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Research Proposal: A Proposed Study on the Effects of a Jigsaw Classroom on Female Math Anxiety

Around the world, girls report higher levels of math anxiety than boys, even when their performance is equivalent (Luttenberger, Wimmer, and Paechter, 2018).

Researchers attribute the math-anxiety gender gap to the stereotype that females are not good at math, a negative stereotype that children internalize from a young age (Ertl, Luttenberger, and Paechter, 2017). One study suggests that girls and boys face similar levels of math anxiety, but because of the stereotype, boys are less likely to report their anxiety (Erturan and Jansen, 2015). These findings suggest that group membership is key in how students experience math anxiety.

In the 1950s, a team of researchers led by Muzafer Sherif set up an experiment at a boys' summer camp. They separated the boys into two groups and arranged competitions between the two groups to encourage group pride, effectively creating outgroup bias and intergroup hostility. Then, they set up a scenario that required the two groups to work together to accomplish a superordinate goal, effectively eliminating the antagonism (M. Sherif, Harvey, White, Hood, and C. Sherif, 1961). Twenty years after Sherif's experiment, Elliot Aronson applied superordinate goals to a classroom to reduce tension in newly integrated Texas schools. He and his colleagues called the system a "jigsaw classroom." In a jigsaw classroom, a topic is taught by dividing students into groups, each responsible for a subtopic, then each student responsible for part of the subtopic. The students must work together to understand the entire topic.

Jigsaw classrooms have been found to decrease segregation and students' belief in ethnic and cultural stereotypes. At the same time, they increase students' empathy and the performance of low-achieving students ("How to Build," n.d.).

This research aims to investigate the effects of classroom superordinate goals on students' math anxiety, specifically girls' math anxiety, utilizing Aronson's jigsaw model. We hypothesize that female students will experience less math anxiety when they must collaborate toward a common goal with their peers. Our hypothesis is centered in the findings that girls' math anxiety is rooted in stereotypes and that jigsaw classrooms can decrease stereotypes.

Method

The experiment will take place in four fourth-grade classrooms. All students will be given a short mathematical skills assessment and asked to fill out a survey about their feelings toward math and about how they perceive their classroom environment. The bulk of the experiment will be a lesson in percentages, decimals, and fractions. Two classrooms are the control groups; the teachers will teach the entire class at the same time how to work with percentages, decimals, and fractions.

The other two classrooms will be jigsaw classrooms. We will divide each class into three teams: Percentage Experts, Decimal Experts, and Fraction Experts. In their teams, students will learn about their topic with worksheets that include written explanations and practice problems using coloring to understanding adding, subtracting, and simplifying. Students will collaborate on these worksheets and the teacher will provide support and encouragement as needed. Then, students will meet in groups of

three with one person from each Expert team. Each student “teaches” their new group about their topic, then the teacher facilitates a conversation about how to represent the same values in the three different forms and the groups will practice converting from one to another together. Next, the teacher will reveal a bucket one hundred marbles, some blue and some red. The teacher will explain that the class goal is to figure out the ratio of blue to red marbles in the bucket. Each set of three students will receive a handful of marbles, until they are all distributed. The three students will work together to reflect the amount of blue marbles in their handful as a percentage, a decimal, and a fraction. Then, they will pair with another team to add their values together. The groups will continue merging until the entire classroom forms a group and the class has found the overall percentage, decimal, and fraction of blue marbles in the bucket.

After the class, all students will again be given a short mathematical skills assessment and fill out a survey about their feelings about math and their classroom.

Anticipated Results

Our primary prediction is that in the jigsaw classroom, girls will experience less math anxiety. Previous studies have found jigsaw classrooms to create environments with less stereotyping and greater empathy (“How to Build”, n.d.). Thus, it also may occur that boys report greater math anxiety in the jigsaw classroom. We anticipate that students will report a greater sense of belonging after completing the jigsaw activity. Finally, we anticipate that we will observe more altruism in the jigsaw classroom and more aggression in the control classroom.

Potential Implications

We theorize that currently, in math classrooms, male students perceive themselves as an ingroup. Due to ingroup favoritism, they evaluate other boys as better at math than the girls, who are the outgroup. Even if there are some girls who are proficient at math, they are all seen as less competent because of the outgroup homogeneity effect. If the predicted result occurs, we have evidence to suggest that superordinate goals can be used to “overwrite” gender groups in a classroom.

One obstacle we must consider comes from Robert Zajonc’s model of social facilitation (Zajonc, 1995). According to this model, performance is enhanced in the presence of observers if the dominant response is easy or well learned, but it is impaired in the presence of observers if the dominant response is difficult or not well learned (Gazzaniga, 2018). This poses a problem in the context of this experiment if the dominant response for girls in the jigsaw classroom is to struggle with math problems and the dominant response for boys in the jigsaw classroom is to solve them well. We believe that this will be mitigated when the class is divided into Expert teams, which we hope will transform their current group identity from their gender to their team.

Further Research

If the predicted result does not occur, it is possible that adjusting the ratio of boys and girls in groups in the jigsaw classroom could provide insight as to why superordinate goals were not sufficient to reduce females’ math anxiety. Students in groups of all girls, predominantly girls, and predominantly boys could be compared.

References

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