Published in final edited form as:
J Numer Cogn. 2019 ; 5(2): 122–139. doi:10.5964/jnc.v5i2.195.

The Nature of Math Anxiety in Adults: Prevalence and Correlates

Sara A. Hart[*],
Department of Psychology & Florida Center for Reading Research, Florida State University

Colleen M. Ganley
Department of Psychology & Learning Systems Institute, Florida State University

Abstract

It is important to understand the nature of math anxiety in the general adult population, as the importance of math skills does not end when one leaves school. To this end, we present a well-powered, preregistered study of English-speaking U.S. adults describing the nature of math anxiety in this population. 1000 participants were recruited online. Math anxiety was approximately normally distributed, with the mean between "some" and "moderate". Math anxiety was significantly negatively correlated with probability knowledge and math fluency, and significantly positively correlated with general anxiety and test anxiety. Women reported higher math anxiety than did men. Participants who had completed graduate school or had a STEM career had significantly lower levels of math anxiety than did those with less education, or non-STEM careers. Thus, we see evidence for math anxiety in U.S. adults and that it correlates with factors also reported in previous studies using younger and student populations.

Keywords

individual differences; math anxiety; affect; adult development; mathematical ability

Math anxiety is defined as a fear of or an adverse emotional response to the idea of doing mathematics (Ashcraft, 2002; see Dowker, Looi & Sarkar, 2016, for review), and it is related to poor math outcomes (Ashcraft, 2002; Carey et al., 2016; Foley et al., 2017; Hembree, 1990; Ho et al., 2000; Ma, 1999; Maloney & Beilock, 2012), and poor academic achievement more broadly (Betz, 1978; Felson & Trudeau, 1991). Given the importance of math anxiety as a negative correlate of academic outcomes, it is rightfully under intensive study right now. However, we are not aware of any work describing the nature of math anxiety in a general adult population that is not made up of only students. In our continually more complex technological society, there is an increasing demand for math skills in adult workers (OCED, 2013a), yet it is not clear what math anxiety looks like in typical adults. Therefore, in this study we conduct a well-powered, preregistered study of math anxiety in a sample of U.S. English-speaking adults to examine the nature of math anxiety.

[*]Corresponding author: Sara A. Hart, 1107 W. Call Street, Tallahassee, FL 32306, 850-645-9693, hart@psy.fsu.edu.
Open Science Framework preregistration, materials, data, and code: https://osf.io/fh752/.
Shiny app that allows for interaction with the raw data: https://idcdlab.shinyapps.io/hart_and_ganley/

Considerable work has examined math anxiety in children and adolescents (e.g., Chinn, 2009; Johnston-Wilder, Brindley & Dent, 2014), including an international study of 65 countries and economies which found that 33% of 15-year-old students reported feeling helpless when solving math problems (OCED, 2013b; see also Lee, 2009). In adults, the focus of research has been on special groups, primarily college students' math anxiety (e.g., Cipora, Szczygiel, Willmes & Nuerk, 2015; Ferguson, Maloney, Fugelsang & Risko, 2015), but also teachers' math anxiety (Beilock, Gunderson, Ramirez, & Levine, 2010), nurses' math anxiety (McMullan, Jones & Lea, 2012), parents' math anxiety (Maloney, Ramirez, Gunderson, Levine & Beilock, 2015), and seniors' math anxiety (Donelle, Hoffman-Goetz & Arocha, 2007). The theme of this research in adults has been to determine the nature of math anxiety in these special groups, with one goal to understand the consequences of higher math anxiety (e.g., if parents with higher math anxiety negatively affect their children's math learning; Maloney et al., 2015). However, thus far this research is not able to reference the levels of math anxiety in a general sample of adults to determine if the subgroup under study even has unusual amounts of math anxiety. To get around this, across the body of published work in math anxiety, it is exceptionally common to cite Hembree (1990) as the key work for the descriptive nature of math anxiety.

Hembree (1990) used meta-analysis to characterize the nature of math anxiety, including examining performance, attitude, and other anxiety correlates, and describing overall levels of math anxiety based on gender, school grade, ability, major, race, and ethnicity. However, the eldest participants in Hembree's paper were undergraduate students. Because the importance of math skills does not end when one leaves school (OCED, 2013a), it is important to understand how adults experience math anxiety and how it relates to important correlates during adulthood. Thus, we sought to use a well-powered sample to set a baseline for papers describing the nature of math anxiety in English-speaking U.S. adults (not limited to college students), focusing on correlational and subgroup analyses mirroring Hembree. We preregistered the sample, design, research questions, hypotheses, and analysis plan of this study with the Open Science Framework (https://osf.io/fh752/). The following were our preregistered research questions (RQ) and hypotheses:

> RQ#1. What is the distribution of math anxiety in the general adult population? We had no specific hypothesis for this RQ.
>
> RQ#2. What variables correlate with math anxiety in the general adult population, from probability knowledge, math fluency, general anxiety, test anxiety, and income? We hypothesized that math anxiety would be significantly negatively correlated with probability knowledge, math fluency and income, and significantly positively correlated with general anxiety and test anxiety.
>
> RQ#3. What group differences are there in math anxiety in the general adult population, specifically among genders, educational backgrounds, STEM career status, and race/ethnicity? We hypothesized that women would have higher math anxiety than men, individuals with a college degree completed or a graduate degree completed or in progress will have lower levels of math anxiety than individuals who have not completed college, individuals in a STEM career will have lower levels of

math anxiety than those who are not, and Caucasians and Asians will have lower levels of math anxiety than all other race/ethnicity groups.

Method

The Florida State University Institutional Review Board approved this study (HSC No. 2018.25904).

Participants

The 1000 participants for this sample were recruited using two strategies: (1) Mechanical Turk (MTurk), and (2) social media advertisements. All data were combined into one dataset. We recruited 875 MTurk workers from www.mturk.com through a single HIT (i.e. Human Intelligence Task), which is a particular task that a MTurk worker can work on and get a reward for completing. Participants were required to be at least 18 years old, English-speaking United States residents, have completed at least 1000 HITs, and have a HIT approval rate greater than or equal to 98%. No other inclusion or exclusion rules were used. Participants were paid $1 after completion of the HIT. The HIT was available for 2 weeks. Research shows that though not a nationally representative sample, MTurk workers are more diverse in many ways than typical college population samples and data quality is just as good (Buhrmester, Talaifar & Gosling, 2018; Paolacci & Chandler, 2014). The MTurk sample was 54.92% female (n = 480), with a mean age of 37.78yrs old (SD = 11.86yrs, range = 18–74yrs). The MTurk sample was 81.19% White, 9.46% Black or African American, 6.66% Asian, 1.40% Multiracial, 1.05% American Indian or Alaska Native, and 0.23% Native Hawaiian or Other Pacific Islander. The MTurk sample was 4.99% Hispanic/Latino, who live in neighborhoods with a mean household income of $56,298.49.

We also recruited 125 participants through social media accounts on Facebook and Twitter. On Facebook, lab members posted a link to the Qualtrics survey on their wall and/or status, and on Twitter they posted a link to the survey via a tweet. Participants were required to be 18 years old, and English-speaking. No other inclusion or exclusion rules were used. If participants chose to leave an email address, they were entered into a raffle for one of five $20 Amazon gift cards. We used this recruitment technique for 2 weeks, over the same time as the MTurk data collection. Our initial goal was to get 300 participants from the social media sample, but after 2 weeks we only had 125, so to obtain our overall sample goal of 1000, we recruited additional participants on MTurk the day the 2 weeks ended (as our pre-registered recruitment method dictated). The social media sample was 67.74% female (n = 84), with a mean age of 30.28yrs old (SD = 11.01yrs, range = 18–71yrs). The social media sample was 77.05% White, 15.57% Black or African American, 1.64% Asian, 4.92% Multiracial, and 0.82% American Indian or Alaska Native. The social media sample was 9.20% Hispanic/Latino, who live in neighborhoods with a mean household income of $55,934.34.

