

Exploring Math Anxiety and Math Stereotypes in American Second Graders During a Controlled or Autonomous Math Activity

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INTRODUCTION

- **Math anxiety** is tension, fear, or apprehension surrounding mathematics performance¹
- Starting in early elementary school, girls start reporting more anxiety than boys²
 - It is unknown how children of different racial backgrounds, particularly minoritized children, may differ
- **Stereotype threat** is the fear of contributing to a negative stereotype about a group you belong to³
- Minoritized children in elementary school can be aware of negative math stereotypes about their own race, affecting math performance, potentially leading to more math anxiety⁴

CURRENT STUDY

Research Questions

- How do children’s math anxiety levels differ depending on gender, race, pre/post math activity, and type of activity?
- Are children more likely to believe that gender- or race-matched children are better at math than reading depending on pre/post math activity or type of activity? Could this be affected by math anxiety as well?

Participants and Procedure

- 152 second graders from across the United States (87 girls, 61 participants of color)
- In a one-hour zoom session, children completed:
 - A pre-activity math survey
 - A 15-minute math activity with a parent in an experimental (child selects math problems) or control (child is assigned math problems) condition
 - A post-activity math survey

EXAMPLE SURVEY QUESTIONS

Children chose which face depicted how they felt about different hypothetical math problems



Children were shown 8 children, one at a time, differing in gender and race, and picked if each child was better at math or reading



Question types in the math activity were either:

- Formal math problems
- Math word problems
- Math games



Doggie was roaming the backyard when he spotted something sparkling under a shady old tree—a mysterious box secured by a strange lock. Curious and excited, he wagged his tail and gave the lock a quick sniff. "I wonder what's inside," Doggie thought.

Now, it's up to you to help him crack the lock's secret code and uncover the surprise hidden within!

