An Exploration of Teacher Perspectives of Mathematics Anxiety and Gender Stereotyping

2015

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AN EXPLORATION OF TEACHER PERSPECTIVES OF MATHEMATICS ANXIETY AND GENDER STEREOTYPING

by

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A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Interdisciplinary Studies
in the College of Undergraduate Studies
and in the Burnett Honors College
at the University of Central Florida
Orlando, Florida

Spring Term 2015

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Abstract

The purpose of this study was to identify the current perspective of grades three through twelve in-service teachers regarding mathematics anxiety, its causes, and its relation to gender stereotyping. A short online survey was conducted to gain insight into their classrooms and perspectives of the subject. The results showed that mathematics anxiety did exist in the classroom, and in-service teachers did report seeing a gender gap between the anxiety experienced by females and males. I believe that from these findings it is important to conduct further research on in-service teachers to see in depth what they think. This is important because their beliefs about the subject can have a lasting impact on their students and their feelings towards mathematics.

Dedication

For my grandfather: Myron Ebert (September 1939 – August 2014)

Words cannot express how grateful for the experiences you gave me growing up, from fishing as a child, to buying my first car as a teenager and having you show me how to change my tires. You always taught me to try my best at life and accomplish my goals, which inspired me to write this thesis. I thank you for all of the life lessons you taught me throughout the years and everything you did for me.

Acknowledgments

I have to give huge thank you to Dr. Gina Gresham for serving as my Thesis Chair and providing unlimited assistance throughout this journey. Not only did you help me with the editing and grammatical side, but you were also a huge help with your knowledge of the subject. You not only opened my eyes to the large issue with mathematics anxiety but have inspired me to try and learn more about it and make a difference. I want to wholeheartedly thank you for helping me accomplish this; I could have never done it without you.

I also want to thank Dr. Sherron Roberts and Dr. Erhan Haciomeroglu for serving on my committee, and helping me with additional guidance and support. I really appreciate everything that you two have done, from helping with the editing to answering any questions I had.

I also want to thank everyone at the Burnett Honors College for all of the resources and assistance you have provided.

Additionally, I want to say thank you to the professors and students who took their time to be involved in this survey which made this thesis possible.

Lastly, I want to say thank you to my friends and family who have supported me throughout my time at UCF, making this experience a great one. Specifically, I want to thank my husband for giving me unconditional support and guidance. You were always there when I needed you and have made my life much more fun than I could have imagined. I could have never gotten this far without you.

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Chapter 1: Introduction

When people think of mathematics, many thoughts come to mind, ranging from excitement and curiosity, to frustration, confusion, and irritation. One thing that does stand out in the realm of mathematics education is the feeling of anxiety one can feel – when they hear the word mathematics or become involved in solving problems that involve numbers. Mathematics is one of the only subjects where serious examples of anxiety have been studied in association with the subject material. Mathematics anxiety affects students' mathematics performance (Meece, 1988) and is more prevalent in females (Gresham, 2007). According to Goetz, Bieg, Ludtke, Pekrun, & Hall, (2013) this could contribute to the underrepresentation of females in math intensive domains such as physical science, technology, and engineering.

Many studies have been undertaken to determine the cause of mathematics anxiety or what specifically contributes to it. This research project focused on the effect that negative stereotypes have on student mathematics anxiety, specifically females and possible causes of mathematic anxiety. A survey to local educators was conducted to determine whether perpetuation of this stereotype contributes to studies showing females possessing more mathematics anxiety than males.

Relevance of Study

In the last few decades, many school systems have increased focus on mathematics and science. According the United States Department of Education (http://www. ed.gov/k-12reforms, n. d.), students stateside should be able to compete competitively with other students on a global scale. With this increased pressure political decisions are being made that will affect

our classrooms. The most recent example of this is the implementation of the State Common Core Standards across the nation.

The Common Core Standards are national learning goals for what students should know and be able to accomplish at their particular grade level. Until now, each state has had its own education standards. With Common Core, forty-three states have voluntarily adopted these standards which are specifically designed to ensure that students who are close to graduation will be prepared to take courses at a college level or enter the workforce (http://www.corestandards.org/about-the-standards/frequently-asked-questions/). Additionally, with a large number of states following the same educational standards, it makes education more uniform across the nation. This importance of mathematics is echoed as:

> "For more than a decade, research studies of mathematics education in high-performing countries have concluded that mathematics education in the United States must become substantially more focused and coherent in order to improve mathematics achievement in this country. To deliver on this promise, the mathematics standards were designed to address the problem of a curriculum that is 'a mile wide and an inch deep'" (Common Core State Standards, 2014, para. 1).

With an increased focus on mathematics as a nation, the issue of mathematics anxiety needs to be addressed further. Although the idea of mathematics is complex and multifaceted, anxiety does play a role in how our students perform and what degrees and jobs they will pursue. The impact mathematics anxiety has on achievement is especially true of female students, since

they have a disadvantage due to stereotyping. To address our national problem, part of the answer lies in addressing and reducing mathematics anxiety.

Research Question

The following research questions were posed:

1. What current perspectives do in-service, grades three through twelve, teachers possess regarding mathematics anxiety in students and within themselves?
2. What identifiers do in service teachers contribute to the possible cause of mathematics anxiety?

Chapter Two will discuss the literature review and previous research completed on mathematics anxiety. The subjects to be discussed are mathematics anxiety, transmission of mathematics anxiety from teacher to student, mathematics anxiety and female student achievement, and possible causes of mathematics anxiety. Chapter Three will discuss the methodology of this study, including information about the target population, development of survey questions, and survey distribution. Chapter Four will go over the survey results in depth for each question. Finally, Chapter Five will discuss the conclusion, study limitations, and recommendations for further study.

Chapter 2: Literature Review

This section of my thesis will serve mainly as background knowledge in the issue of mathematics anxiety. Previous literature and research studies will be examined and discussed to provide further understanding of the topic. This section will evaluate the different aspects of mathematics anxiety, including transmission from teacher to student, the effect mathematics anxiety has on female student achievement, and finally possible causes of mathematics anxiety.

Mathematics Anxiety

According to Richardson and Suinn (1972), "Mathematics anxiety involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations" (p. 551). It is considered to be specific to mathematics instruction and mathematics related activities, and can be so debilitative in nature in that it can interfere with mathematics performance and inhibit subsequent learning (Hembree, 1990). Mathematics anxiety is a feeling of helplessness, tension, or panic when asked to perform mathematics operations or problems. It has been described as an "I can't syndrome," a feeling of uncertainty, of not being able to do well in mathematics or with numbers (Tobias, 1998). It has its roots in teaching and teachers and has been tied to poor academic performance. It is an emotional reaction towards mathematics (sometimes intense) that interferes with future mathematical learning.

Mathematics anxiety has been measured in different ways. One measurement is to observe the emotions that students exhibit while in mathematic situations such as tests or mathematic instruction. Fenzel, Pekrum, & Geotx, (2007) illustrated that research indicates large

gender differences exist between fifth grade students regarding the emotions of mathematics experiences. Specifically, girls exhibited higher levels of negative emotional reactions to mathematics experiences including anxiety, hopelessness, and shame while boys exhibited higher levels of enjoyment and pride as it related to their mathematics experiences. According to Frenzel, Pekrun, and Geotz (2007), "gender-linked stereotypes of domain-related abilities are plausible candidate for explaining the discrepancy between gender differences found for achievement and those emotions" (p. 507). Goetz, Bieg, Ludtke, Pekrun, and Hall (2013) described the psychological aspects of mathematics anxiety: trait and state anxiety. Trait anxiety is considered habitual whereas state anxiety is momentary. Their study found that females do not truly experience more anxiety than boys (state) when asked questions about their current feelings during present situations involving math, even though they report higher feelings of anxiety (trait) overall. This can be linked back to gender stereotypes since the girls displayed lower competency beliefs. If these negative feelings and emotions were addressed, then perhaps the reported trait anxiety would be closer to the actual state of anxiety observed in females.

Transmission of Mathematics Anxiety

Bielock, Gunderson, Ramierz, Levine, and Smith (2010) indicated that mathematics anxiety and negative feelings can be transmitted from teacher to student. This appears evident when female students' mathematics achievement is negatively affected by their female teachers' mathematics anxiety, which actually alters the student's abilities and beliefs. The students see a fulfillment of the stereotype that females are bad at mathematics, which in turn affects their belief about their own mathematics ability. Boys are not influenced by this phenomenon (Bielock, Gunderson, Ramierz, Levine, & Smith, 2010).