The combined final sample of 1000 participants was 56.51% female (n = 564), with a mean age of 36.84yrs old (SD = 12.01yrs, range = 18–74yrs). The final sample was 80.67% White, 10.22% Black or African American, 6.03% Asian, 1.84% Multiracial, 1.02% American Indian or Alaska Native, and .20% Native Hawaiian or Other Pacific Islander. The final sample was 5.50% Hispanic/Latino, who live in neighborhoods with a mean household income of $56,255.03.

Materials

The full text of all measures in this report is available in the preregistration of this study at the Open Science Framework website (OSF; https://osf.io/fh752/). The Math Anxiety Scale for Teachers general math anxiety scale and the 0 to 10 math anxiety scale were not preregistered, although they are also available at the same OSF link. The methods for creating composite variables, conducting variable transformations, and doing variable recoding, were preregistered.

Math Anxiety.

Hopko Math Anxiety Rating Scale-Revised scale (Hopko MARS-R).: Participants completed the Math Anxiety Rating Scale-Revised (Hopko, 2003), a 12-item Likert scale (1 = *low anxiety* to 5 = *high anxiety*) designed for use with college students. Following a general prompt "Some individuals feel anxiety when in certain situations involving math. Please rate your level of anxiety when considering the following situations" participants rated items such as "Thinking about an upcoming math test one day before". A mean score was calculated (α = .94).

Math Anxiety Scale for Teachers general math anxiety (MAST-GMA) scale.: Participants completed the general math anxiety subscale of the Math Anxiety Scale for Teachers (MAST-GMA; Ganley, Schoen, LaVenia, & Tazaz, submitted), specifically the 11-items which included general questions applicable to any adult population (Likert scale, 1 = *not true of me at all* to 5 = *very true of me*). Following a general prompt "Please indicate whether the following statements are true for you on a scale from "Not true of me at all" to "Very true of me"" participants rated items such as "I start to worry when I am given advanced math problems to solve". A mean score was calculated (α = .97). This scale was not preregistered, and will be used for exploratory purposes only.

0 to 10 scale of math anxiety.: Participants also completed a one-item scale of math anxiety, "On a scale of 0 (not at all) to 10 (very much), how math anxious are you" (originally from Ashcraft, 2002; exact wording used here from Núñez-Peña, Guilera, & Suárez-Pellicioni, 2014). They then used a slider to select a value between 0 and 10. This scale was not preregistered, and will be used for exploratory purposes only.

Math performance.

Probability knowledge.: Participants completed the Berlin Numeracy Test (Cokely, Galesic, Schulz, Ghazal, & Garcia-Retamero, 2012), which is made up of probability questions. This test is adaptive such that participants complete either two or three items depending on their performance on previous items. Participants were then placed into ordered quadrants based on their performance.

Math fluency.: Participants had 1 minute to complete as many of 48 simple math items as possible. These items required participants to add, subtract, or multiply two one-digit numbers, and was investigator created. Their score was the total number of items that they answered correctly.

Other anxieties.

General anxiety.: We measured general anxiety using the DASS-21: General Anxiety Subscale (Lovibond & Lovibond, 1995), a seven item Likert scale. We created a mean score (α = .91).

Test anxiety.: We administered four items from the Cognitive Test Anxiety Scale (Cassady & Johnson, 2002) and created an average on these four items (α = .92).

Demographics.

Age.: Participants selected their numerical age.

Gender.: Participants indicated whether they were a man or a woman. They could also select *Prefer not to answer*, which was coded as missing (n = 2).

Race.: Participants indicated whether they were *American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, Black or African American, White, Multirace, Other*. "Other" was recoded into the above categories as possible (n = 1, race was reported as "Caucasian" and so was recoded to "White"), and when not possible, was coded as missing (n = 4). They could also select *Prefer not to answer*, which was coded as missing before any analysis was conducted (n = 18, total missing n = 22).

Ethnicity.: Participants indicated whether they were Hispanic or non-Hispanic. They could also select *Prefer not to answer*, which was coded as missing (n = 18).

Income.: Participants provided their zip code and we harvested the median household income for that zip code from the U.S. census 2015 American Community Survey (https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml) as a proxy for income. A participant could choose to not provide a zip code, which meant income was coded as missing (n = 28).

Educational Attainment.: Participants who were not students indicated their highest level of education from the following choices: *Grade 6 or less*, *Grade 7–12 (without graduating high school or equivalent)*, *Graduated high school or high school equivalent*, *Some college*, *Graduated from 2-year college*, *Graduated from 4-year college*, *Attended graduate or professional school without graduating*, *Completed graduate or professional school*. Participants who were still students selected the diploma/degree they were currently working towards from the following choices: *High school diploma or GED, 2- or 3-year degree/diploma (often called an Associate's degree), 4-year degree (often call a Bachelor's degree), or Graduate or professional degree.* We recoded their choices as follows: currently working towards "High school diploma or GED" was recoded into "Grade 7 – 12 (without graduating high school or equivalent)", currently working towards a "2- or 3-year degree/diploma (often called an Associate's degree)" and "4-year degree (often called a Bachelor's degree)" was recoded into "Some college", and currently working towards "Graduate or professional degree" was recoded into "Attended graduate or professional school without graduating". Any participant could also chose *Prefer not to answer*, which was coded as missing ($n = 3$).

STEM Career.: Participants who selected that they were employed full- or part-time were asked to self-report "*What is your current occupation (please be specific)*?" ($n = 750$). We used this to do a keyword search for the occupation on the O*NET website (https://www.onetonline.org/find/) (we were unable to find $n = 2$ occupations, leaving our final missing $n = 252$). We cross-referenced the occupations to those that O*NET assigns as "require education in science, technology, engineering, and mathematics (STEM) disciplines" (https://www.onetonline.org/find/stem?t=0&s=0). If the reported occupation was listed as requiring STEM, it was coded as a STEM career. If we were otherwise able to find the occupation using the O*NET but it was not coded as STEM, it was coded as a non-STEM career.

Procedure

The online survey took, on average, 32 minutes to complete. The questions were in a set order: math fluency, probability knowledge, math anxiety (Hopko MARS-R scale, MAST-GMA scale, then 0 to 10 math anxiety scale), general anxiety, test anxiety, and demographics. There were additional measures included that are not discussed in this report.

Most analyses were pre-registered, with a significance level of $p < .05$ set. Any not pre-registered will be marked as exploratory. After descriptive statistics were calculated, it was determined that the income variable was highly kurtotic (kurtosis = 7.32). We forgot to include our plan for correcting for kurtosis issues in the preregistration. We therefore elected to use our preregistered plan for possible skew issues to correct the kurtosis issue, which stated that we would bring any outliers that were +/− three standard deviations to the three standard deviation fence. This effected 10 observations for income, and corrected the high kurtosis (see Table 1 for descriptives after correction). All analysis were conducted in SAS 9.4. All code and anonymized data are available on the project OSF page, https://osf.io/fh752/, and an interactive Shiny app is available, https://idcdlab.shinyapps.io/hart_and_ganley/.

Results

Descriptive statistics and a histogram for the Hopko MARS-R scale are presented in Table 1 and Figure 1, respectively. We found that our sample's average math anxiety was 2.30, which on the 5 point scale of 1 = *low anxiety* to 5 = *high anxiety*, meant that the sample's average was between "some" and "moderate" anxiety. Moreover, 5.4% of the sample reported considerable levels of math anxiety (at least a score of 4, or "quite a bit of anxiety"). Exploratory descriptive statistics and histograms for the two additional math anxiety scales, as well as descriptive statistics for all included variables, are also included in Table 1, and Figures 2 and 3.

