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The effect of cooperative groups on math anxiety

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COLLEGE OF EDUCATION

This is to certify that the doctoral study by

Melissa Batton

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Walden University
2010

Abstract

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Ed.S. Nova Southeastern University, 2001
M.S. Nova Southeastern University, 2000
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Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Teacher Leadership

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Abstract

Research indicates that many students have difficulty with mathematics, which can be attributed to many factors including math anxiety. Students who experience math anxiety have poor attitudes towards mathematics and perform below grade level based on class and statewide assessments. The purpose of this quasi-experimental quantitative study was to investigate the effectiveness of cooperative groups on the math anxiety levels of Grade 5 male and female students. The theoretical foundation of the study included Vygotsky's social learning and Piaget's concept of knowledge. Thirty-two students from 2 Grade 5 classrooms were administered the pre and post MASC inventory. A repeated-measure ANOVA was used to compare the overall mean difference for each group. Key results revealed that students in the treatment group (cooperative grouping) had less math anxiety after 9 weeks than students involved in the control group (noncooperative grouping). Females in the treatment group had lower math anxiety scores than the females in the control group, while males in the treatment group showed no change in math anxiety levels when compared to males in the control group. A conclusion from this study suggests that cooperative grouping, especially for females, may have a positive impact on students' attitudes and overall mathematics performance. It is recommended that administrators schedule professional development on cooperative grouping to implement successful cooperative learning in the classroom. Positive social change could be realized by teachers incorporating strategies in lessons that promote a positive learning environment as well as support learning and academic achievement.

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Dedication

I dedicate this doctoral study to my husband, Dewey. You have earned this degree as much as I have. Thanks for being able to sleep with the light on and being accepting of the keyboard clicks invading your dreams. You helped me stay motivated and energized when I felt downtrodden and almost defeated. You've been a constant source of support and I thank you for being my helpmate, best friend, lover, and companion. We still have dreams to fulfill, and I'm ready to get started. I love you always.

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It is with heartfelt emotion that I thank my committee members, Dr. Judith Orth and Dr. Kathleen Hargiss. What a journey this has been. Thank you for sharing it with me. Dr. Orth, thank you for being my lioness.

I thank God for providing me with the strength and determination necessary for completing this endeavor. Without Him this accomplishment would never have materialized. God provided me with an Ephesians 3:20 year in 2010.

To my children, Laura, Bryan, and Ben, you three are the best. Thanks for eating out of paper plates and being understanding when the laptop had to tag along. I know many of my weekends were spent tied to the computer. I don't think any of you complained.

Last, but not least, to my mother, Velma Curl, you now have the "bragging rights" you've wanted every week since I started this degree program. I learned my work ethics from you and Daddy. I've never started something and quit before it was finished. You were my first teacher, and I thank you for instilling me with the love of learning and the importance of having an education.

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Section 1:

Introduction to the Study

This study focused on the math anxiety of Grade 5 students at a rural southeastern school in the United States. Furner and Berman (2002) found that many students entered the upper elementary classroom anxious about math. If fear or anxiety was a concern, often it remained secret due to embarrassment or shame. They found mathematics may have been viewed as unimportant or superfluous to the student's future. This attitude may have concealed students' anxieties about learning new math. Math anxiety may have led to low performance with class work, low standardized test scores, no basic understanding or comprehension of basic skills, and may have kept students from actively participating in the class activities (Furner & Berman, 2002).

Math anxiety was verified and defined in the literature as the "inability by an otherwise intelligent person to cope with quantification, and more generally, mathematics" (Malinsky, Ross, Pannells, & McJunkin, 2006, p. 1). Students with math anxiety were able to function in other subjects without anxiety as proven by the state's standardized test scores. Math anxiety is real and must be controlled. If not controlled, students may forego an opportunity to take higher math courses that may improve their economic status in their county and region.

The rural school where the study took place is at an all-time low in standardized math scores. In order to counteract the low test scores, the principal set up a math learning community. McAnear (2007) defined the Learning Community as a learning experience used to build up or restructure our math philosophy, curriculum, and student

awareness of mathematics. It is a time for educators to learn "new skills and strategies" (p. 5). Each grade level of the Learning Community is linked to one another through the mathematics program.

The Learning Community involves every math teacher at the school. The math teachers meet once a month to discuss strategies for improving standardized math scores. Teachers are also encouraged to observe teachers of other grade levels in order to get a better understanding of mathematics at a different grade level. The Learning Community continues to focus on improving standardized test scores and discuss what does or does not work in the mathematics classroom.

The use of Learning Communities has failed to provide the direction necessary, as math anxiety continues to be problematic. This contributes to the low math averages and poor standardized test scores of both the male and female students. It is likely that math anxiety is affecting the student attitudes, and thereby causing a problem. At the school where this study took place, students complained about the lack of mathematical understanding, and teachers complained about the students' lack of basic skills. Students have no desire to work the problems on paper, or dedicate the time needed for problem solving (Tiedemann, 2000).

If this trend of poor student attitudes does not change soon, math anxiety may affect the students even more once they reach middle school and high school. Gentry, Gable and Rizza (2002) found this may cause students to decide that they will not take the advanced math courses offered in high school or college. The students may opt for college careers or jobs that do not require math skills beyond basic adding and

subtracting. Gentry, Gable, and Rizza believed this attitude or trend may inadvertently pass along to others such as teacher to student or parent to child.

The United States is lagging behind other countries on international mathematics tests (Brown & Gray, 1992; Cai, 2001; Ferrini-Mundy & Schmidt, 2005; Greenberg & Walsh, 2008). Math anxiety may be a contributing factor. Esmonde (2009) agreed with Greenberg and Walsh that the United States is lagging behind other countries. Esmonde asserted, "In an increasingly technological society, mathematics plays a central part in governmental and corporate decision making, and these decisions disproportionately affect marginalized people—the very people who are less likely to have access to quality mathematics education" (p. 1008). According to Malinsky, et al. (2006) and Stodolsky (1985), there have been many possible factors contributing to the problem of math anxiety, such as parents who are not comfortable assisting their child with math homework, the student's low level of success with mathematics, or the teachers who are not comfortable teaching mathematics, but teach it anyway. Patton and Roschelle (2008) considered math textbooks to be a factor of math anxiety, blaming the textbook companies and publishers for cramming too much content into the textbook in order to meet the requirement for all 50 states. Patton and Roschelle affirmed that this "leads to one-size-fits-all textbooks" (p. 10) and teachers and students look at the textbook and feel a sense of doom. One of these mentioned factors alone may lead a student to have math anxiety but, with the proper support from the teacher and parents, students may overcome math anxiety to the extent that grades improve. In turn, students may take advanced math

classes once they enter high school and then college if math anxiety is not a factor (Cai, 2001).

Problem Statement

The elementary school at which this study was conducted has been confronted with the problem of math anxiety, demonstrated by student attitudes and low standardized test scores. The problem addressed in this study was the math anxiety experienced by fifth grade students, as determined by their attitudes and negative comments about math. The literature review confirmed that math anxiety comes from many areas and is not the same as test anxiety. Prime examples of math anxiety included beliefs that males were better at math than females, or if a parent had low success in mathematics, so would the child (Barnett & Rivers, 2004). Through the use cooperative groups in the mathematics classroom, the ideal situation was to identify a positive change in the Grade 5 program (Johnson & Johnson, 1995). Cooperative groups had not been part of the math strategies used by the school's math teachers. The hypothesis of the study involved whether or not using cooperative groups in the classroom would lessen math anxiety in the Grade 5 students. The significance of this study can be generalized to other Grade 5 classrooms in the United States with similar demographics.

Nature of the Study

This gender based, quasi-experimental quantitative study used the Math Test 1 and Math Test 2 (Appendix F). The Mathematics Anxiety Scale for Children (MASC) was used to identify the students' math anxiety in the treatment group and control group (Appendix H). In order not to cause any undue math anxiety, teachers used the same class

structure of two testing instruments for this study. Normal classroom procedures included a two instrument procedure during each testing session. Since this was a normal procedure, a nongraded math test was administered followed by the MASC inventory. The math test for the beginning of the study was labeled Math Test 1, and the math test for the ending of the study was labeled Math Test 2 (Maletsky & Andrews, 2007). Both tests were identical and measured the same concepts. The research study used the MASC (Henry & Chiu, 1990) to track and examine the changes in the math anxiety levels of the Grade 5 male and female students by allowing the students to self-evaluate their math feelings. The students rated themselves without adult assistance. I examined the impact cooperative groups had on the math anxiety of the Grade 5 boys and girls.

