

Investigating Teaching Interventions to Reduce Math Anxiety: Exam Corrections

Rebecca MacKinnon, Ph.D.
University of Wisconsin – Parkside, Department of Mathematics and Physics

What is Math Anxiety?

Math anxiety is the feeling of fear or apprehension about math. This is of concern to educators because math anxiety has been correlated to low participation and achievement in mathematics (Foley et al, 2017). Reducing math anxiety will increase access to higher level mathematics to more students, especially those statistically more likely to have math anxiety. Further, it has been shown that elementary school girls with math-anxious teachers performed worse than those who had teachers with low math anxiety (Beilock et al. 2010), indicating that an individual's math anxiety may influence others. Reducing math anxiety in general will help create a more numerically literate society, allowing us to make more informed decisions towards our collective future.

How to Reduce Math Anxiety

In the literature, there are two main types of solutions to reduce math anxiety in the math classroom. There are solutions which focus on the feelings of an individual students. There are also solutions that focus on structural changes in the classroom.

Individual solutions include:

- Relaxation exercises, like journaling or meditating
- Psychological treatment

Curricular or instructional interventions include:

- Re-testing
- Self-paced learning
- Single-sex classes
- Use of manipulatives and technology

“It has given me the ability to not put myself down for not doing well on a problem/making mistakes that are easy fixes.” – Fall 2022 student