Our hypotheses for RQ#2 were mostly borne out. Correlations between the Hopko MARS-R scale and the key measures of probability knowledge, math fluency, general anxiety, and test anxiety, were moderate to high in the expected directions, and statistically significant (see

Table 2). The exception was the low and nonsignificant relation between math anxiety and income (which was hypothesized to be significant and negative; $r = -0.04$, $p = .203$; see Table 2). Exploratory correlations between the other two math anxiety scales and the key measures are also shown in Table 2. We also conducted an exploratory correlation between the Hopko MARS-R scale and age, and found almost no correlation ($r = -0.06$, $p = .082$).

Group differences were found between men and women on the Hopko MARS-R scale, with women showing significantly higher math anxiety, supporting our hypothesis ($t(975.20) = -8.67$, $p < .001$, $d = 0.55$; women $M = 2.53$, $SD = 0.98$, $n = 564$; men $M = 2.02$, $SD = 0.87$, $n = 434$). Exploratory analyses with the MAST-GMA scale ($t(978.20) = -9.36$, $p < .001$, $d = 0.59$; women $M = 2.83$, $SD = 1.16$, $n = 564$; men $M = 2.19$, $SD = 1.02$, $n = 434$) and the 0 to 10 math anxiety scale ($t(979.08) = -9.78$, $p < .001$, $d = 0.62$; women $M = 4.77$, $SD = 3.08$, $n = 564$; men $M = 2.98$, $SD = 2.69$, $n = 434$) mirrored these findings. We followed up this gender difference with additional exploratory analyses, and found that women scored significantly lower on the math fluency task than did men ($t(992) = 3.05$, $p = .002$, $d = 0.19$; women $M = 29.96$, $SD = 10.56$; men $M = 32.08$, $SD = 11.27$), scored significantly lower on the probability knowledge test than did men ($t(865.41) = 5.75$, $p < .001$, $d = 0.37$; women $M = 1.96$, $SD = 1.11$; men $M = 2.40$, $SD = 1.27$) and were less likely to have a STEM career than were men (χ^2 (1, N=746) = 8.35, $p = .004$, $\varphi = 0.11$; 8.98% women had a STEM career, 11.93% of men had a STEM career).

Next we explored racial group differences on the Hopko MARS-R scale. The preregistered analysis was to examine differences among the American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, Black or African American, and White groups, and no significant group differences were found ($F(4, 959) = 1.19$, $p = .314$). Our hypothesis had been that Caucasian and Asian participants would show significantly lower math anxiety than the other racial groups, and therefore this hypothesis was not supported. However, during preregistration we had not considered what we would do if we had low sample sizes size for some groups (which our sample shows), so as an exploratory analysis we examined potential differences between Asian, Black or African American, White, or Other (combining the American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, and Multirace groups), which also showed non-significant differences between the racial groups for the Hopko MARS-R scale ($F(3, 977) = 1.55$, $p = .200$). Additionally exploratory analysis used the same four-group classification, and again found no racial group differences for the MAST-GMA scale ($F(3, 977) = 1.04$, $p = .372$) or the 0 to 10 math anxiety scale ($F(3, 977) = 1.52$, $p = .207$). Results of the Tukey HSD analyses are available in Table 3 (none are significant).

There were no ethnic group differences for math anxiety when measured by the Hopko MARS-R scale ($t(980) = -1.25$, $p = .211$, $d = .17$; Hispanic/Latino $M = 2.46$, $SD = 1.04$, $n = 54$; Non-Hispanic/Latino $M = 2.29$, $SD = 0.96$, $n = 928$), or for the exploratory analysis using the MAST-GMA scale ($t(980) = -0.87$, $p = .386$, $d = .12$; Hispanic/Latino $M = 2.68$, $SD = 1.21$, $n = 54$; Non-Hispanic/Latino $M = 2.54$, $SD = 1.14$, $n = 928$), or the 0 to 10 math anxiety scale ($t(980) = -0.32$, $p = .749$, $d = .04$; Hispanic/Latino $M = 4.11$, $SD = 3.34$, $n = 54$; Non-Hispanic/Latino $M = 3.97$, $SD = 3.04$, $n = 928$).

Next we examined possible group differences in math anxiety based on level of education. The results for the Hopko MARS-R scale indicated significant differences in math anxiety based on education level ($F(6, 996) = 5.50$, $p < .001$). Exploratory results for the MAST-GMA scale ($F(6, 996) = 5.75$, $p < .001$) and the 0 to 10 math anxiety scale also indicated significant differences in math anxiety based on education level, ($F(6, 996) = 4.84$, $p < .001$). Results of the Tukey HSD analyses are displayed in Table 4. We hypothesized there would be a difference by education, and indeed we did find one, although not quite as hypothesized. The results indicated that participants who completed graduate or professional school had significantly lower (by about a half standard deviation) math anxiety than participants who had education equal to or less than graduating from a 2-year college. No other differences were seen, which suggests that only participants who have considerable amounts of education show lower math anxiety, meaning that typical college graduates do not differ in math anxiety levels compared to adults who did not graduates from college.

There were significant differences on the Hopko MARS-R scale between participants who had a STEM career versus those who did not, with those with STEM careers having lower math anxiety, as hypothesized ($t(302.78) = 5.04$, $p < .001$, $d = 0.48$; STEM career $M = 1.91$, $SD = 0.76$, $n = 157$; non-STEM career $M = 2.33$, $SD = 0.97$, $n = 591$). This same pattern was seen for the exploratory analysis using the MAST-GMA scale ($t(283.69) = 5.34$, $p < .001$, $d = 0.45$; STEM career $M = 2.09$, $SD = 0.97$, $n = 157$; non-STEM career $M = 2.57$, $SD = 1.15$, $n = 591$), and the 0 to 10 math anxiety scale ($t(281.48) = 5.25$, $p < .001$, $d = 0.49$; STEM career $M = 2.74$, $SD = 2.61$, $n = 157$; non-STEM career $M = 4.14$, $SD = 3.06$, $n = 591$).

Our final sample had a large number of individuals who self-reported being a parent ($N = 422$), so we decided to run an exploratory analysis to examine differences in math anxiety between parents and non-parents. There were no group differences in math anxiety between participants who reported being a parent or not when measured by the Hopko MARS-R scale ($t(998) = -1.09$, $p = .278$, $d = 0.07$; Parent $M = 2.34$, $SD = 0.97$, $n = 422$; Non-Parent $M = 2.27$, $SD = 0.96$, $n = 578$), or for the MAST-GMA scale ($t(998) = -0.83$, $p = .406$, $d = 0.04$; Parent $M = 2.58$, $SD = 1.15$, $n = 422$; Non-Parent $M = 2.53$, $SD = 1.14$, $n = 578$), or the 0 to 10 math anxiety scale ($t(998) = -1.96$, $p = .050$, $d = 0.12$; Parent $M = 4.20$, $SD = 3.02$, $n = 422$; Non-Parent $M = 3.82$, $SD = 3.06$, $n = 578$). Further exploratory analyses indicated that individuals with at least one school-aged child did not have higher math anxiety on the Hopko MARS-R scale compared to any other participant ($t(998) = -0.37$, $p = .709$, $d = 0.02$; Parent of at least one child age 6 to 18 $M = 2.32$, $SD = 0.99$, $n = 228$; any other participant $M = 2.30$, $SD = 0.96$, $n = 772$), nor did parents with only school aged children when compared to any other parent ($t(420) = 0.41$, $p = .683$, $d = 0.04$; Parent of at least one child age 6 to 18 $M = 2.32$, $SD = 0.99$, $n = 228$; any other parent $M = 2.36$, $SD = 0.96$, $n = 194$).

