Supporting Students with Math Anxiety

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Supporting Students with Math Anxiety

Abstract
Math anxiety has been the focus of much research throughout the years. Math anxiety is defined as the feeling of discomfort and disturbance that is experienced when facing mathematical problems. Math anxiety causes students to avoid mathematics and learning of it because of the feeling of distress when confronted with a problem to complete. Math is studied so that students can learn about numbers in order to complete simple and complex calculations each and every day. The studying of mathematics has even impacted future career options for individuals. Career fields in the Science, Technology, Engineering, and Mathematics (STEM) have been on the decline because individuals have been avoiding taking classes in mathematics which results in fewer individuals pursuing such careers. Research has shown that beliefs about math are developed early on; once they have been established, they are hard to change. This study was conducted to determine how to support students with math anxiety. The study involved five math teachers, five science teachers, three special education teachers, and four administrators. Through the survey responses and the interviews, I found that educators need to support students with math anxiety. Educators need to make sure every student has opportunities to be successful in math.

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Abstract

Math anxiety has been the focus of much research throughout the years. Math anxiety is defined as the feeling of discomfort and disturbance that is experienced when facing mathematical problems. Math anxiety causes students to avoid mathematics and learning of it because of the feeling of distress when confronted with a problem to complete. Math is studied so that students can learn about numbers in order to complete simple and complex calculations each and every day. The studying of mathematics has even impacted future career options for individuals. Career fields in the Science, Technology, Engineering, and Mathematics (STEM) have been on the decline because individuals have been avoiding taking classes in mathematics which results in fewer individuals pursuing such careers. Research has shown that beliefs about math are developed early on; once they have been established, they are hard to change. This study was conducted to determine how to support students with math anxiety. The study involved five math teachers, five science teachers, three special education teachers, and four administrators. Through the survey responses and the interviews, I found that educators need to support students with math anxiety. Educators need to make sure every student has opportunities to be successful in math.
Introduction

Math anxiety is defined as an irrational and impeditive fear of mathematics. Students, with math anxiety, describe a feeling of panic, helplessness, paralysis, and mental disorganization when faced with mathematical problems (Dossel, 2016). Individuals who face math anxiety tend to avoid activities that require computations (Wadlington & Wadlington, 2008). They avoid computations found in everyday life and future academics (Andrews & Brown, 2015). In this research study, ways to support students with math anxiety will be discussed. It is imperative to find strategies to support students with math anxiety because math is used in everyday life, and when students with math anxiety receive help, they will be able to pursue further math opportunities.

In the research study, I surveyed twenty five participants at the middle school and high school level in a school in upstate New York. The twenty five participants consisted of six science teachers, six math teachers, five administrators, and five special education teachers. Further interviews were done with two mathematics teachers, one special education teacher, and three science teachers.

I received permission and consent from all participants. My role in this study was to administer the survey through a Google platform. I further interviewed six of the twenty five participants and recorded their responses.

The result of this study shows that each student suffering has varying degrees of dealing with the onset of math anxiety, and that it is important that educators develop strategies and supports to help students to work through the anxiety. The survey results imply that
conversations with parents and guardians are needed so that they can support their child at home. Furthermore, it is important that educators collaborate to help students with math anxiety.

**Researcher Stance**

My role in this study was to develop and administer a survey as well as interview participants. I administered the survey to twenty five staff members through a Google platform. Surveys were anonymous. Through these questions, I analyzed the causes of math anxiety, how it impacts students, and what supports are currently in place for students.

As an interviewer in the study, I interviewed six science teachers, six math teachers, five administrators, and five special education teachers. Through these interviews, I analyzed the similarities and differences of the opinions of the administrators and teachers regarding how math anxiety impacts their subject area, how students with math anxiety perform, the identification of math anxiety in students, and supports that are used to help students with math anxiety.

I am currently certified in Elementary Education, Grades 1-6 and Mathematics Education, Grades 7-12. I am presently enrolled in a program working towards earning a Master’s of Science in Special Education. While I am working towards this certification, I am also employed as a mathematics teacher at the school where I conducted my study.
Definition of Math Anxiety

For some individuals, the word math conveys a feeling of dread and pain (Mutawah, 2015). Pellicioni, Nunez-Pena, and Colome (2015) define math anxiety as “an irrational and impeditive dread of mathematics” (p. 22). They further explain it as “the panic, helplessness, paralysis and mental disorganization that arises among some people when they are required to solve a mathematical problem” (Pellicioni et al., 2015, p. 22). Another prominent definition of math anxiety comes from Andrews and Brown (2015) who write that it consists of “negative cognitions, avoidance behaviors, and feeling pressured and inadequate in performance that when combined interfere with solving math related problems in both general life and academic situations” (p. 362). Dossel (2016) explains that the phrase math anxiety describes panic, helplessness, and paralysis that is the effect when one tries to solve a mathematical problem. The definitions of Pellicioni et al. (2015), Andrews and Browns (2015), and Dossel (2016) have the common theme of avoidance, dread, fear, and panic in completing tasks in mathematics.