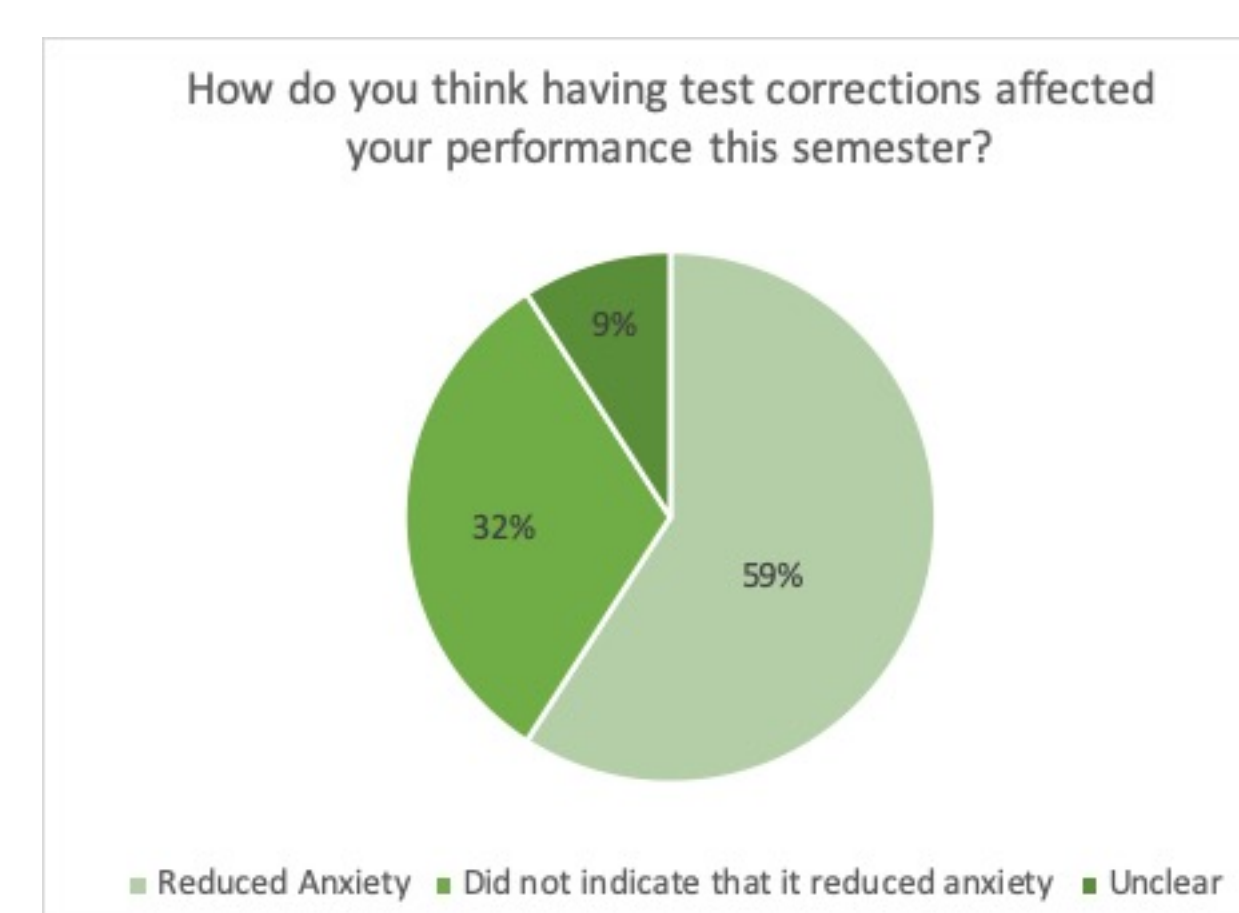
What I Did

For this project, I surveyed my Math 114: College Algebra II and Trigonometry class in both Fall 2022 and Spring 2023. In Fall 2022, 26 students took the initial survey and 22 students took the end of semester survey. There were a cumulative 57 mid-semester reflections turned in, which averages to 14 surveys per unit exam. More results will be coming at the conclusion of the Spring 2023 semester.

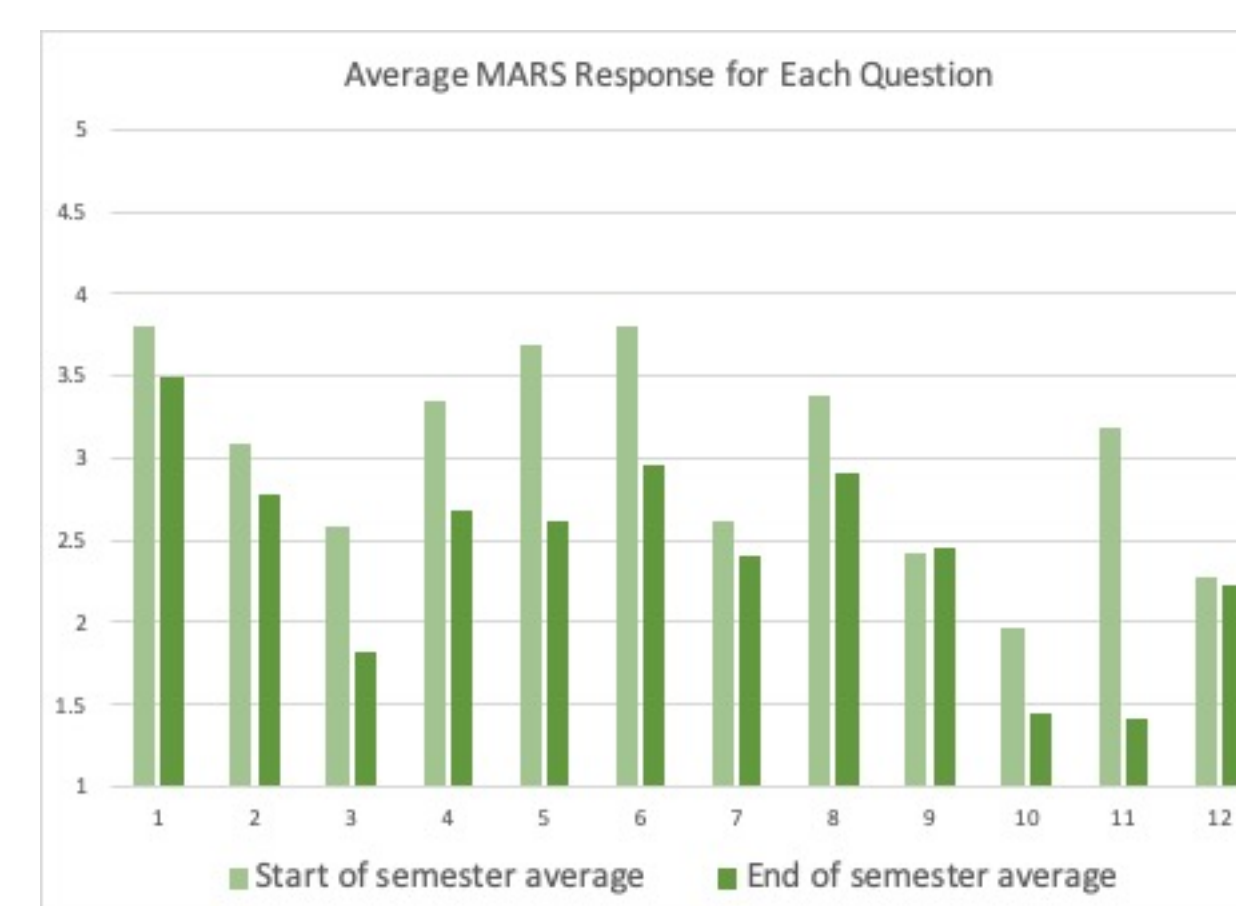
I gave my students six surveys throughout the semester. I gave my students the short version of the MARS survey at the start of the semester to get a baseline measurement of their levels of math anxiety. Then, every time a student chose to submit test corrections, I had them complete a free response survey about their mood and study habits around the exam. Finally, at the end of the semester, students were asked to fill out a combination of MARS questions and free response questions to compare their experiences with anxiety and tests in this class with other math classes. Because the intervention I am testing is specifically about testing, I only included questions on the MARS that have to do with the classroom setting.