A second study by Marx, Monroe, Cole, & Gilbert (2013) verified the impact that role models or teachers can have on mathematics anxiety. The study used both male and female role models, with male and female subjects. One male role model demonstrated doubt in their mathematic abilities, while one male role model demonstrated confidence. The female role models for this study were instructed to act the same way the males did: one demonstrating confident and the other demonstrating doubtfulness. The study observed students exposed to these role models and their mathematic performance. The results showed the male students who were exposed to confident role models, actually performed worse than the group exposed to the doubtful role model. The hypothesis for what occurred is that the males were intimidated by the math-talented role model and may have felt that they could not attain the same level of success The group who was exposed to the doubtful role model did not have a difference in performance. Marx, Monroe, Cole, & Gilbert (2013) contributed this to the positive stereotype placed on males and mathematics. For the females, the study found that female students who were subjected to even a small portion of doubt from the role model showed a decrease in their performance, whereas females which were exposed to a confident role model showed signs of improvement. The study concluded that,

> "Doubt expressed by a fellow in-group member may be another burden that women may have to bear when entering math-related situations, because this doubt may compound women's own concerns about how they will perform in math, which could further facilitate perceptions that women do not belong in math or science-related fields" (Marx, Monroe, Cole, & Gilbert, 2013, p. 555)

With an overwhelming majority of our elementary school teachers being female, this finding is alarming. Female teachers who show signs of mathematics anxiety could potentially have a negative impact on their female students which might only increase the gender gap in mathematics. This simple observation could impact the views that female students will carry with them for the rest of their academic career and potentially their professional career path.

Mathematics Anxiety and Female Student Achievement

Good, Aronoson & Inzlict's study (2013) showed the effects of mathematics anxiety on student achievement, specifically looking at females and standardized testing. The study focused on seventh grade students and stereotype threat, which caused anxiety. Each student was paired with a college mentor who would discuss certain topics that were intended to help the student cope with stereotype threat. After the students and mentors had worked together throughout the year, the students took the standardized tests. The findings of this study showed that although there was a large gender gap between the male and female students in the control setting, the gap was completely erased in the experimental settings. It is true that the males and females both increased their test scores after participating in the mentor program, but females particularly benefited, which implies that their performance was being suppressed by stereotype threat. This study demonstrates the achievement effect that mathematics anxiety (caused by stereotype threat) has on female student achievement.

These findings are also consistent with the fact that females score 4.4% lower on the mathematics section of the SAT than males (Good, Aronson, & Inzlicht, 2003). This is noteworthy because acceptable SAT scores on college applications are required, and hold a heavy weight in terms of college acceptance or denial. The same conclusion is also true for

grades in mathematics classes. Colleges also take into account high school GPAs and class rigor. If females score lower in these areas or avoid taking difficult mathematics classes because of mathematics anxiety, this can affect their college admission status, which impacts life decisions and career choices.

Possible Cause of Mathematics Anxiety: Funding

Not all schools or students are demographically the same. If this were the case then the mathematics achievement gap could be easily seen and causes could be determined quickly. Instead, our schools are a melting pot of students from different backgrounds, experiences, and from different walks of life which could have an impact on their mathematic achievement. One major example of this diversity and the impact on education is income. Schools that have more funding are able to spend more per pupil, which in turn leads to better facilities and resources for students. Personal finances are also a factor, since some parents can afford to purchase books for their children and tutors if they need additional help. For example, in 2003-2004 the Detroit area saw these drastic differences. The Bloomfield Hills district spent $12,825 per pupil and had only 2% of families that qualified for low income. The Detroit School District was only able to spend $9,576 per pupil and had 59% of families who were considered low income (Kozol, 2005).

Less funding per pupil can contribute to mathematics anxiety because there is a lack of resources available to these students compared to their counterparts. Lee (2012) conducted a study which related mathematic achievement to adequate school funding. He used the National Assessment of Educational Progress to determine the level of mathematic achievement between thirty-nine states, and the level of school funding to develop his conclusions. Lee concluded that there was a signification relationship between mathematical achievement and per-pupil

expenditures. From his study, a one-point increase in mathematics proficiency was associated with a $21.73 increase in educational spending. This funding was able to provide additional resources and supplies, which in turn allowed for improved mathematic understanding (Lee, 2012). As discussed earlier, improved understanding can decrease mathematics anxiety as a whole.

Possible Cause of Mathematics Anxiety: Gender Stereotypes

Although it has been established that gender influences the presence/amount of mathematics anxiety in students, biological differences between males and females are not the cause (Cheem & Galluzzo, 2013). Female students show higher levels of mathematics anxiety and negative emotions when exposed to mathematic experiences but, "gender-linked stereotypes of domain-related abilities are plausible candidate for explaining the discrepancy between gender differences found for achievement and those emotions" (Frenzel, Pekrun, & Geotz, 2007, p. 507). Women have been stereotyped as performing more poorly than men when it comes to mathematics, which causes them to be more vulnerable to stereotype threat (Johnson, Barnard-Brak, Saxon, & Johnson, 2012). Stereotype threat is described as judgments or stereotypes about a specific group which causes members of that group to conform to the negative stereotype held. With mathematics, female students tend to act in a way that confirms the stereotype that males perform better than females (Johnson, Barnard-Brak, Saxon, & Johnson, 2012). In this study on exposure to stereotypes, female students performed better when they were exposed to a mathematics situation where there was a stereotype lift, while male students actually performed better when a stereotype threat was present (Johnson, Barnard-Brak, Saxon, & Johnson, 2012). These gender stereotypes are not just seen by students, but also prospective teachers. Schwartz

& Sinicrope (2011) performed a study that focused on the perspective of graduate and undergraduate students who were either in education programs, or pursuing a different degree with the intention of teaching at the elementary level. The study exposed both groups of subjects to a male and female cartoon character taking a math test and asked the subjects to determine the character's attitude about math. The study found that most of the subjects viewed the female cartoon as having a negative attitude. Two main reasons were given by the subjects as to why they had negative perceptions of the girl's attitude, which were self-reflective of the subjects own mathematics anxiety and/or caused by typical gender stereotypes (Schwartz & Sinicrope, 2011).

Chapter Three will discuss the methodology used in this study. First, the target population will be identified. Then the development of survey questions will be discussed, along with survey distribution and the gathering of results. This will include the use of Qualtrics as a survey platform. There will also be a conclusion which will identify the survey objectives and how they were accomplished.

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Chapter 3: Methodology

The methodology chapter discusses the logistics of this study. This section will specifically go into depth discussing the target population of the study and why the target population was chosen. Additionally, the process of developing the survey questions will be explained. This will include the organization of the survey as well. Survey distribution methods will also be discussed along with the gathering of survey results final analysis through Qualtrics. This section will end with a short conclusion.

The purpose of this study was to determine the current perspectives in-service teachers possess regarding mathematics anxiety in students and themselves. This study was also developed to conclude what identifiers in-service teachers contribute to be the possible cause of mathematics anxiety. To gather this information a survey (see Appendix B) was developed that would assess two different things. The first half of the survey questioned in-service teachers about their classrooms and students. The second half of the survey identified information regarding mathematics anxiety within the in-service teachers themselves. This identifiable information was used to interpret the results about the students.

Target Population

The survey focused on in-service teachers currently teaching grades three through twelve. The in-service teachers used for this survey were all pursuing a master's degree in education either in the University of Central Florida's K-8 program or the Lockheed Martin Program. This grade range was chosen because research indicates mathematics anxiety typically begins around third grade. Teachers in this grade range are also more likely to teach mathematics in their

classrooms independently. Once students reach middle and high school teachers usually spend the year on one subject with multiple classes. This target population would allow for results to reflect a range of mathematics anxiety, from the beginning stages to the higher developed stages later in life.

Development of Survey Questions

Survey questions were developed specifically to give a clear picture of in-service teacher perspectives of mathematics anxiety. In-service teachers were first asked questions about their specific classrooms. They were asked to evaluate if they thought mathematics anxiety was present which allowed a baseline for further questioning. In-service teachers who reported that there was no mathematics anxiety were automatically routed to the second part of the survey where the questions focused on themselves. In-service teachers were also asked to identify the number of boys and girls that experienced mathematics anxiety. This allowed for a measurable statistic to see if there was a gender gap between male and female students who experienced mathematics anxiety. Finally, in-service teachers were asked to list and identify specific traits that led them to believe said students suffered from mathematics anxiety. The purpose was to compare in-service teacher identifiers with the traits listed by research experts in the field of mathematics. The in-service teachers were also asked to determine what they believed the cause of mathematics anxiety was among their students.