We ended up having enough students in the sample that we decided to run exploratory group differences tests between students and non-students in the sample. Any participant who reported being a part-time or full-time student was coded as a student, and the remaining participants were coded as non-students. There were significant differences on the Hopko MARS-R scale between students and non-students, with students having higher math anxiety than did non-students (t(998) = −3.75, $p < .001$, d = 0.31; students M = 2.55, SD = 0.97, n = 174; non-students M = 2.25, SD = 0.96, n = 826). This same pattern was seen for the exploratory analysis using the MAST-GMA scale (t(998) = −3.45, $p < .001$, d = 0.29; students M = 2.82, SD = 1.11, n = 174; non-students M = 2.49, SD = 1.14, n = 826), and the 0 to 10 math anxiety scale (t(998) = −3.02, $p < .003$, d = 0.26; students M = 4.61, SD = 2.87, n = 174; non-students M = 3.84, SD = 3.06, n = 826).

Discussion

Here we provide a well-powered, preregistered, contemporary resource for the nature of math anxiety in English-speaking U.S. adults. We found that math anxiety was approximately normally distributed in the population (according to the skew and kurtosis statistics), and mild to moderate levels of math anxiety are reported by most adults. Only a small percentage of the sample had considerable math anxiety, and future work might examine if this might be considered a clinically-relevant population.

Our correlational results were remarkably similar to Hembree (1990), who found a mean correlation of math anxiety with math computation of −.25 (present r = −.25), with generalized anxiety of .35 (present r = .44), and test anxiety of .52 (present r = .64), when examining the cumulative literature to date on children to college-aged students. These findings fall in line with work in adolescence that has shown that math anxiety is negatively associated with math performance across the world, which may have negative implications for STEM career training and success (Foley et al., 2017). These findings replicate and extend the work from younger samples that suggests that math anxiety is distinct, but related, to generalized anxiety and test anxiety (Ashcraft, 2002; Ganley & McGraw, 2016; Hill et al., 2016). There is building work in students that suggests that trait generalized anxiety might be a precursor to math anxiety (Wang et al., 2014), whereas test anxiety, similar to math anxiety, is a state anxiety, perhaps learned through negative schooling experiences (Wood, Hart, Little, & Phillips, 2016). We were surprised by the null correlation between income and math anxiety, and have no explanation for the finding. We had hypothesized a negative correlation, as socioeconomic status is consistently an important positive predictor of math performance in students (e.g., Sirin, 2005), and our previous work has found a significant correlation between math anxiety and household income in parents (Hart et al., 2016).

We show for the first time in a general adult population that women report higher math anxiety than do men, here with an effect size of approximately half a standard deviation. This is a very large effect size for a gender difference, even higher than that found for generalized anxiety (ds = −.26 to −.32; Feingold, 1994). Hembree (1990) also found women had higher levels of math anxiety than men, but with smaller effect sizes, .19 for precollege samples, and .31 for college samples. Mirroring Hembree, we followed up the gender differences by examining potential gender differences in math performance and career outcomes, finding significant differences favoring men in math performance and STEM career participation. Interestingly, the gender difference in math anxiety was larger than those for math performance, which fits with patterns found with children and adolescents (Lubienski & Ganley, 2017). We cannot know if women are just more likely to admit their math anxiety, or if women are indeed more math anxious. If they are more math anxious, we do not know the source of this difference, and how it is related to our reported gender differences in math performance and career participation (Goetz et al., 2013).

There is a race-based gap in math achievement in U.S. students (Musu-Gillette et al., 2016). Given the moderate negative association between math anxiety and math achievement in students, we hypothesized that math anxiety would be higher in Black and Hispanic adults, as these marginalized groups are commonly found to be lower in math achievement as students. We found that there were no such race or ethnic group differences in math anxiety. Hembree (1990) reported a statistically significant "Hispanic vs. White" math anxiety difference, contrary to the statistically nonsignificant "Black vs. White" difference. However, for both, he found that there were very few studies that examined math anxiety differences between racial/ethnic groups, and all were in college-aged samples, who were therefore already selected for academic success. We also could not find much empirical work that examined race/ethnic group differences in math anxiety in students or adults, which forces us to conclude that this is an understudied area, and/or suffers from a file drawer problem.

There is currently considerable effort to get women and people of color into STEM careers, as they are underrepresented in these typically higher paying fields (Dey & Hill, 2007; Ryan, 2012). There are certainly many systemic blocks to STEM careers for these individuals, but also there is building evidence that they may be self-selecting out (e.g., for women, due to perceived gender bias against women; Ganley, George, Cimpian, & Makowski, 2018). Part of this might be because individuals with higher math anxiety are more likely to avoid math experiences (Chipman, Krantz, & Silver, 1992). We found that adults with a STEM career had approximately half a standard deviation lower math anxiety score than those without a STEM career, a finding that mirrors Hembree's (1990) result that math and science majors in college had lower math anxiety than other majors. We cannot be sure of the direction of our finding, but it is certainly quite plausible that individuals with math anxiety are less likely to select into a STEM career, although it certainly may be the case that poor math achievement resulted in higher math anxiety and fewer opportunities to get into a STEM career.

We included exploratory analyses examining math anxiety in parents compared to adults who are not parents because work is building highlighting the transmission of math anxiety from parents to children through the home environment (Maloney et al., 2015), and through inherited genetic influences (Wang et al., 2014). Although we do not have any data from the children of parents in our sample, we can report that parents do not have higher math anxiety on average than someone who is not a parent. This suggests that any familial transmission of math anxiety is occurring at a normal base rate, and that being a parent of a school-age child does not appear to increase math anxiety levels.

To mirror the math anxiety work with college-aged samples, we did an exploratory analysis that examined math anxiety in adult students in our sample and found they have higher levels of math anxiety than adult non-students. This finding is not entirely surprising, given that it's likely that experiencing math anxiety is more commonplace for students as they are, on average, probably using math more often than are non-students. More interestingly, even though math anxiety is lower, non-students still experience math anxiety in the same range as students do.

Extending previous work, we measured math anxiety using three different scales, all of which took different approaches to measuring math anxiety, yet all were highly related to each other and showed similar patterns of results in subsequent analyses. Future work may give consideration to using the 0 to 10 scale, as a simple yet effective way to measure math anxiety when time resources are low. In general, the field suffers from having many poorly designed measures of math anxiety, many of which are focused on student experiences only (which we show are different than non-student adults), or are considerably long, both of which make them less than ideal for studying math anxiety in general adult populations.

Our work provides a well-powered, preregistered description of math anxiety in a general sample of U.S. English-speaking adults, as of yet not available in the literature. As a reminder, analysis that are labelled as exploratory were not preregistered, and should be treated cautiously. The data were collected from Mechanical Turk and a social media convenience sample, both of which come with some disadvantages but also substantial benefits, including increased diversity (Casler, Bickel, & Hackett, 2013). Also, this study was correlational and cross-sectional. Longitudinal work is needed to disentangle the relations we present here. Finally, unfortunately we did not include a measure of working memory in our battery. Given that a major theory of math anxiety suggests that math anxiety overwhelms the working memory system during math problem solving, leading to decreased math performance (Ashcraft, 2002; Eysenck et al., 2007), future work should include this important measure. Together, our results suggest that the importance of math anxiety does not end when one leaves school (Skagerlund et al., 2018), especially as the current adult population is faced with increasing demands for technological skills. Thus, it is important to understand the nature of math anxiety in adults, and here we show that adults are experiencing, on average, moderate math anxiety that negatively relates to math performance, and differentially affects women.

Funding:

This work was supported by the NICHD grant HD052120.

References

Ashcraft MH (2002). Math anxiety: Personal, educational, and cognitive consequences. Current Directions in Psychological Science, 11(5), 181–185.

Beilock SL, Gunderson EA, Ramirez G, & Levine SC (2010). Female teachers' math anxiety affects girls' math achievement. Proceedings of the National Academy of Sciences, 107(5), 1860–1863.

