressing this fear is crucial to increasing confidence and improving performance in quantitative contexts for students in the Arts stream, who are often perceived to have weak math skills.

Furthermore, research suggests that factors such as students' use of technology to learn math and their perceived mathematical anxiety self-efficacy levels in college math courses have a major impact on their math achievement. Pursuing math based courses and careers is hampered by this concern. College students' attitudes and levels of mathematics anxiety have been shown to affect their academic achievement. Students who are anxious about math often drop out of math related

[2] Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. Journal for Research in Mathematics Education, 21(1), 33.

[3] Kumarage, T. S. N. D., & Silva, H. P. T. N. (2024). Empirical Study on Attitude towards Making Decision to Select Mathematics for First-Degree Program. Anatolian Journal of Education, 9(2),171-180

[4] Cheng, D., Ren, B., Yu, X., Wang, H., Chen, Q., & Zhou, X. (2022). Math anxiety as an independent psychological construct among social-emotional attitudes: An exploratory factor analysis. Annals of the New York Academy of Sciences, 1517(1), 191–202

classes, which affects both their general academic performance and their ability to solve mathematical problems[5].

Mathematics anxiety has a direct impact on students' academic path choices at the university level. With society increasingly relying on skilled workers in STEM (science, technology, engineering, and mathematics) industries, mathematical anxiety has a significant impact on individual students and society as a whole.

Accordingly, math anxiety is a multidimensional construct that adds complexity to the study of this field, as anxiety is influenced by various factors[6]. This interference leads to a decrease in performance since anxiety inhibits the ability to complete calculation. 2016. Affective disorders have been identified as a secondary component of mathematics anxiety, which means that people who experience mathematical anxiety may also be susceptible to affective disorders. Furthermore, the emotional component that a person experiences due to mathematical anxiety and the accompanying physical symptoms are called the affective dimension. Accordingly, the symptoms that a person may experience include trembling, nausea, sweating, and rapid heartbeat[7]. The primary aim of this study is to examine the factors that influence mathematical anxiety in undergraduate students of the Faculty of Arts. This anxiety may arise from experience, lack of guidance, or systemic problems in education[8]. The lack of research on mathematical anxiety among Arts students in Sri Lanka limits the development of targeted interventions. Factors contributing to this anxiety include negative experiences, ineffective teaching methods, and social perceptions that associate mathematical ability with innate

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[6] Devine, A., Hill, F., Carey, E., & Szűcs, D. (2017). Cognitive and emotional math problems largely dissociate: Prevalence of developmental dyscalculia and mathematics anxiety. Journal of Educational Psychology, 110(3), 431–444

[7] Ashcraft, M. H., & Moore, A. M. (2009). Mathematics anxiety and the affective drop in performance. Journal of Psych educational Assessment, 27(3), 197–205

[8] Schillinger, F. L., Vogel, S. E., Diedrich, J., & Grabner, R. H. (2017). Math anxiety, intelligence, and performance in mathematics: Insights from the German adaptation of the Abbreviated Math Anxiety Scale (AMAS-G). Learning and Individual Differences, 61, 109–119

talent[9]. Accordingly, this paper discusses the factors that influence mathematics anxiety.

**Review of the Literature**

Mathematical anxiety has been studied since the mid-20th century, and was originally called numerical anxiety. Later, in 1967, it was identified as a physiological construct that influenced mathematical anxiety[10]. A scale to measure mathematical anxiety was not developed until the 1970s, which led to an increase in research in this area. One of the pioneers in this field, Tobias and Weissbrod (1980), described math anxiety as the "fear, helplessness, and mental disorganization" that some people experience when faced with a math problem. Furthermore, the seminal work of Ashcraft and Faust (1994) on how mathematical anxiety affects basic math processing has opened up new directions in the study of mathematical anxiety. Since the 2000s, with the advancement of technology, research has increasingly focused on how fear of mathematics negatively affects an individual's academic performance, cognition, stress levels, and career opportunities[11]. Various factors have been identified in the development of mathematical anxiety as studied.

Accordingly, various factors contribute to the prevalence of mathematical anxiety in Art Faculty. These factors have been identified by various researchers. Accordingly, Suarez-Pelliconi et al., (2016), have shown that cognitive and affective factors play a significant role in the development and maintenance of mathematical anxiety. It has also been found that students with high levels of math anxiety have

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[9] Mehmet, C., & Hulya, S. (2021). Factors that cause students to develop math anxiety and strategies to diminish. Retrieved 3rd March 2025 form https://eric.ed.gov/?id=EJ1316557

[10] Wigfield, A., & Meece, J. L. (1988). Math anxiety in elementary and secondary school students. Journal of Educational Psychology, 80(2), 210–216.