Uysal and Selisik (2016) demonstrate that the investigation of mathematics anxiety dates back over 40 years, with research that shows a link between the ranges of attitudes toward mathematics and career choices in fields that require mathematics. Research has shown that “student’s performance in mathematics is one of the main concerns of the students, teachers, and parents in the country, where there is a common belief that achievement in mathematics is linked to economic development” (Mutawah, 2015, p. 239). Math is an integral part of a person’s daily life and this is exemplified because “reports have indicated that 58% of American adults do not have the knowledge to calculate a tip for their waiter when out to eat, 71% cannot calculate miles per gallon, and 78% do not know how to calculate the interest paid on a loan” (Andrews & Browns, 2015, p.362). This lack of mathematical knowledge is concerning because if students
are afraid of math they will not obtain the skills they need to be successful in this area (Mutawah, 2015). Thompson, Wylie, and Hanna (2016) agree with Mutawah (2015) that the longer math anxiety persists, it causes the student to avoid math related subjects at the university level, which in turn, causes him to select a career path that does not involve math. Furthermore, educators fear that students with this type of anxiety will avoid math (Mutawah, 2015). Math anxiety is problematic because in today’s world where academic fields in science, technology, engineering, and mathematics (STEM) are on the rise, it is important that students have math knowledge; therefore, the study of mathematics is imperative (Andrews & Brown, 2015; Geist, 2015).

**The Causes of Math Anxiety**

Math anxiety leads to students struggling in math (Kulkin, 2016). Kulkin (2016) lists the causes of math anxiety as “communication and language barriers, quality of instruction, evaluation methods, and difficulty of materials. Other causes include the negative attitude that can be inadvertently communicated by teachers, and parents who also fear math” (p. 29). Children, before they enter into a school setting, have preconceived ideas about various subjects depending on the environment they are brought up in. Then, when this is combined with preconceived ideas and other school setting factors, there is a potential for students to develop a fear of any subject, but in this context, mathematics (Wadlington & Wadlington, 2008). Furthermore, Wadlington and Wadlington (2008) discuss that students who have low self-esteem in math tend to avoid mathematical situations.

Both Kulkin (2016) as well as Wadlington and Wadlington (2008) discuss communication and language barriers; however, Wadlington and Wadlington (2008) further address that math can be viewed as its own language which contains both symbols and special
terms. The authors discuss that terms in mathematics can have different meanings in other subjects. Disabilities with language processing such as dyslexia or dysgraphia can hinder a person’s ability to learn mathematics, especially in the areas of vocabulary, concepts and use of symbols, signs, and operations (Wadlington & Wadlington, 2008). Thus, mathematics is a subject that involves a significant number of vocabulary words. If one struggles to understand the vocabulary, one will struggle to comprehend what a question is asking, resulting in the inability to answer the question, and most likely the avoidance of that topic, or mathematics as a whole. Ding (2016) describes this further as a vicious cycle for children with low math skills; they will struggle with math which will cause them to become anxious about math, potentially avoid further math learning, become more nervous, and it will continue on. Hence, it is a never ending cycle of avoidance of mathematics that hinders students’ futures.

Wadlington and Wadlington (2008) look deeper into this cycle of math anxiety and discuss two types of math anxiety: specific math anxiety and global math anxiety. The researchers describe specific math anxiety as “an individual who is anxious about a particular mathematical situation” (p. 3) whereas global math anxiety is “an individual who feels stressed in all mathematical situations and, who spends time and energy in avoiding mathematics” (p. 3). Math anxiety is considered global when someone avoids everything that has to do with mathematics; however, math anxiety is specific when a certain topic of mathematics is avoided (Wadlington & Wadlington, 2008).

Wadlington and Wadlington (2008) focus on global and specific math anxiety whereas Dossel (2016) focuses on eight factors that may lead to the establishment of math anxiety. According to Dossel (2016), time needs to be allocated to asking students how they feel about math and then addressing any negative feelings that students express. The eight factors Dossel
(2016) describes are the pressure from authority figures, time pressure, the effect of public failure, the right-wrong dichotomy, constructive criticism, competitive classrooms, student’s perceptions of the causes of difficulty, and negative coping strategies. Uysal and Selsik (2014) further confirm that math anxiety emerges from many factors. According to Uysal and Selsik (2014), these factors can be negative attitudes towards mathematics, negative school experiences, self-esteem, the language of mathematics, and even the teachers’ attitudes (Uysal & Selsik, 2014).

