The Sum of All Fears: The Effects of Math Anxiety on Math Achievement in Fifth Grade Students and the Implications for School Counselors

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Abstract

Low math achievement is a recurring weakness in many students. Math anxiety is a persistent and significant theme to math avoidance and low achievement. Causes for math anxiety include social, cognitive, and academic factors. Interventions to reduce math anxiety are limited as they exclude the expert skills of professional school counselors to help overcome this nervousness. The effectiveness of a school counseling small group intervention to reduce math anxiety and increase achievement in fifth grade participants is presented.

Since President John F. Kennedy challenged congress in May of 1961 to be the first country to put a man on the moon, the United States has worked to reform education and increase achievement to keep up with the achievement displayed by students in other countries. Even after winning the race to the moon in 1969, the United States continues to struggle to match its international counterparts in mathematic achievement. In 2009, The Program for International Student Assessment (PISA) performed a cross-country comparison on the performance of 15 year-old students in reading, mathematics and science. American students scored below the international average in mathematic literacy. Among 33 industrialized countries, 17 countries had higher average scores than U.S. students, five countries had lower average scores, and 11 countries had scores that were not statistically different from American students (National Center for Educational Statistics (NCES), 2011).

In 2012, the National Assessment of Educational Progress (NAEP), group provided a snapshot of the condition of education in the United States based on results from its 2011 national study. Students in 4th, 8th, and 12th grade were assessed in reading, mathematics, and social studies. Eighty two percent of the elementary students assessed reached only partial mastery of math knowledge and skills fundamental for proficient work at the 4th grade level. In addition to the national implications from the results, there are also local implications as a comparison was made amongst the 50 states and the District of Columbia. The results indicated that 4th grade students from 33 other states scored higher in math literacy than 4th grade students in Georgia, students from 15 states scored lower and two states, Arkansas and New York, scored the same as Georgia students (NCES, 2012). Despite the continued education reform and political efforts over the past decades, the math achievement gap has not closed.

Numerous research studies have been conducted to pin-point the reasons for the gaps in mathematic achievement for American students. The causes are wide ranging. It is difficult to single out a particular cause for low achievement for American students, but a persistent theme is math anxiety. The negative effects of math anxiety on achievement are extensive. Geist (2010) suggests that for many children math achievement is not related to potential level but rather to their fear of and/or negative attitudes toward math.

Math anxiety is more than a barrier to math achievement as it has a widespread impact on other aspects of students' lives. Seen as early as kindergarten, math anxiety can impede initial learning which results in poor math skills and negatively affect long-term academic success and career choices (Ashcraft, 2002; & Wu, Barth, Amin, Malcame, & Menon, 2012). Highly math anxious students tend to avoid math in general; anxiety prevents completion of small tasks as homework or paying a restaurant bill and large ones like excluding math and science related career path options (Beilock, Gunderson, Ramirez, & Levine, 2010).

Math anxiety is more than nervousness before a math test; it has pervasive negative impacts on math learning, everyday life, and career choices. This Action Research Study (ARS) reviewed the literature related to math anxiety in children. Current interventions to reduce math anxiety are presented. Additionally, gaps in the literature and action research related to school counseling interventions for math anxiety for elementary students also are addressed.

Literature Review

Since long-term negative impacts of math anxiety begins as early as kindergarten (Ashcraft, 2001) this literature review focuses on early onset in children and proposes interventions to reverse harmful effects. Children are defined as elementary school-age students. To identify relevant scholarly peer-reviewed literature, the parameters were set to research definitions, causes, and interventions for math anxiety related to elementary students.

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Richardson and Suinn (1972) defined math anxiety as stress causing negative physical reactions that interfere with the manipulation of numbers and problem solving in both academic settings and everyday life.