Results

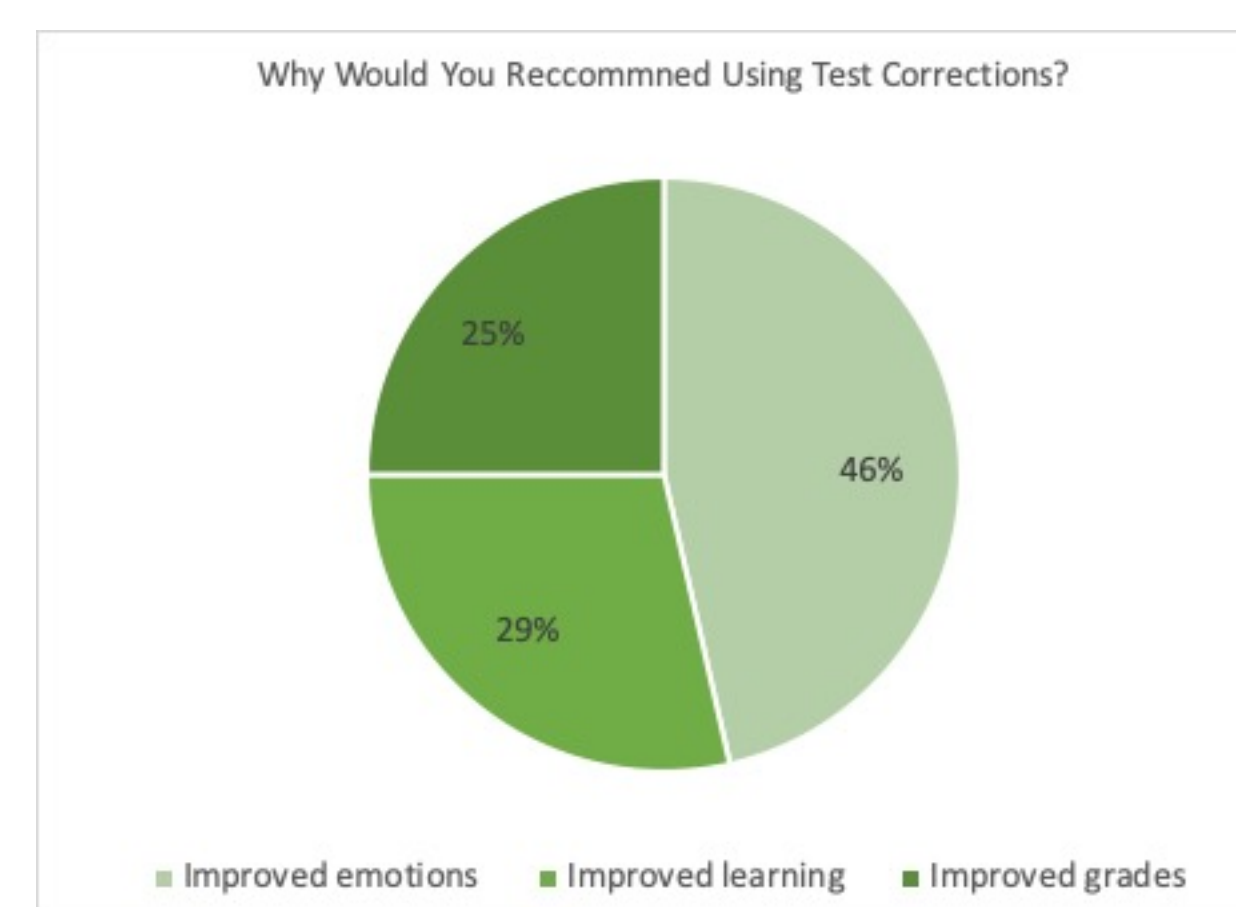
Of the 22 students who completed the end of the semester survey, 59.1% indicated that having the option to complete test corrections reduced their anxiety around the test. This group included students who utilized the corrections and students who did not, indicating that having the option to do the corrections has a positive effect on the emotions of students.