I used cooperative groups to address the math anxiety of the Grade 5 male and female students in the treatment group. There were different types of cooperative learning models, which included the jigsaw method or pair and share. The cooperative group model that was selected for use was Johnson and Johnson's (1995) "Learning Together" Model. The Learning Together model was aligned to the objectives of this study. The rationale for small group instruction as a strategy for improving academic achievement centered on peers working and conversing together to solve an academic task. The small group instruction was used to incorporate the Learning Together Model.

The treatment group worked together on a four-member, mixed-ability, heterogeneous team consisting of two males and two females for 9 weeks. Hancock (2004) believed a cooperative group of mixed ability was the most effective strategy to use with students who are in Grade 3 through Grade 12. The treatment group had one

assignment, twice weekly, to complete and submit. Students worked together two times per week for a total of 70 minutes. Rewards for working together appropriately, completing assignments in the time given, and discussing the activities were given to a group not to an individual. The treatment group worked to improve problem solving skills and attitudes. The treatment group had 32 students that participated in the cooperative group setting and were students of the researcher.

The control group of 32 students participated in a noncooperative group setting that consisted of straight rows, teacher instruction, whole group instruction, and worksheet driven activities. The activities reviewed the math concepts taught earlier in the class period. The control group functioned as a whole group class for 9 weeks. The control group students were math students taught by another certified Grade 5 math teacher. This teacher had appropriate college training to teach and lead in this capacity for the betterment of this research study. The teacher of the control group has taught for six years in Grade 5 mathematics.

The teacher of the control group and the teacher of the experimental group planned together weekly to ensure the same lesson was presented to the students at the same time. Both groups completed the math test, followed by the MASC on the same day and during the same class period. The students were accustomed to completing two tests each testing time. The data procedures were aligned to mimic those of the regular school day. The Math Test 1 and 2 contained two addition problems, one subtraction problem, two problems relating to number sense, six multiplication problems, one geometry problem, and two division problems. All of the math problems were randomly selected

from the Grade 5 math text, *Harcourt Math* (Maletsky & Andrews, 2007). The school district provided all math teachers with professional development opportunities for using the math textbook. The district's objective has been to have all math teachers teaching the material consistently across the grade levels. The school district had a curriculum map the teachers followed.

The independent variables for this research study were the use of cooperative groups and the students' gender. The dependent variable was the students' math anxiety. The study took place at a rural elementary school in southeastern U. S. This quantitative study used the information from the MASC Instrument in order to compare the mean difference of the control group and experimental group over the course of the 9-week study. At the end of the study, an ANOVA determined the difference between the control group and the experimental group. The gender based study of Grade 5 male and female students used the MASC to rate themselves on each question using a scale of 1-Not Nervous, 2- A Little Bit Nervous, 3-Very Nervous, 4-Very, Very Nervous. Each student's score were totaled to begin data analysis.

With principal consent, 64 Grade 5 students, 32 males and 32 females participated in the study. Of those who participated, each student's name was confidential and anonymous (See section 3 for more detail). Each student had a label of "1" for male and "2" for female, and an identifying alphabetical letter such as "A, B, C", and so forth.

Prior to the beginning of the school year, the school's principal placed students in the Grade 5 based on their fourth grade standardized test scores in reading and math. As a result of those standardized test scores, students were placed academically into low,

average, or above average groups by the principal. An ANOVA was used to determine the significance of the study. Threats to validity included the high migrant population with students who were frequently transferring in and out of the system. In addition, the researcher taught the experimental group and the other Grade 5 math teacher taught the control group. Due to different teachers and possible different teaching styles, the classroom environment may have varied to some extent. Both classrooms used the same discipline and classroom management plans. The control group lessons and activities were presented to the whole group. Students not enrolled during the Math Test 1 did not participate in the study. Results proved that cooperative groups did benefit students with math anxiety. It will be possible to address these findings with the staff through a staff development workshop during next school term.

Research Questions and Hypotheses

The following research questions are addressed in this study.

1. Will there be a significant difference between Grade 5 students in a cooperative group and Grade 5 students in a noncooperative group setting on math anxiety as measured by the MASC?

$H_{0:}$ There will be no significant difference between students in a cooperative group and students in a noncooperative group setting on math anxiety as measured by the MASC.

$Ha_{1:}$ There will be a significant difference between students in the cooperative group setting and students in the noncooperative group setting on math anxiety as measured by the MASC.

2. Will there be a significant difference between girls in a cooperative group and girls in a noncooperative group setting on math anxiety as measured by the MASC?

$H_{0:}$ There will be no significant difference between girls in the cooperative group setting and girls in the noncooperative group setting on math anxiety as measured by the MASC.

$Ha_{1:}$ There will be a significant difference between girls in the cooperative group setting and girls in the noncooperative group setting on math anxiety as measured by the MASC.

3. Will there be a significant difference between boys in a cooperative group and boys in the noncooperative group setting on math anxiety as measured by the MASC?

$H_{0:}$ There will be no significant difference between boys in the cooperative group setting and boys in the noncooperative group setting on math anxiety as measured by the MASC.

$Ha_{1:}$ There will be a significant difference between boys in the cooperative group setting and boys in the noncooperative group setting on math anxiety as measured by the MASC.

Purpose of the Study

The purpose of this gender based quasi-experimental quantitative research study was to implement a teaching strategy, cooperative groups, to ascertain if there was an impact on the male and female students' levels of math anxiety in a Grade 5 classroom. The school currently does not incorporate cooperative groups and standardized math

scores have continued to decrease. Using cooperative groups may also benefit the students' standardized test scores as well as decrease feelings of math anxiety. The independent variables were identified as the male students and the female students. The dependent variable was the math anxiety of the Grade 5 students.

Theoretical Foundations and Conceptual Frameworks

The theoretical foundation for this study was based on the socialization theories of Vygotsky (1978), Dewey (1910), Bandura (1976), and Piaget (1969). These theorists indicated that low-level learners as well as high-level learners benefitted from cooperative groups. As applied to this study, the theory held that the use of cooperative groups influenced the math anxiety, because according to the research; cooperative groupings appeared to have a positive effect on how a student learns (Malmgren, 1998).

Vygotsky (1978), in the social cognitive theory, reflected the structure of the cooperative group. Vygotsky believed that infants were born with some level of social-cognitive ability. This ability would have been enhanced as long as the children grew-up with understanding and supportive adults who encouraged their verbalizations and permitted collaborative conversations. Vygotsky found that through these collaborative or cooperative encounters, children or students would learn to think more academically and in ways that were more appropriate. Townsend and Hicks (1997) agreed with Vygotsky that students who enjoyed the peer interaction would benefit the most from the use of cooperative groups. Vygotsky revealed that, when children talked to one another, it became easier to complete a given task.

Piaget and Inhelder (1969), through years of research, attempted to understand how knowledge was developed, or what action was necessary for knowledge to develop. Piaget and Inhelder found that children needed to discuss their findings and outcomes as well as have a stimulating environment in which to learn. Children need to be active learners, have hands-on opportunities, and not become the listless passive learner that is too often the case. Dewey (1910) found students would do much better if they had new experiences to build upon prior experiences. By presenting the students with challenges and allowing them to work together to solve verbally a challenging problem, the students would have advanced in cognitive development. Bandura (1976) asserted that students were apt to act ideally if the result would be of importance to the students and offered desirable rewards.

Piaget and Inhelder (1969) identified the outcome necessary for success in cooperative groups, believing it was effective and beneficial for everyone who participated because they became active supporters and participants with one another. Each group member shared equally in the responsibility for learning and reaching mastery of the lesson or unit; no one could have been slack on his or her part. The entire group depended on the other members for success.

Albert and Antos (2000) asserted that mathematics is a challenge for many male and female students, regardless of the age. To make the learning process easier, students needed to know how to problem-solve using the strategy of cooperative groups. However, the problem stems from more than just the students, the teacher must also be willing to put aside the direct instruction technique in order to allow the children to hear

one another think aloud through verbalizations (Albert & Antos, 2000). Heimlich and Norland (2002) believed the teacher must be willing to incorporate other strategies, asserting that the objective of the teacher is to create an environment conducive to learning. Heimlich and Norland discussed the individual learning styles and preferences of the students that teachers should be aware of and plan around.

Panitz (1997) believed students are able to learn by talking to peers and teachers in an informal as well as formal setting. His comment returns to teaching the students appropriate social skills. Webb, Farivar, and Mastergeorge (2002) found the use of cooperative groups has increased since the 1990s. However, Townsend and Hicks (1997) discovered talking and visiting were more important to students than knowing how to perform a mathematical equation. Barron (2003) added that cooperative groups were often aggravating for students, which in turn led to off-task behavior and feelings of inadequacy. With the formal groups, students were in the groups for a longer amount of time, and the teacher formed the groups according to the objectives of the lesson or unit.