Brown, Westenksow, and Moyer-Packenham (2011) discuss the occurrence of math anxiety. The researchers’ state:

The onset of mathematics anxiety can begin as early as elementary school. They found that 16% of students, in the transition between elementary and secondary school, stated that their first negative mathematics experience occurred by third or fourth grade, and 26% of respondents recalled negative mathematics experiences in secondary education classrooms. (Brown et al., 2011, p. 241)

The researchers further describe that other causes of math anxiety can consist of having negative memories associated with struggling during math instruction, making math mistakes in a large classroom setting, feeling that former math teachers were not compassionate, and being affected by parents’ expectations (Brown et al., 2011). Lastly, Ding (2016) discusses environmental factors that may cause math anxiety which include “teachers’ math anxiety and classroom activities, students’ perceived classroom environment, and parental math anxiety, support, and expectations” (p. 32). Throughout both studies (Brown et al., 2011; Ding, 2016) the common
theme that causes math anxiety seems to be parental influence, classroom interactions with other peers and teachers, and consistent poor math performance.

**Impacts of Math Anxiety**

Andrew and Browns (2011), Gesit (2015), and Mutwah (2015) clearly show that an individual with math anxiety will avoid mathematics and in turn this limits his career options. Anis, Krause, and Blum (2016) agree with Andrew and Brown (2011), Geist (2015), and Mutwah (2015), when they discuss that individuals who have math anxiety will tend to avoid activities that require computation, which directly causes issues with their academic and everyday lives. Andrews and Brown (2015) report that “the number of students in the United States pursuing STEM-related degrees has declined from 32% during the 1994-1995 academic year to 27% in the 2003-2004 academic year” (p.363). As those studying the STEM-related topics declines, employment in those fields also decreases resulting in the outsourcing of jobs in the United States to other countries (Andrews & Brown, 2011). Not only does math anxiety affect an individual’s future, but it impacts the country’s economy (Gesit, 2015).

It has been shown that math anxiety causes low confidence and avoidance behaviors which results in students “taking the minimum required courses” (Andrews & Brown, 2015, p.363). It has also been shown that “math anxiety has a direct effect on performance of math tasks. These effects are greatest when a secondary task is being completed; this might affect retaining lectures, testing situations, or completing complex calculations” (Mutwah, 2015, p. 240). Anis et al. (2016) agree with Mutwah (2015) that math anxiety does not just affect the actual computation of math problems, but it impacts the working memory that affects the mathematical portion of math anxiety. Math anxiety causes problems to the working memory
and this causes those with math anxiety to be unable to solve mathematical problems using resources they have stored in their memories in comparison to someone without mathematics anxiety (Anis, Krause, and Blum, 2016).

One main concern Mutwah (2015) discusses is how to support students in overcoming math anxiety which begins as early as fourth grade and peaks in middle and high school. Mutwah (2015) claims that “75% of Americans stop studying math before they have completed the educational requirements for their career or job according to the National Research Council” (p. 240). Mutwah (2015) stresses the importance of Opie et al. (2014) who state that mathematics is at the core of the advancements recently made in science and technology; the fear of math and the ability to not perform to standards in mathematics has become a worry to those working towards advancements in science and technology. Some reports even found that sixty percent of students failed to meet the credit requirement for mathematics courses (Opie et al., 2014). This represents a significant number of individuals who stopped studying mathematics and this could relate to the decline of people pursuing STEM-related career options. The “National Research Council reports all young Americans must learn to think mathematically, and they must think mathematically to learn” (Geist, 2015, p. 329). Mutawah (2015) further confirms the idea that mathematics is taught so that one can “understand the numerical data presented to them and able to perform simple and complex calculations in day-to-day encounters” (p. 240). Hence, math not only affects future career opportunities, but it impacts day-to-day calculations. It is a subject that cannot be avoided because it is used constantly (Mutawah, 2015).

**Gender Differences in Math Anxiety**
The researchers claim that math anxiety is an emotional and fearful response to mathematics which not only impacts one’s progress in math but also in STEM (Stoet, Bailey, Moore, and Geary, 2016). They further articulate that if math anxiety is reduced, engagement in mathematics will increase and this will directly impact the diversity in the STEM field (Stoet et al., 2016). Girls tend to underperform in mathematics and have fewer educational opportunities than boys; therefore, if the social attitudes towards girls in mathematics change, there is a potential for participation in STEM to increase (Stoet et al., 2016).

Andrews and Browns (2015) further write about math anxiety and gender. The research by Stoet et al, (2016) illustrates that women tend to have higher anxiety in mathematics; however, Andrew and Browns (2015) finds that “the effect of math anxiety was more prominent among males at the precollege level” (p. 364). The researchers further show that males with high math anxiety are less as likely to advance in math courses as girls who also have high anxiety (Andrews & Browns, 2015). Males continue to have higher math anxiety and lower mathematical performance from grades five through twelve in comparison to females in this same age group; furthermore, once in college, math anxiety performance begins to lessen (Andrews & Browns, 2015). Andrews and Browns’ (2015) research concludes that “male and female participants were equally concerned with mathematical academic success. Females reported greater negative reaction to math in comparison to males” (p. 364). The research states that females avoid mathematics courses and choose career paths that do not require mathematics (Andrews & Browns, 2015). Hines, Brown, and Myran (2016) find that prior poor mathematics achievement is related to high math anxiety in males throughout junior and senior year of high school, whereas females experience this only during the transition from junior to senior year in high school. This explains the gender gap in STEM fields that Stoet et al. (2016) reports.
Teachers play a vital role in shaping the minds and opinions of students in mathematics (Stoet et al., 2016). Geist (2015) reports that over “90% of early childhood and elementary teachers are female and for a number of reasons, math anxiety is more prevalent among females” (p. 331). The research goes on to confirm that girls show higher levels of math anxiety in middle school and high school, and this has the potential to have lasting effects on mathematics performance (Geist, 2015). History shows that girls have fewer educational opportunities than boys, especially within the STEM studies (Stoet et al., 2016). Furthermore, Stoet et al. (2016) believe that despite international advancements in gender equality, females are still underrepresented in STEM related fields. By reducing anxiety in mathematics, greater gender diversity in the STEM workforce can occur (Stoet et al., 2016; Bailey, Moore, & Geary, 2016).