The second half of the survey was specifically developed to gain insight about the in-service teachers themselves, rather than their students. Again, a baseline was established by asking in-service teachers if they currently taught mathematics. This helped interpret results from the prior section because if they did not teach mathematics, there may be no mathematics

anxiety to report. Teachers were asked questions about their mathematics anxiety and level of confidence teaching the subject. In-service teachers were also asked to report the cause of their mathematics anxiety, which would allow for more insight into their perspective on what causes mathematics anxiety overall.

Survey Distribution

Once the survey questions were developed, they were uploaded to an online platform named Qualtrics. This specific platform was chosen because it was regularly used for research surveys with the University of Central Florida. The platform also had several helpful tools which allowed for simple formatting and detailed viewing of the results. The survey was organized for easy use and distributed to the participants. Collaboration with several graduate professors at the University of Central Florida was conducted to administer the survey to their students. An email was sent with a link to the professors, who then forwarded this information to their graduate students. These classes were all graduate education courses that served in-service teachers. The survey was optional and voluntary for in-service teachers and took an average of five to ten minutes. The finished survey included a mixture of multiple choice, fill in the blank, and open response questions. This allowed for fast completion by in-service teachers, but areas for elaboration when needed.

Gathering Results

Once in-service teachers completed the survey their answers were recorded anonymously in Qualtrics. Each individual survey was printed for easy access and comparison of results. Charts were developed via computer to visually represent the results in a simple format. This

allowed for easy comparison of teacher answers from the section about their students to the questions about themselves. Each teacher's response was then broken apart individually to analyze their results further, similar to a case study approach. Since questions were individually broken apart, each result either contained a visual chart or an explanation of teacher response. This information was then developed in the results section of the thesis.

Conclusion

This study was developed to determine current in-service teachers possess regarding mathematics anxiety in students and within themselves. A second objective was to conclude what identifiers in-service teachers contribute to be the possible cause of mathematics anxiety. Through this chapter the development of research questions, participants, distribution, and timeline were discussed, which will help answer the research questions. The next section will list in detail the results gathered from this survey.

Chapter Four will have detailed results of the survey. This section will break down each individual survey response in a case study style, which will allow for in depth analysis of each in-service teacher response. In-service teachers were identified using a lettering system ranging from A to K, which would allow for comparison of survey answers to be conducted.

Chapter 4: Survey Results

This chapter is intended to analyze the results of the in-service teacher survey. There were sixteen questions developed to analyze both student and teacher experiences with mathematics anxiety. This chapter will review the question responses and organize the data with the use of charts and graphs. The total number of in-service teachers who responded to the survey was eleven. Since the number of respondents was small, it was decided to analyze the results in an in-depth manner, breaking apart each question, rather than viewing the survey in general. To compare survey responses, each teacher has been labeled with a letter ranging from A-K.

Existence of Mathematics Anxiety

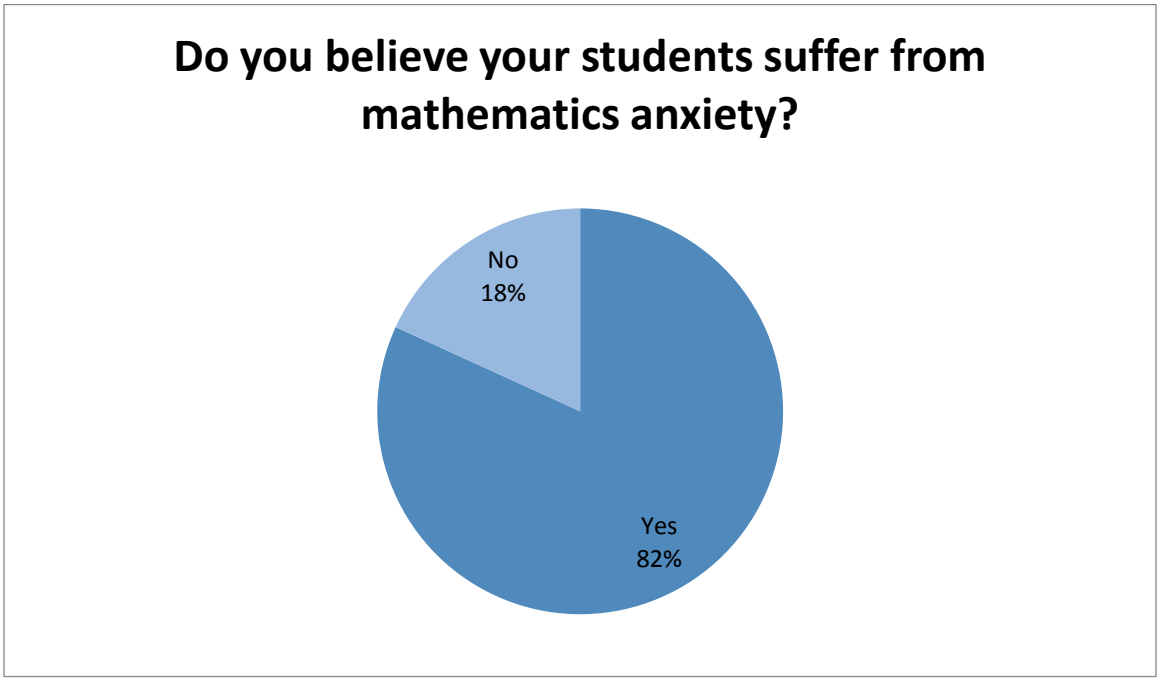


Figure 1. Question Two Results

The results of the survey showed that the majority of in-service teachers surveyed reported seeing some level of mathematics anxiety in their classrooms. Of the 11 in-service teachers who responded, only 2 of them felt that there was no evidence of mathematics anxiety in their classrooms.

Of the two people who believed that there was no mathematics anxiety existed in their classrooms, Teacher H reported that he or she does not teach math, while the other one, Teacher G, reported teaching mathematics for five to ten years. This teacher also stated that he or she is very confident in teaching mathematics.

Gender and Mathematics Anxiety Reported

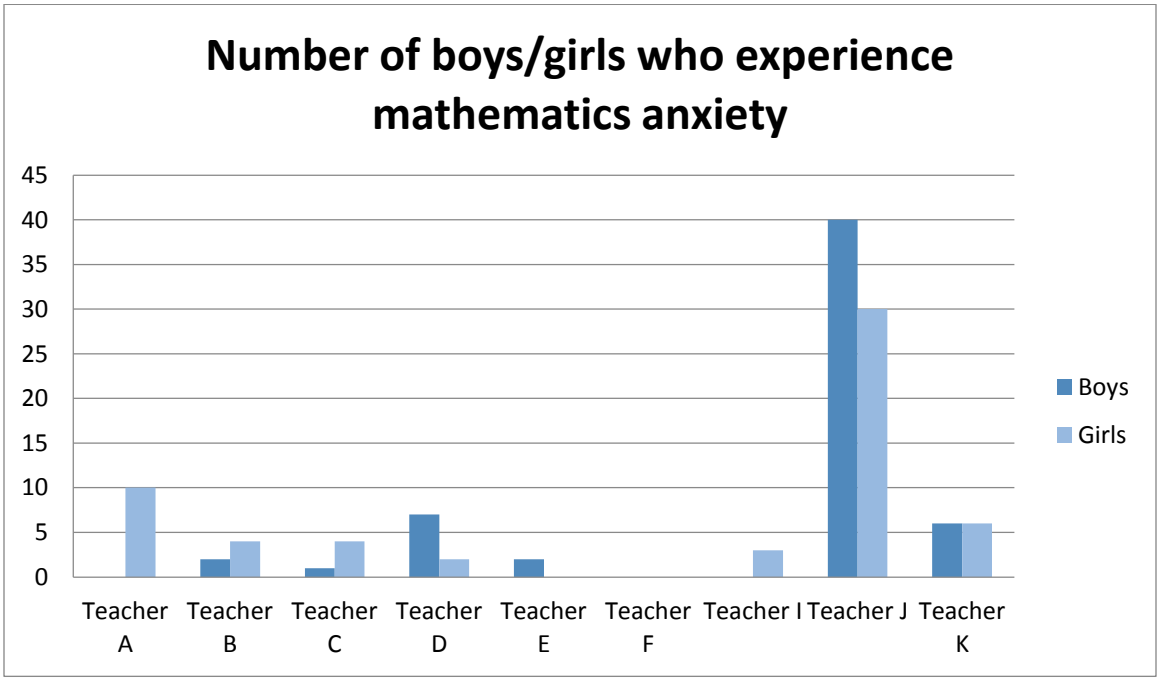


Figure 2. Question Three and Four Results

In-service teachers who reported that mathematics anxiety did exist in their classrooms were then asked to list the number of boys and girls this applied to. These results were rather

interesting. Teacher F had listed that her or she did believe that anxiety exists, but was unable to identify the specific number of individuals this applied to.