Gardner, Mason, and Matyas (1989) cited by Townsend and Hicks (1997) that girls benefitted from cooperative groups more than boys benefitted from cooperative groups. Duckworth and Seligman (2006) believed control and academics gave females an edge in all subject areas versus that of male students. Duckworth and Seligman affirmed males out-performed females on standardized tests and intelligence tests. Pomerantz, Altermatt, and Saxon (2002) asserted that males will have external problems, but females will keep their feelings internalized. These internalized feelings will eventually lead to depression and fear.

Working in small groups, eliminated the feelings of math anxiety. Math anxiety is a factor students bring on themselves according to Kaplan, Olah, and Locuniak (2006). Meaning, students believe math is too challenging; however, Fulano (2001) and Piaget and Inhelder (1969) believed students picked up tendencies of math anxiety from parents and other adults, but Perina (2002) felt math anxiety came from the teacher who hated teaching mathematics.

Math anxiety was the fear of performing mathematical tasks according to Uusimaki and Kidman (2004). It was a fear of not having the knowledge or expertise to be successful in completing a math task regardless of whether it is simple or complex. Math anxiety occurred to students who did not understand the mathematical procedure. When the math grades began to drop below the students' acceptable level and students no longer believed they could be successful in math, math anxiety had began to set. Math anxiety was an emotional response to what was happening to the students, and it did not matter at what age that occurred (Gierl & Bisanz, 1995 & Uusimaki & Kidman, 2004). Farrell (2006) stated that math anxiety seemed to develop during the elementary and secondary school years, and according to Townsend and Wilton (2003) math anxiety increased the older a student became. Students with math anxiety have viewed the math anxiety as a threat to their self-esteem, and eventually considered it acceptable to fail at math (Gierl & Bisanz, 1995; Uusimaki & Kidman, 2004).

Population and Sample

The population of the study was Grade 5 male and female students in a rural public or charter school in a southeastern state in the U. S. This study could be

generalized to a similar Grade 5 public school population from a rural setting. The sample was $n = 64$ Grade 5 math students that participated, from the rural southeastern elementary school in Georgia. There were 32 males and 32 females in this 9 week study. The students from the treatment group who did not participate in this study did the same assignments as students in the control group. This was a convenience sample due to the convenience and availability of the students.

Operational Definitions

Cooperative groups: Two or more students working together with a common goal of mastering academic material (O'Donnell, et al. 1986). Groups may be formed based on gender, strength, weakness, or interest.

Title 1 Schools: Schools with remedial programs for students who are disadvantaged and attend schools in poverty-stricken districts (U. S. Department of Education, 2007). The remedial programs may include the after-school program, and/or additional remediation services offered during the regular school day.

Math anxiety: A "negative emotional reaction to situations requiring mathematical thought" (Hadfield, et al. 1998, p. 85). Math anxiety is viewed as a negative impact on students.

Self-discipline: "The ability to suppress pre-potent responses in the service of a higher goal and further specifying that such a choice is not automatic but rather requires conscious effort" (Duckworth & Seligman, 2006, p. 199).

Assumptions, Limitations, Scope, and Delimitations

Assumptions

It was assumed that students responded accurately and honestly as they reflected on their experiences pertaining to mathematics and completed the MASC Instrument. It was assumed the male and female students were able to complete the MASC without additional teacher/researcher clarification or input. It was assumed that the cooperative groups were not aware when making problem-solving mistakes since the students were homogeneously grouped by academics. It was assumed the students would work effectively with students of the opposite gender. It was assumed that self-discipline would be used and the cooperative groups would not be praised for their work until the appropriate time to do so (Duckworth & Seligman, 2006). It was assumed that the students would display some episodes of math anxiety due to the problems on the math pretest and the various levels of difficulty. It was assumed the Hawthorne Effect (Rosenzweig, 2007) or The John Henry Effect (Colman 2001) would not affect the student data. It was assumed the control group and the treatment group would not realize the experiment involved the math class. No changes were made in the noncooperative group that caused alarm or signaled that an experiment was being conducted. When the research project began implementing the cooperative groups, the students were not alerted the research project had started. No changes in behavior or academics were expected to skew the male and female data in this research study. It was assumed that rearranging the desks into 4-desk clusters did not alarm the students. It was assumed that the two different teaching styles between the control group and experimental group did not skew the Grade 5 male and female data.

Limitations

A potential weakness of the study was the minute number of students entering the school throughout the duration of the school year for the planting and harvesting seasons for the area. Since these students may have more math anxiety because of their frequent moves and school changes, these students were included in the research study, if they were present for the entirety of the research project. It was a limitation that the community was a rural setting.

Difference in teaching styles may have been a possible limitation. Two teachers teaching the same material may have been varied in their student instruction. Another weakness of the study included the fact that some student participants may have feared adverse consequences from the teacher if they responded negatively on the MASC. Students may have believed their negative answers may have given them a bad grade. Students were reassured there were no negative consequences for honesty. The students rated themselves on the MASC without teacher assistance. Although, according to Henry and Chiu (1990) teachers may clarify any statement for the student to understand. Permission to use the MASC was granted by Henry (Appendix E).

An additional limitation of this study was the lack of parental interest. There was little to no input from the parents of the students. Parents of the Grade 5 students seldom attended the teacher-parent conferences. This limited the enthusiasm the students were entitled to feel for math.

Scope

During the 9 week study, the experimental group participated in cooperative group work using 32 students to determine if cooperative groups had any effect on a student's feelings of math anxiety. These results were compared with the control group of 32 students that did not participate in cooperative groups. The control group and experimental group were considered equivalent in mathematics performance based on their standardized test scores from April 2009. Students were not aware of the standardized test scores findings.

Delimitations

The study was confined to the rural southeast Georgia school of Grade 5 math classes. The study incorporated a math class, as the noncooperative group, taught by another certified Grade 5 math teacher and a Grade 5 math class was taught by the researcher. Since this is a Title 1 school, several students involved in the research study were also involved in a remediation class for enhancing their basic math skills. This school system utilized 9 week grading periods; therefore, the time span for the study ran for 9 weeks. In this quantitative study I focused on the students' math anxiety. The quantitative study contained data comprised from the MASC Instrument. The Math Tests 1 and 2 was not be used for collecting data, but instead created the educational structure and testing environment the students were accustomed to having in Grade 5. The math test was identical each time and covered identical concepts. The math test is usually administered at the beginning and end of the school year; however, for the purpose of this research study, the math test was administered at the beginning and end of the 9 week

research study. The math teacher can administer any test at any time for educational purposes such as diagnosing student strengths or weaknesses. The math test contained math problems from the end-of-the-year test from Grade 5. The math test problems came from the adopted math curriculum of the school district, *Harcourt Math* (Maletsky & Andrews, 2007). The questions were selected randomly from a test question bank provided by the textbook company. *Harcourt Math* gave written permission to use the test bank questions (see Appendix D). The MASC gave the data necessary for identifying the similarities and differences of the quantitative study between the genders in the treatment and control groups. The MASC Instrument was validated and was found to be reliable (Henry & Chiu, 1990).

Significance of the Study

This quantitative study investigated the effectiveness of cooperative groups on Grade 5 students with math anxiety. After participating in this study, students were able to view themselves as successful in mathematics. This student success gave significance to this study. The effects from this study gave students the courage to take and complete the state standardized test in mathematics. According to Tobias (1991), adults are intelligent enough to learn math, but believe they are not able; therefore, adults set themselves up for failure. The results of this study are fundamental in adapting a classroom environment to one that includes the use of cooperative groups and combats math anxiety. Since research is indicating math anxiety begins as early as the primary grades, this study is especially important for teachers of young students.

At this time, there are no professional development programs for this school system dedicated to cooperative instruction. Since cooperative groups do make a significant reduction in math anxiety, a professional learning workshop may be necessary to train interested teachers on the use of cooperative groups (Alsup, 2005). It may be necessary to provide the support for implementing the cooperative group strategy.

The objective of this study was to establish social change by creating students who contribute to a global society when they enter the workforce. A social objective of this study included the desire to have positive statistical data that would be implemented into the classrooms of the research site. Olivera (2004) asserted that, "The social…approach argues that working in groups promotes a sense of identification and concern for others" (p. 446). Levine (2009) interjected that teachers need to put students into leadership roles in the K-12 classroom. Students who are leaders in the classroom are students who are confident and assured of their math performance and understanding. This confidence and assurance will carry over into the adolescent, teen, and adulthood stages and is a factor in other areas such as the community.