Definitions of Math Anxiety

For decades, the subject of math has been plagued with fear and anxiety by some students. As early as the 1950's, educators and researchers began to recognize the significance and prevalence of students with fears and negative attitudes toward math. Studies emerged trying to identify and define this phenomenon. After observing students struggle with math, Gough (1954) described her students' fear and avoidance of math as a disease and called for interventions to help these students. Dreger and Aiken (1957) described "number anxiety" as negative emotional responses to mathematics. Richardson and Suinn (1972) defined math anxiety as stress causing negative physical reactions that interfere with the manipulation of numbers and problem solving in both academic settings and everyday life. Additional studies from the 1970's to present day used these definitions or similar ones for math anxiety. All definitions include an extreme negative physical, emotional, and cognitive reaction to math that hinders a person's ability to learn and perform math activities (Ashcraft, 2002; Beilock, et al., 2009; Henry & Chiu, 1990; Mattarella-Micke, Mateo, Kozak, Foster, & Beilock, 2011; Tobias, 1978). For this ARS, math anxiety is defined as an intense fear, nervousness, and dread related to math leading to avoidance of mathematic activities and impedes math learning (Ashcraft, 2002).

Causes for Math Anxiety

The literature discussing causes and/or contributing factors for the prevalence of math anxiety in elementary students involves various social, cognitive, and academic elements. Social factors include continued race and gender stigmas and lack of parental support in low socioeconomic (SES) households. Cognitive factors comprise dyscalculia and deficits in working memory. Academic factors encompass the traditional math curriculum used in classrooms, ineffective teaching styles, and the influence of math anxious teachers.

Social factors. Gillen-O'Neel, Ruble, & Fuligini, (2011) found students aware of negative subgroup stigmas are more likely to exhibit anxiety, poor self-esteem, and lack motivation. Several studies attribute elevated math anxiety and low math achievement in females to the enduring stereotype, that "Girls are not good at math" (Beilock et al., 2010; Geist, 2010, Sparks, 2011; Tobias, 1978). Sparks (2011) reviewed studies confirming that regardless of math ability, girls are more likely to have higher math anxiety and lower math achievement than boys.

The perpetuation of stereotypes also increases math anxiety and poor self-esteem in other minorities. Renya (2000) revealed that ethnic minorities are more apt to lose motivation and interest in math when stereotyped as low achievers. Due to self-doubt and anxiety, African Americans who are doing poorly in math, consistent with the stereotype, are more likely to disengage in tests and activities than are white students. Gillen-O'Neel et al., (2011) explained elementary-aged ethnic students are aware of negative stigmas and this is linked with higher levels of academic anxiety and less motivation in comparison to their non-minority peers.

Beyond gender and racial stereotypes, parental expectations and beliefs related to education can negatively affect self-esteem and students' attitudes towards math. Scarpello (2007) discusses math anxious students from low SES backgrounds often have less educated parents who also struggle with math anxiety. Often negative parental attitudes and beliefs are passed on and academic achievement is not encouraged. Rown-Kenyon, Swan, & Creager, (2012) explained that parental support is crucial to the self-efficacy in math and science demonstrated by students. Students of low SES status may lack this support due to their parents not being physically

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present or lacking the educational background to help the students with homework. Social expectations, negative stereotypes, and lack of support in academic and family settings increase the chances of math anxiety in students.

Cognitive factors. Biological make-up in regards to cognition can increase susceptibility to math anxiety. Sparks (2011) interviewed several neurologists studying math learning and performance. A wide range of math learning disabilities, also known as dyscalculia, was linked to math anxiety. Neurologists found difficulties recognizing the differences in numerical magnitude also exhibited high levels of math anxiety. Numerical magnitude, identifying which of two numbers is bigger, is a foundational concept for advanced math learning. Elementary students with this deficiency could develop poor self-esteem, frustration, and negative reactions to math as they are introduced to more complex concepts.

Students with average to high math capabilities also may have cognitive factors that could attribute to math anxiety. Mattarella-Micke et al. (2011) discussed that high math anxious students tend to have lower cognitive skills than their less math anxious peers due to avoidance of math activities and practice yet may have high inherent capabilities. Ramirez, Gunderson, Levine, & Beilock (in press) found that the cognitive element of working memory is a strong predictor of skill acquisition. Students with higher levels of working memory may be more susceptible to stress and anxiety which negatively impacts their math learning and performance. Willis (2010) explained that the emotional reactions of math anxiety can shut down working memory that is needed to learn and solve problems. She states "when students are stressed, they can't use their thinking brains" (p. 10). Cognitive factors are considerable components contributing to the level of math anxiety demonstrated in elementary students.