Overall, when a difference between boys and girls was noted, a slightly higher amount of in-service teachers reported that girls illustrated signs of mathematics anxiety more than boys. In these classes when the ratio of girls with mathematics anxiety to boys with mathematics anxiety was viewed, a slightly higher amount of classes reported females experiencing mathematics anxiety. Teacher J had the highest number of students due to the grade level he or she taught, but the distance between male and females students was mathematically around the same when viewing the ratios.

Behaviors of Mathematics Anxiety Determined

Each in-service teacher was then asked to list what behaviors or academic performances these students exhibited that allowed the teachers to identity the mathematics anxiety. Teacher A listed students being off task, asking repeated questions, acting out, or just refusing to do their work. Teacher B again listed lack of participation or academic avoidance as a red flag, but expanded the symptoms to physically tearing up as well. Teacher C added that many students tend to get nervous or shut down. The lack of participation in his or her opinion is due to being fearful of making a mistake in front of the class. Teacher J agreed, stating that there was a refusal to complete math assignments, which led to low scores. Lastly, teacher K concurred stating that students were intimidated and reluctant to work on math problems independently.

In addition to the physical behaviors that were listed by Teacher B, Teacher D talked about how his or her students may yell, hit, or scream in frustration. Students in this class have

also ripped up homework or scribbled on the paper instead of completing the problems. Lastly, Teacher F added that his or her students show signs of self-doubt when it comes to completing mathematic problems.

Overall, the in-service teachers listed many different behaviors that they viewed as indicators of mathematics anxiety. The most common behavior listed for this question was lack of participation. Students did this either by not completing their assignments or by not participating in group discussions related to mathematics. Additionally, there were physical symptoms listed which all could be traced back to negative emotions.

When Mathematics Anxiety is Most Prevalent

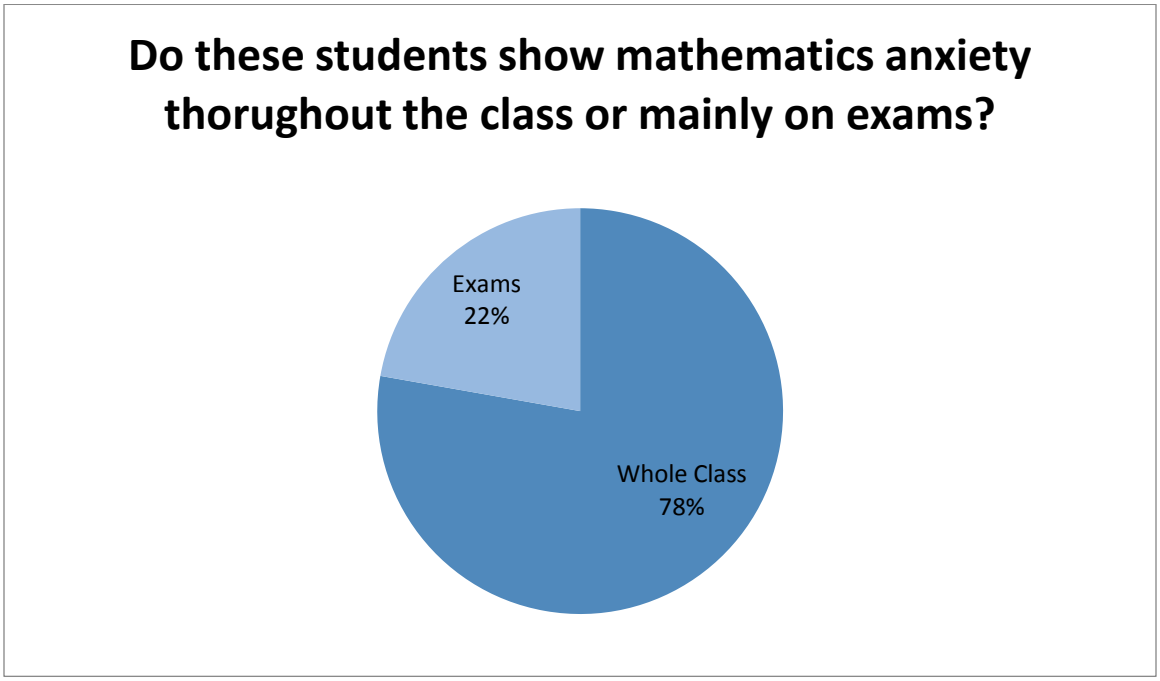


Figure 3. Question Six Results

Question six asked to identify the traits most seen in their classrooms, and if the identified students with mathematics anxiety showed these traits throughout the course as a whole, or mainly around times of high pressure, such as an exam.

Over three-fourths of in-service teachers stated that these students showed behaviors congruent to mathematics anxiety throughout the whole class, rather than just exams. This showed that even in times of "lower pressure" students still felt the anxiety and negative emotions in regards to mathematics.

Specific Traits

In-service teachers were then asked to select which of the follow traits their students exhibited. These traits were specifically based on current research findings regarding those listed for mathematics anxiety.

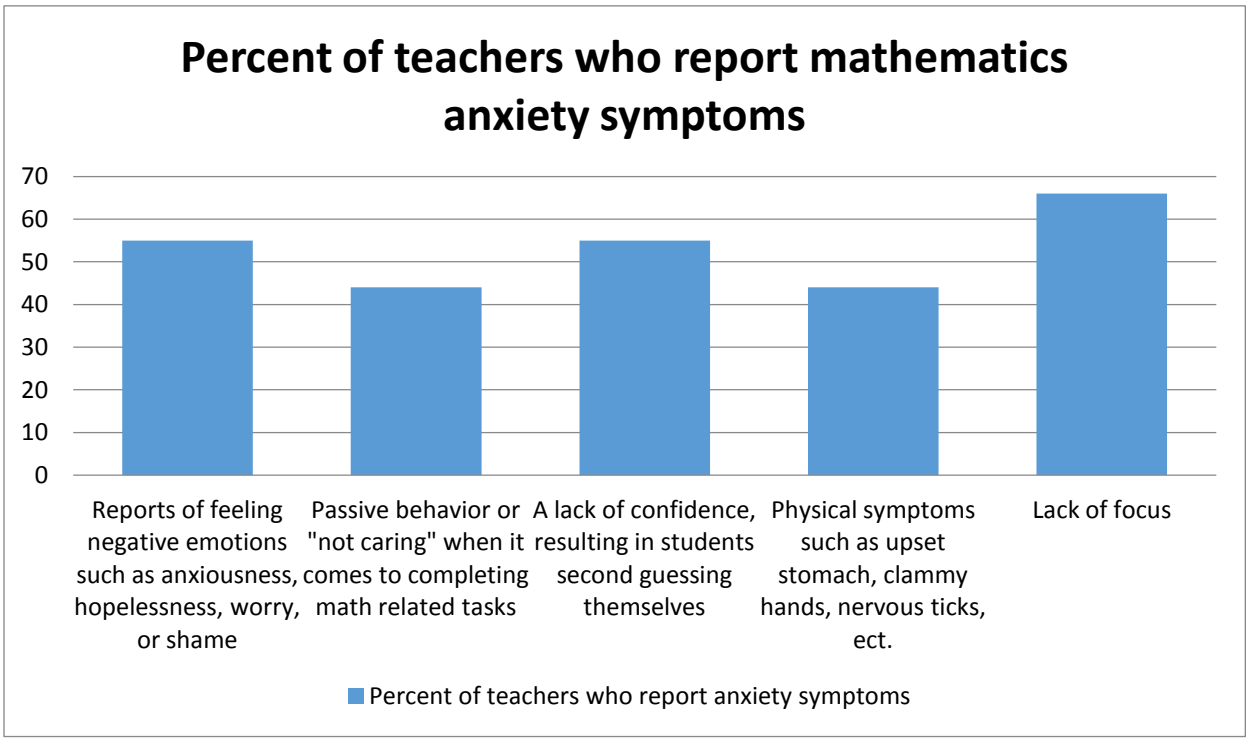


Figure 4. Question Seven Results

As you can see from the chart out of the nine in-service teachers who stated that mathematics anxiety existed in their classrooms, six responded that students had a lack of focus in class. Reports of negative emotions and a lack of understanding were reported by five teachers. The less common traits were passive behavior and physical symptoms, which were reported by four teachers.