Society does not encourage tackling one's fear of mathematics. It seems the norm allows the fear of mathematics to continue to grow, fester, and remain secret. Teachers need to be aware of their influence on students and realize they can do much to help alleviate some of the math fears students possess (Malinsky, et al., 2006). Educators more cognizant of their own beliefs and attitudes towards math are fundamental in changing the attitudes and beliefs of their students (Malinsky, et al.).

It was not the intent of the study to provide students with a "crutch" that would prohibit them from ever working independently. This study increased the motivation of the participants so that social change is imminent. The goal was to create students who were math-able and motivated to be active participants in advanced math classes and able to function in a society that requires much from its citizens. A key component of this study was to have students who were focused mathematically and ready to take an active role in the community, performing a task that contributed to society locally, nationally, or globally. It was the intent of this study to prepare students who were math proficient, who believed they could take advance math courses, who desired to compete in life, and who were motivated to thrive in their community or in a global society as adults.

Transition Statement and Summary

This local study assisted to answer the question about the value of using cooperative groups in an upper elementary classroom at a rural upper elementary school. The results of this study may be of interest to other educators working in a similar grade level or interested in using cooperative groups. These findings may be generalized to a larger population and may be generalized to any grade level.

The use of cooperative groups in an upper elementary classroom may eliminate or reduce the students' feelings of math anxiety. It was necessary for groups to have a challenge within their realm of academics to have success. The quantitative research study accommodated the students with special needs and had a plan for assigning those students with appropriate tasks to carry out during the cooperative group session. In order

for each concern to be minimized, the cooperative groups were formed in a manner that best benefited the students, taking into consideration their gender and mathematical ability. Taking into consideration the formation of the cooperative groups, social change was forthcoming since students were working in groups that previously did not socialize together and had different socioeconomic backgrounds or ethnicity. Social change will also benefit the future of these students since it may assist them in becoming productive individuals in society. The hypothesis for this study was that cooperative groups assisted male and female students who had math anxiety so they too were successful in mathematics. This study will contribute to the body of knowledge needed to address this problem by measuring math anxiety before and after students were involved in cooperative groups.

A review of the literature is presented in section 2. Section 3 explains the methodology and research design used for this project. Section 4 will be a discussion of the findings. Conclusions, discussion, limitations, and recommendations will comprise section 5.

Section 2:

Literature Review

Introduction

Since 2000, students entering Grade 5 have demonstrated a lack of basic math skills (Slavin & Lake, 2008). This literature review includes discussion of the area of math anxiety and its effect on student learning, as well as the effect cooperative groups have on math anxiety with Grade 5 students. The purpose of this research project was to determine whether using cooperative groups reduced a student's feelings of math anxiety and improved student participation and achievement in the Grade 5 classroom.

The review covered math anxiety and discussed the causes as well as implications for students. Next, gender differences and the use of cooperative groups were discussed. The literature review was strategically developed through an intensive review of current research. Supporting documentation was gathered through Internet searches, EBSCOhost, ProQuest, and ERIC (Educational Resources Information Center), peer-reviewed journals and textbooks. The keywords used to identify scholarly or peer-reviewed research articles were *cooperative groups, cooperative learning, collaboration, gender differences, elementary mathematics,* and *math anxiety.*

The U.S. Department of Education (2007) compared the United States elementary or high school mathematics programs to the math programs in other nations and believing the U. S. was lacking in the field of mathematics (Clough, 2008). Furner, Yahya, and Duffy (2005) wrote, "In this high-tech and globally competitive society, it is becoming more and more important that all citizens be confident in their ability to do mathematics.

Knowledge of mathematics is an important skill necessary [for success] in today's world" (p. 16). Slavin and Lake (2008) reported that in the United States, students in the eighth and ninth grades ranked in the 28th percentile with mathematics. Farrell (2006) stated, "Attrition rates in mathematics…programs average about 60 percent nationwide. And only about 2 percent of undergraduates major in math" (p. 3).

Math Anxiety

There was a large body of literature relating to math anxiety, its causes, and the strategies to decrease it. Researchers have not covered using cooperative groups to reduce math anxiety. Math anxiety derives from several different theories. Tobias (1991) claimed math anxiety was one of a political nature. Piaget and Inhelder (1969) found students get math anxiety from parents and other adults. However, Brady and Bowd (2005) found that math anxiety came from the teacher who hated teaching mathematics. Alsup (2005) and Woodard (2004) found preservice teachers, unqualified teachers, and teachers with low self-esteem were causes of math anxiety. Regardless of the orientation of math anxiety, Alsup (2005) stated, "Math anxiety…can have…a crippling effect upon students learning mathematics" (p. 4). An effective strategy must be used in order to assist the student to reach his or her highest level of mathematics success.

Causes of Math Anxiety

Malinsky, et al. (2006) explored the math anxiety of preservice teachers who were in their last semester of college, but in the classroom for the student-teaching experience. Malinsky, et al. conducted research at Arkansas State University during the 2005-2006 school year. They discovered preservice teachers, who possibly had math anxiety and

were teaching young children, were effective in passing the math anxiety on to their students. The project results indicated the participants believed stereotypical math myths were true and evident in their own learning situations as indicated on the Mathematics Anxiety Rating Scale (MARS) and Mathematics Anxiety Rating Scale Revised (MARS-R) tests (p. 4). However, according to Stodolsky (1985), math anxiety is normally identified though self-assessment with questionnaires that covers scenarios involving math class and math tests. Math anxiety was the factor that, according to research, students brought on themselves or was passed down by the teachers (Malinsky, et al. 2006).

Uusimaki and Kidman (2004) found math anxiety was the fear of performing mathematical tasks. It was a fear of not having the knowledge or expertise to be successful in completing a math task regardless of whether it was simple or complex. Math anxiety could present in a student who did not understand the mathematical procedure.

Jordan, Kaplan, Olah, and Locuniak (2006) claimed some students eventually learned to dislike everything relating to math and developed math anxieties or phobias. It did not begin or stop with the students, occasionally a teacher also became a factor for a student's math anxiety. In addition to the findings of Jordan, et al. Woodard (2004) added unqualified teachers and low self-esteem to the list of causes for math anxiety in students. However, based on the No Child Left Behind (2001) ruling, at this time, teachers must be highly qualified to teach in the U. S. schools.

Wigfield and Meece (1988) stated that in studying students who were ages 12 through 18, the highest level of anxiety occurred in Grade 9. Students with the lowest level of math anxiety were in grade six, but according to the study of Wigfield and Meece gender did not determine the results of either group. Gierl and Bisanz (1995) conducted a study with students in Grades 3 and 6. Gierl and Bisanz looked at three areas relating to math anxiety. One area focused on relating math anxiety to student attitudes, and secondly whether a difference existed between the levels of math anxiety in Grade 3 versus Grade 6. Using the MARS-E, they tested a total of 95 public school students in grades three and six, regardless of gender. They found that math anxiety gradually increased at every grade level especially in the area of problem solving. They also found that in Grade 3 and 6, students were more likely to worry over mathematics which led to the math anxiety.

Jackson and Leffingwell (1999) and Steele and Arth (1998) supported Uusimaki and Kidman (2004) by pointing out that, after third grade, students began to change their attitudes about math and other subjects too. Students answered questions about the mathematical concepts they disliked most, and fractions and long division seemed most problematic. Uusimaki and Kidman found that, since fractions and division were not part of the early elementary curriculum anxiety could begin as early as second grade and continue through adult life.

Effects of Math Anxiety

Math anxiety exists. Engelhard (1990) found math anxiety could lead students to avoid additional math classes or math related activities. Teachers who have math anxiety

may not teach math daily or may avoid it entirely, and those who do teach math may change tones, be uptight, or respond to the students negatively. Students race through the tests and assignments, or turn in blank assignments at the end of class due to math anxiety. Math anxiety may affect anyone, although some look calm and accept the outcome of poor performance and grades as failure. Tobias (1991) concluded that once students feel the math anxiety or the panic had begun, the teacher needed to be able to recognize the math anxiety signs in order to aid in reducing the feeling, not elevating it.

The Gender Factor

Relevant to this research study was consideration of the differences between the genders pertaining to math anxiety and cooperative groups. Pomerantz, et al. (2002) studied males and females ages 9 to 11, looking at academic performance in math, language arts, science, and social studies, and anxiety levels over a 12 month period. The study included 466 male and 466 females of various ethnic groups. Pomerantz, et al. found that differences in gender were small when comparing performance and characteristics. However, Pomerantz, et al. found that females are academically better than males in subject areas such as language, writing, and reading. The study reported it was females and not males who worked to please the adults they interacted with daily. Pomerantz, et al. believed this desire to please adults and teachers may have lead female students to experience inner anxiety at the first sign of lacking success especially whenever failure is confronted. Boys, on the other hand, were not concerned about disappointing anyone so their lack of motivation or lack of success in the classroom was of no concern to them. Pomerantz, et al. concluded females cannot be forgotten or pushed

aside on the mere fact that females are doing better academically. It was imperative that males and females continue to be monitored.

