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Transforming Learning through Inclusion: A Study of Mathematics Anxiety, Gender, and Personality Characteristics in Secondary Schools of Chhattisgarh

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ABSTRACT

This pilot study looked at the association between math anxiety, gender disparities, and personality traits among secondary school pupils in Chhattisgarh, India. As part of the larger goal for Chhattisgarh@2047, this study looked into how reforming education through inclusiveness and indigenous knowledge systems may address mathematical learning issues. This mixed-methods study included 120 students (60 men and 60 females) in grades 9-10 from five schools in both urban and rural Chhattisgarh. Data were gathered using conventional instruments such as the Mathematics Anxiety Rating Scale (MARS), the Big Five Inventory (BFI), and academic performance records. Results showed substantial gender differences in mathematics anxiety levels ($t = 2.34$, $p < 0.05$), with female students reporting higher anxiety than males ($M = 78.5$ vs. $M = 71.2$). Personality traits such as neuroticism ($r = 0.42$, $p < 0.01$) and conscientiousness ($r = -0.38$, $p < 0.01$) were found to significantly correlate with mathematics anxiety. The study also discovered that pupils with moderate mathematics anxiety (65.8%) performed better academically than those with high anxiety levels. These findings highlight the necessity for culturally relevant instructional techniques that incorporate indigenous knowledge systems while also addressing psychological aspects influencing mathematics learning. The implications for inclusive education approaches that line with the Chhattisgarh@2047 goal are highlighted.

1. Introduction

Mathematics anxiety presents a considerable challenge to academic success and later career prospects, especially in developing regions where educational advancements are key to social and economic growth. In the Indian education context, this form of anxiety is widespread among students from varied demographics. This exploratory study investigates the relationships among mathematics anxiety, gender differences, and personality traits in secondary students in Chhattisgarh. It aligns with the state's vision to transform education by 2047 through sustainability, inclusivity, innovation, and integrating Indian Knowledge Systems (IKS).

Prior studies worldwide have documented the widespread presence and impact of mathematics anxiety. For example, females often report higher anxiety levels than males, with the gap most pronounced in grades 9 and 10. Longitudinal data suggest that girls' anxiety tends to persist more strongly through school years compared to boys. Personality plays a role too, especially traits measured by the Big Five model. Conscientiousness generally predicts better academic outcomes, whereas neuroticism tends to correlate with higher anxiety and poorer math performance.

1.1 Recent Research Findings (2020-2025)

Studies from several countries pinpoint diverse trends in mathematics anxiety. A 2024 Vietnamese study revealed variations by grade level and performance, with senior students and those scoring high in math unexpectedly showing elevated anxiety. Early childhood research indicates gender differences in math anxiety appear early and may be mediated by general anxiety. Moreover, recent work highlights math anxiety's role as a moderator between self-esteem and achievement, showing its active influence on how psychological factors affect learning.

Szczygieł's (2021) longitudinal study of children in first and second grade revealed that gender differences in mathematics anxiety begin early in the schooling process, with girls showing higher levels than boys in both test-related and overall math anxiety. The research also found that general anxiety fully mediates the connection between gender and mathematics anxiety, underscoring the intricate relationship between emotional and cognitive influences.

More recent research has highlighted the influential role of mathematics anxiety in academic dynamics. According to Peteros (2025), mathematics anxiety plays a significant moderating role between self-esteem and math achievement, indicating that anxiety not only correlates with academic performance but also shapes how other psychological factors impact learning outcomes.

1.2 Cultural and Indigenous Perspectives

The use of Indigenous Knowledge Systems (IKS) within mathematics education is increasingly recognized as an effective strategy to decrease anxiety and boost student engagement, especially in settings with cultural diversity. Kadonsi's (2024) study in Zambia found that incorporating indigenous approaches into math teaching greatly improved students' involvement, understanding, and academic results, while also strengthening their cultural identity and pride. In India, embedding traditional mathematical ideas found in local customs, arts, and cultural heritage provides valuable opportunities to develop more inclusive and meaningful learning experiences. Such integration supports the Chhattisgarh@2047 initiative's aim to transform education by utilizing local knowledge systems.

1.3 Theoretical Framework

This study is informed by multiple theoretical perspectives to explore mathematics anxiety concerning gender and personality factors. Social Cognitive Theory explains that anxiety develops through learning by observation, personal experiences, and social feedback, with gender differences possibly arising from varying societal expectations and stereotypes about math ability. Trait Theory of Personality sheds light on how enduring individual traits affect emotional reactions to mathematical challenges. The Five-Factor Model provides a detailed framework for examining how different personality traits interact with academic stress. Additionally, Culturally Responsive Pedagogy Theory highlights the value of integrating students' cultural backgrounds and indigenous knowledge into instructional methods, which may help lower anxiety by making learning more meaningful and accessible.