Gender Difference

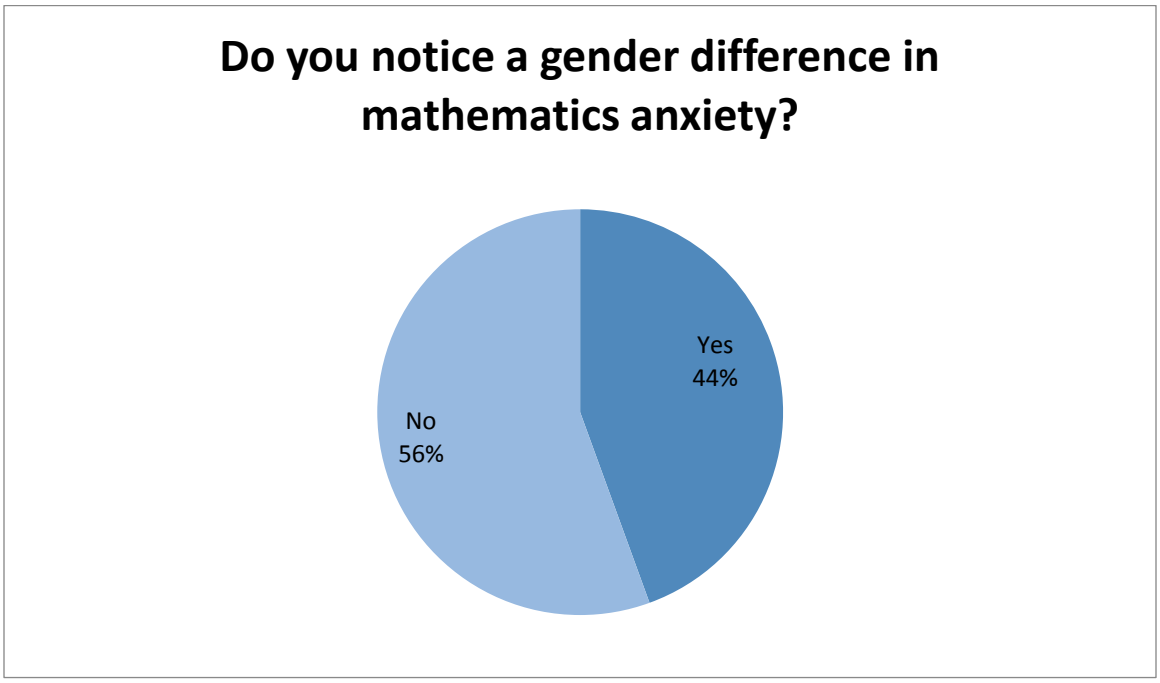


Figure 5. Question Eight Results

Although the results from questions three and four showed that overall, girls exhibited slightly more mathematics anxiety than boys, only 4 of the 11 teachers reported this as the case in their classrooms. The other teachers stated that they did not notice a gender difference at all.

This is noteworthy because the data collected from question two showed a gender gap that favored girls, but only four of the teachers reported noticing this.

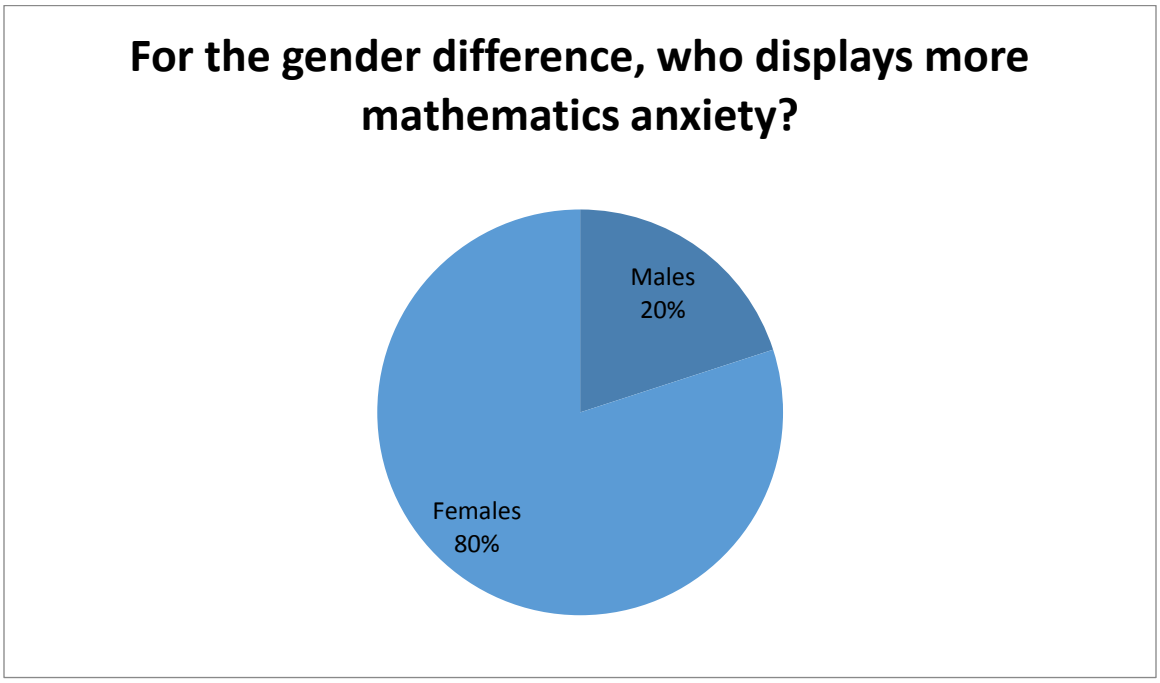


Figure 6. Question Ten Results

This chart displays which gender the in-service teachers believed were affected more by mathematics anxiety. Almost all of the in-service teachers stated that they felt females exhibited more mathematics anxiety than males in their classrooms.

Two in-service teachers elaborated on what they think was the cause of this gender difference. Teacher C stated that most of the girls in his or her class just did not like the subject. The boys in the class enjoy learning mathematics over any other subject. They enjoy learning the new skills and techniques that mathematics has to offer and seem to "soar" in the subject. Teacher I reported that self-doubt seemed to be the cause of the gender difference in his or her

class. Teacher I also reported that girls suffer higher levels of mathematics anxiety than the boys.

Possible Causes of Mathematics Anxiety

In-service teachers were asked what they thought may be possible causes of mathematics anxiety. Teacher B stated that a possible cause in his or her classroom was a lack of mathematical understanding. This led to decreased strength in the subject as a whole. Teachers C and D stated that his or her students tend to shut down and this is what causes avoidance behavior. Teacher F listed memorization and formulas as a cause since it can intimidate some students or be difficult for them. Teacher I listed lack of confidence in one's self to be the cause of mathematics anxiety in his or her classroom. Teacher J stated that weak math skills through the duration of primary education cause mathematics anxiety. This is noteworthy because Teacher J teaches tenth grade math and states that the anxiety has developed in primary school, which concurs with the findings from the literature review. Lastly, teacher K stated that students do not understand abstract concepts, which decreases confidence. This is noteworthy since teacher K stated she taught seventh grade, where math has multiple abstract concepts, especially in Algebra.

Analyses of teacher responses were then analyzed to interpret the results from the first half of the survey. This analysis was meant to clarify in-service teacher perspectives about mathematics anxiety. Once the results were recorded, connections were made between the in-service teachers' perspectives and the data reported from their classrooms.