Betz NE (1978). Prevalence, distribution, and correlates of math anxiety in college students. Journal of Counseling Psychology, 25(5), 441–448.

Buhrmester MD, Talaifar S, & Gosling SD (2018). An evaluation of Amazon's Mechanical Turk, Its rapid rise, and its effective use. Perspectives on Psychological Science, 13(2), 149–154. [PubMed: 29928846]

Carey E, Hill F, Devine A, & Szucs D (2016). The chicken or the egg? The direction of the relationship between mathematics anxiety and mathematics performance. Frontiers in Psychology, 6: 1987. [PubMed: 26779093]

Casler K, Bickel L, & Hackett E (2013). Separate but equal? A comparison of participants and data gathered via Amazon's MTurk, social media, and face-to-face behavioral testing. Computers in Human Behavior, 29(6), 2156–2160.

Cassady JC, & Johnson RE (2002). Cognitive test anxiety and academic performance. Contemporary Educational Psychology, 27(2), 270–295.

Chinn S (2009). Mathematics anxiety in secondary students in England. Dyslexia, 15, 61–68. [PubMed: 19089884]

Chipman SF, Krantz DH, & Silver R (1992). Mathematics anxiety and science careers among able college women. Psychological Science, 3(5), 292–296.

Cipora K, Szczygieł M, Willmes K, & Nuerk HC (2015). Math anxiety assessment with the abbreviated math anxiety scale: applicability and usefulness: insights from the polish adaptation. Frontiers in Psychology, 6, 1833. [PubMed: 26648893]

Cokely ET, Galesic M, Schulz E, Ghazal S, & Garcia-Retamero R (2012). Measuring risk literacy: The Berlin numeracy test. Judgment and Decision Making, 7(1), 25.

Dey JG, & Hill C (2007). Beyond the pay gap. Washington, DC: American Association of University Women Educational Foundation.

Donelle L, Hoffman-Goetz L, & Arocha JF (2007). Assessing health numeracy among community-dwelling older adults. Journal of Health Communication, 12(7), 651–665. [PubMed: 17934942]

Dowker A, Looi CY & Sarkar A. (2016) Mathematics anxiety: What have we learned in 60 years? Frontiers in Psychology 7:508 [PubMed: 27199789]

Eysenck MW, Derakshan N, Santos R, & Calvo MG (2007). Anxiety and cognitive performance: attentional control theory. Emotion, 7, 336–353. [PubMed: 17516812]

Faul F, Erdfelder E, Lang A-G, & Buchner A (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods, 39, 175–191. [PubMed: 17695343]

Feingold A (1994). Gender differences in personality: A meta-analysis. Psychological Bulletin, 116(3), 429. [PubMed: 7809307]

Felson RB, & Trudeau L (1991). Gender differences in mathematics performance. Social Psychology Quarterly, 54(2), 113–126.

Ferguson AM, Maloney EA, Fugelsang J, & Risko EF (2015). On the relation between math and spatial ability: The case of math anxiety. Learning and Individual Differences, 39, 1–12.

Foley AE, Herts JB, Borgonovi F, Guerriero S, Levine SC, & Beilock SL (2017). The math anxiety-performance link: A global phenomenon. Current Directions in Psychological Science, 26(1), 52–58.

Ganley CM, & McGraw AL (2016). The development and validation of a revised version of the math anxiety scale for young children. Frontiers in Psychology, 7, 1181. [PubMed: 27605917]

Ganley CM, George CE, Cimpian JR, & Makowski MB (2018). Gender equity in college majors: Looking beyond the STEM/Non-STEM dichotomy for answers regarding female participation. American Educational Research Journal, 55, 453–487.

Ganley CM, Schoen R, LaVenia M, & Tazaz A (submitted). The construct validation of the Math Anxiety Scale for Teachers.

Goetz T, Bieg M, Lüdtke O, Pekrun R, & Hall NC (2013). Do girls really experience more anxiety in mathematics? Psychological Science, 24(10), 2079–2087. [PubMed: 23985576]

Hart SA, Ganley CM, & Purpura D (2016). Understanding the home math environment and its role in predicting parent report of children's math skills. PLoS ONE, 11(12), e0168227. [PubMed: 28005925]

Hill F, Mammarella IC, Devine A, Caviola S, Passolunghi MC, & 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.

Ho H-Z, Senturk D, Lam AG, Zimmer JM, Hong S, Okamoto Y, … Wang C-P (2000). The affective and cognitive dimensions of math anxiety: A cross-national study. Journal for Research in Mathematics Education, 31(3), 362–379.

Hopko DR (2003). Confirmatory factor analysis of the Math Anxiety Rating scale–Revised. Educational and Psychological Measurement, 63(2), 336–351.

Johnston-Wilder S, Brindley J, & Dent P (2014). Technical Report: A Survey of Mathematics Anxiety and Mathematical Resilience amongst Existing Apprentices. Coventry: University of Warwick.

Lee J (2009). Universals and specifics of math self-concept, math self-efficacy, and math anxiety across 41 PISA 2003 participating countries. Learning and Individual Differences, 19, 355–365.

Lovibond PF, & Lovibond SH (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. Behaviour Research and Therapy, 33(3), 335–343. [PubMed: 7726811]

Lubienski ST, & Ganley CM (2017). Research on gender and mathematics. In Jinfa Cai (Ed.), First Compendium for Research in Mathematics Education. Reston, VA: National Council of Teachers of Mathematics.

Ma X (1999). A meta-analysis of the relationship between anxiety toward mathematics and achievement in mathematics. Journal for Research in Mathematics Education, 30(5), 520–540.

Maloney EA, & Beilock SL (2012). Math anxiety: who has it, why it develops, and how to guard against it. Trends in Cognitive Sciences, 16(8), 404–406. [PubMed: 22784928]

Maloney EA, Ramirez G, Gunderson EA, Levine SC, & Beilock SL (2015). Intergenerational effects of parents' math anxiety on children's math achievement and anxiety. Psychological Science, 26(9), 1480–1488. [PubMed: 26253552]

McMullan M, Jones R, & Lea S (2012). Math anxiety, self-efficacy, and ability in British undergraduate nursing students. Research in Nursing & Health, 35(2), 178–186. [PubMed: 22261975]

Musu-Gillette L, Robinson J, McFarland J, KewalRamani A, Zhang A, & Wilkinson-Flicker S (2016). Status and Trends in the Education of Racial and Ethnic Groups 2016 (NCES 2016–007). U.S. Department of Education, National Center for Education Statistics. Washington, DC. Retrieved May 22, 2018 from http://nces.ed.gov/pubsearch.

Núñez-Peña MI, Guilera G, & Suárez-Pellicioni M (2014). The single-item math anxiety scale: An alternative way of measuring mathematical anxiety. Journal of Psychoeducational Assessment, 32(4), 306–317.

Organization for Economic Co-operation and Development. (2013a). OECD skills outlook 2013: First results from the survey of adult skills. Paris, France: Author

Organization for Economic Co-operation and Development. (2013b). PISA 2012 results: Ready to learn: Students' engagement, drive and self-beliefs (Vol. III). Paris, France: Author.

Paolacci G, & Chandler J (2014). Inside the Turk: Understanding Mechanical Turk as a participant pool. Current Directions in Psychological Science, 23(3), 184–188.

Ryan C (2012). Field of degree and earnings by selected employment characteristics: 2011. Washington, DC: American Community Survey Briefs.

Sirin SR (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. Review of Educational Research, 75(3), 417–453.

Skagerlund K, Lind T, Strömbäck C, Tinghög G, & Västfjäll D (2018). Financial literacy and the role of numeracy–How individuals' attitude and affinity with numbers influence financial literacy. Journal of Behavioral and Experimental Economics, 74, 18–25.