Academic factors. Academic factors also carry a heavy influence on math anxiety. Geist (2010) believes math curriculum used in public school classrooms contributes to math difficulties. Reliance on timed tests and memorization has increased anxiety making math a high-risk activity. Many college students who exhibit math anxiety presented negative experiences they had in elementary math classes. Current math curriculum in elementary grade levels does not provide conceptual understanding of mathematics; instead it focuses on acquisition of superficial knowledge of basic computational skills and math operations. The students lack the ability to understand the "why" of mathematics and instead regurgitate facts. As a result, students quickly forget the concepts they have learned and experience continuous frustration (Perry 2004). Swars, Daane, and Geisen, (2010) agreed that math classes using traditional curriculum which concentrates on basic skills, teacher lecture, seatwork, and whole class instruction are more likely to have students with math anxiety than math classes that utilize non-traditional curriculum which focuses on real-life applications and group work.

In addition to research that traditional curriculum increases math anxiety, extensive literature is dedicated to how teachers' relationships, attitudes, and efficacy influence math anxiety. Current research indicates that teachers who struggle personally with fear and anxiety related to math inadvertently pass on math anxiety to their students (Beilock et al., 2010; Bekdemir, 2010; Geist, 2010; Renya, 2000 & Swars et al., 2010). Bekdemir (2010) explained that a majority of math anxious individuals report fear onset and hatred of math to a negative experience with a hostile or inadequate teacher during elementary school. Beilock et al. (2010) reported that 1 year with a math anxious elementary teacher was correlated with lower math achievement and increased negative attitudes toward math in students. Math anxious teachers perpetuate math anxiety as they lack confidence in their ability to teach math. These frustrated teachers spend more time avoiding math and relying on answer keys in textbooks than learning how to teach math creatively. Geist (2010) suggested that math anxiety appears from the way it is taught in math class and may have been presented to math teachers when they were children.

Interventions for Math Anxiety

Despite the various proposed causes, math anxiety results in one significant negative consequence, low math achievement. As researchers recognized and investigated the causes for math anxiety and its link

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to low math achievement they designed and implemented interventions to reduce math anxiety in elementary students. Some researchers explored the social factors and developed interventions to raise awareness of gender and racial stereotypes for school staff. Parent education and workshops were suggested to increase student support of academic endeavors at school and home (Geist, 2010; Gillen -O'Neel et al., 2011; Renya, 2000; Tobias, 1978). Other researchers focused on the cognitive factors of math anxiety and discussed changes in assessment techniques to identify early math learning disabilities and specialized instruction (Ashcraft, 2002; Mattarella-Micke et al., 2011; Mundia, 2012; Ramirez et al., in press) Changes in curriculum such as group work, open discussion, real-life applications, and group or peer assessments were offered as interventions to replace anxiety provoking traditional math curriculum (Geist, 2010; Sparks, 2011; Willis, 2010;). Additional researchers focused on encouraging teachers to explore their own math anxiety and take steps to create stress free and positive classroom environments (Beilock et al., 2010; Bekdemir, 2010; Swars et al., 2010).

Gaps in the Literature

The interventions discussed are valuable if implemented effectively, but they rely heavily on systemic and social change that is not easily attained. Moreover, the majority of these interventions focus on instructional or classroom changes which require instituting more work, planning, and training to already overwhelmed classroom teachers. Additionally, the interventions seem to neglect the psychological and emotional aspects of math anxiety. Schools employ professional school counselors (PSCs) who are uniquely trained to assist students with a wide range of academic and personal/social stressors and could be effectively used to help students cope with math anxiety yet a further search of the literature related to school counseling and anxiety varied in suggestions to assist kindergarten to college students. Many of the interventions varied from moderate school phobia and generalized anxiety disorder to test anxiety and transitional stress (Bruce, Getch, & Ziomek-Daigle, 2009; Cheek, Bradley, Reynolds, & Coy, 2012; Miller, Short, Garland, & Clark, 2010). When keywords limited the search to school counseling and math anxiety fewer documents were suggested. Two promising studies incorporated cognitive-behavioral therapy techniques such as cognitive reframing to replace negative and fearful thoughts related to mathematics with positive visualizations of success and achievement, however these focused on high school and college-aged students (Perry, 2004; Shobe, Brewin, & Carmack, 2005). The majority of counseling research for math anxiety was conducted in colleges and high schools and little in elementary schools.