**Supporting Students with Math Anxiety**

Opinions are formed early on in life and take years to change (Linder, Smart, and Cribbs, 2016). The research of Linder et al. (2015) indicates that viewpoints about mathematics are developed early and are difficult to change. Linder et al. (2015) explain that there is a relationship between motivation and achievement; therefore, positive interactions with mathematics at an early age influence mathematics motivation in elementary grades. Similarly, Mutwah (2015) finds an association between anxieties and learning environments. The research defines learning environment as the social, psychological, and pedagogical contexts where learning occurs and where students’ achievement and attitudes are formed. Educators need to be aware of math anxiety and the effect their own classroom has on the students. Thus, effective teaching methodologies must be used to lessen the anxiety and maximize learning (Mutwah, 2015). Dossel (2016) agrees with Linda et al. (2015), as well as Mutwah (2015) by noting that learned helplessness results from continued failure and since the teacher is in the position of
influencing success or failure, he can provide opportunities for students to feel success and change the mindset of failure. Educators cannot directly tell a student he has math anxiety because it will only increase student discomfort (Thompson, Wylie, & Hannah, 2016). Dossel (2016) agrees with Thompson et al. (2016) that math anxiety should be approached in a preventive way. Since anxiety tends to be a self-reinforcing behavior, the focus should be on integrating preventative measures into the learning environment to help combat the onset of math anxiety (Dossel, 2016).

Future careers rely on mathematics that are taught and understood at a young age. Kulkin (2015) states that “in the real world, the heart of math is problem solving” (p. 29). If teachers focus only on performance, grades, or achievement of specific skills, students will believe that their performance depends on their ability, and that their ability is not sufficient (Kulkin, 2015). Teachers need to focus more on students’ mastery and goal setting. Success in a mastery goal classroom focuses on improvement, with an emphasis on effort and the learning process. Students gain satisfaction from working hard and learning (Kulkin, 2015). Educators need to focus more on real life application and problem solving in the mathematical setting. Students need to see the importance of studying mathematics because it applies to them in all aspects of their lives (Kulkin, 2015). The applications of mathematics to real life situations relates to Linder et al.’s (2015) idea that “motivation has the potential to predict student performance, self-regulation, and effective goal setting, persistence, as well as other positive predictors of student learning” (p. 392). When motivation is acknowledged and supported, students increase their ability to persist through difficult tasks (Linder et al., 2015). If a student’s interest is peaked, then the student may become more persistent and accept challenges. Kulkin (2016) further acknowledges Linder et al. (2015) by proclaiming that educators need to offer opportunities for
all students to excel in math. Hence, educators need to support students as they reach their potential in mathematics.

Mathematics anxiety does not only occur in grade school or even high school, but it is also prevalent at the university level, especially if students do not receive support at the lower levels. Thompson et al. (2016) discuss that anxiety can be reduced in higher education “mathematics bridging” courses. These courses are described as courses that reintroduce mathematics topics to students (Thompson et al., 2016). Math anxiety can further be reduced at the university level by introducing a service learning component to a mathematics course, where college students work with school aged-children and tutor them in math (Thompson et al., 2016).

Every person, despite his age, deserves to feel successful in education. This success comes from the support individuals are given and the quality of education they receive (Ciftci, 2015). Ciftci (2015) describes this as the quality in education where the learning environment is organized, managed, and taught in a way that learning occurs and educational outcomes are achieved. This further establishes an effective school where all staff and students share the same mission, and they are dedicated to the school community and learning (Ciftci, 2015).