Unlocking Tips

23 + 25 =

52 + 17 =

48 - 36 =

🐶 = 48

🐱 = 53

🐭 = 36

🐹 = 47

🐰 = 69

🐇 = 46

🐫 = 84

🐼 = 12

🐾 = 41

RESULTS

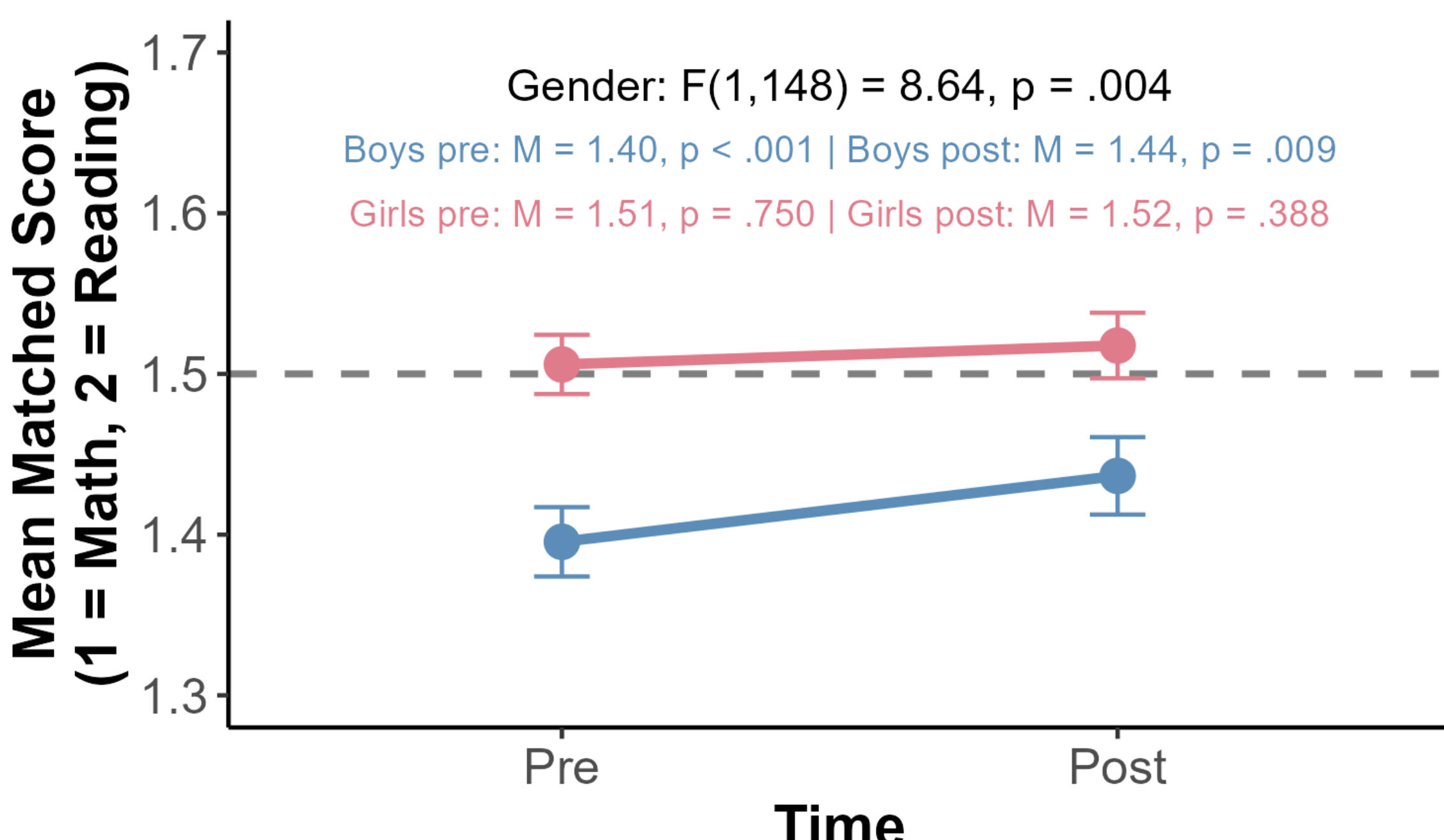
- The child math anxiety scale demonstrated acceptable internal consistency at pre ($\alpha = .71$) and post ($\alpha = .76$). Math anxiety significantly decreased from pre to post (gender model: $F(1, 148) = 11.67, p = .001, \eta^2p = .07$, race model: $F(1, 148) = 13.92, p < .001, \eta^2p = .09$) for all children, regardless of gender, race, or condition (all $ps > .05$).
- Stereotype assessment differed by gender. Boys expected same-gender targets to be better at math than reading (pre: $p < .001$, post: $p = .009$), whereas girls showed no preference ($ps > .05$).
- There were not differences in assessment by race ($p > .05$), but there was a time effect with white children switching from a math bias to a reading bias ($F(1, 123) = 5.04, p = .027, \eta^2p = .04$).
- Stereotype assessment within gender was modulated by children’s math anxiety. Children with higher math anxiety were more likely to expect same-gender children to be better at math than reading, and this effect was particularly marked in boys (pre: $p = .021$, post: $p = .016$). Higher anxiety and lower anxiety girls did not significantly differ ($ps > .05$).