2. Methodology

2.1 Research Design

A cross-sectional mixed-methods approach was used, combining quantitative data with qualitative insights to explore links among mathematics anxiety, gender, and personality traits in secondary school students of Chhattisgarh.

2.2 Participants

The study included 120 students equally divided by gender (60 boys and 60 girls), aged between 14 and 16 years, from grades 9 and 10. Participants were drawn through purposive sampling from five schools representing both urban and rural areas, and covering government, aided, and private institutions to reflect diverse socio-economic and geographic backgrounds.

Inclusion Criteria:

- Students enrolled in grades 9-10

- Age range 14-16 years

- Minimum six months enrolment in current school

- Consent from parents/guardians and student assent

2.3 Research tools used

1. Mathematics Anxiety Rating Scale (MARS) – A 25-item scale measuring different dimensions of math anxiety, rated on a 5-point Likert scale with solid reliability (Cronbach's alpha = 0.89).
2. Big Five Inventory (BFI-44) – A 44-item questionnaire assessing five personality traits: openness, conscientiousness, extraversion, agreeableness, and neuroticism, also using a 5-point scale with good reliability scores.
3. Academic Records – Recent math grades standardized across the various schools.
4. Demographic Survey – Collected data on age, gender, parental education, family income, and school type to control for confounding factors.

2.4 Procedure

Data were collected in October-November 2024 following ethical approvals. The process involved administering the demographic questionnaire, MARS, and BFI, followed by gathering academic records. Group assessments were conducted in regular classrooms, with instructions given in Hindi and English.

The assessment protocol involved:

1. Administration of demographic questionnaire (10 minutes)

2. Completion of MARS (20 minutes)

3. Administration of BFI-44 (25 minutes)

4. Collection of academic performance data from school records

The assessments were carried out in group formats inside typical classroom settings. To accommodate diverse language needs, instructions were given in both Hindi and English to ensure all participants understood.

2.5 Data Analysis

Statistical analysis was conducted utilizing SPSS version 28.0. Descriptive measures such as means, standard deviations, and frequency distributions were computed for all variables. Independent t-tests were used to investigate gender differences in mathematics anxiety and personality traits. Pearson correlation analyses examined associations among mathematics anxiety, personality factors, and academic achievement. Additionally, multiple regression analysis was applied to determine key predictors influencing levels of mathematics anxiety.

3. Results

3.1 Descriptive Statistics

The sample demographic characteristics revealed a balanced representation across key variables. The mean age was 15.2 years (SD = 0.8), with equal gender distribution as planned. Regarding parental education, 42% of students had at least one parent with secondary education or higher, while 58% came from families with primary education or below. Mathematics anxiety scores ranged from 32 to 118 (M = 74.8, SD = 18.6), indicating considerable variability within the sample. The distribution showed slight positive skewness (0.23), suggesting a tendency toward higher anxiety levels among some students.

Characteristic	**Statistic Value**
Mean Age	15.2 years (SD = 0.8)
Gender Distribution	Equal
Parental Education ≥ Secondary	42%
Parental Education ≤ Primary	58%
Math Anxiety Score Range	32–118
Math Anxiety Mean	74.8 (SD = 18.6)
Math Anxiety Skewness	0.23 (slight positive skew)

3.2 Gender Differences in Mathematics Anxiety

Significant gender differences emerged in overall mathematics anxiety levels t (118) = 2.34, p = 0.021). Female students reported higher mean anxiety scores (M = 78.5, SD = 19.2) compared to male students (M = 71.2, SD = 17.4), representing a medium effect size (Cohen's d = 0.40).

Gender	Mean Anxiety Score	Standard Deviation
Female	78.5	19.2
Male	71.2	17.4

Analysis of mathematics anxiety subscales revealed:

Anxiety Type	Female Mean (M)	Male Mean (M)	t-value	p-value
Mathematics Test Anxiety	28.3	25.1	2.18	0.031
Numerical Anxiety	-	-	1.42	0.158
Mathematics Course Anxiety	26.8	23.9	2.05	0.043

- Mathematics Test Anxiety: Females (M = 28.3) > Males (M = 25.1), t(118) = 2.18, p = 0.031

- Numerical Anxiety: No significant difference, t(118) = 1.42, p = 0.158

- Mathematics Course Anxiety:

Females (M = 26.8) > Males (M = 23.9), t(118) = 2.05, p = 0.043

3.3 Personality Characteristics and Mathematics Anxiety

Correlation analyses revealed significant associations between personality dimensions and mathematics anxiety:

Personality Trait	Correlation with Math Anxiety (r)	p-value
Neuroticism	0.42	<0.01
Conscientiousness	-0.38	<0.01
Openness to Experience	-0.24	0.009
Extraversion	-0.16	0.081
Agreeableness	-0.12	0.201

Neuroticism showed the strongest positive correlation with mathematics anxiety ($r = 0.42$, $p < 0.01$), indicating that students with higher emotional instability experienced greater mathematical anxiety.