There are two types of learners: qualitative and quantitative learners (Wadlington & Wadlington, 2008). Wadlington and Wadlington (2008) describe quantitative learners as those who have good language skills and concepts. On the contrary, qualitative learners are individuals who focus on visual, holistic, inductive, and intuitive aspects in mathematics (Wadlington & Wadlington, 2008). Both learners have different styles of acquiring knowledge; qualitative personalities learn through direct and step-by-step teaching methods, whereas quantitative personalities learn through inductive, visual, and pattern strategies (Wadlington & Wadlington, 2008). One person can have a specific learning style where both quantitative and qualitative
approaches need to be used in the study of mathematics (Wadlington & Wadlington, 2008). When planning lessons, educators should keep in mind the learning styles of their students to ensure that success occurs in mathematics (Wadlington & Wadlington, 2008). Dossel (2016) suggests four ways educators can modify their lessons and the learning environment to ensure students are successful: they must focus on the climate, feedback, input, and output. When all of these factors are considered, the classroom environment is supportive and reduces math anxiety (Dossel, 2016). Students need to realize that failure is not pre-determined and it can be overcome; to do so, they need the support of all of those around them (Dossel, 2016).

Finally, students need a supportive learning environment (Wadlington & Wadlington, 2008). Students need to feel safe and supported; teachers should praise students frequently for large and small successes. Educators need to encourage students to value progress in learning instead of focusing on the correct answer (Wadlington & Wadlington, 2008). Wadlington and Wadlington (2008) suggest the following ideas that will help students deal with anxiety: break the big picture into smaller manageable chunks, have students each day summarize what they learned, use a math tutor, understand that there are many ways to solve a problem, and think out-loud mathematical terms and ideas. These ideas are described as a tool box of heuristic strategies and once students come across a problem they are unsure of how to solve, they can return to their tool box for support in solving the problem (Wadlington & Wadlington, 2008). If a student has processed through trying to solve the problem, and using their tool box when it is needed, they have worked through mathematics (Wadlington & Wadlington, 2008).
Methodology

Context

My study on supporting students with math anxiety took place in a middle and high school in Upstate, New York. My study occurred at these schools, because I am currently employed as a mathematics teacher with the school. I was given the opportunity to help support students in their mathematics courses.

Participants

The participants in this study were seventeen educators at the middle school and high school level. The participants consisted of five math teachers, five science teachers, three special education teachers, and four administrators. Three of the five math teachers were at the middle school level, and two were at the high school level. Two of the five science teachers taught at the middle school, and three taught at the high school. One of the three special education teachers were at the middle school level, one worked at both the middle and high school level, and one was at the high school level. One of the four administrators was at the middle school level and three were at the high school level. Of the seventeen participants, six of them took part in an interview, and they worked at the high school. The interview participants consisted of two high school math teachers, three 9-12 grade science teachers, and one high school special education teacher.

Method

The purpose of this study was to determine how to support students with math anxiety. In doing so, I also wanted to determine how students with math anxiety are identified, what current
supports are being used for these students, and what supports can further be implemented to help students with math anxiety. This study will be used to enhance the supports educators offer to students facing mathematical difficulties and other ways to improve mathematical ability.

In order to serve the purpose of this study, I administered surveys to all participants. The surveys were administered during the second half of the school year. The surveys were administrated through a Google platform, and participants were given a week to complete the surveys. I further interviewed a portion of the participants during the second semester. These interviews were completed over the course of a week.

Procedure

I obtained a signed consent form from each participant. Once I had all signed consent forms returned to me, I sent out the survey to all participants through a Google platform. During this period, I set up times to interview a selection of the participants. Over a course of a two week period, participants completed the survey and anonymously submitted them through the Google platform. Over the course of the week, I interviewed the participants. Upon the completion of the interviews and surveys, I closely read through all the data and took notes. I began to compare and contrast responses to the survey data as well as interview responses.

Informed Consent and Protecting the Rights of the Participants

I received informed consent from the participants in my study. Each participant received a letter of consent. Signing the letter of consent meant that the participant is fully aware that my study was in no way affecting him and his performance as a teacher. The participants were aware that their involvement in the study was voluntary. The participants also knew that the survey, the interview, and their responses were completely confidential and that their responses
were going to be used in my study on math anxiety. Survey responses are being kept in a password protected computer file. All interview responses will be kept in a secure location. Data and consent forms will be kept for three years in a secure location, after which they will be destroyed.

**Data Collection**

The data I collected for this study consisted of survey and interview responses. Both survey and interview questions were self-created. All participants were given a week to complete and submit their survey anonymously through a Google platform. Along with the survey, I also interviewed two math teachers, three science teachers, and one special education teacher. Through the interview process, I recorded the views of the teachers on what math anxiety is, how it impacts their classrooms, what supports they currently use, and what strategies should the school implement to help students.

**Data Analysis**

After collecting the data from the surveys and interviews, I analyzed the data in a number of ways. First, I read through all the survey responses and highlighted similarities between the answers for each question. Then, I noted the differences. Therefore, I compared and contrasted the views, strategies, and experiences of the participants. I read through the survey responses a few times to make sure I had thoroughly analyzed the data.

After comparing and contrasting the survey responses, I followed the same procedure with the interview responses. I read through each question one at a time. I highlighted trends within the responses. Therefore, I also compared and contrasted the views, strategies, and experiences of the participants that took part in the interviews.
Findings and Discussion

Findings

Survey results.