Academic success in the area of math achievement proves to be a recurring weakness in American students. This gap has been documented as early as kindergarten. A persistent and significant theme related to low math achievement is math anxiety. The research suggests several causes for math anxiety including social, cognitive and academic factors. Based on these causes, some early interventions were developed to reduce math anxiety in elementary students. These include, parent and teacher trainings negative social stigmas, early assessment and specialized education for students with math learning disabilities, new and creative math curriculum, building teacher confidence in math, and increasing positive learning environments. Research supports that interventions have positive results when implemented effectively. Weaknesses for interventions include amending district policies and procedures and relying heavily on curriculum and classroom instruction changes which could add extra exertion to already overwhelmed classroom teachers. Fantuzzo et al. (2012) revealed that high levels of teachers' job stress were related to increased responsibilities and instructional changes that decreased their time dedicated to teaching math and reading basics. Moreover, these studies are limited as they ignore the expert qualities and skills of PSCs as possible resources to reduce math anxiety in elementary students. The deficit in this literature warranted this ARS that designs, implements, and evaluates the effectiveness of PSC's to reduce math anxiety in fifth grade students.

Method

This action research (AR) was defined as a study conducted by a PSC within the school environment to gather information about a counseling intervention and how the participants responded to the intervention. The AR goal was to gain insight by evaluating the intervention effectiveness and developing new practices to improve student outcomes and the lives of those involved (Mills, 2011). This ARS addressed how PSC skills in personal/social development make them uniquely qualified to assist students in overcoming barriers in math learning by reducing math anxiety (Barna & Brott, 2011). A mixed method design was used to identify the nature and degree of problems in math achievement for fifth grade students, in a Georgia public suburban elementary school, by exploring their attitudes and beliefs about math.

There were three research questions (RQs)

1) How does math anxiety negatively impact math achievement in fifth grade students?

2) How can PSCs reduce math anxiety and reverse the negative effects on math achievement?

3) How can the results from the intervention be used to make improvements in future counseling programs to address math achievement?

Instrumentation

RQ 1 was confirmed from previous research collecting data about the negative attitudes and beliefs young students have towards math. The Math Anxiety Scale for Children (MASC) (Henry & Chiu, 1990) was administered to all fifth grade students (N=63). This survey contains 22 items related to math that students rated on a 4 point Likert scale. The MASC demonstrated validity and reliability through a factor analysis compared to other assessments used to measure math anxiety (Henry & Chiu, 1990; Beasley, Long & Natali, 2001). In addition to the MASC, students were asked 5 open ended questions (ARS Survey) probing feelings and perceptions about math. Besides the ARS Survey, the PSC developed a Post-Test consisting of 5 open-ended questions to probe the small group intervention's impact on participants' attitudes and beliefs about math and improvement in coping skills. The ARS Survey and the Post-Test items were designed for this ARS and were not tested for validity or reliability.

MASC scores and ARS survey results were compared to the student's scores on the winter math benchmark exams. The AIMSweb Math Computation Measure (MCOMP) and the Math Concepts and Applications measure (MCAP) benchmarks used by the district are standardized and nationally normed. These data served as a baseline measure and the criteria to identify students to participate in the intervention. Baseline scores and spring scores on the MCAP and MCOMP were compared to evaluate the effectiveness of the intervention.

Post-intervention teacher interviews were conducted for triangulation data. A 16 item questionnaire composed of rating scales and open-ended questions was developed and used during structured interviews with teachers about their observations and perceptions of the impact the small group intervention had on participants. The teacher questionnaire was developed from the literature and not tested for validity or reliability.

Identification and Recruitment of Participants

Student participants. Fourteen students were identified as possible participants in the intentional small group intervention to reduce math anxiety and increase achievement. They did not meet the winter target on one or both math sections of the benchmark assessment and showed significant scores on the MASC. Parent consent and student assent were acquired from 13 students (N= 13): 6 females (3 African-American, 2 Caucasian, and 1 Hispanic) and 7 males (6 African-American, and 1 Hispanic). These demographics were consistent with the literature.