Conscientiousness demonstrated a significant negative correlation ($r = -0.38$, $p < 0.01$), suggesting that more organized and disciplined students reported lower anxiety levels.

Openness to Experience exhibited a modest negative correlation ($r = -0.24$, $p = 0.009$), indicating that students more open to new experiences had reduced anxiety.

Extraversion and Agreeableness showed non-significant correlations with mathematics anxiety ($r = -0.16$, $p = 0.081$; $r = -0.12$, $p = 0.201$, respectively).

3.4 Mathematics Anxiety and Academic Performance

The relationship between mathematics anxiety and academic performance revealed a significant negative correlation ($r = -0.34$, $p < 0.001$). Students were categorized into three anxiety levels based on score distributions:

Anxiety Level	Number of Students	Percentage (%)	Mean Academic Grade (%)
Low Anxiety (≤60)	28	23.3	76.2
Moderate Anxiety (61-85)	79	65.8	68.5
High Anxiety (>85)	13	10.9	58.1

A one-way ANOVA confirmed significant differences in academic performance across anxiety levels, $F(2,117) = 8.47$, $p < 0.001$.

3.5 Multiple Regression Analysis

Multiple regression analysis identified significant predictors of mathematics anxiety ($R^2 = 0.32$, $F(5,114) = 10.8$, $p < 0.001$):

Predictor	Beta (β)	p-value
Neuroticism	0.35	<0.001
Gender (female)	0.28	0.002
Conscientiousness	-0.23	0.009
Previous Mathematics Performance	-0.19	0.025
School Type (government)	0.16	0.048

4. Discussion

4.1 Gender Disparities in Mathematics Anxiety

The results support well-documented trends showing that female students experience notably higher levels of mathematics anxiety compared to male students. This gap is consistent with global research and highlights the ongoing impact of cultural and societal influences on how adolescents in India perceive their mathematical abilities. Notably, female students displayed significantly greater anxiety related to math tests and courses, whereas no gender differences were observed in numerical anxiety, suggesting that the anxiety experienced by females may be more context-dependent. This indicates that targeted interventions focusing specifically on improving test-taking skills and fostering a supportive classroom environment could be especially effective for reducing anxiety among female learners.

4.2 Personality as a Mediating Factor

The observed strong positive relationship between neuroticism and mathematics anxiety emphasizes the critical role of emotional regulation within math education settings. Students characterized by high levels of neuroticism might benefit from programs designed to provide stress reduction and emotional coping strategies integrated into math instruction. On the other hand, conscientiousness acts as a protective trait, with students who are more organized, diligent, and motivated better positioned to handle math challenges without excessive anxiety. This insight underscores the value of incorporating training in

study habits and self-regulatory skills into mathematics curricula to support students' emotional resilience and academic success.

4.3 Academic Performance Implications

The inverse association between mathematics anxiety and academic achievement highlights a reinforcing cycle wherein elevated anxiety depletes the cognitive capacity needed for solving mathematical problems, resulting in lower performance, which then intensifies anxiety further. This cyclical pattern underscores the urgency for early interventions that target both the emotional and cognitive challenges faced in learning mathematics. Additionally, the observation that the majority of students (65.8%) exhibited moderate levels of anxiety indicates that anxiety is not binary but exists along a spectrum, suggesting that tailored intervention strategies could effectively support a large segment of students.

4.4 Cultural and Indigenous Knowledge Integration

Although this pilot study primarily investigated psychological dimensions, its outcomes bear significant relevance for culturally responsive teaching approaches in line with the Chhattisgarh@2047 initiative. The fact that the type of school emerged as a meaningful predictor points to the influence of educational settings and available resources on the development of mathematics anxiety.

Incorporating indigenous mathematical ideas and local cultural traditions into education has the potential to alleviate anxiety by:

- Enhancing the relevance of mathematics through connections to students' everyday lives and experiences
- Questioning dominant Western mathematical narratives that might reinforce negative stereotypes
- Offering diverse approaches to understanding mathematics that respect a variety of cognitive preferences
- Encouraging students to take pride in their cultural heritage and indigenous knowledge systems

4.5 Implications for Inclusive Education

The findings highlight the necessity for comprehensive mathematics education strategies that consider individual differences in personality, gender socialization, and cultural context. Important recommendations include:

- Teacher Training: Educators should be equipped to identify and address mathematics anxiety, with particular attention to female students and those exhibiting high levels of neuroticism.
- Curriculum Design: Math curricula should integrate varied instructional approaches, incorporate cultural relevance, and include emotional support to cater to diverse learner needs.
- Assessment Practices: Evaluation methods must reduce anxiety triggers while upholding academic standards, potentially by using portfolio assessments and culturally appropriate problem-solving scenarios.
- Community Engagement: Engaging families and local communities in math education can play a significant role in combating stereotypes and offering support to students struggling with anxiety.