[11] Ashcraft, M. H. (2002). Math anxiety: personal, educational, and cognitive consequences. Current Directions in Psychological Science, 11(5), 181–185.

poor math performance[12]. Genetics has also been identified as another factor in mathematical anxiety, and Wang et al. (2014) examined the genetic contribution to mathematical anxiety and cognitive traits. Research has also identified a relationship between mathematical anxiety and general anxiety. Accordingly, cognitive, educational, and genetic factors have been identified as the main factors influencing mathematical anxiety.

In addition, it has been identified that mathematical anxiety is influenced by sociocultural aspects[13]. Research has revealed that environmental factors also affect mathematical anxiety. Educationally, it has been found that not only the influence of teachers but also the influence of parents has an impact on mathematical anxiety. Accordingly, it can be recognized that all these factors, including other factors, affect math anxiety, and that different intensities of their effects affect Art undergraduates.

According to cognitive and affective factors, cognition is an emotional response that contributes to math anxiety[14]. According to studies on mathematical anxiety, the interaction between cognitive and affective factors plays a crucial role in the development of mathematical anxiety in affected individuals. Cognitive based interventions have been identified as a treatment method that helps students reevaluate negative beliefs about math[15]. Since the 2000s, research on the harmful effects of mathematical anxiety has expanded with technological advances and has examined its adverse effects on academic performance, cognitive abilities, stress levels, and career aspirations. Cognitive and affective factors contribute significantly

[12] Luu-Thi, H., Ngo-Thi, T., Nguyen-Thi, M., Thao-Ly, T., Nguyen-Duong, B., & Tran-Chi, V. (2021). An investigation of mathematics anxiety and academic coping strategies among high school students in Vietnam: a Cross-Sectional study. Frontiers in Education, 6.

[13] Tosto, M. G., Momi, S. K., Asherson, P., & Malki, K. (2015). A systematic review of attention deficit hyperactivity disorder (ADHD) and mathematical ability: current findings and future implications. BMC Medicine, 13(1).

[14] Park, D., Ramirez, G., & Beilock, S. L. (2014). The role of expressive writing in math anxiety. Journal of Experimental Psychology Applied, 20(2), 103–111

[15] Passolunghi, M. C., Caviola, S., De Agostini, R., Perin, C., & Mammarella, I. C. (2016). Mathematics Anxiety, working Memory, and Mathematics Performance in Secondary

to the development and persistence of mathematical anxiety[16]. It has been linked to poor mathematical performance and general academic achievement, as well as negatively affecting attitudes and perceptions towards mathematics.

Research has also identified genetic factors that influence mathematical anxiety. However, their effects are often indirect, nonlinear, and mediated by other factors. After examining various potential causes of mathematical anxiety, such as social variables, external influences, and cognitive biases, genetics can be considered the final contributing factor in the broad framework of mathematical anxiety [17]. According to research, mathematical anxiety may be associated with an inherited predisposition that may stem from previous experiences of poor math performance and, in some cases, missed learning opportunities. Due to the complexity of both mathematical anxiety and human genetics, establishing a direct relationship between them has proven challenging. Some researchers have suggested that identifying specific genetic factors for mathematical anxiety is extremely difficult[18]. Genetic factors contribute to mathematical anxiety by influencing characteristics such as general anxiety, cognitive abilities, and personality. In addition, the interaction between genes and environment plays a critical role in mathematical anxiety. Educational methods and social environments can help to reduce genetic risks. Further research into the genetic basis of math anxiety will help to find more effective strategies for prevention and intervention [19]

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[17] Wang, Z., Hart, S. A., Kovas, Y., Lukowski, S., Soden, B., Thompson, L. A., Plomin, R., McLoughlin, G., Bartlett, C. W., Lyons, I. M., & Petrill, S. A. (2014). Who is afraid of math two sources of genetic variance for mathematical anxiety Journal of Child Psychology and Psychiatry,55(9), 1056–1064

[18] Dowker, A., Sarkar, A., & Looi, C. Y. (2016). Mathematics anxiety: What have we learned in 60 years? Frontiers in Psychology, 7.