Muzzatti and Agnoli (2007) conducted two experimental studies; both investigated the gender differences or stereotyping that occurs in mathematics during the fourth through eighth grades. The first study included 264 boys and 212 girls in Padna, Italy from Grade 2 to Grade 5. The second study contained 271 students in Grades 3, 5 and 8. The experimental group environment was constantly reminded that math was a male domain by use of poster manipulation of male mathematicians. The control group environment refrained from identifying gender by using posters of neutral stimuli such as flowers and fruits. The research projects were conducted with 2 weeks between the treatments. After the treatment, students were asked to rate the male or female mathematical ability. Muzzatti and Agnoli found that the younger students did not display any evidence that boys are better at mathematics than girls are, but by Grade 5, both genders believed that boys were better mathematicians than females.

Following the second experimental project Muzzatti and Agnoli (2007) found that before age 12, girls are participants in math but, once girls reach middle school age, the characteristics of math anxiety begins to build negativity and self-doubt. Muzzatti and Agnoli found that 10-year-old boys and girls agreed that mathematics was a subject where males were superior to females. By the time these same students entered high school, they were more inclined to believe males and females were equally good at math.

Tiedemann (2000) conducted a research study in Germany using 589 predominantly middle-class White students. The study looked at the parents, gender

stereotypes, and the mathematic ability of their children. The results showed parents and teachers believed boys to be better at mathematics than girls even though the students had no differences when it came to performance. This study provided the foundation for the biases that parents passed on their children.

Duckworth and Seligman (2006) conducted a research study to determine if females were more self-disciplined than males, as well as why males out performed females on standardized tests and IQ tests. The researchers gathered data from parents, teachers, and the 140 Grade 8 students. Their study found females brought home better grades on the report cards, but due to stereotype threats, the males outperformed on tests such as the Scholastic Aptitude Test (SAT) using the multiple choice format. However, Duckworth and Seligman reported females outperformed males on open-ended response items. Duckworth and Seligman found that females who used self-discipline and completed academic tasks prior to beginning a more pleasurable task performed better academically than males the same age. Duckworth and Seligman found girls are more self-disciplined when it comes to their academics and their studying.

Researchers have studied the effect of math anxiety on gender. Esmonde (2009) found the groups with mixed gender achieved higher compared to groups that were homogeneously grouped by gender. Esmonde discovered there was little difference between the two genders regarding math ability. Mulryan (1992) discovered girls benefitted “more from involvement in cooperative small-group work than do boys, especially in terms of achievement gains on higher order mathematics tasks” (p. 262).

Marsh and Tapia (2002) conducted a study with 124 college students using the Attitudes Towards Mathematics Instrument (ATMI). Marsh and Tapia found males and females are equal in math and science until age 13. Muzzatti and Agnoli (2007) found the same gap with the gender. At age 13, a gap begins to form. Marsh and Tapia postulated that if students have positive attitudes about mathematics, they may perform better. Their study showed that the effect of gender was not significant on whether or not a student had math anxiety.

Sepie and Keeling (2001) conducted a study with 246 students from Grade 6. The project data, taken over a course of 8 days, showed a discrepancy between genders. Girls scored higher with feelings of anxiety. Sepie and Keeling gave a possible reason as being boys do not feel threatened by math tests. This supported the findings of Pomerantz, et al (2002) affirming that males did not care about grades.

Normally, students developed math anxiety during middle school. However, it has been proven that math anxiety could begin earlier than age 13. Englehard (1990) and Wigfield and Meece (1988) found that math anxiety was found in males more so than females prior to this age. Furner and Berman (2002) found females do not display math anxiety until age 14 or later.

Barnett and Rivers (2004) affirmed students in the early elementary grades saw mathematics no differently and did so until about 12 years old, but at this time, girls began to change their attitudes towards mathematics. Arbor (1994) pointed out that with children ages 9 to 12 years old, changes began to emerge a little but, by 13 years old students decided good grades represented success or failure in math. It was necessary for

teachers and parents to encourage students to pursue advanced math classes in high school and college. Parents and teachers should have been knowledgeable enough to explain how vital math was to our global economy as well as personally (Barnett & Rivers, 2004). Horace Mann, as cited by Badolato (2002), felt that, by having the comprehension of mathematics, science, reading, and writing each student can gain the ability to attain things that would otherwise have been unavailable to them. If students did not have the proper skills when they entered the workforce, the job would go to someone who did have the proper math skills (Badolato, 2002).

The Home Environment Relating to Math Anxiety

Englehard (1990) found the home environment may have contributed to students having math anxiety. Englehard discovered in his study with Thailand and the United States, using 13 year olds, that the mother's educational achievement, or lack of achievement, played a major role in the math anxiety of children. Englehard conducted his study using more than 4,000 students in the U.S. and 3,600 students in Thailand. Englehard reported the mother's education influences the home environment, the learned language skills, and the educational goals established by the children had an impact on the math anxiety level. In the study, Englehard revealed that math anxiety was more dominant in the United States than in Thailand and both genders had high levels of math anxiety.

One reason for math anxiety may have stemmed from parents unconsciously portraying math in a negative light. Maslow, as cited by Fulano (2001) established parents passed feelings onto their children unconsciously. Piaget and Inhelder (1969)

added other adults who played part of the parental role may have forced their conscious feelings upon the children too. Arbor (1994) advised parents to be careful with the negative comments they unintentionally made about math. There was not a math gene to inherit from mom or dad regardless of what the children and parents believed, but parents did play a major role in how children viewed mathematics. Tobias (1991) revealed parental input had a great deal of bearing on students and math anxiety. Research showed the mother's education had an influence on the children in the home, and the higher the education of the mother; the less math anxiety children have (Engelhard, 1990).

Furner, et al. (2005) and Tobias (1991) stated the mother's fear, father's demands, sibling pressure, and peers had a negative impact on the person with math anxiety. Math held panic for many people, young and old, and parents were no different. Parents could have math anxiety, and unknowingly model math anxiety to their children.

Teachers Causing Math Anxiety

Math anxiety in college students was higher than the math anxiety level of students in Grades 4-12, based on the research of Ashcraft (2002). Ashcraft agreed that math anxiety among college students has continued to rise. According to Ashcraft, college students selected a college degree program based on the math courses needed to complete the degree requirement. Greenberg and Walsh (2008) revealed some student teachers could avoid math classes entirely during their undergraduate studies and never take a math class. Students would actually change their career choices to avoid having to take additional or advanced math courses such as calculus. This may be a contributing

factor of why the United States has continued to lag behind other countries academically such as New Zealand, China, and Japan, in the areas of mathematics and the sciences (Brown & Gray, 1992; Cai, 2001; Ferrini-Mundy & Schmidt, 2005). Agreeably, Clough (2008) asserted that the United States is consistently being surpassed by other nations simply because students are not selecting careers in the fields of science and engineering. Patton and Roschelle (2008) gave yet another perspective, arguing math textbooks are a reason the U. S. is lagging behind other countries in mathematics. Patton and Roschelle found some countries use a mathematics curriculum that emphasized deeper content but fewer topics unlike the math curriculum of the U. S. It may have become necessary to make adjustments in order to change the participants' attitudes towards mathematics and lessen the math anxiety.

The mathematics classroom may have several contributing factors for causing math anxiety. Brady and Bowd (2005) and Englehard (1990) found that, when the student teachers disliked math, they may not have taught math regularly or with confidence. Perina (2002) found teaching styles may have also been a math anxiety inhibitor. Harper and Daane (1998) found in their research with 72 elementary classrooms that student experiences lead students towards confidence in mathematics or the lack of confidence in mathematics. The lack of confidence eventually created a barrier in secondary mathematics classes.

Brady and Bowd (2005) used 238 education students who were ready to begin student teaching. Brady and Bowd administered two instruments, a survey and the MARS test. They found females scored higher on math anxiety traits than males. Brady and

Bowd noted that approximately one-fourth of all high school teachers were not certified for teaching mathematics. In 1999, the U. S. had approximately 85 % female educators in the elementary school setting, and many felt unprepared to teach mathematics (Klecker, 1999).

To counteract this problem, the U. S. Department of Education (2001) implemented the NCLB law, it was determined that teachers being unprepared was slowly changing, and teachers were being certified in the field they were teaching. Moyer-Packenham, Bolyard, Kitsantas, and Oh (2008) agreed. They looked into the "behaviors, practices, and beliefs…subject knowledge, pedagogical knowledge, experience, certification status, and general ability" of student teachers who had completed a survey or questionnaire (p. 562-564). Moyer-Packenham, et al. (2008) reviewed 123 annual reviews of highly qualified teachers finding the instruments used, questionnaires and surveys, adequately identified the highly qualified teachers for mathematics and science.