Teacher participants. Fifth grade teachers were asked to participate in interviews about group effectiveness. The volunteers taught math to one or more participants daily.

Materials and Procedures

RQ 2 was addressed by designing and implementing a small group intervention with fifth grade participants in a lunch and learn format. The group met twice a week for 6 weeks for 12 sessions facilitated by the PSC. The curriculum was based on Building Math Confidence by Brigman and Goodman (2008) and Managing the Mean Math Blues: Math Study Skills for Student Success by Ooten and Moore (2010). Session topics included identifying and expressing feelings, positive and negative self-talk, changing negative thought patterns, stress reduction and relaxation exercises, self-advocacy-knowing when and how to ask for help, goal setting, accepting mistakes as a part of learning, celebrating success, specific math study skills, journaling, self -evaluation, and termination. At the final session, a second MASC, ARS Survey, and Post-Test items were administered to assess any impact on beliefs and attitudes toward math. Participants participated in the spring

Post data demonstrated most participants experienced lower levels of math anxiety and increased math achievement.

administration of the AIMSweb MCOMP and MCAP.

Data gathered during the post-intervention teacher interviews summarized teacher observations related to the participants' use of skills and strategies gained from the group. Additionally, teachers related changes they noticed in attitude and motivation in math class, and behavior changes they observed related to the subject of math.

Data Analysis

Qualitative and quantitative data was gathered and analyzed by using a mixed methods design of grounded theory and descriptive statistics. Data analysis was meant to confirm the literature's description of the negative effects of math anxiety on math achievement in elementary students. Other data was analyzed to measure the effectiveness of the small group intervention to reduce math anxiety and increase math achievement.

Quantitative data. Both MASC scores were analyzed using descriptive statistics to compare percentage changes in participants' scores after the intervention. Descriptive statistics compared percentage of change on spring and winter benchmark scores. Post data demonstrated most participants experienced lower levels of math anxiety and increased math achievement.

Qualitative data. All qualitative data were analyzed using grounded theory. The goals of grounded theory are to code qualitative responses and classify into emerging themes (Walker & Myrick, 2006). Attention was paid to themes that correlated with the literature connecting math anxiety and low math achievement. For triangulation, teacher interviews were coded and compared for similar themes relating to the impact of the intervention and participant's pre and post attitudes and beliefs toward math. Qualitative data was translated into numeric form to represent the percentage of positive and negative themes found in teacher and student responses.

Results

Quantitative Student Data

To measure the impact of the intervention on participants' stress and anxiety levels in math, both MASC scores were compared for each participant (Figure 1). The

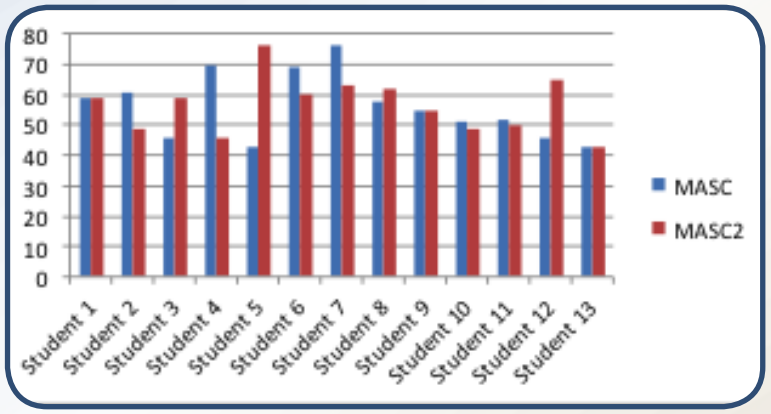

Figure 1: Comparison of Student Participants First and Second MASC Scores

results demonstrated 46% of participants (N=6) had a decrease, 31% (N=4) had an increase, and 23% (N=3) of the MASC scores remained the same.

To examine the impact of the intervention on math achievement, the winter and spring fifth grade math benchmark scores were compared. Analysis of basic math computation skills displayed that 84% of participants (N=10) increased their second MCOMP score, 8% (N= 1) decreased the score, and 8% (N=1) had the same score. The MCAP measures students' skills in math concepts and applications. Results revealed 58% of participants (N=7) had an increase, 33% (N=4) had a decrease, and 8% of the participants (N= 1) had the same MCAP score. One participant was absent and did not participate in the second benchmark administration.