[19] Wang, Z., Hart, S. A., Kovas, Y., Lukowski, S., Soden, B., Thompson, L. A., Plomin, R., McLoughlin, G., Bartlett, C. W., Lyons, I. M., & Petrill, S. A. (2014). Who is afraid of math two sources of genetic variance for mathematical anxiety Journal of Child Psychology and Psychiatry,55(9), 1056–1064

When identifying other factors that influence mathematical anxiety (the missed opportunity factor), the contribution of teachers can be identified. In addition to pedagogical influence, teachers can also cause anxiety by projecting their own anxiety onto students. Research has shown that female educators, in particular, are more likely to transfer their own anxiety to their students [20]. Students who have negative attitudes about math from their parents or teachers may develop mathematical anxiety as a result. Furthermore, a key factor in the development of mathematical anxiety is parental involvement. Parents who are anxious about math may unknowingly exacerbate their own anxiety when helping their children with schoolwork [21].

Parents' mathematical anxiety can significantly affect their children's behavior and interactions. Early discussions can help identify learning difficulties and prevent future anxiety. Parental math anxiety can lead to decreased learning during the school year and increased anxiety at the end of the year[22]. Similarly, environmental factors have also been identified as influencing mathematical anxiety. There are a variety of environmental factors that can contribute to mathematical anxiety. Another factor that influences mathematical anxiety is peer fear of math. Peer boredom is a major contributor to math related fear. Peers can negatively affect their peers' academic progress at any stage of the learning process[23]. Accordingly, the extent to which these various factors influence it can be identified to some extent.

## Methodology

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[23] Khasawneh, E., Gosling, C., & Williams, B. (2021). What impact does math's anxiety have on university students BMC Psychology, 9(1).

Considering the structured design or framework used to investigate the relationship between factors influencing mathematical anxiety among university students, the research was conducted through a quantitative approach. Quantitative research allows for the collection of quantitative data and provides the ability to accurately measure variables[24]. This allows the researcher to use statistical techniques to identify relationships between variables. In quantitative research, large sample sizes enhance external validity and allow the results to be generalized to a wider population[25]. The target population of this study includes all undergraduate students in the Faculty of Arts of the Universities of Kelaniya (UOK), Jayewardenepura (USIP) and Peradeniya (UOP). As recognized by the University Grants Commission (UGC), these universities were selected based on the highest student enrollment among state universities offering Arts degrees.

Accordingly, these three institutions were selected as the population for this study. Accordingly, 6021 Bachelor of Arts candidates from the University of Kelaniya, 3840 Bachelor of Arts candidates from the University of Jayewardenepura and 4859 Bachelor of Arts candidates from the University of Peradeniya were selected as the population for the study[26]. The use of formulas is relevant for selecting the relevant sample for this study. In studies such as computational anxiety, it is relevant to select the sample using formulas as it helps in varying the reliable conditions and nonresponsive conditions as requested for the study. For this, Yamane's formula is used. As a result, when the population size is known, the relevant significance level is followed, and when the requested sample size is unknown, it is important to consider using Yamane's formula[27]. Furthermore, Yamane's system can be applied to determine the relevant sample size for all

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[26] University Grants Commission. (2021). Sri Lanka University Statistics 2021. Ugc.ac.lk.Retrieved February 11, 2025,

[27] Al-hasnawi, M., & Hotson, D. (2023). R Sampling Methods & Sampling Size. Retreviw 22nd April,2025 from: https://www.re searc hgate.net/publication/372518813

confidence levels, ensuring consistency across continuous and categorical variables. Yamane's system is used to calculate the sample size for a 90-confidence level. A 90 confidence level is also used as a practical approach to balance responsibility and feasibility. The time scale was chosen as follows.

According to that, from the population of 14720 students, under a 90% confidence level, the number of units obtained as 99.32 was selected as 99 units for the convenience of studying. The non-responsive rate should be included in the final sample size calculation. A 10% nonresponse rate is frequently seen as acceptable in a variety of study domains, such as the social sciences and economics

**Table 1: Population and Sample Size Composition**

| University | Actual sample size |
|---|---|
| University of Kelaniya | $\frac{6021}{14720} \times 99 = 40$ |
| University of Peradeniya | $\frac{4859}{14720} \times 99 = 33$ |
| University of Jayewardenepura | $\frac{3840}{14720} \times 99 = 26$ |

Source: University Grants Commission (2021)

Table 1 presents the sample selection process. The population is divided into three universities. The sample size selected from each university is calculated using proportional separation. This undergraduate students of selected universities in Sri Lanka. It is considered appropriate to use a simple random sampling technique to ensure an equal chance of selecting an undergraduate student for the study and to prevent selection bias. Also, the results can be generalized because they are selected randomly. In this case, the sample was obtained first. In this case, students are selected without bias using a random number generator. Here, the accuracy and validity of the study are improved because a probability based statistical technique is used[28].