Teachers of Mathematics

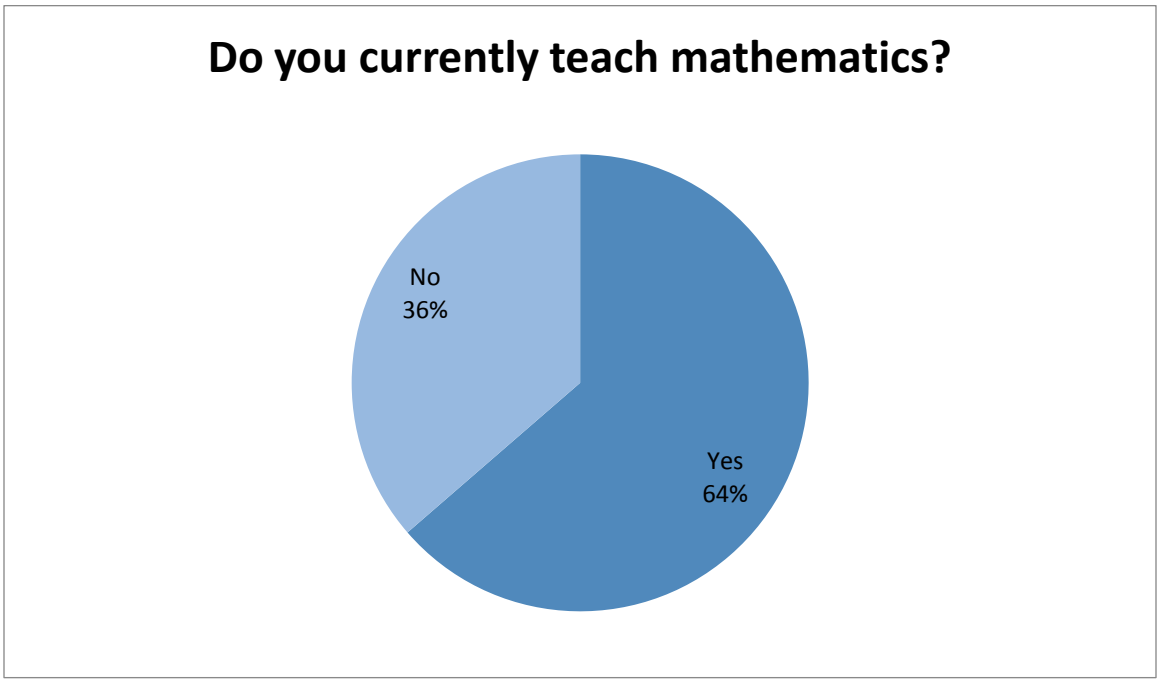


Figure 7. Question Twelve Results

Question 7 was used to determine how many of the respondents taught mathematics. Out of the ten teachers, six reported that they currently teach mathematics. It is important to note that even those in-service teachers who did not teach mathematics reported that some of their students showed signs of mathematics anxiety (Teachers A, F, and J). Teacher G, who also taught mathematics, was the only one who reported no signs of anxiety in his or her classroom.

Teacher H was the only one who listed that he or she did not teach mathematics and had no signs of anxiety in his or her classroom.

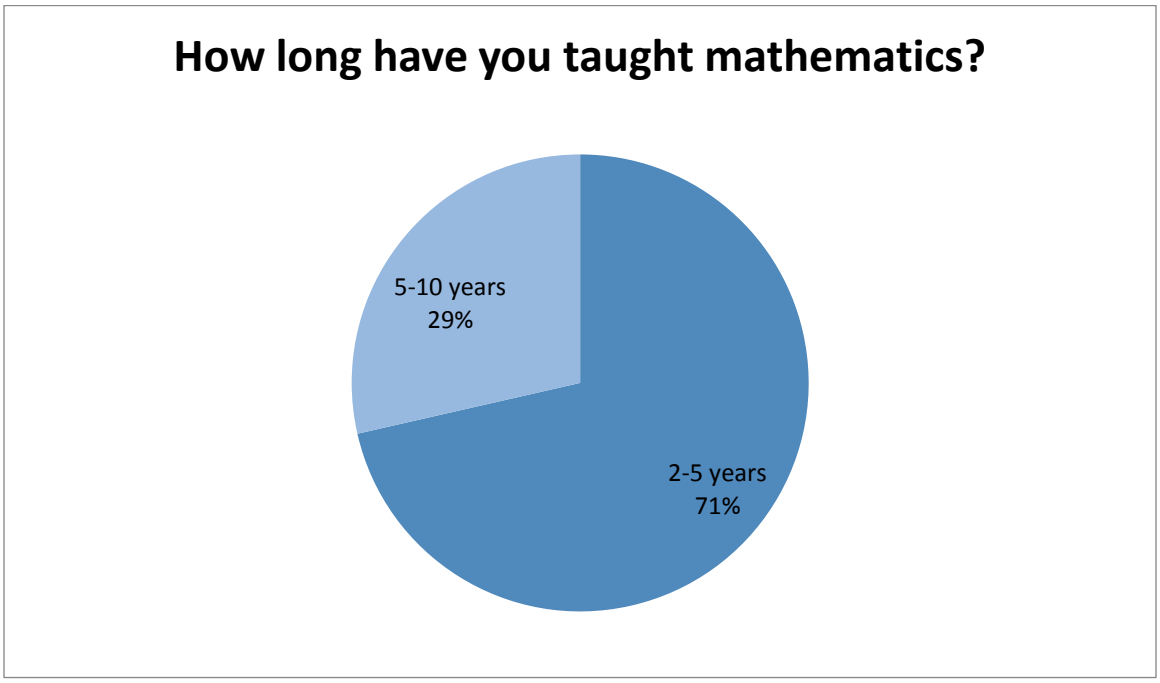


Figure 8. Question Thirteen Results

Of the seven teachers who taught mathematics five said that they have been doing it for two-five years (Teacher B, D, E, I and K) while the other two stated that they have been teaching mathematics five-ten years (Teacher C and G).

Confidence of Teaching Mathematics

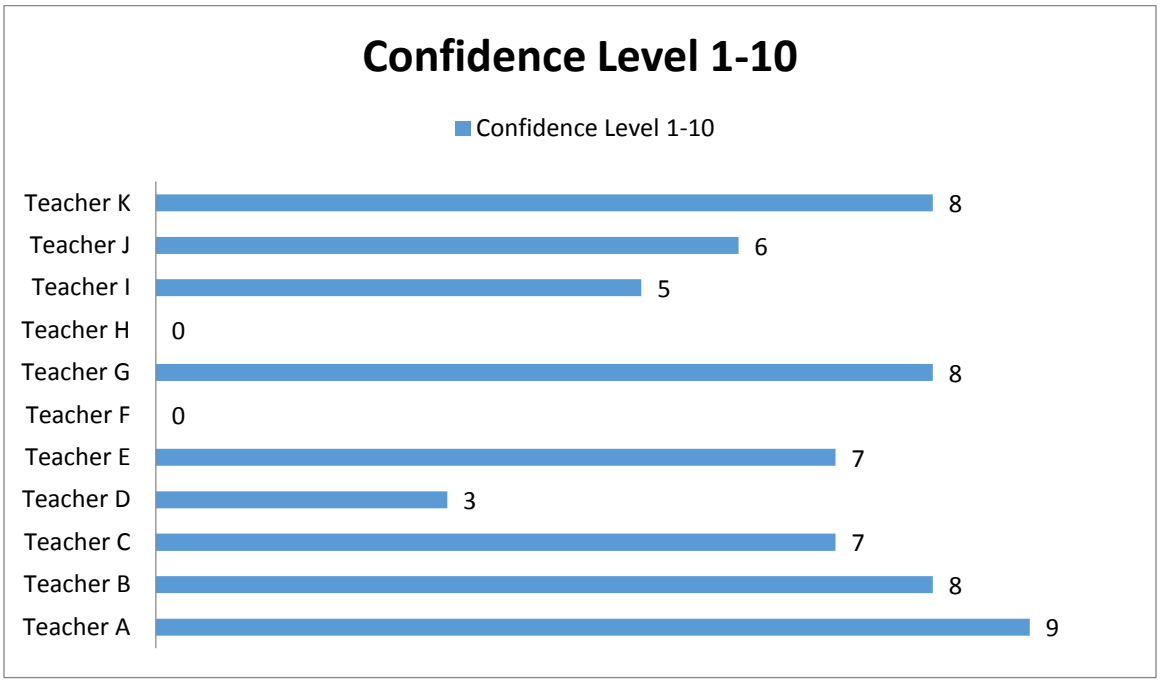


Figure 9. Question Fourteen Results

Question fourteen was to determine how confident each in-service teacher felt either while teaching mathematics, or in a situation where they had to teach mathematics outside of their normal curriculum. The two teachers who reported a zero on the scale were one of the three who currently do not teach mathematics content in their classroom. It is interesting to note that Teacher A, who reported the highest level of mathematical confidence, does not report currently teaching mathematics.