Qualitative Student Data

Using grounded theory five themes emerged from the ARS survey responses to include stress and frustration, negative self-talk and avoidance behaviors, positive attitudes toward math, and positive self-talk and motivated behaviors (See Figure A).

Figure A: Qualitative Matrix of Student Responses to ARS Survey

Pre-Intervention Themes	Examples	Post-Intervention Themes	Examples
Stress & Frustration 52%	"It's really scary when you get called to the board." "I don't like math and I am afraid of math." "I get scared when I don't get the problem." "I get really scared and start sweating." "I feel stupid and can't do it" "Really confusing and frustrating"	Stress & Frustration 30%	"I get a little nervous" "Math is boring "Freak Math!" "Difficult" "Math is a little hard."
Negative Self-talk & Avoidance Behaviors 18%	"Math is hard for me." "I give up instantly." "I just sit there and scratch my head." "I mess with my hair." "I say I can't do it. "I am dumb and don't know anything." "I feel stupid and helpless"	Negative Self-talk & Avoidance Behaviors 5%	"Math is hard for me." "I give up instantly." "I just sit there and scratch my head." "I mess with my hair." "I say I can't do it. "I am dumb and don't know anything."
Positive Attitudes Toward Math 14%	"Sometimes math is hard but sometimes it is not." "Math is great." "Math is good for you." "Ok"	Positive Attitudes Toward Math 30%	"Math is an education that helps your brain to think everyday" "Math is about dealing with real life problems." "Kind of cool" "Better now"
Positive Self-talk & Motivated Behaviors 16%	"I would ask the teacher to help me." "I would solve the problem." "Ask teacher for help" "Ask for some help."	Positive Self-talk & Motivated Behaviors 35%	"I can do it" "I can do this." "I'll try this again." "Keep trying ask questions" "I just count to ten." "I try my best."

After identifying the themes, theme frequency before and after small group intervention was charted and translated into numerical percentages. Student responses before the small group intervention determined 52% displayed stress and frustration with math, 18% displayed negative self-talk and avoidance behavior, 14% displayed positive attitudes toward math, and 16% displayed positive self-talk and motivated behaviors. The frequency changed after the small the group intervention as only 30% of the respondents reported stress and frustration, 5% displayed negative self-talk and avoidance behavior, 30% revealed positive attitudes toward math, and 35% displayed positive self-talk and motivated behaviors.

Another post-test item asked students to respond to the following: Imagine you are in math class and you are about to take a test. How do you feel? The majority of participants still found this to be an anxiety provoking situation as 92% displayed stress and frustration and only 8% displayed positive feelings and attitudes (See Figure B).

Figure B: Qualitative Matrix of Student Responses to Post-Test Questions 1-2

Imagine you are in math class and you are about to take a test? How do you Feel?	Examples	Imagine you are in math class and you are about to take a test? What do you do?	Examples
Stress & Frustration 92%	"Nervous" "Mad" "I feel like I might pass or fail" "Like butterflies are in my stomach" "Scared" "Mad and anxious" "Sometimes stress" "Worried"	Positive Self-Talk & Motivated Behaviors 85%	"Have confidence and say I can do it" "Say I can do this" "Count to Ten" "Practice" "I keep on trying" "Relax" "Ask for help when it's time to check" "Meditate" "I breathe in and out and count to 10"
Positive Feelings & Attitude 8%	"Ok"	Negative Self-Talk & Avoidance Behaviors 15%	"Hold my tummy" "Tense up and get nervous"

The same situation was described and participants were asked what do you do? A majority responded positively to the situation as 85% displayed positive self-talk and motivated behaviors and 15% displayed negative self-talk and avoidance behaviors (See Figure B). The participants were asked to describe their feelings about

math before joining the small group and 92% of the responses displayed stress and frustration with math and 8% displayed positive feelings and attitudes toward math. When asked to describe feelings about math after participation 100% displayed positive feelings and attitudes toward math (See Figure C).