Wang Z, Hart SA, Kovas Y, Lukowski S, Soden B, Thompson LA, … & Petrill SA (2014). Who is afraid of math? Two sources of genetic variance for mathematical anxiety. Journal of Child Psychology and Psychiatry, 55(9), 1056–1064. [PubMed: 24611799]

Wood SG, Hart SA, Little CW, & Phillips BM (2016). Test anxiety and a high-stakes standardized reading comprehension test: A behavioral genetics perspective. Merrill-Palmer Quarterly, 62(3), 233–251. [PubMed: 28674461]

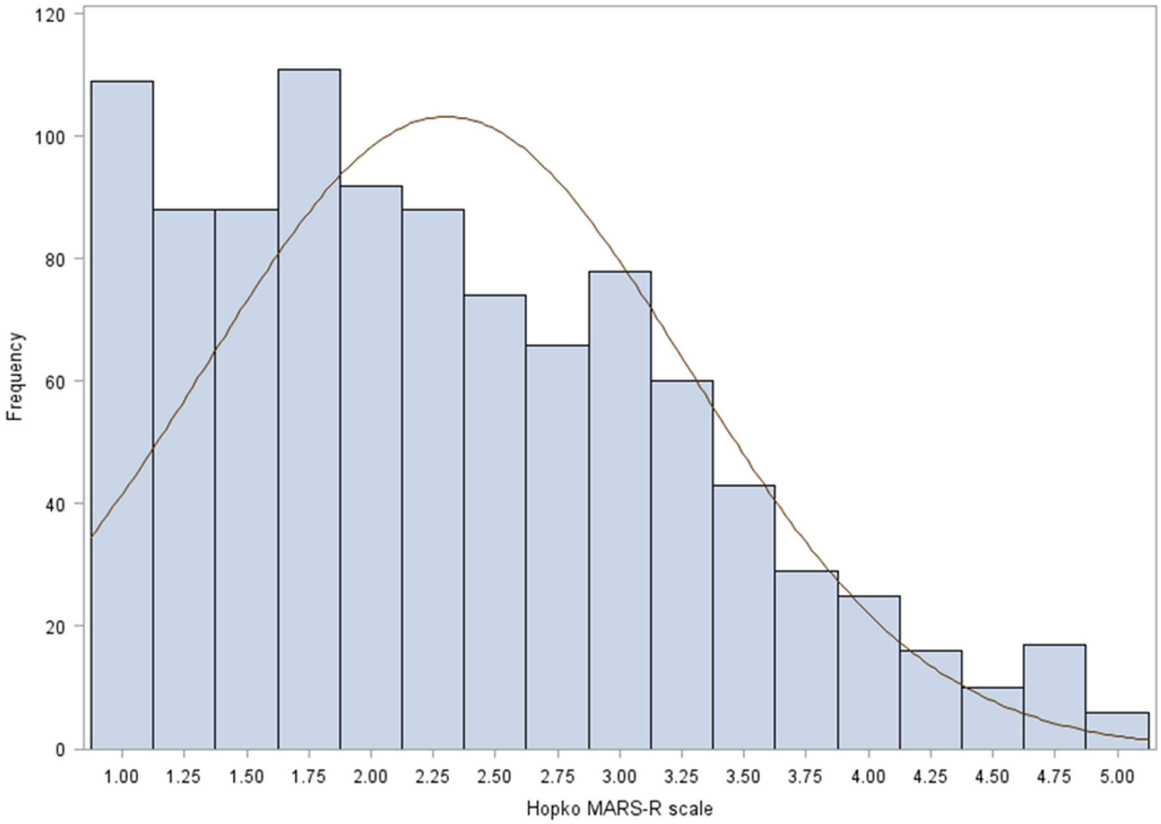

Figure 1.
Distribution of responses for mean math anxiety score using the Hopko MARS-R scale (Hopko, 2003).

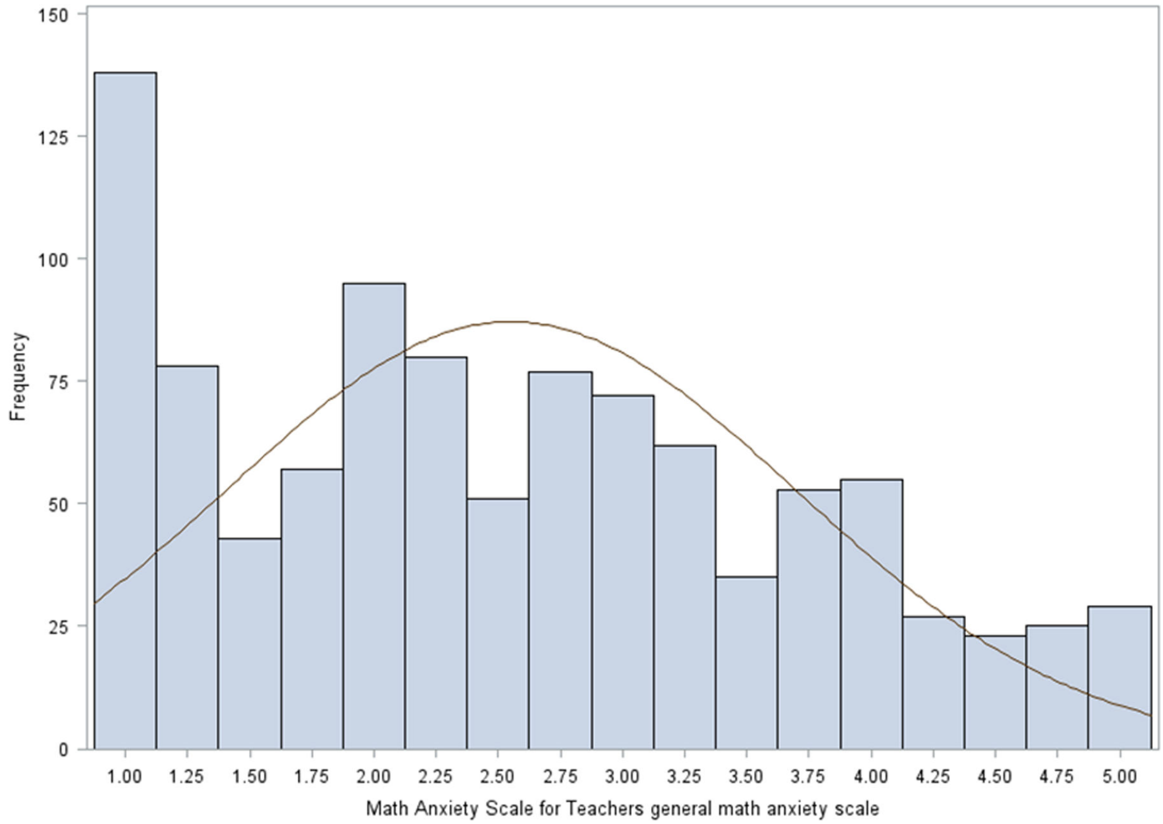

Figure 2.

Distribution of responses for mean math anxiety score using the Math Anxiety Scale for Teachers general math anxiety scale (Ganley et al., submitted).