Comparing the MARS results pre- and post-semester indicates a decrease in math anxiety. For each question asked at both the beginning and end of the semester, the average score either decreased or stayed approximately the same. Taking the change in Question 11 as an outlier, the average percent decrease in anxiety was 15.23%, with a maximum decrease of 29.46% on Question 3 and a percent increase of 1.24% on Question 9. This indicates that students felt less anxiety in this course with test corrections available than in other math courses.



All students who completed the end of semester survey indicated that they would recommend to continue the use of exam corrections in the course. When asked why, 46% of students indicated that having the option of test corrections improved their emotional state in the course, 29% indicated that it improved their mastery of the material, and 25% indicated that it improved their grade.



“It helped ease a lot of negative emotions when I did bad on a test and helped me not feel like a failure.” – Fall 2022 student

Measuring Math Anxiety

The Math Anxiety Rating Scale (MARS) is a questionnaire with Likert scale questions to reliably measure math anxiety (Richardson and Suinn, 1972). The 98 item questionnaire was reduced to a 30-item “short” version of the MARS (Suinn and Winston, 2003). I used the short version of the MARS.

“Having a safety net helped me struggle a little less with second guessing myself.” – Fall 2022 student

Directions and Sample Questions from the short MARS

Directions: The items in the questionnaire refer to things that may cause fear or apprehension. For each item, place a check in the box under the column that describes how much you are frightened by it nowadays. Work quickly, but be sure to consider each item individually.

- Taking a final exam in a math course.
- Thinking about an upcoming math test one hour before.
- Taking a quiz or exam in a math course.
- Totalling up a dinner bill that you think overcharged you.
- Watching someone work with a calculator.
- Studying for a driver's license test and memorizing the figures involved, such as the distances it takes to stop a car going at different speeds.

“They made it a lot easier to not worry about the initial grade as much, and therefore feel better about taking the tests.” – Fall 2022 student

Reflection

Going into this project, I was hopeful that having test corrections would reduce the anxiety of my students, and it seems that it did. This instructional intervention joins the ranks of interventions like re-testing and self-paced learning as a structural change instructors can make in their classes to reduce the level of math anxiety their students have. Given that it has been shown that test corrections improve student learning (a sentiment that my students echoed), there is minimal reason not to implement this change in all of my classes going forward.

“I haven't done [test corrections] much but the fact that they are an option helps me stay more calm before a test.” – Fall 2022 student

Acknowledgements

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