Brady and Bowd (2005) discussed the fears of preservice teachers after the preservice teachers completed a six week practicum course in an elementary school. The preservice teachers who disliked math scored higher in anxiety. In addition, Brady and Bowd found student teachers who disliked math and teaching math to others may have made the student teacher less effective in the area of mathematics. When the preservice teacher disliked math, without realizing it was anxiety, he or she may have spent less time in teaching mathematics. That time was given to completing other subjects or activities (Brady & Bowd, 2005). Other researchers agreed, reporting that female college

students majoring in early childhood education displayed attitudes of higher math anxiety than males exhibited (Ashcraft, 2002; Brady & Bowd, 2005; Vinson, 2001).

Uusimaki and Kidman (2004) discovered from their work with student teachers in Brisbane, Australia that most of the student teachers began as primary students disliking math because of their teachers' actions and attitudes. Uusimaki and Kidman found students needed to see others struggle in math as they did in order to understand they were not alone. Students also needed the opportunity to work with other students in order to see the many different ways to answer a problem. When working as a collaborative group, new ideas formed. The group offered constructive criticism to one another, and this helped establish a learning opportunity. Uusimake and Kidman (2004) found that once the student teachers became aware of their math anxiety, they were able to work with their fears and control the anxiety. The anxiety did not go away immediately, but the student teachers were aware of its existence.

Furner and Berman (2002) and Uusimaki and Kidman (2004) found teachers have had a major impact on how the students viewed their love or hatred for mathematics. Ultimately, teachers have had the key to helping students reduce or eliminate their anxiety toward math. However, teachers had to be aware it existed in order to help the students. The students were impressionable and noticed the teacher's love or hatred for mathematics. A teacher's negative feeling towards math created students with negative feelings towards math, whereas the teacher's positive attitude towards math reflected positive attitudes towards math onto the students. The students

came to view math as fun and inviting rather than viewing math with trepidation, or as boring (Furner & Berman, 2002).

Poor Achievement and Math Anxiety

Sepie and Keeling (2001) conducted a study using 246 Grade 6 students. Students were given the Progressive Achievement Tests (PAT) to determine if under-achieving students would show a greater measure of anxiety than over-achievers. Sepie and Keeling discovered there appeared to be a relationship between math anxiety and achievement with students between 9 to 12-years old. In their study, Sepie and Keeling found under-achieving students had separated themselves from those who were over-achievers since the over-achievers had no signs of math anxiety. Sepie and Keeling reported that the students were given a standardized test and intelligence test to determine the ranges of the participants. Micallef and Prior (2004) found that children who were under-achievers in mathematics were poor problem solvers. Students who were poor problem solvers often lagged behind their classmates in mathematics. Ezarik (2001) believed math anxiety led to lower competence in mathematics.

Math Anxiety and Memory

The investigation into math anxiety has been found to impact memory. Miller and Bichsel (2003) found the visual memory of the student is most impacted. Colleges provided study skills classes that devoted time to students with math anxiety. Some literature claimed math anxiety was all about memory. Ezarik (2001) stated, “Anxiety leads to avoidance, …and… anxiety inhibits the capacity of working, or temporary, memory, possibly by the person’s failure to ignore intrusive thoughts; this results in

slower performance and more mistakes" (p. 1). Memorization has been necessary for basic mathematics. However, children who have Arithmetic Learning Difficulties (ALD) struggled in mathematics much like students with math anxiety. Micallef and Prior (2004) reported that students who have been diagnosed with ALD are slower in learning mathematics and its procedures than their classmates. The students with ALD have decreased memory skills and poor long-term development of memory.

Social Skills for Cooperative Groups

Before students are able to work together cooperatively, certain social skills may need to be taught by the teacher. The literature includes studies regarding cooperative groups, math anxiety, and socialization skills. Archer-Kath, et al. (1994) demonstrated that social skills were needed for providing encouragement in cooperative groups. Johnson, Johnson, and Stanne (1975) believed cooperative groups "are effective for increasing social interactions, inter-racial relationships, and mutual concern" (p. 372). According to Biehler and Snowman (1997) students needed to learn basic social skills of leadership and decision-making, building trust, conflict management, and praise. Williams and Sheridan (2006) found cooperative groups would assist students in reaching their potential academically, socially, and personally, as well as develop their communication skills, artistic ability, and critical thinking so that the students are motivated to learn more than previously. Panitz (1997) claimed learning is more likely in a social setting when students talked and interacted with one another. It was better to group the students away from friends if possible, but this was not to say friends could

never work together or remain on-task. They could, but teachers needed to form the "friend" groups in moderation (Johnson & Johnson, 1995).

Researchers Augustine, et al. (1990) stated, "Many regular education students lack social skills and had low self-esteem and students in a heterogeneous group, with specific tasks, may have had achievement increase, and better psychological health" (p. 5). Socially, cooperative groups allow the students to "share their experiences, ideas, see things from different perspectives, evaluate and re-evaluate their knowledge, and learn how to deal with various situations, or…constitute meaning of the world" (Williams & Sheridan, 2006, p. 87). Augustine and Williams and Sheridan found cooperative groups to be beneficial for students in the short term as well as in the long term.

Research showed students working in groups of two or more learned more than students working independently. The study of O'Donnell, et al. (1986) demonstrated this. Their research found the third person assisted in keeping the other two students on task, however, the key to successfully implementing cooperative groups was to train the students on how to use appropriate social skills when working in the small group.

Slavin (1990) found an additional benefit of using cooperative groups as one that incorporates students of different ethnic backgrounds to work together a common objective that builds to include respect and acceptance for one another. Students who worked closely with one another developed a bond that overrode the social and ethnic barriers that may have otherwise existed within the classroom. However, Webb (2009) pointed out that "Negative socio-emotional processes have also been shown to short-circuit effective elaboration in group work" (p. 5).

Malmgren (1998) stressed the benefit to low-achievers in small-group, peer-mediated instructional setting, research in cognitive psychology points to benefits for high-achievers in small-group settings as well" (p. 2). In addition, students from different socioeconomic or ethnic backgrounds improved in the area of social relationships when heterogeneous groups are part of the educational makeup of the classroom. Malmgren found when working in groups the students had other viewpoints to consider when making decisions or generalizations.

The research of Lopez-Reyna (1997) claimed, students in a cooperative learning environment reached new levels of self-esteem, liked school and its subjects better; had more time-on-task, and had better attendance. Furthermore, cooperative groups provide a chance for creating future social change with the students. Students may open themselves up to better job opportunities as well as acquiring a strategy they can use in other avenues of life. Mulryan (1992) and Entonado and Garcia (2003) reported when teachers used cooperative groups in math, the students often had the extra motivation to continue learning about math. Johnson and Johnson (1995) affirmed, cooperative learning groups impacted so much from a positive standpoint that teachers who used it found they had a valuable teaching strategy at their disposal. Lopez-Reyna pointed out cooperative groups could form new and lasting friendships that would not exist otherwise, and when groups are heterogeneous in nature, the outcome provides a more positive learning experience. The positive results included higher learning, motivation, and better racial relations (Chiu & Khoo, 2003).

Archer-Kath, et al. (1994) found students must learn appropriate social behaviors before cooperative groups would work adequately. They found, "Social skills are necessary for exchanging information within cooperative groups and for providing members with assistance and encouragement" (p. 1). Kocak (2008) found a small group cohort encourages students to work together, learn together, and the small group environment even promotes better social skills. Archer-Kath, et al. agreed that social skills were necessary for providing encouragement in cooperative groups.

Cooperative Groups

Cooperative learning is the instructional use of small groups, so students could work together to maximize their own learning and the learning of others in the group (Johnson & Johnson, 1995). In a cooperative learning situation, students learned from one another because they listened to their peers, and their peers, in turn, clarified any misunderstandings. While a cooperative group has been beneficial in many circumstances, and has shown to improve social skills, research shows cooperative groups improves a student's achievement also. However, it has not been a certainty that cooperative groups would provide the desired outcome of changing a student's negative attitude or fear of math. According to research, cooperative groups increased student achievement, and groups functioned without the teacher by their side. Students depended on their group to problem-solve for the answers (Augustine, Gruber, & Hanson, 1990).