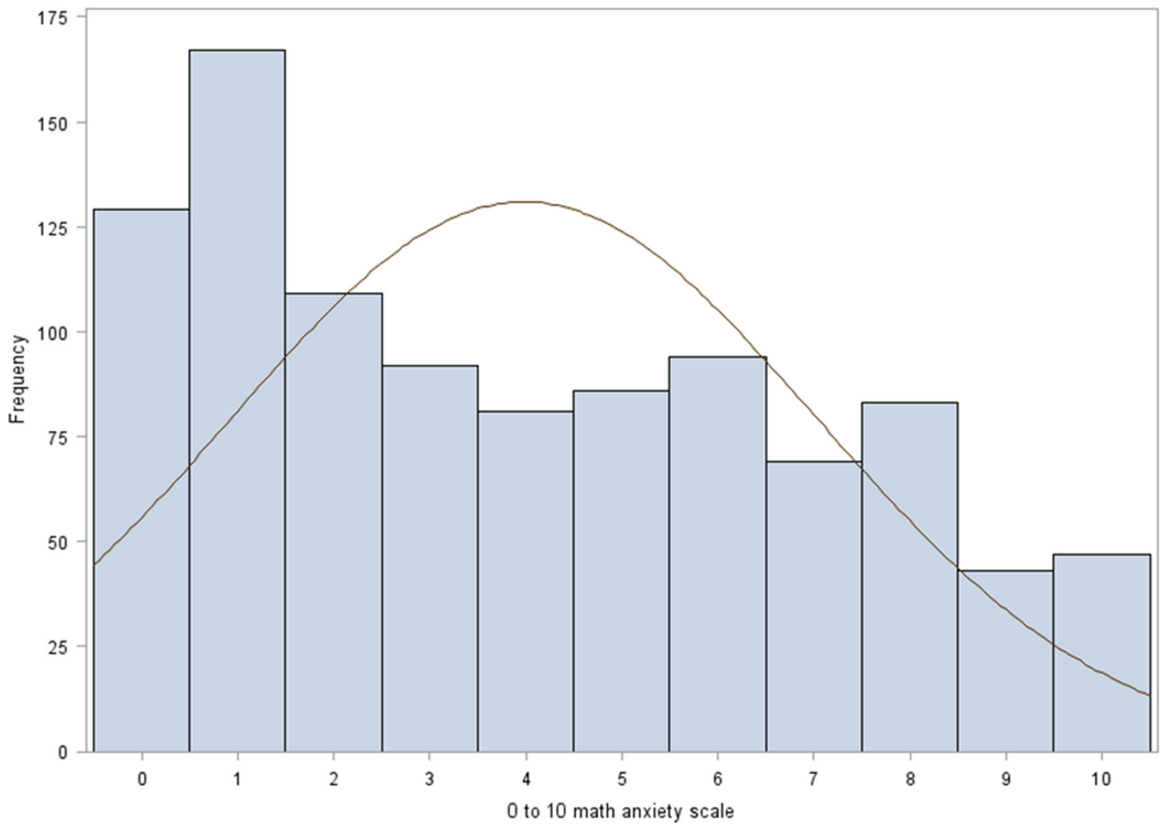

Figure 3.

Distribution of responses for math anxiety using the 0 to 10 math anxiety scale (Núñez-Peña, Guilera, & Suárez-Pellicioni, 2014)

Table 1

Descriptive statistics for math anxiety measures, probability knowledge, math fluency, generalized anxiety, test anxiety, and household income.

Variable	*N*	Mean	*SD*	Min	Max	Skew	Kurtosis
Hopko MARS-R scale	1000	2.30	0.97	1.00	5.00	0.61	−0.32
MAST-GMA scale	1000	2.55	1.14	1.00	5.00	0.35	−0.89
0 to 10 math anxiety scale	1000	3.98	3.05	0.00	10.00	0.36	−.1.08
Probability knowledge	1000	2.16	1.20	1.00	4.00	0.48	−1.35
Math Fluency	996	30.89	10.93	2.00	48.00	−0.02	−0.97
Generalized Anxiety	1000	1.46	0.63	1.00	4.00	1.67	2.39
Test Anxiety	1000	3.31	0.84	1.00	4.00	0.99	0.11
Income	972	56255.03	21018.26	12786.00	124500.85	0.97	0.97

Note. MAST-GMA = Math Anxiety Scale for Teachers general math anxiety

Table 2

Correlations between the math anxiety measures and probability knowledge, math fluency, generalized anxiety, test anxiety, and income.

Variable	1.	2.	3.	4.	5.	6.	7.
1. Hopko MARS-R scale	--						
2. MAST-GMA scale	0.84 $p < .001$ (1000)	--					
3. 0 to 10 math anxiety scale	0.83 $p < .001$ (1000)	0.87 $p < .001$ (1000)	--				
4. Probability knowledge	−0.34 $p < .001$ (1000)	−0.31 $p < .001$ (1000)	−0.33 $p < .001$ (1000)	--			
5. Math Fluency	−0.25 $p < .001$ (996)	−0.26 $p < .001$ (996)	−0.27 $p < .001$ (996)	0.22 $p < .001$ (996)	--		
6. Generalized Anxiety	0.44 $p < .001$ (1000)	0.42 $p < .001$ (1000)	0.36 $p < .001$ (1000)	−0.19 $p < .001$ (1000)	−0.16 $p < .001$ (996)	--	
70. Test Anxiety	0.64 $p < .001$ (1000)	0.67 $p < .001$ (1000)	0.63 $p < .001$ (1000)	−0.26 $p < .001$ (1000)	−0.22 $p < .001$ (996)	0.54 $p < .001$ (1000)	--
8. Income	−0.04 $p = .203$ (972)	−0.04 $p = .238$ (972)	−0.03 $p = .397$ (972)	0.06 $p = .047$ (972)	0.09 $p = .006$ (968)	−0.04 $p = .177$ (1000)	−0.02 $p = .474$ (972)

Note. MAST-GMA = Math Anxiety Scale for Teachers general math anxiety. Pairwise *n* reported in parentheses.

Table 3

Multiple comparison results from the Tukey HSD analysis for the racial group differences for math anxiety.

Racial Group	Mean (*SD*)	Racial Group	Mean (*SD*)	Mean Difference	95% confidence intervals	Cohen's *d*
Hopko MARS-R scale						
Asian	2.18 (0.86)	Black or African American	2.48 (1.03)	−0.30	−0.70, 0.11	−0.32
		White	2.28 (0.96)	−0.10	−0.44, 0.23	−0.11
		Other	2.38 (0.90)	−0.20	−0.76, 0.36	−0.23
Black or African American	2.48 (1.03)	White	2.28 (0.96)	0.19	−0.07, 0.46	0.20
		Other	2.38 (0.90)	0.10	−0.42, 0.61	0.10
White	2.28 (0.96)	Other	2.38 (0.90)	−0.10	−0.56, 0.36	−0.11
MAST-GMA scale						
Asian	2.32 (1.01)	Black or African American	2.64 (1.15)	−0.33	−0.81, 0.16	−0.30
		White	2.55 (1.15)	−0.23	−0.63, 0.16	−0.22
		Other	2.58 (1.16)	−0.26	−0.92, 0.39	−0.24
Black or African American	2.64 (1.15)	White	2.55 (1.15)	0.19	−0.08, 0.46	0.08
		Other	2.58 (1.16)	0.09	−0.22, 0.40	0.05
White	2.55 (1.15)	Other	2.58 (1.16)	−0.03	−0.58, 0.51	−0.03
0 to 10 math anxiety scale						
Asian	3.49 (2.52)	Black or African American	4.47 (3.04)	−0.98	−2.26, 0.30	−0.35
		White	3.94 (3.07)	−0.45	−1.50, 0.61	−0.16
		Other	4.36 (3.55)	−0.78	−2.53, 0.98	−0.28
Black or African American	4.47 (3.04)	White	3.94 (3.07)	0.53	−0.30, 1.36	0.17
		Other	4.36 (3.55)	0.20	−1.42, 1.83	0.03
White	3.94 (3.07)	Other	4.36 (3.55)	−0.33	−1.78, 1.12	−0.13

Note. Asian $n = 59$, Black of African American $n = 100$, White $n = 789$, Other $n = 30$. All differences were not statistically significant.

Table 4

Multiple comparison results from the Tukey HSD analysis for the educational attainment group differences for math anxiety.