[28] Saunders, M. n.k., Philip Lewis, & Adrian Thornhill. (2023). Research methods for business students (9th Ed.). https://www.researchgate.net/publication/240218229

## Results

To test the research objective, structural equation modeling is used. SEM is a statistical method for analyzing and assessing causal links between variables. To describe intricate interactions between observed and latent (unobserved) variables, it combines multiple regression analysis with component analysis[29]. SEM gives researchers a thorough grasp of the underlying structures of a data set and enables them to investigate both direct and indirect effects across variables. Accordingly, the primary causes of mathematics anxiety among undergraduate students in the Faculty of Arts are identified and estimated in this study using SEM analysis. The purpose of this analysis is to determine how lost opportunities, genetics, and cognitive and affective factors contribute to the development of math fear. SEM is an analytical method for comprehending the intricate connections among various variables. The SEM model's fit to the empirical data is evaluated using the goodness of fit (GOF) test[30]. Absolute fit indices, incremental fit indices, and parsimony fit indices are the three primary categories into which these fit indices can be separated[31]. In the absolute fitness index, the Chi-Square to degrees of freedom ratio (CMIN/DF) value should be $\leq 3$, the goodness of fit index (GFI) and the adjusted goodness of fit index (AGFI) values should be close to 1, and the root mean square residual (RMR) value and the root mean square error of approximation (RMSEA) value should be less than 0.1. Also in the incremental fitness index the comparative fit index (CFI), the tucker lewis index (TLI), the relative fit index (RFI) and the normed fit index (NFI) should all have values close to 1. Furthermore, the parsimony fitness index, the parsimony ratio (PRATIO), parsimony normed fit index (PNFI), parsimony comparative fit index (PCFI), and parsimony goodness of fit index (PGFI) related to this index should all be close to 1.

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The Main Factors Contributing to Mathematical Anxiety among Art Faculty Undergraduates. The measurement model specifies indicators for each construct and enables and assesses construct validity[32]. Figure 1 is a visual diagram showing the initial measurement model or model for confirmatory factor analysis (CFA). Based on the conceptual model, there are four latent variables: cognitive and affective factors (CAF), genetics factors (GF), missed opportunity factors

(MOF) and overall effect of anxiety (OEA). The goodness of fit (GOF), goodness of fit index (GFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were used to evaluate the measurement model.

To achieve this objective, SEM was used, which consists of two parts: structural model and path analysis. The variable structure coding used for this was coded as follows.

Table 2: Variables of the Structural Equation Model

| | |
|---|---|
| CAF | Cognitive and affective factors |
| GF | Genetic factors |
| MOF | Missed opportunity factors |
| OEA | Overall mathematical anxiety |

Source: Author Developed (2025)

Table 2 describes the variables of the structural model employed in this analysis, categorizing them into dependent and independent variables, The dependent variable in this study is overall math anxiety, which is denoted by OEA. Only three independent variables are considered, which are CAF (Cognitive and affective factors), GF (Genetic factors), and MOF (Missed opportunity). This structure

[32] Hair, J. F., Howard, M. C., & Nitzl, C. (2019). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. Journal of Business Research, 109, 101

facilitates a clear understanding of the interaction between math anxiety and the factors that affect it.