The survey data showed the opinions of educators on math anxiety and how to support students with this type of anxiety. The survey consisted of seven agree and disagree statements and five extended response questions. When it came to the seven agree and disagree statements the following data was found: 88.2% agreed that math can convey a feeling of dread and pain in students. All participants agreed that students avoid math when they feel pressured. Furthermore, 52.9% of participants agreed that there is a link between mathematics and economic development. Additionally, 94.1% of participants agreed that math is a part of a person’s everyday life, math consists of its own language made up of symbols and special terms, and math anxiety causes low confidence and avoidance behaviors in students. Moreover, 82.4% participants agreed that math anxiety can impact future career opportunities.

In regards to the five open response questions, participants were asked about the definition of math anxiety, its causes, impacts, gender difference, and supports for students with math anxiety. The majority of the participants believe that students with math anxiety feel helpless and nervous. In turn, this may cause some students to not put forth effort.

There were various responses regarding the causes of math anxiety. These responses ranged from participants believing that students’ negative experiences impact students’ ability, the view that not everyone is strong in math, and the pressure that students feel about remembering formulas and attaining correct responses. Seven of the seventeen participants surveyed believed that students’ past experiences and a history of failure impact a student’s
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ability to complete mathematical problems. Four of the seventeen participants agreed that the belief that students are not strong in mathematics causes math anxiety. One participant went on to explain that parents tend to discuss that they cannot do math and due to this, their child may feel he cannot be successful in math either. Nine out of the seventeen participants think that students feel an increase in pressure when they are asked to remember formulas, and symbols, as well as getting the correct answer. Furthermore, one participant wrote that when students lack foundational math knowledge and skills, they will begin to struggle with harder concepts. In turn, this leads to a feeling of anxiety. Two of the seventeen participants had a different viewpoint on the causes of math anxiety. One participant believed that when students do not see the connection to their own lives, they begin to think of math as a mysterious subject, and it becomes harder than it should be. Another participant wrote that the cause of math anxiety comes from educators lacking the skill set to identify math learning disorders combined with the little training being given to these same educators on how to differentiate instruction so that all students feel successful. When students lack a feeling of success, it creates uneasiness and nervousness.

Lower self-esteem can have a great impact on students. When participants were asked what the impacts of math anxiety are, they responded by stating that it causes less participation in class, a decrease in effort, and lower self-confidence. Additionally, each participant stated that students with math anxiety tend to give up on a math problem before attempting it. Eight participants agreed that students with math anxiety do not put forth their best effort. One participant explained that when a student does not attempt the work in math, he will begin to fall behind, and this will cause greater anxiety. Another participant wrote that although students may be able to understand the science portion of a question, when they see the math portion of a
question, they lose their engagement and stop working. Lastly, six participants wrote that math anxiety impacts students’ self-esteem and students choose to not take courses that involve mathematics.

Participants were asked if they thought a correlation exist between gender and math anxiety. Twelve participants stated that there is not a correlation. Three participants said “yes” there is a gender difference, and two participants stated that they had not noticed a gender difference in regards to math anxiety. If participants thought there was a correlation, they were asked to explain their thoughts on this topic. One participant wrote that more females experience math anxiety and there is a lack of extra help or math clubs geared towards females in mathematics. Another participant thinks there is a correlation between math anxiety and gender because for years, society has imposed the notion that females are not strong in math. Due to this notion, this participant feels that this causes females to have greater math anxiety. Lastly, a participant wrote that she notices math anxiety more in females because they express their emotions by crying, running away, and verbally showing frustrations whereas males tend to stay silent, or rarely display it.

The final question in the survey asked participants about ways to support students with math anxiety. Participants wrote about explicit ways to help students inside the classroom and ways to encourage students to feel successful in mathematics. Eleven participants wrote about instructional strategies they use to help students in their classrooms. One participant wrote that educators should break down problems into smaller segments, students need to be taught how to use strategies, and that an educator should return to the basics in order to help students become proficient in mathematics at all grade levels. Another participant went on to state that students’ areas of weakness should be identified early on so that they can be taught the skills they have not
gained. Six participants believe that to overcome math anxiety, students must be confident in themselves. Furthermore, one participant believes that focusing on a student’s social emotional learning is important because when a student can identify and understand his struggles, then he can begin to realize that he can work on areas that he finds difficult.

**Interview results.**

Seven participants were asked a series of five questions regarding the impact of math anxiety in the classroom setting as well as supports that can be implemented to help students with math anxiety. All participants agreed that math anxiety impacts their subject areas. Participants were further asked to explain how, and in which ways, their classrooms are impacted. One participant articulated that students lack courage which negatively impacts their participation. Another participant wrote that because students lack basic skills, students will shut down before even attempting the work. Three participants agreed that students shut down and do not attempt to complete the classwork.

Students with math anxiety greatly impact a classroom setting because students tend to refuse to complete the work assigned in class and participate during instruction. Five participants stated that students tend to refuse to complete work while two participants articulated that students who exhibit math anxiety do not participate in the classroom setting. Finally, two participants reported students needing additional support in the classroom. One participant stated that when students lack confidence, students require prompts to complete the tasks as well as to refocus.