Education Level	Mean (*SD*)	Education Level	Mean (*SD*)	Mean Diff	95% C.I.s	Cohen's *d*
Hopko MARS-R scale						
Grade 7–12	4.21 (0.53)	Graduated high school	2.44 (0.99)	1.77	−0.25, 3.78	2.23
		Some college	2.45 (0.97)	1.76	−0.24, 3.76	2.25
		Graduated from 2-year college	2.32 (0.97)	1.89	−0.12, 3.90	2.42
		Graduated from 4-year college	2.27 (0.96)	1.94	−0.06, 3.39	2.50
		Attended graduate or professional school	2.49 (1.06)	1.72	−0.33, 3.77	2.05
		Completed graduate or professional school	2.02 (0.87)	**2.19**	**0.19, 4.19**	**3.04**
Graduated high school	2.44 (0.99)	Some college	2.45 (0.97)	−0.01	−0.35, 0.34	−0.01
		Graduated from 2-year college	2.32 (0.97)	0.12	−0.28, 0.53	0.12
		Graduated from 4-year college	2.27 (0.96)	0.17	−0.16, 0.50	0.17
		Attended graduate or professional school	2.49 (1.06)	−0.04	−0.60, 0.52	−0.05
		Completed graduate or professional school	2.02 (0.87)	**0.42**	**0.06, 0.79**	**0.45**
Some college	2.45 (0.97)	Graduated from 2-year college	2.32 (0.97)	0.13	−0.20, 0.46	0.13
		Graduated from 4-year college	2.27 (0.96)	0.18	−0.06, 0.41	0.19
		Attended graduate or professional school	2.49 (1.06)	−0.04	−0.55, 0.47	−0.04
		Completed graduate or professional school	2.02 (0.87)	**0.43**	**0.15, 0.71**	**0.47**
Graduated from 2-year college	2.32 (0.97)	Graduated from 4-year college	2.27 (0.96)	0.05	−0.27, 0.37	0.05
		Attended graduate or professional school	2.49 (1.06)	−0.17	−0.72, 0.39	−0.17
		Completed graduate or professional school	2.02 (0.87)	0.30	−0.05, 0.65	0.33
Graduated from 4-year college	2.27 (0.96)	Attended graduate or professional school	2.49 (1.06)	−0.21	−0.71, 0.29	−0.22
		Completed graduate or professional school	2.02 (0.87)	0.25	−0.01, 0.51	0.27
Attended graduate or professional school	2.49 (1.06)	Completed graduate or professional school	2.02 (0.87)	0.47	−0.05, 0.99	0.48
MAST-GMA scale						
Grade 7–12	4.45 (0.64)	Graduated high school	2.80 (1.19)	1.65	−0.73, 4.03	1.73
		Some college	2.72 (1.03)	1.73	−0.63, 4.10	2.02
		Graduated from 2-year college	2.64 (1.11)	1.81	−0.57, 4.19	2.00
		Graduated from 4-year college	2.47 (1.16)	1.98	−0.38, 4.35	2.11
		Attended graduate or professional school	2.73 (1.18)	1.72	−0.70, 4.15	1.81

Education Level	Mean (*SD*)	Education Level	Mean (*SD*)	Mean Diff	95% C.I.s	Cohen's *d*
		Completed graduate or professional school	2.21 (1.05)	2.24	−0.13, 4.61	2.58
Graduated high school	2.80 (1.19)	Some college	2.72 (1.03)	0.08	−0.33, 0.49	0.07
		Graduated from 2-year college	2.64 (1.11)	0.16	−0.32, 0.64	0.14
		Graduated from 4-year college	2.47 (1.16)	0.33	−0.06, 0.72	0.28
		Attended graduate or professional school	2.73 (1.18)	0.07	−0.59, 0.74	0.06
		Completed graduate or professional school	2.21 (1.05)	**0.58**	**0.16, 1.05**	**0.53**
Some college	2.72 (1.03)	Graduated from 2-year college	2.64 (1.11)	0.08	−0.32, 0.47	0.07
		Graduated from 4-year college	2.47 (1.16)	0.25	−0.03, 0.53	0.23
		Attended graduate or professional school	2.73 (1.18)	−0.01	−0.61, 0.59	−0.01
		Completed graduate or professional school	2.21 (1.05)	**0.50**	**0.17, 0.83**	**0.49**
Graduated from 2-year college	2.64 (1.11)	Graduated from 4-year college	2.47 (1.16)	0.17	−0.21, 0.55	0.15
		Attended graduate or professional school	2.73 (1.18)	−0.09	−0.74, 0.57	−0.08
		Completed graduate or professional school	2.21 (1.05)	**0.43**	**0.01, 0.84**	**0.40**
Graduated from 4-year college	2.47 (1.16)	Attended graduate or professional school	2.73 (1.18)	−0.26	−0.85, 0.33	−0.22
		Completed graduate or professional school	2.21 (1.05)	0.26	−0.05, 0.56	0.24
Attended graduate or professional school	2.73 (1.18)	Completed graduate or professional school	2.21 (1.05)	0.51	−0.10, 1.13	0.47
0 to 10 math anxiety scale						
Grade 7–12	6.50 (0.71)	Graduated high school	4.63 (3.04)	1.87	−0.50, 8.24	0.85
		Some college	4.40 (3.12)	2.10	−4.22, 8.43	0.93
		Graduated from 2-year college	4.28 (3.01)	2.22	−4.14, 8.58	1.02
		Graduated from 4-year college	3.78 (3.03)	2.72	−3.60, 9.03	1.24
		Attended graduate or professional school	4.63 (3.29)	1.87	−4.61, 8.35	0.79
		Completed graduate or professional school	3.11 (2.79)	3.39	−2.95, 9.72	1.67
Graduated high school	4.63 (3.04)	Some college	4.40 (3.12)	0.23	−0.86, 1.32	0.07
		Graduated from 2-year college	4.28 (3.01)	0.35	−0.94, 1.64	0.12
		Graduated from 4-year college	3.78 (3.03)	0.84	−0.21, 1.89	0.28
		Attended graduate or professional school	4.63 (3.29)	−.002	−1.77, 1.77	0.00
		Completed graduate or professional school	3.11 (2.79)	**1.51**	**0.36, 2.66**	**0.52**
Some college	4.40 (3.12)	Graduated from 2-year college	4.28 (3.01)	0.12	−0.93, 1.17	0.04
		Graduated from 4-year college	3.78 (3.03)	0.61	−0.13, 1.36	0.20
		Attended graduate or professional school	4.63 (3.29)	−0.23	−1.84, 1.38	−0.07

Education Level	Mean (*SD*)	Education Level	Mean (*SD*)	Mean Diff	95% C.I.s	Cohen's *d*
		Completed graduate or professional school	3.11 (2.79)	**1.29**	**0.41, 2.16**	**0.44**
Graduated from 2-year college	4.28 (3.01)	Graduated from 4-year college	3.78 (3.03)	0.49	−0.52, 1.50	0.17
		Attended graduate or professional school	4.63 (3.29)	−0.35	−2.10, 1.40	−0.11
		Completed graduate or professional school	3.11 (2.79)	**1.16**	**0.05, 2.28**	**0.40**
Graduated from 4-year college	3.78 (3.03)	Attended graduate or professional school	4.63 (3.29)	−0.84	−1.89, 0.21	−0.11
		Completed graduate or professional school	3.11 (2.79)	0.67	−0.15, 1.50	0.40
Attended graduate or professional school	4.63 (3.29)	Completed graduate or professional school	3.11 (2.79)	1.52	−0.13, 3.16	0.50.

Note. Grade 7–12 $n = 2$, Graduated high school $n = 91$, Some college $n = 248$, Graduated from 2-year college $n = 101$, Graduated from 4-year college $n = 343$, Attended graduate or professional school $n = 35$, Completed graduate or professional school $n = 177$. Bolded estimates are statistically significant.