Stereotype by Gender

Gender: $F(1, 148) = 8.64, p = .004$

Boys pre: $M = 1.40, p < .001$ | Boys post: $M = 1.44, p = .009$

Girls pre: $M = 1.51, p = .750$ | Girls post: $M = 1.52, p = .388$



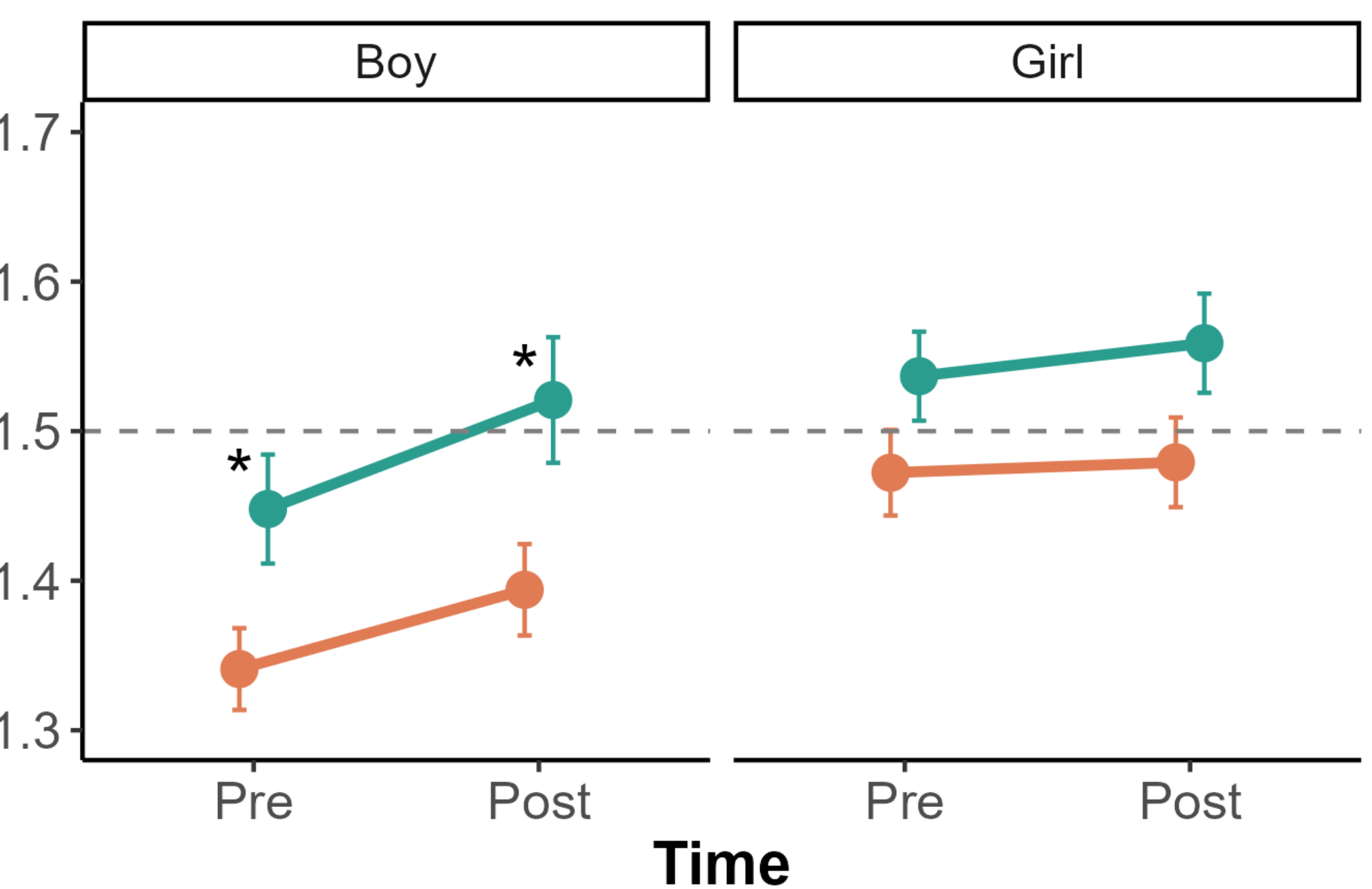
Gender ● Girl ● Boy

Dashed line = chance (1.5)

Gender Stereotypes by Anxiety Group

Boy

Girl



Anxiety Group ● High Anxiety ● Low Anxiety

Dashed line = chance (1.5). * $p < .05$

DISCUSSION

- Children in this study did not start off as very math anxious on average ($M = 1.9$), possibly skewing results as parents with math-anxious children may not have registered for a math game
- Children became less math anxious from pre to post, indicating the math activity may have temporarily relieved math anxiety
- Boys believe that other boys are better at math than at reading, suggesting that math stereotypes are already prevalent in second grade
- Stereotypes to do with math and race may develop differently across groups

CONCLUSION

- Math anxiety and stereotypes appear to be related constructs, especially for boys, and should be investigated together in the future
- A larger, more diverse sample of children may reveal more distinct differences in how both anxiety and stereotyping develop

REFERENCES

1. Ashcraft, M. H. (2002) Math Anxiety: Personal, Educational, and Cognitive Consequences. *Current Directions in Psychological Science*, 11(5), 181-185.
2. 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. *Behav Brain Funct.*
3. Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology*, 69(5), 797–811.
4. Wasserberg, M. J. (2014). Stereotype Threat Effects on African American Children in an Urban Elementary School. *The Journal of Experimental Education*, 82(4), 502–517.

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