Cooperative groups consist of approximately four to six students, but more than six students defeated the purpose of small group learning. Students showed more motivation at completing a task when working with a group versus working

independently. The groups worked best as a mixture of ability, ethnicity, and gender (Lopez-Reyna, 1997). Cooperative groups were more beneficial with Hispanic, Native American, or African-American students as proven by Lopez-Reyna who believed it was due to the Hispanic, Native American, or African-American cultures and was part of their heritage. Jacobs (2003) found with cooperative learning students work in groups of two or more to reach a common objective. The learning that incurs assists students in creating a learning community of their own that depends on one another to complete the assignment.

According to Dewey, (1910) extra activities such as playing a game could have helped students retain basic skills; however, conflict may have developed over differences in opinion. Jacobs (2003) added students should feel enough trust in their groups to question mistakes and ask for assistance, however, before trust occurs, team-building activities might be necessary. Team building games helped alleviate anxiety and mistrust.

Barron (2000) found team learning is collaboration with classmates. Barron's study (2000) of 12 Grade 6 triads, of 48 students, was a mixed study. The students were in same sex groups of three students for four 1-hour sessions. Barron (2000) also found that group work led to students being better problem-solvers than students who worked independently. Rohrbeck, Gingsburg-Block, Fantuzzo, and Miller (2003) found with their meta-analysis of peer-assisted learning that when students work together in cooperative groups the learning process seems more natural and student-controlled.

As students became older, cooperative groups dwindled to practically non-existent status in grades four and above. According to Barron (2003), when teachers incorporated peer assignments or strategies into the classroom a positive impact occurred. In the upper elementary grades, informal groups could have been part of any subject or grade; there was not a limit on its uses; the informal groups were temporary student groups, and teachers could use cooperative groups without realizing the important impact it was having on students (Johnson & Johnson, 1995). Based on work of Johnson and Johnson (1995), cooperative groups have many benefits for grades 2 through 9 that includes more than achievement and raising test scores.

Panitz (1997) found that students in cooperative groups learned from discovery when the groups were student-centered. However, Lloyd (2008) reported students learned mathematics most often as a whole group, using the lecture format. Chiu and Khoo (2003) claimed the results proved positive when students worked together cooperatively. Olivera and Straus (2004) revealed cooperative learning was students working together in small groups without competition.

Biehler and Snowman (1997) found students in cooperative groups learned from discovery when the groups were student-centered. Malmgren (1998) found cooperative groups are especially beneficial for low-level learners and learners with special needs or were mentally challenged students. Cooperative groups aided students because it increased their knowledge and participants were able to learn through others.

Archer-Kath, et al. (1994) conducted a study using 56 eight-grade students for 14 class sessions spanning 11 weeks. The cooperative groups contained five students each.

The results showed that cooperative groups provided better acceptance among peers and better grades which made their achievement rates increase.

In cooperative classrooms, students assisted one another in reaching the teacher selected goals or objectives (Johnson & Johnson, 1995). By interacting with more advanced students, the students who were weak in certain subject areas received additional support, motivation, and avenues for learning that otherwise would remain unknown. The additional support increased the knowledge and ability levels of each student in the cooperative learning group. With the cooperative group that was heterogeneous, students learned different ways to think and process the new information (Johnson & Johnson, 1995).

King (1993) conducted a study with 22 students targeting 8 American third grade students who were in two cooperative groups of four students each to observe. King placed the students into mixed ability groups of two high-achievers with two low-achievers. The groups were used one day per week for four math lessons. Of the eight children, group 1 contained two males and two females, and group 2 contained four females. King found the same-sex group worked much better together than the mixed-gender group. King found the students in the cooperative groups who were identified as low-level learners, had a greater perception of mathematics and enjoyed themselves more, as well as socially benefited from the interaction with the other students. However, King noted, the low-level learners were more passive learners than the high-achieving students. The high-achieving students were more dominant in the role of leader. King

(1993) has suggested that the roles of the group members be rotated in order to share the responsibility for completing the group assignments.

Nattiv (1994) conducted a study with 101 participants in grades 3-5 from a small school in Utah. Students were videotaped for approximately 80 minutes per week over a period of 6 weeks. Students worked in cooperative groups for approximately 40 minutes per day during the study. Nattiv used three classroom teachers who enjoyed teaching math and had attitudes conducive for a positive math experience. Nattiv wanted to determine "if gender, grade, or ability related to achievement gain" (p. 290). Nattiv used the ANCOVA to validate her findings regarding gender, ability level, and achievement. Nattiv found high-achieving students were more active participants and volunteered more than the low-achieving students regardless of the grade level of the student. The more a student participated in the cooperative group, the higher the achievement gains.

Mulryan (1995) conducted a study using 48 students from Grade 5 or Grade 6 from a small Midwestern town. For 9 weeks the students worked in cooperative groups or in a traditional classroom setting of whole group instruction completing the same assignments and activities. Students were randomly assigned to the group of mixed ability. Students were grouped with high-to-average ability students or average-to-low ability students. Mulryan found low-achieving students demonstrated less time on-task than the high achieving students. There were no differences between the genders noted. In the study Mulryan found the students were more active in the small group environment when compared to the whole group setting. The female students in the cooperative groups asked more questions than the male students in the cooperative groups. Mulryan believed

the female students perceived themselves to have more difficulty in working in a cooperative group.

McCaslin, Tuck, Wiard, Brown, LaPage, and Pyle (1994) involved 112 fourth grade students from a Missouri school. McCaslin, et al. wanted to determine if friendships had any bearing on success in a mathematics classroom. Cooperative groups were established with two males and two females or four students with the same gender. All students were similar in socioeconomic (SES) status and ethnicity. Group members remained consistent during the research study of two weeks containing six lessons. Students were grouped high-achieving with average-achieving and average-achieving with low-achieving students. Students were given a pretest with 41 items and following the study, students were given tests following each lesson and a posttest containing 12 items. The data showed that students from the mixed gender groups received more assistance in completing assignments than peers from the same gender groups. Students in the mixed gender groups also participated more in their learning experiences than those in the same gender groups. The study indicated that mixed-gender groups has more benefits and are better suited for student learning (McCaslin et al, 1994).

Gillies and Ashman (2000) conducted a study using 152 Grade 3 Australian students in a gender-balanced cooperative group for a 6-week unit in social studies. Students worked in cooperative groups or the control groups for 3-hours per week during the study. Gillies and Ashman found that when students of mixed ability were trained on how to work in a cooperative group with others, they out-performed students who were untrained. As agreed upon in the studies of Mevarech (2001) and Mulryan (1995) the

high-achieving students were more active and provided better explanations when working with their group. However, Gillies and Ashman did acknowledge that even the average to low-achieving students participated better than students in the untrained (control) group. Gillies and Ashman did not have significant results in their study to determine the effectiveness of cooperative groups. However, Gillies and Ashman believed that structured groups would provide better results than groups that were nonstructured.

Kuntz, McLaughlin, and Howard (2001) used cooperative groups with eight students from Washington in grades 3 to 6 who had a learning disability or had mild mental retardation. The IQ level of the students had a range of 41 to 91. The students worked in cooperative groups of two or three students and groups changed daily. The study was conducted over a period of 10 weeks. The data analysis showed that after working in the cooperative groups, the students with mild learning disabilities had better work ethics and were more accurate in their work production than students who were in groups of whole group instruction or individual instruction.

Mevarech (2001) conducted a study using 134 Grade 5 Israeli students placed in cooperative groups. The experimental designed research study lasted 15 weeks. Students worked in cooperative groups 4 times per week. Students were randomly assigned to classes by the school principal and randomly assigned to the treatment group or the control group by the principal based on class. All classes used the same lesson plan and resources. Results proved that students who were involved in the cooperative learning sessions scored higher than those who were in the control group. In comparing the

findings of Mevarech to researchers such as King (1993), McCaslin, et al. (1994), Mulryan (1995), and Nattiv (1994) students who were high-level learners made the most progress and academic gains as compared to average or low-level learners.

Slavin and Lake (2008) provided their work with 36 instructional studies in which nine of the studies used cooperative groups. Slavin and Lake found cooperative groups were effective in elementary student learning. Slavin and Lake encourage a minimum of 12 weeks and found that strategies used to change daily classroom practices are more beneficial than the textbook or computer alone.

Tarim and Akdeniz (2008) used 248 fourth grade students from Adana, Turkey to conduct their cooperative group study. The 14 week study used a pretest, posttest, and an Attitudes Towards Mathematics Scale (ATMI) for mathematics as the instruments of choice. The treatment group contained students of mixed ability-high, average and low and received five lessons during the course of the 14 weeks. The teacher in the control group used the same material, textbook, and resources as the treatment group. The data analysis showed the students in the treatment group outperformed the students academically from the students in the control group. All groups had good attitudes towards mathematics before the study began, and those results remained consistent on the posttest when rating the students' attitudes towards mathematics.