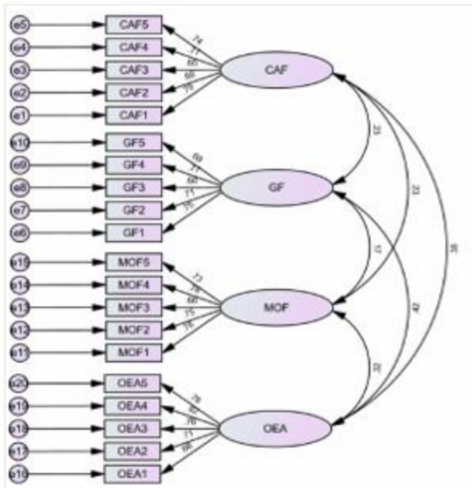


*Figure 1: Illustrates the Measurement Model and Standardized Estimation*
**Source: Field Survey Data (2025)**

Table 3 presents the results of the Convergent validity and Reliability Test. All standardized factor loadings for reflective indicators exceed the recommended threshold of 0.7, indicating strong relationship between indicators and their construct. Additionally, the Average Variance Extracted (AVE) values for each construct are all above 0.5, suggesting convergent validity. Composite Reliability (CR) measures are all above 0.7, indicating good internal consistency reliability.

Table 3: Results of the Convergent Validity Test

| Construct | No. of Items | Standardized Factor Loadings | | AVE | CR |
|---|---|---|---|---|---|
| | | Min | Max | | |
| CAF | 5/5 | .650 | .785 | 0.528 | 0.848 |
| GF | 5/5 | .676 | .772 | 0.519 | 0.844 |
| MOF | 5/5 | .665 | .785 | 0.552 | 0.860 |
| OEA | 5/5 | .681 | .817 | 0.548 | 0.858 |

Source: Field Survey Data (2025)

Notably, all constructs show high minimum factor loadings (lowest 0.650), which rise to an even stronger maximum (highest 0.681), indicating that the items have strong loadings on the respective constructs Thus, and the constructs demonstrate adequate convergent validity and reliability. To assess discriminant validity, squared interconstruct correlation estimates were compared with the AVE for each construct is higher than the squared correlation between that construct and others, confirming discriminant validity. Consequently, these results suggest that the measure used in the study possess satisfactory convergent and discriminant validity as well as reliability.

The procedure for model fitting includes determining the goodness of fit between hypothesized model and the sample data. Generally, absolute fit indices, incremental fit indices and parsimony fit indices are evaluated to test the goodness of the fitted model goodness of the fitted model.

Table 4: Results of the Goodness of Fit of the Measurement Model

| The Goodness of Fit Index | | Observed Value | Threshold |
|---|---|---|---|
| Absolute Fit Indices | CMIN/DF | 0.985 | <3 |
| | GFI | 0.974 | Close to 1 |
| | AGFI | 0.967 | Close to 1 |
| | RMR | 0.046 | <0.1 |
| | RMSEA | 0.000 | <0.1 |
| Incremental Fit Indices | CFI | 1.000 | Close to 1 |
| | TLI | 1.000 | Close to 1 |
| | RFI | 0.963 | Close to 1 |
| | NFI | 0.968 | Close to 1 |
| Parsimony Fit Indices | PRATIO | 0.863 | Close to 1 |
| | PNFI | 0.836 | Close to 1 |
| | PCFI | 0.863 | Close to 1 |
| | PGFI | 0.761 | Close to 1 |

Source: Field Survey Data (2025)

Since the CMIN/DF value is less than 3, RMSEA and RMR values are less than 0.1 and other goodness of fit indices are close to one in the table 4, the overall goodness of fit in the measurement model can be verified. The GFI and AGFI values are close to 1, indicating the improvement of the model. Also, the incremental fit indices such as CFI and TLI both report perfect values of 1.0, while RFI and NFI are also close to 1, confirming that the model is performing well. Furthermore, indices such as PRATIO ratio, PNFI index, PCFI index and PGFI index are close to 1, suggesting a good model fit, maintaining a reasonable balance between fit and complexity. Thus, overall, the measurement model is statistically sound and well-fitting.

Table 5: Comparison of Square Inter Construct Correlation with AVE

| | MOF | CAF | GF | OEA |
|---|---|---|---|---|
| MOF | **0.743** | | | |
| CAF | 0.228 | **0.727** | | |
| GF | 0.174 | 0.227 | **0.720** | |
| OEA | 0.320 | 0.375 | 0.419 | **0.749** |

Source: Field Survey Data (2025)

Table 5 indicates the Square Root of Average Variance Extracted (AVE) and the Inter construct relationships table offer information about the measuring model's discriminant validity. It indicates relationships between the components and calculates the percentage of variance accounted for by each construct Discriminant validity can assessed by contrasting off-diagonal relationship with the diagonal (AVE). Indicated that the square root of AVE for each construct was higher than the relationship between that construct and other constructs. It confirmed the discriminant validity of the model.