Figure C: Qualitative Matrix of Student Responses to Post-Test Questions 4-5

Describe how you felt about math before joining math group?	Examples	Describe how you feel about math after participating in math group?	Examples
Stress & Frustration 92%	"I had always hated it" "It sucked I failed everything" "I hated math before joining" "Like I am stupid" "Hated it" "Scared" "Stress" "I hated math and wished it never existed." "Dumb" "Nervous" "Very Very Stressed"	Positive Feelings & Attitude 100%	"I feel like I have progressed" "I get 2s and 3s" "I feel good and confident" "A little better" "Easy" "Good" "Pretty Good" "I feel very happy and calm" "Smart" "Awesome" "Like I can do it" "I love it"
Positive Feelings & Attitude 8%	"I loved it"		

Qualitative Teacher Data

Teachers rated each student's stress level in math class using a scale of 0-10 before and after the small group intervention. Responses revealed a decrease in participants' stress level in math class as the mean stress level before joining the math group was 5.6 and the level after participation was 3.0. Teachers' responses also displayed an increase in participation in math class after the intervention as the mean involvement before joining the small group was 5.6 and the current mean after participation was 7.8. When asked if the small group contributed to increased math achievement, 75% stated "Yes", 17% were "Not Sure", and 8% said "No".

The teachers were asked to describe how the small group was effective in increasing math achievement. Common themes were coded and frequencies were translated into numerical percentages (See Figure D). Three themes emerged from teacher observation of participants in class, increased participation and assignment completion, displays confidence and positive attitude, and less fearful and accepting mistakes. Thirty eight percent observed increased participation and completed assignments, 38% responded participants display confidence and positive attitudes, and 24% responded participants were less fearful and accepted mistakes.

Figure D: Qualitative Matrix of Teacher Responses to Structured Interview Question 15

Describe how the small math confidence building group contributed to math achievement	Examples
Increased participation and completed assignments 38%	"I had always hated it" "It sucked I failed everything" "I hated math before joining" "Like I am stupid" "Hated it" "Scared" "Stress" "I hated math and wished it never existed." "Dumb" "Nervous" "Very Very Stressed"
Displays confidence and positive attitude 38%	"She gives when called upon in class, she's more confident in herself." "She believes that she will pass math on the CRCT and I believe she has a chance to." "Strong use of positive self-talk"
Less fearful and accepts mistakes 24%	"Calm demeanor which leads to methodic step by step approach to math" "He seems more willing to share his answers or explanation even though he wasn't sure he was right" "He seems more assertive, He's not scared to be wrong because he knows he's going to get help"

Discussion

Comparison of baseline and post-intervention data answered RQ1. All fifth grade participants had high MASC and low math achievement scores on one or both winter math benchmarks. A lower second MASC score correlates to a decrease in math anxiety, a higher second MASC score correlates with an increase in math anxiety, and the same score on the MASC correlates with the same level of math anxiety exhibited by participants after the small group intervention. To measure the effects of math anxiety on math achievement the data from the second MASC and spring benchmark assessments were analyzed. Of the 46% (N=6) of participants who displayed a decrease in math anxiety on the second MASC, 83% (N=5) scored

higher on the spring benchmark MCOMP and 67% (N=4) showed improvement in their MCAP scores indicating an increase in math achievement. Of the 31% (N=4) who showed an increase in math anxiety on the second MASC, 75% (N=3) scored higher on the MCOMP and 25% (N=1) showed improvement in the MCAP. These findings are consistent with the literature correlating math anxiety and math achievement as more achievement growth was demonstrated in participants who displayed less math anxiety (Ashcraft, 2002; Beilock, et al., 2009; Henry & Chiu, 1990; Mattarella-Mick et al., 2011; Tobias, 1978; Wu et al., 2012).

RQ2 was answered by evaluating effectiveness of the small group intervention to reduce math anxiety. The counseling intervention was moderately effective in reducing math anxiety and its effects on math achievement as nearly half of the participants scored lower on the second MASC and the majority of these participants had higher spring math benchmark scores. Moreover, a majority of the teachers reported improvements in confidence and participation in math class and 75% stated the small group intervention contributed to math achievement. These results indicate the PSC is uniquely qualified to build confidence and increase math achievement in fifth grade students through a small counseling group intervention.

