Examining Gender and Age Effects on Math Anxiety

Emily Czerw, Kendall Leach, Dr. Nathan Lau, Dr. Sara Hart, and Dr. Callie Little

Department of Psychology, College of Arts and Sciences, Florida State University

INTRODUCTION

Past Research

Math anxiety can be characterized as feelings of tension, apprehension, or fear that could affect an individual's ability to perform mathematical tasks to their full potential (Ashcraft & Faust, 1994).

- Math anxiety can impact an individual's math achievement and career trajectory.
- Higher levels of math anxiety, particularly among girls, may contribute to the underrepresentation of women in Science, Technology, Engineering, and Mathematics (STEM) fields.

Girls tend to report higher levels of math anxiety compared to males which could be due to social, cultural, or psychological factors (Devine et al., 2012).

Gender differences have been found to favor girls having higher mathematics achievement scores, but they have higher math anxiety. (Milovanović, 2020).

Math anxiety can be introduced in early childhood and increase during adolescence (Meece et al., 1990).

Importantly, few studies have examined whether gender differences in math anxiety interact with development.

Research Questions

The present study aimed to determine if there is

a) an age effect of math anxiety
b) a gender effect of math anxiety
c) an age x gender interaction effect

H1. Girls will exhibit higher math anxiety than boys.

H2. Older students will experience greater math anxiety than younger students.

H3. There is an interaction effect of gender and age.

METHODS

Data Source

The data comes from the National Project on Achievement in Twins (NatPAT; Hart et al., 2019). NatPAT collects data from 1,344 twins and 672 adult parents, including information on students age, gender, math motivation, math self-concept, math anxiety, and math avoidance behaviors.

Participants

We analyzed data from 1,302 twins in the NatPAT dataset who had reported their age. The final sample contains 597 boys and 607 girls.

Variables

Children's Math Anxiety

A self-report questionnaire explores a child's feelings about math anxiety. The measure was a single-item question where children rated their math anxiety on a scale from 0 (not at all) to 10 (very much) by answering the question: "On a scale of 0 to 10, how anxious about math are you?" (Hart & Ganley, 2019).

Child's Gender

The child's self-reported gender is used.

Child's Age

The child's age is operationalized as 3 age groups corresponding with elementary, middle, and high school levels. See table below for frequencies.

	Males	Females
Elementary School	322	286
Middle School	194	258
High School	81	63

Analysis

A two-way Analysis of Variance (ANOVA) was conducted to determine whether there were any statistically significant age or gender effects on math anxiety. An ANOVA allows experimenters to compare means across groups to assess whether the observed differences had a true effect on the results instead of random variation.

RESULTS

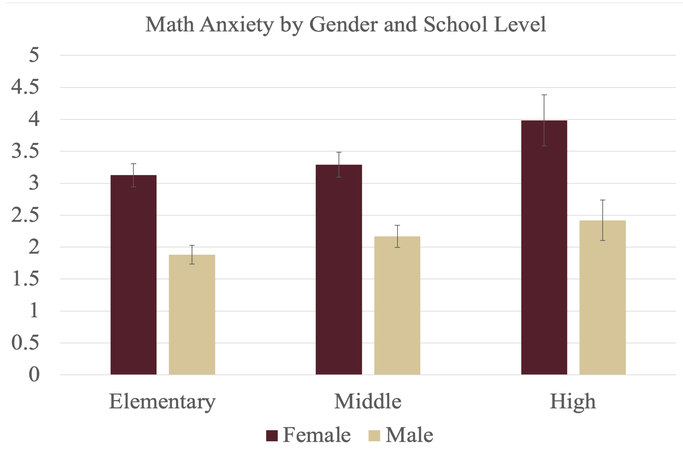
ANOVA – Math Anxiety

Cases	Sum of Squares	df	Mean Square	F	p	η^2
Gender	352.005	1	352.005	43.038	< .001	0.034
School Level	58.433	2	29.216	3.572	0.028	0.006
Gender ∗ School Level	5.305	2	2.653	0.324	0.723	5.194×10^{-4}
Residuals	9798.281	1198	8.179			

Note. Type III Sum of Squares

A two-way ANOVA was performed to analyze the effect of gender and school level on math anxiety. The results indicated significant main effect for gender, $F(1, 1198) = 43.038$, $p < .001$, partial $\eta2 = .034$; significant main effect for school level, $F(2, 1198) = 3.572$, $p = .028$, partial $\eta2 = .0057$; and no significant interaction between gender and school level, $F(2, 1198) = .324$, $p = .723$, partial $\eta2 < .001$.

A post hoc Tukey-controlled t-test revealed a significant difference in math anxiety between high school and elementary school students ($p = .024$), but no significant differences between high school and middle school students ($p = .202$) or between elementary and middle school students ($p = .414$).



CONCLUSIONS

The results of this study suggest that both gender and age significantly impact math anxiety levels, but their interaction does not. Specifically, girls across all three school levels experience higher math anxiety than boys. Although there is progression in math anxiety from elementary to middle to high school, there is only a significant difference in math anxiety between elementary school to high school.

The findings of this study agree with the findings of previous studies that state females experience higher levels of math anxiety than males. However, they disagree with the suggestion that find significant interaction.

The data suggested that math anxiety is more strongly influenced by gender than age groups, with a medium effect size for gender and a small effect size for age groups. These results suggest that interventions focusing on gender-based differences may be more potent than age-specific variations.

This study helped reveal who may be more prone to having math anxiety (i.e., girls and older students). With this knowledge we can focus resources on these at-risk populations.

For future studies we can focus on collecting a larger data set to have even school level distributions for school level mean comparisons.

REFERENCES

Ashcraft, M. H., & Faust, M. W. (1994). Mathematics anxiety and mental arithmetic performance: An exploratory investigation. Cognition and Emotion, 8(2), 97–125. https://doi.org/10.1080/02699939408408931

Beilock, S. L., & Willingham, D. T. (2014). Math anxiety: Can teachers help students reduce it? American Educator, 38(2), 28-32.

Devine, A., Fawcett, K., Szűcs, D., & Dowker, A. (2012). Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. Behavioral and Brain Functions, 8, 33.

Hart, S. A., & Ganley, C. M. (2019). The nature of math anxiety in adults: Prevalence and correlates. *Journal of Numerical Cognition*, 5(2), 122.

Hart, S. A., Martinez, K., Kennedy, P. C., Ganley, C. M., & Taylor, J. (2019). The national project on achievement in twins. *Twin Research and Human Genetics,* 22(6), 761-764.

Meece, J. L., Wigfield, A., & Eccles, J. S. (1990). Predictors of math anxiety and its influence on young adolescents' course enrollment intentions and performance in mathematics. Journal of Educational Psychology, 82(1), 60-70.

Milovanović, I. (2020). Math anxiety, math achievement and math motivation in high school students: gender effects. Croatian Journal Educational/Hrvatski Casopis Za Odgoj I Obrazovanje, 22(1)