Participants were further asked how they identify students as having math anxiety. Participants articulated that they identify students by lack of stamina and based upon the manner
in which students express themselves when working on math tasks. One participant stated that when students are asked to answer a question, students with math anxiety will commonly attempt the question and then say “never mind.” Another participant commonly hears students say that chemistry is hard when students come across questions that involve chemistry and mathematics. Five participants reported common behaviors they notice. One participant noted that students with math anxiety tend to avoid math class. Another participant articulated that students with math anxiety use their calculators when it is not necessary.

Interviewees were asked if they collaborate with other subject areas and resource teachers in order to help students with math anxiety. One participant reported that he collaborates with a special education teacher in order to support students during resource room. Five participants reported that they don’t collaborate while three participants reported that they collaborate with other teachers. However, those who articulated that they do not collaborate, did state that they communicate with parents and provide additional support during class and outside of class time. Two participants stated that they communicate with the students’ former math teachers in order to inquire information about what the students learned in their previous math courses.

Finally, interviewers were asked what supports the school community needs to implement in order to help students with math anxiety. Based upon the interview results, participants articulated that classroom supports, as well as after school help, and ways to increase student self-esteem is necessary. One participant reported that math anchor posters and visuals need to be hung inside the classroom because by looking at these posters, students may learn the content on them. Another participant wrote that classrooms need more manipulatives and visuals. Three participants reported that students need extra support outside the classroom. Two participants suggested math club being offered, and another participant suggested extra help after
school as well as before sports practices. Six participants agreed that students need more homework and continuous practice on all topics requiring mathematics. According to these participants, the more exposure students have with math problems, the easier it becomes to solve them. One participant reported that all students, even those with learning disabilities and anxiety need to be given a chance to feel successful, including students with learning disabilities and anxiety. Two other participants agreed with this idea of supporting students to build up their confidence.

Discussion

Pellicioni, Nunez-Pena, and Colome (2015) define math anxiety as “an irrational and impulsive dread of mathematics, the panic, helplessness, paralysis and mental disorganization that arises among some people when they are required to solve mathematical problems” (p. 22). According to my study, 88.2% of participants agreed with the findings of Pellicioni et al (2015). One participant, in my study wrote that math anxiety is a “genuine fear of the unknown, lack of extra support and confidence. Lack of knowledge impedes many career choices” (Personal Communication, Spring 2018). This response relates closely with the findings of Mutawah (2015) who discusses that there is a strong correlation between math and economic development. Furthermore, 82.4% of participants in my study believe that math anxiety impacts future career opportunities for students. In the interviews, participants were asked about the impact of math anxiety in the classroom setting. Five participants noted that students with math anxiety exhibit behaviors of avoidance, sleeping in class, refusal to collaborate with others, and failure to share their thoughts. However one participant in the survey defined math anxiety slightly different from Pelliconi et al (2015). The participant wrote that math anxiety is when a “students has the
capability to perform the math but is too nervous to take the chance” (Personal Communication, Spring 2018).

Participants of the survey were asked to write what they think are the causes of math anxiety. Four participants wrote that math anxiety arises from the impact that others have on individuals (like parents and teachers) and how students view themselves academically. This idea closely relates to the work of Kulkin (2016) who list one of the causes of math anxiety to be the “negative attitude that can be inadvertently communicated by teachers, and parents who also fear math” (p. 29). Seven of the participants in the survey discussed that math anxiety can be caused by not doing well in the past, and the fear of being wrong, Andrews and Brown (2015) also found that the causes of math anxiety come from “having negative memories associated with struggling during math instruction, and in making math mistakes in a large classroom setting” (p. 241). Wadlington and Wadlington (2008) found that students with low math self-esteem tend to avoid mathematical situations. Four participants agreed with the findings of Wadlington and Wadlington (2008). One participant expressed that students with math anxiety tend to avoid math class, are either frequently absent during that class, or come to school after the class is over. Three interviewees expressed that students feel nervous in class when it comes to answering questions and starting their work. One participant wrote that when a student is asked to answer a question, he may attempt to answer the question and then quickly states “never mind.” Two interview participants reported hearing students say “I can’t do this,” or “it’s too hard,” after having attempted the problem on their own.

Math anxiety impacts students in the classroom. Eight participants wrote that students stop working when math is involved, and four participants expressed concerns with students easily giving up and not applying themselves. These ideas are closely linked to Andrew and
Browns (2015), Geist (2015), and Mutwah (2015) who discuss how individuals with math anxiety tend to avoid activities that require computation, which causes issues with their academic and everyday lives. One respondent expressed that “math anxiety gives students an expectation of failure which sometimes transfers to other subject areas” (Personal Communication, Spring 2018). The findings of Andrew and Browns (2015), Geist (2015), and Mutwah (2015) correlate to the responses of one of the participants who articulated that “students limit their diploma opportunities by avoiding or fearing math” (Personal Communication, Spring 2018). Uysal and Selsik (2014) believe that math anxiety emerges from negative attitudes towards mathematics, negative school experiences, self-esteem, the language of mathematics, and even the teachers’ attitudes. Of those surveyed, eleven participants believe that math anxiety stemmed from negative attitudes toward mathematics, and five participants believe that math anxiety was related to self-esteem.