Teacher Mathematic Anxiety

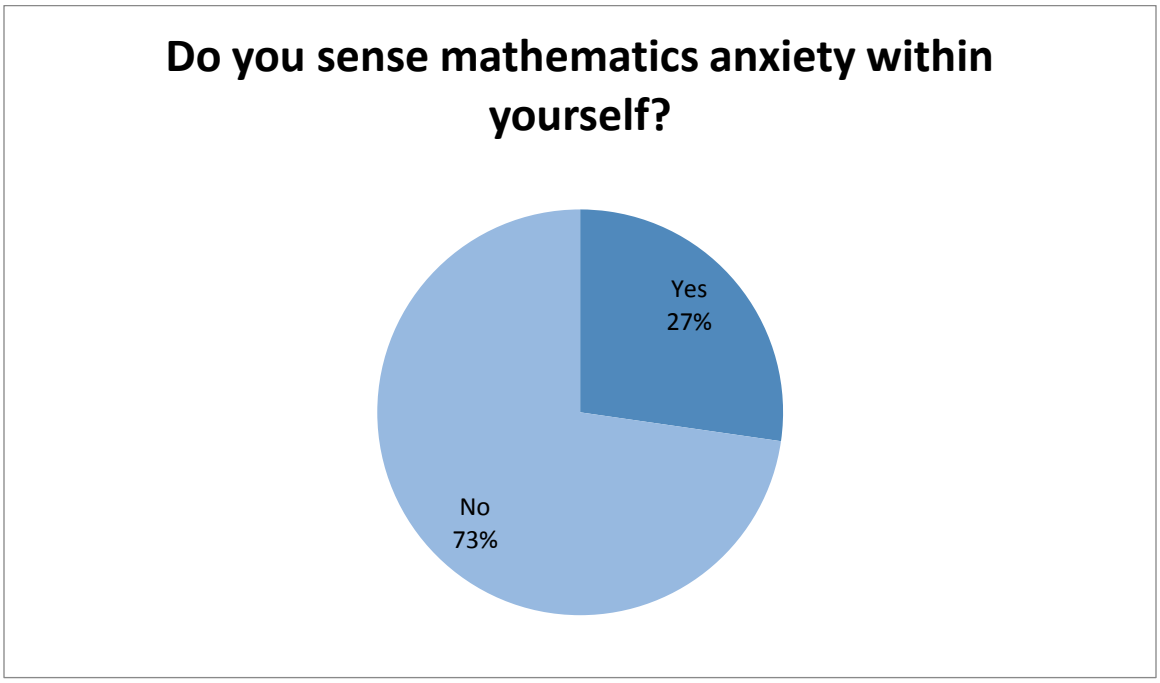


Figure 10. Question Fifteen Results

Of the in-service teachers surveyed eight of them reported not having any mathematics anxiety where three of them reported that they did have some form of anxiety. A few teachers elaborated as to what they believed caused this anxiety, or lack thereof.

Possible Causes of Teacher Mathematic Anxiety

Teacher C, who does teach mathematics, reported a seven on the confidence scale. This teacher stated that he or she does experience anxiety. He or she believes the reason for this is that he or she was not a strong math student while attending school and that has followed him or her up to this point.

Teacher D, who does teach mathematics, and reported a three on the confidence scale in teaching the subject, stated that he or she is not naturally good at the subject. He or she felt the

lack of confidence in understanding mathematical concepts as the underlying cause of his or her mathematics anxiety.

Teacher F, who does not teach mathematics, and reported a zero on the confidence scale, stated that he or she is horrible in math. The symptoms that this teacher experienced included headaches when looking at mathematic problems and getting confused when trying to solve such problems.

Teacher G, who does teach mathematics, and reported an eight on the confidence scale, stated that he or she has always been strong in mathematics. He or she is extremely confident in his or her understanding of the concepts.

Teacher I, who does teach mathematics, and reported a five on the confidence scale, stated that mathematics came easy to him or her. With this particular teacher, he or she also stated that there is not much thinking with mathematics since it is naturally easy for them to do.

Teacher J, who does not teach mathematics, and reported a six on the confidence scale, stated that he or she teaches chemistry, which uses a lot of mathematics so she does not have any anxiety since he or she uses it daily.

Lastly, Teacher K, who does teach mathematics, and reported an eight on the confidence scale, stated that he or she is confident in mathematics. Even if there is a lack of understanding, he or she will review the question, notes, and work to figure out the solution. He or she also stated that forming good study habits helps reduce anxiety.

Chapter Five will offer the conclusion this study. Here, conclusions will be made from the data analysis in combination with the findings from the Literature Review in Chapter Two. Additionally, study limitations will be identified and recommendations for further research will be discussed.

Chapter 5: Conclusion

Chapter Five will conclude this study. Data from the survey will be analyzed in combination with the findings of the Literature Review from Chapter Two to develop a conclusion. Any study limitations will then be identified and discussed. This will also include how the limitations impacted the survey results. Final recommendations will also be made for further study of mathematics anxiety. The purpose of this study was to identify the current perspective of grades three through twelve in-service teachers regarding mathematics anxiety, its causes, and its relation to gender stereotyping. A short online survey was conducted to gain insight into their classrooms and perspectives of the subject. The results showed that mathematics anxiety did exist in the classroom, and in-service teachers did report seeing a gender gap between the anxiety experienced by females and males. From these findings it is important to conduct further research on in-service teachers to see in depth what they think. This is important because their beliefs about the subject can have a lasting impact on their students and their feelings towards mathematics.

One of the major research questions posed was to identify the current perspectives in-service teachers possess regarding mathematics anxiety in students. The definition of mathematics anxiety used in this study was from Richardson and Suinn (1972) which stated, "Mathematics anxiety involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations" (p. 5510). The target population for this study was in-service teachers who taught in grades three through twelve. In-service teachers were interviewed to determine their thought on whether mathematics anxiety did or did not exist in their classrooms.

Interviews concluded that mathematics anxiety did exist in the majority of classrooms. In-service teachers indicated mathematics anxiety was apparent from the different signs and symptoms that different students exhibited. The symptoms relating specifically to mathematics anxiety included physical, mental, and behavioral signs and identifications. These all lead to negative emotions associated with the subject material, which include anxiety, hopelessness, and shame (Frenzel, Pekrun, & Geotz, 2007). Although each teacher had his or her own perspective on identification of mathematics anxiety in his or her classroom, an underlying identifying theme seemed to be a lack of focus, confidence, or participation on the students' behalf.

The next research question was to determine in-service teachers' perspectives on what they think causes mathematics anxiety. The literature review identified multiple mathematics anxiety causes, including gender stereotyping. Schwartz & Sinicrope (2011) study indicated that gender stereotypes were evident within undergraduate and graduate education students. They used cartoons of male and female students and found that most of the subjects viewed the female cartoon character as having a negative attitude towards mathematics. An additional possible cause was the transmission of mathematics anxiety from teacher to student. Students can observe their teacher's mathematic anxiety which can affect their belief about their own mathematics ability (Bielock, Gunderson, Ramierz, Levine, & Smith, 2010).

In-service teachers listed the main cause to be lack of understanding or confidence in the subject. Without a solid understanding of the concepts, students became nervous and uncomfortable. In-service teachers indicated students would start to withdraw from classroom activities, shown physical signs of anxiety, or act out. In-service teachers stated that lack of mathematical understanding caused the lack of mathematical confidence in the subject.

Although in-service teachers did not specifically list gender stereotypes to be a cause of mathematics anxiety, it is something noteworthy to think about when analyzing the data. From the review of related research Chapter Two, it was established that female students show higher levels of mathematics anxiety and negative emotions when exposed to mathematics experiences. Gender-linked stereotypes were identified as a plausible candidate for explaining this discrepancy between males and females in the classroom (Frenzel, Pekrun, & Geotz, 2007). In this study, only a little over half of the in-service teachers reported that a gender gap existed. The other portion of teachers believed that there is no difference between the mathematics anxiety between females and males. As identified in Chapter Three, Figure two does show a gender gap present in some classes. The classrooms where a gender gap is present seem to have a higher level of female mathematics anxiety than male mathematics anxiety. Overall, most of the teachers agreed that anxiety exists in their classroom and the majority, although smaller, stated that it affected females at a higher rate.

Each in-service teacher was asked to list his or her confidence level in teaching mathematics, as well as if he or she had mathematics anxiety. Of the 11 teachers surveyed, 3 stated that they suffered from mathematics anxiety with confidence scores ranging from zero to seven. These three in-service teachers reported seeing mathematics anxiety in their classrooms. In this study, unfortunately, no observational data was able to be gathered to explore whether these teachers unknowingly contributed to their students' levels of mathematics anxiety; however it would be cause for future study in this area.

Study Limitations

This study had several limitations. The first limitation was the small number of in-service teacher responses to the survey. Although general information about mathematics anxiety can be observed from this study, it is difficult to place it onto a larger scale and make general conclusions about teacher perspectives as a whole. Additional teacher responses would have to be recorded to make statistically sound conclusions about the entire population.