Considerations

It is possible that some participants who increased MASC scores underrated their anxiety on the first MASC or over reported it on the second MASC. This is suggested as post-test qualitative data showed 92% reported feeling stress and frustration in math before the intervention and 100% reported positive attitudes and feelings toward math after the small group intervention. Other factors could have contributed to the higher second MASC scores. In the structured interviews, teachers commented that some participants showed inconsistency in math class that they attributed to variables such as bullying situations, frequent school absences or difficult transition to a new school. Another factor may have been an increase in stress among students as the administration of the Criterion Referenced Competency Test (CRCT) was near.

Lastly, throughout the group intervention several participants reported stress and frustration with math teachers and instruction. These factors are consistent with causes for math anxiety found in the literature (Geist 2010; Perry, 2004; Swars et al., 2010). Continuous exposure to these stressful situations could have increased the students' level of math anxiety.

Limitations

Triangulation of data indicates the small group intervention was moderately effective; however, other variables may have been involved. It is possible that teacher instruction and classroom interventions increased math skills and abilities which led to increased confidence and a reduction in math anxiety.

This ARS was limited in controlling possible stressful situations that may have contributed to an increase in math anxiety and decrease in math achievement. These include teacher/student conflicts, peer conflicts, teaching styles and traditional math instruction, and pressure to perform well on high stakes assessments. Teachers noted peer conflicts as a possible source of inconsistency in students' motivation and performance. Participants also reported negative peer interactions, teaching styles and teacher conflicts as continuous sources of stress in math class. Students expressed anxious feelings about the upcoming CRCT administration as fifth graders are required to meet expectations on the math and reading portions to advance to sixth grade. Although, positive coping skills were taught and practiced in the small group intervention, the PSC could not control participant's continued exposure to these factors.

This ARS was limited to a relatively small group of participants. Gladding (2012) suggests that psycho-educational groups can be large yet are most effective with 8-12 participants. The small group intervention was based on these parameters to include a maximum of 15 participants, approximately one-fourth of fifth grade students. In the structured interviews, teachers discussed other students who may have benefited and were not included in the study.

Triangulation of data indicates the small group intervention was moderately effective; however, other variables may have been involved. It is possible that teacher instruction and classroom interventions increased math skills and abilities which led to increased confidence and a reduction in math anxiety.

Future Implications

The results and limitations reveal areas for improvement and expansion (RQ 3). Consistent with the literature, factors such as traditional math instruction and teaching styles could not be controlled and might have impacted the effectiveness of the intervention. Future studies should examine how PSC's advocate for students and address math concerns with administration and faculty. PSC's could teach faculty to identify students with math anxiety and incorporate interventions into classroom instruction that reduce stress and frustration for these students. Discussions with administration should center on monitoring teaching styles that increase math anxiety and encouraging positive math learning environments in the classroom.

In future ARS the PSC should consider the timing of the small group interventions. Changing the time of the small group was suggested by three teacher participants. Before or after school scheduled group times could allow for less interruption of classroom instruction and longer periods for group intervention. School year schedule should also be considered as students feelings about the upcoming spring CRCT administration may have been stressful.

Lastly, the limitation of this ARS to a relatively small group of participants suggests expansion to include larger student populations. One teacher commented that she felt all fifth grade students could benefit from the skills and lessons addressed in the small group intervention. This preliminary ARS was designed to measure if confidence was built by participation. Possible benefits for all fifth grade students needs to be reviewed. Future ARS could be expanded to include classroom guidance to build math confidence with all fifth graders.

In a final conclusion, more research addressing the psychological and social aspects of math learning and achievement are needed. PSC's are uniquely qualified to identify and create interventions to address these aspects of math learning. As school leaders, PSC's are called to be actively involved with the mission of the school in advocating for the personal/social and academic needs of the students. PSC's can do so by raising awareness of the psychological aspect of math learning among faculty and administration and encouraging collaboration to incorporate interventions to address this aspect in math instruction. By developing classroom guidance and other counseling interventions to effectively reduce math anxiety and increase math achievement, the PSC develops a comprehensive school counseling program that aligns with the academic focus of the school's mission.

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