Similarly with the participants’ responses, Thompson, Wylie, and Hannah (2016) explain that learned helplessness results from continued failure and those teachers need to provide opportunities for students to feel success and change the mindset of failure. Therefore, both the participants and researchers emphasize the importance of supporting students. In the survey, 94.1% of participants agreed that math is part of a person’s everyday life. This data correlates with Kulkin (2015) who writes that it is important that math is studied because it is necessary in all aspects of life. Six survey participants stated that students must have a growth mindset and receive positive praise. Wadlington and Washington (2008) also articulate that students need to feel safe and supported.

Conclusion
In this research, the ways educators in the 9-12 setting supported students whom they identified as having math anxiety were analyzed. The research question that guided this study was: What supports can classroom teachers use to help students with math anxiety? The findings of this study provide educators with supports to consider when working with students with math anxiety, particularly at the middle and high school levels.

The participants in this study were seventeen educators at the middle school and high school level. The participants consisted of five math teachers, five science teachers, three special education teachers, and four administrators. By surveying the educators and thoroughly analyzing their responses to the questions that I had written, it was evident that there are varying methods educators are currently using to help support students with math anxiety. After interviewing educators, it was further confirmed that there is a lack of consistency and collaboration among the way educators are supporting students. It is important that students with math anxiety are supported in an environment that allows them to feel comfortable and successful.

Math anxiety has a significant impact on students’ future academics and career opportunities. According to Mutawah (2015), the longer math anxiety persists, it causes the student to avoid math related subjects at all levels, especially those at the university level. In turn, this causes him to select a career path that does not involve math. Andrews and Brown (2015), as well as Geist (2015), report that math anxiety is problematic in today’s world because the fields of science, technology, engineering, and mathematics are growing, and it is imperative that students have knowledge in mathematics to be successful in these fields. Therefore, in order for students to be successful in the future with mathematical situations, they must be supported early on by educators.
The findings of this study impact general education teachers and special education professionals. It is evident from this study that teachers should consider collaborating with additional teachers when they observe a student who displays math anxiety. Teachers need to be open to collaborating with others when they have students with math anxiety. By doing so, the school community will work together using common strategies and supports to help students with math anxiety. Hence, as students move from one teacher to another each year, they can have consistent strategies and supports.

This study has limitations. The first limitation is time. I had a semester to complete this research, and I did not have a large participation pool. In the future, I would survey educators in the kindergarten to grade five setting, as well as interview participants in the kindergarten to grade eight setting in order to gain data regarding math anxiety at all grade levels (Kindergarten-12).

The study opens the door for further investigations regarding ways to support students with math anxiety. For example: How does a math anxiety early intervention support help students in the future? Can an assessment be used to identify math anxiety? Therefore, more studies need to be constructed to address such questions in this field.
References


Appendix

Survey questions:

Please read the following questions and circle your response.

1. Math can convey a feeling of dread and pain in students.
   o Agree
   o Disagree

2. Students avoid math when they feel pressured.
   o Agree
   o Disagree

3. Achievement in mathematics is linked to economic development.
   o Agree
   o Disagree

4. Math is a part of a person’s everyday life.
   o Agree
   o Disagree

5. Math is its own language made up of symbols and special terms.
   o Agree
   o Disagree

6. Math anxiety causes low confidence and avoidance behaviors in students.
   o Agree
   o Disagree

7. Math anxiety impacts future career opportunities in students.
   o Agree
   o Disagree

Please answer the following short response questions.

8. How would you define math anxiety?
9. What do believe are the causes of math anxiety in students?
10. How do you think math anxiety impacts students?
11. Do you think there is a gender difference in math anxiety? If so, please explain.
12. How do you support students with math anxiety?
Interview questions

1. Do you think math anxiety impacts your subject area? If so, how/which ways?

2. How do students with math anxiety impact your classroom activities/tasks (group work, independent work, etc.)?

3. How do you identify students in your classroom with math anxiety?

4. Do you collaborate with other subject areas and resource teachers to help students with math anxiety? If so, what supports do you utilize?

5. As a school community, what supports can we implement to support students with math anxiety?
Data results from agree/disagree survey questions:

- Math can convey a feeling of dread and pain in students. 88.2% agree, 11.8% disagree.

- Students avoid math when they feel pressured. 100% agree.

- Achievement in mathematics is linked to economic development. 52.9% agree, 47.1% disagree.
math is a part of a person’s everyday life

math is its own language made up of symbols and special terms

math anxiety causes low confidence and avoidance behaviors in students