The structural model without controlled variable is illustrated in Figure 1 once the overall model fit is considered, CMIN/DF recorded 0.985, making the measurement model acceptable. As shown in Table 4, the Root Mean Square Error of Approximation (RMSEA), which assesses the hypothesized model fit with a population covariance matrix is 0.000 for the estimated model and the Root Mean Square Residual (RMR) value for the current study (RMR = 0.046) is less than the critical value of 0.1 while GFI (Goodness of Fit Index) that represent the overall amount of the covariance among the observed variables that can be accounted for the model is 0.974. The Comparative Fit Index (CFI) and the Tucker Lewis Index for the model fit were respectively and the values for the model are greater than 0.9 (CFI=1, LTI=1) indicating a good overall fit of the measurement model. The Normed Fit Index (NFI) value and Relative Fit Index (RFI) values of this study were 0.968 and 0.963, they show a value close 0.9. The Tucker-Lewis Index for model was respectively, and it indicates a good. All the model fit indices meet the requirement for a good fitting measurement model.

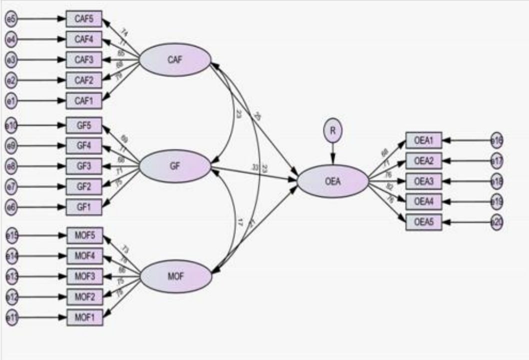


*Figure 2: Path Analysis*

Source: Field Survey Data (2025)

The relationship between math anxiety and factors influencing math anxiety is shown in Table 6, According to the analysis, it is expected to reveal significant relationships between overall math anxiety (OEA) and cognitive and affective factors (GF), genetic factors (CAF), and missed opportunity factors (MOF).

Table 6: Results of the Path Analysis

| **Standardized Path** | | | |
|---|---|---|---|
| **Parts** | **Coefficient** | **P value** | **Decision** |
| OEA→GF | 0.325(0.044) | 0.001* | Support |
| OEA→CAF | 0.255(0.041) | 0.001* | Support |
| OEA→MOF | 0.205(0.039) | 0.001* | Support |

Standard errors of Coefficients in Parenthesis
*Denotes the significance of the hypothesis at 5%

Source: Field Survey Data (2025)

There is a positive and statistically significant relationship between OEA and GF. The standardized coefficient is (0.325) and suggests a moderate effect, indicating that genetic factors play a significant role in explaining math anxiety. There is also a significant positive relationship between OEA and CAF. The standardized coefficient is (0.255) which suggests moderate. This suggests that psychological factors mediate math anxiety. OEA and MOF are statistically significant but show relatively weak effects compared to GF and CAF. That is, the P value for all three factors is 0.001, indicating that all independent variables affect the dependent variable.

**Discussion**

The study's findings reveal that cognitive and affective factors (CAF), genetic factors (GF), and missed opportunity factors (MOF) all significantly contribute to mathematics anxiety among Arts undergraduates in Sri Lanka. The strongest influence comes from genetic factors ($\beta = 0.325$, $p = 0.001$), suggesting that inherited predispositions, such as general anxiety tendencies or cognitive traits, play a substantial role in math anxiety. Cognitive and affective factors ($\beta = 0.255$, $p = 0.001$) also exhibit a moderate impact, aligning with prior research indicating that negative emotional responses and self-efficacy beliefs shape math-related stress. Missed opportunity factors ($\beta = 0.205$, $p = 0.001$), while still significant, have a comparatively weaker effect, implying that external influences such as inadequate prior instruction or teacher attitudes contribute to anxiety but are less dominant than intrinsic factors. It suggests that gaps and lack of reinforcement in early math education contribute to anxiety.