A second limitation is that specific in-service teacher grade levels were not recorded in the survey. The majority of the in-service teachers did not teach grade three, four, or five and selected the "other" option which did not allow for a specific grade level to be recorded. Three teachers provided additional information stating that one taught third grade, one taught fourth, and one taught tenth. The other grade levels of the in-service teachers surveyed were unidentifiable. Knowing each in-service teacher's grade level would have been beneficial because it would have helped pinpoint when mathematics anxiety became a problem for the students. For example, if more teachers in grade five reported mathematics anxiety than grade three, one could see that the mathematics anxiety developed between these grade levels. It would have been beneficial to see the rate of change in mathematics anxiety throughout the grades to determine any patterns. Additionally, research found that transmission of mathematics anxiety occurs between teacher and his or her students, so it would have been beneficial to see if teachers of these primary grades had more mathematics anxiety than secondary schools.

A final limitation was the scope of the study. The study was developed to identify in-service teacher responses to an online survey. In-service teacher observation was unable to be conducted, which would have allowed for student observation, identification of classroom

atmosphere, and in-service teacher behavior. This would have been helpful in observing if the mathematics anxiety of the in-service teachers affected their teaching methods. One could also observe to see if there was any evidence of a transfer of mathematics anxiety from teacher to student, as indicated by Bielock, Gunderson, Ramierz, Levine, and Smith (2010).

Recommendations

Although there have been many studies done on the signs and causes of mathematics anxiety, more studies should be conducted to determine in-service teacher views. Students are usually with the same teacher throughout the entire year in elementary school, and have the same mathematics teachers throughout the year in middle and high school. With this long time period, a teacher could unknowingly impose his or her anxiety or views of the subject onto his or her students and alter their interpretations of the subject. For instance, if a teacher believes that males are naturally better at math than females, he or she could pass this view along to his or her female students, which could carry it throughout the next year. The same logic could go for a student who is struggling in mathematics and observes that his or her math teacher possesses mathematics anxiety. This feeling of nervousness and tension could transfer to the student. This can in turn affect what future class decisions, what major they study in college, and ultimately their career.

Further research is needed to determine teacher perspectives on the causes of mathematics anxiety. Research indicates that mathematics anxiety can be transferred from teacher to pupil. It would be interesting to determine if the perspectives of in-service teachers and students perspectives regarding the causes of mathematics anxiety were consistent, rather than just anxiety levels. Additionally, further research should be conducted analyzing the effect

female mathematics teachers or role models have on female student mathematics perspectives, and the same for male teachers or role models on male students.

Appendix A: IRB Approval

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Regina Harwood Gresham** and Co-PI: **Jessica Browning**

Date: **March 02, 2015**

Dear Researcher:

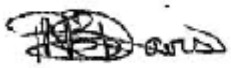
On 03/02/2015, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Project Title:	Teacher perspectives of mathematics anxiety on female student achievement.
Investigator:	Regina Harwood Gresham
IRB Number:	SBE-15-11024
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:



Signature applied by Patria Davis on 03/02/2015 09:12:02 AM EST

IRB Coordinator

Appendix B: In-service Teacher Survey

Question 1: What grade level do you teach?

Third Grade

Fourth Grade

Fifth Grade

Other

Question 2: Based on your knowledge of mathematics anxiety, do you believe any of your students have mathematics anxiety?

Yes

No

Question 3: Can you list the number of boys this applies to?

Question 4: Can you list the number of girls this applies to?

Question 5: Thinking of those students with math anxiety, can you explain the behaviors/academic performance of these students that allows you to recognize math anxiety?

Question 6: Do these students show signs of mathematics anxiety throughout class or mainly on exams?

Throughout Class

Mainly on Exams

Question 7: Please check off any traits that they exhibit.

Reports of feeling negative emotions such as anxiousness, hopelessness, worry, or shame

Passive behavior or "not caring" when it comes to completing math related tasks

A lack of confidence, resulting in students second guessing themselves

Physical symptoms such as upset stomach, clammy hands, nervous ticks, ect.

Question 8: Do you notice a gender difference with the mathematics anxiety?

Yes

No

Question 9: If you do notice a gender difference in regards to mathematics anxiety, can you explain how/why you notice this difference? If you answered no, please put N/A.

Question 10: If you do notice a gender difference in regards to mathematics anxiety, who displays more anxiety?

Males

Females

Do not notice a difference

Question 11: In your opinion, what are the possible causes of mathematics anxiety in your students?

Question 12: Do you currently teach mathematics?

Yes

No

Question 13: If you do currently teach mathematics, how many years have you been teaching it?

1 year or less

2-5 years

5-10 years

10 years or longer

I currently do not teach mathematics

Question 14: On a scale of 1-10(10 being most confident) how confident are you in teaching mathematics?

Question 15: Do you sense mathematics anxiety within yourself?

Yes

No

Question 16: In regards to mathematics anxiety within yourself, why do you believe this to be true/not true?

Appendix C: Complete List of Teacher Responses

Individual Teacher Responses Question 1-5

	Question 1	Question 2	Question 3	Question 4
A	Other	Yes	0	10
B	Other	Yes	2	4
C	Third	Yes	1	4
D	Other	Yes	7	2
E	Other	Yes	2	0
F	Other	Yes	n/a	n/a
G	Other	No	Skipped	Skipped
H	Other	No	Skipped	Skipped
I	Other	Yes	0	3
J	Tenth Grade	Yes	40	30
K	Seventh Grade	Yes	6	6

Individual Teacher Responses Questions 5-10

	Question 5	Question 6	Question 7	Question 8
A	Off task, asking repeated questions, acting out, refusing to work	Entire course	Trait 2, 3, 4, 5	Yes
B	Lack of participation, avoidance, tearing up in some cases	Mainly exams	Trait 1, 3, 4, 5	Yes
C	When teaching a new math concept, they tend to get really nervous and shut down. They do not participate much in whole group discussions because they are afraid of making a mistake.	Entire course	Trait 1, 2, 3, 5	Yes
D	Rips up homework, scribbles on paper, yells, hits, screams	Entire course	Trait 4, 5	No
E	No answer recorded	Entire course	Trait 1	No
F	No answer recorded	Mainly exams	Trait 1, 5	No
G	Skipped	Skipped	Skipped	Skipped
H	Skipped	Skipped	Skipped	Skipped
I	Frequent signs of frustration during math, self-doubt	Entire course	Trait 3	Yes
J	Low scores on math content, refusal to complete assignments	Entire Course	Trait 1, 2	No
K	Student is intimidated and reluctant to work on problems alone	Entire Course	Trait 2,3,5	Yes

Individual Teacher Response Question 11-15

	Question 9	Question 10	Question 11	Question 12
A	n/a	Males	No answer recoded	No
B	n/a	Females	Lack of understanding/strength	Yes
C	Out of the students in which I teach, many of the girls in my class do not like math. Mostly the boys in my class enjoy math than any other subject. They soar at learning new math skills and techniques.	Females	I think they get overwhelmed and shut down and use avoidance behavior.	Yes
D	n/a	Females	Task escape	Yes
E	n/a	No difference	No answer recorded	Yes
F	n/a	No difference	The formulas and memorization	No
G	Skipped	Skipped	Skipped	Yes
H	Skipped	Skipped	Skipped	No
I	Self-doubt	Females	Lack of confidence	Yes
J	n/a	No difference	Weak math skills through duration of primary education	No
K	n/a	No difference	Students do not understand abstract concepts, have little confidence, and do not want to fail	Yes

Individual Teacher Response Question 13-16

	Question 13	Question 14	Question 15	Question 16
A	No Math	9	No	No answer recorded
B	2-5 years	8	No	n/a
C	5-10 years	7	Yes	I believe that I experience math anxiety because I was not a strong math student while attending school.
D	2-5 years	3	Yes	I'm not good at math.
E	2-5 years	7	No	No answer recorded
F	No Math	0	Yes	I am horrible in math and get headaches when I look at the problems. I also get confused.
G	5-10 years	8	No	I have always been strong in mathematics and very confident in my understanding of concepts.
H	No Math	0	No	n/a
I	2-5 years	5	No	Math comes easy to me. There is not much thinking to it.
J	No Math	6	No	I teach chemistry which includes a lot of math. No anxiety.
K	2-5 years	8	No	I am confident in mathematics, even if I do not understand, I review the question, the notes, and work to figure out the solution. I have formed good study habits that helps me not to be anxious.

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