5. Conclusion

This pilot study offers preliminary evidence highlighting significant links between mathematics anxiety, gender, and personality traits among secondary school students in Chhattisgarh. The results indicate that female students tend to experience higher levels of math anxiety, especially related to tests and courses, while personality traits such as neuroticism and conscientiousness play critical roles as risk and protective factors, respectively.

These findings advocate for the creation of comprehensive, culturally sensitive interventions that address both psychological and teaching-related contributors to math anxiety. Consistent with the Chhattisgarh@2047 vision, future educational programs should incorporate indigenous knowledge systems, foster inclusive teaching strategies, and provide focused support for at-risk student groups.

Further research is recommended to include larger and more diverse samples, as well as to evaluate the success of interventions combining psychological assistance with culturally responsive pedagogy. Longitudinal studies monitoring the progression of anxiety and the effects of inclusive educational practices will be essential to establish evidence-based methods for transforming mathematics education in Chhattisgarh and similar regions.

Beyond enhancing academic outcomes, this research has wider implications for promoting educational equity, preserving cultural heritage, and supporting sustainable development. By tackling mathematics anxiety through inclusive and culturally grounded methods, educational systems can better equip students to meet the demands and possibilities of the 21st century while honoring their cultural identities and indigenous knowledge.

References

Ashcraft, M. H., & Moore, A. M. (2009). Mathematics anxiety and the affective drop in performance. *Journal of Psychoeducational Assessment, 27(*3), 197-205.

Awasthi, D., Imam, A., & Singh, G. P. (2015). Relationship between mathematics anxiety among secondary school students with school type and parental education. *Indian Journal of Applied Research, 50*(12), 1-4.

Barroso, C., Ganley, C. M., McGraw, A. L., Geer, E. A., Hart, S. A., & Daucourt, M. C. (2021). A meta-analysis of the relation between math anxiety and math achievement. *Psychological Bulletin, 147*(2), 134-168.

Ferguson, A. M., Maloney, E. A., Fugelsang, J., & Risko, E. F. (2015). On the relation between math and spatial ability: The case of math anxiety. *Learning and Individual Differences, 39*, 1-12.

Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. *Journal for Research in Mathematics Education, 21*(1), 33-46.

Hill, F., Mammarella, I. C., Devine, A., Caviola, S., Passolunghi, M. C., & Szűcs, D. (2016). Maths anxiety in primary and secondary school students: Gender differences, developmental changes and anxiety specificity. *Learning and Individual Differences, 48*, 45-53.

Kadonsi, K. (2024). Empowering students through indigenous knowledge: Benefits of indigenizing mathematics education in Southern Province, Zambia. *International Journal of Innovative Research and Scientific Studies, 6* (3), 1034-1059.

Luu-Thi, H. T., Ngo-Thi, T. T., Nguyen-Thi, M. T., Thao-Ly, T., Nguyen-Duong, B. T., & Tran-Chi, V. L. (2021). An investigation of mathematics anxiety and academic coping strategies among high school students in Vietnam: A cross-sectional study. *Frontiers in Education, 6*, 742130.

Ma, X., & Xu, J. (2004). The causal ordering of mathematics anxiety and mathematics achievement: A longitudinal panel analysis. *Journal of Adolescence, 27* (2), 165-179.

Peteros, E. D. (2025). Mathematics anxiety as a moderator between self-esteem and mathematics achievement. *STEM Education*, *5* (1), 41-58.

Richardson, F. C., & Suinn, R. M. (1972). The Mathematics Anxiety Rating Scale: Psychometric data. *Journal of Counseling Psychology, 19* (6), 551-554.

Sitorus, J., Sinaga, B., Handayani, L., & Siagian, D. J. M. (2025). Influence of students' learning style and personality characteristics on their mathematics problem-solving skills. *Frontiers in Education, 10*, 1540865.

Szczygieł, M. (2021). Gender, general anxiety, math anxiety and math achievement in early school-age children. *Issues in Educational Research, 31* (4), 1126-1142.

Trigueros, R., Padilla, A. M., Aguilar-Parra, J. M., Rocamora, P., Morales-Gázquez, M. J., & López-Liria, R. (2020). The influence of emotional intelligence on resilience, test anxiety, academic stress and the Mediterranean diet. A study with university students. *International Journal of Environmental Research and Public Health, 17* (6), 2071.