These results are consistent with existing research and highlight the unique contextual factors in Sri Lanka that influence math anxiety. The strong influence of genetic factors (GF) supports Wang et al. (2014), who found that math anxiety has a heritable component linked to general anxiety and cognitive traits. Similarly, Tosto et al. (2015) established a genetic correlation between math anxiety and broader anxiety disorders, reinforcing the idea that some students may be biologically predisposed to math-related stress. The significant role of cognitive and affective factors (CAF) corroborates research by Beilock & Maloney (2015), who demonstrated that negative self-beliefs and emotional responses impair mathematical performance. Additionally, Passolunghi et al. (2016) found that cognitive interventions, such as reframing negative thoughts, can mitigate math anxiety, suggesting that psychological factors are modifiable through targeted strategies. Regarding missed opportunity factors (MOF), the results are consistent with Beilock et al. (2010), who found that teacher attitudes and parental anxiety significantly influence students' math apprehension. The Sri Lankan context may amplify these effects due to systemic educational gaps, such as limited access to quality math instruction in early schoolinga factor less emphasized in Western studies but critical in developing nations. However, the study contrasts with some Western findings where environmental factors (e.g., teaching quality) often dominate over genetic explanations. This discrepancy may stem from cultural differences in educational expectations or the specific challenges faced by Arts students in Sri Lanka, who may have had fewer opportunities to develop mathematical confidence compared to STEM-focused peers.

Longitudinal studies could explore how math anxiety evolves over time, while cross-cultural comparisons could clarify the role of societal expectations. Additionally, incorporating qualitative methods may provide deeper insights into students' personal experiences with math anxiety. Overall, the study highlights the need for tailored interventions in Sri Lankan higher education to mitigate math anxiety and enhance students' academic and career prospects in an increasingly quantitative world.

**Recommendation / Conclusion**

This study investigated the factors influencing mathematics anxiety among undergraduate students in the faculties of arts of three universities in Sri Lanka. The findings revealed that cognitive and affective factors (CAF), genetic factors (GF), and missed opportunity factors (MOF) significantly contribute to mathematics anxiety, with genetic factors showing the strongest effect ($\beta = 0.325$, $p < 0.001$), followed by cognitive and affective factors ($\beta = 0.255$, $p < 0.001$) and missed opportunities ($\beta = 0.205$, $p < 0.001$). These results are consistent with previous research, indicating that mathematics anxiety is a multidimensional problem influenced by psychological, genetic, and environmental factors. Structural equation modeling (SEM) analysis confirmed a strong model fit, strengthening the validity of these relationships.

The study highlights the need for targeted interventions such as anxiety management workshops, curriculum reforms, and teacher training to reduce math anxiety and improve students' academic and career prospects, especially in STEM fields where math proficiency is critical.

That is, universities should implement workshops that focus on stress reduction, cognitive behavioral techniques, and mindfulness to help students manage math-related anxiety. These programs should emphasize positive reinforcement and self-efficacy to build confidence in solving math problems. That is, anxiety management workshops should be implemented. Further, a more student-centered approach to teaching math should be adopted through curriculum reforms, and interactive and practical applications should be included to make the subject more engaging. Reducing reliance on memorization and introducing real-world problem-solving opportunities can also help to alleviate anxiety.

Schools and universities should organize seminars to educate parents about how their attitudes toward mathematics affect their children. Providing parents with resources to support their children without transmitting anxiety can create a more positive learning experience. Establishing peer tutoring and study groups can also help reduce anxiety by creating collaborative learning environments. Students with low anxiety levels can mentor their peers and reinforce concepts in a less intimidating setting. Early identification of students at risk of developing math anxiety through diagnostic assessments, such as early intervention programs, can provide timely support, such as remedial classes or counseling, before anxiety takes root. By integrating digital tools such as adaptive learning platforms with technology-enhanced learning, mathematics can be made more accessible and less stressful for students of varying proficiency levels. By implementing these strategies, higher education institutions can reduce math anxiety, improve academic outcomes, and better prepare arts students for careers that require quantitative skills.

This study highlights key areas for further exploration to deepen our understanding of mathematics anxiety among undergraduates. Future research could adopt mixed-methods approaches to combine statistical data with qualitative insights, allowing for a richer analysis of students' experiences. Longitudinal studies could track the development of mathematics anxiety over time and identify critical periods when interventions may be most effective. Further comparative studies could reveal how mathematics anxiety varies based on educational backgrounds. Experimental studies could also develop evidence-based strategies for reducing mathematics anxiety. Addressing these gaps would enhance efforts to improve mathematical confidence and academic success among students.

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## Declarations:

Authors' Contribution:

- **Conceptualization, and intellectual revisions**
- **Data collection, interpretation, and drafting of manuscript**

- The authors agree to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed

- **Conflict of Interest**: NIL

- **Funding Sources**: NIL