There are different types of cooperative learning models. Models include the jigsaw method or pair and share. This study will use the Learning Together model. The Learning Together model is aligned to the objectives of this study. The rationale for small

group instruction as a strategy for improving academic achievement centers on peers working and conversing together to solve an academic task.

Vygotsky (1978) defined this idea as the Zone of Proximal Development (ZPD). The ZPD is "The distance between the actual developmental level, as determined by independent problem solving, and the level of potential development, as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). By interacting with more advanced students, students weak in certain subject areas receive additional support, motivation, and avenues for learning. The additional support increased the knowledge and ability levels of each student in the cooperative learning group (Malmgren, 1998).

With formal groups, students were in the groups for a longer amount of time, and the teacher formed the groups according to the objectives of the lesson or unit. Panitz (1997) pointed out cooperative learning is students who are working towards one common goal or objective. The teacher had to hand-select the groups in order to have them function properly since students who played together at recess did not always work well together. Instead, it seemed to lead to off-task student behavior. When forming cooperative groups the teacher needed to look to the ending result in order to determine how the groups would function best so that each and everyone could reap the reward of success (Johnson & Johnson, 1995).

Toumasis (2004) covered math anxiety through his work with high school study teams or student teams at Bar-Ilan University in Israel. Toumasis believed, after decades of looking at cooperative learning, it did improve academic achievement areas as based

on the works cited of Johnson and Johnson (1995) and Slavin (1990). Cooperative groups have been popular in the primary setting and using cooperative groups in mathematics did provide benefits such as with academics (Johnson & Johnson, 1995; Slavin, 1990). Gillies (2000) acknowledged, "Cooperative learning has been used successfully as a classroom strategy that promotes learning and achievement across different curriculum areas from mathematics understanding and problem-solving, conceptual learning in science to narrative writing in small groups" (p. 98). Gillies explained that when students work together in cooperative groups they become aware of one another's weaknesses and work together to assure the needs of their group are met. By doing this, the group fosters a sense of ease, allowing for discussion and assistance in problem-solving activities.

Mevarech (2001) said cooperative groups may have been the best strategy for some students, but too often, the cooperative groups did not have the support or reinforcement necessary for students to be successful. Mevarech discovered too often teachers who used cooperative groups did so with little regard for the long-term benefits and eventually stopped using the strategy. Frequently, the students went without feedback or were ill equipped academically and not aware when the group made errors. This may have been problematic when the students were homogeneously grouped. It was less likely to be a problem if the students were grouped heterogeneously however, the teacher had to take into consideration the strengths and weaknesses of each student (Mevarech, 2001). Furner, et al. (2005) found cooperative learning environments work with students from various academic levels. The cooperative group provides students with positive support

as they learn from one another. Students who speak other languages or have disabilities are surrounded by positive role models that assist the foreign students to learn the new material when involved in a cooperative group.

Williams and Sheridan (2006) claimed the teacher often left the students alone and unsupported in reaching their goal. Because the students were left alone, Williams and Sheridan found the students avoided working together. The cooperative group needed monitoring and the teacher as facilitator had to have control of that role. In the Mevarech (2001) study the students were assigned to a class by the school principal. The study was to investigate the effects of cooperative groups on student achievement. The participants were 134 Grade 5 students in Israel. The fifteen-week study used the pretest and posttest scores to show the effects of cooperative groups. This study found that high-achieving students made the most progress. Those students who were average students did not make the same amount of progress. Mevarech assumed these average students needed more time to master the material than the top group and more one-on-one with the facilitator. However, Mevarech found the most popular benefit regarding the use of cooperative groups was the effect on enhancing social skills.

Mkhize (2005) found cooperative groups enhanced critical thinking, higher-level thinking, and improved upon the problem solving abilities of students. Mkhize conducted the study with 30 students and 8 teachers from Johannesburg, South Africa. The participants believed the use of cooperative groups was an effective teaching strategy. In addition, Biehler and Snowman (1997) found students from cooperative groups are

motivated better because they have higher self-esteem, better attitudes, remain on-task more often, and are better problem solvers.

According to the study of Archer-Kath, et al. (1994) cooperative learning placed the responsibility for learning onto the student, but remained closely monitored by the teacher. However, students who were lacking in confidence appeared completely uninvolved in the cooperative group and assumed a passive role. It was necessary for the teacher to monitor the groups closely at the onset of the project.

Disadvantages of Cooperative Groups

There have been known problems arising from cooperative groups. One problem pertained to teachers not wanting to relinquish control in the classroom, and the other pertained to students not wanting to work in a group. Mkhize (2005) and Webb (2009) discussed the negativity associated with cooperative groups. Mkhize stated educators hesitated to form the cooperative groups due to the planning necessary to implement the groups adequately. However, Mkhize recognized the powerful results cooperative groups had on the students. Webb discovered educators hesitated to form the groups due to the required planning necessary to implement the groups adequately. Webb stated there is more involved in using cooperative groups than creating the group. In order to get around some of the problems, Garfield (1993) suggested discussing the grading policy with the students and perhaps the discussion of the grading policy would have alleviated the problem with the student, allowing time for the student to relate his/her concerns also.

According to Archer-Kath, et al. (1995) group feedback has not been as effective as individual feedback. When cooperative groups were not part of the classroom, Biehler

and Snowman (1997) claimed dislike for ethnic groups or gender may have kept friendships from forming. Biehler and Snowman contended cooperative groups should have been heterogeneous, containing males and females with different ability levels, ethnicity, and socioeconomic backgrounds. Jacobs (2003) took it a step further revealing, heterogeneous cooperative groups may have been formed using various criteria items. Schmitz and Winskel (2008) found that occasionally students working in cooperative learning groups are not successful due to confusion with the assignments or problems within the group. With individual personalities involved, students may be confrontational or rude to their cohorts which hinder success. Chiu and Khoo (2003) and Schmitz and Winskel (2008) agreed that rudeness could damage the cooperative group and its effectiveness. Kocak (2008) believed students would be better friends and more cooperative when in cooperative groups. However, according to Arvaja, Hakkien, Rasku-Puttonen, and Etelapelto (2002) the ideal cooperative group consisted of peer partners who kept "personal views, status, and power in check" (p. 162).

According to Slavin (1990) controversy existed in whether to use cooperative groups because not everyone agreed on the conditions to make the cooperative learning strategy effective. Entonado and Garcia (2003) found, "Asking a classmate for help often has a negative meaning because some consider it a sign of dependence or weakness" (p. 93). It seemed especially true in classrooms encouraging competitiveness amongst the students. Unknowingly, teachers introduced biases when saying "girls and boys" instead of "class" when getting everyone's attention (Entonado & Garcia, 2003).

Related Research

There was a gap in the literature concerning the relationship between math anxiety and cooperative groups. Research was abundant regarding gender based research studies. This study was important because it may assist in creating a turning point in the area of mathematics for our country as a whole.

Summary

The literature suggested that cooperative groups are an effective strategy to use with all learners regardless of academic level or ability level. The students in math, who have been lagging behind their peers, need a successful strategy in order to succeed in math. Students must learn not to be afraid of mathematics or of making mistakes. Cherkas (1992) said teachers need to encourage students and empower them to accept the mistakes as a time for learning, and a normal step for understanding mathematics. Wieschenberg (1994) stated teachers need to display mathematics as a learning opportunity that is expected, challenging, but not impossible to grasp. Teachers must encourage positive thinking while implementing cooperative groups to counteract the math anxiety students may feel.

It is not known how many teachers have used cooperative groups. In the 1990s Johnson and Johnson (1995) believed, teachers did not use cooperative groups, and some teachers in using cooperative groups, may not have used them correctly. Rogers (2001) stated teachers needed instructions about using cooperative groups effectively in their classrooms and what benefits they could have expected from the work it required before

implementation began. Many teachers liked the classroom setting they had, and saw no reason for changing to a teaching method out of their comfort zone.

Of course, with any teaching or learning strategy, there have been pitfalls and myths to dispel, such as skin color and socioeconomic class determines the math group placement. Goodwin (1999) stated the cooperative group has been a successful strategy to use with all children regardless of age, race, gender, and social skills. The fact remains; group placement is a result of student performance and ability according to Rogers (2001).

This section reviewed the relevant literature related to the topics of cooperative learning, gender differences, and math anxiety. The literature review investigated the components of cooperative groups as well as the benefits and disadvantages of their use in the elementary classroom. Section 3 describes the research design, the data collection, the analysis procedure, and the context of the study. Section 4 discusses the result of the study, the instruments, data analysis, and the findings. Section 5 interprets the findings of the study and recommendations for future research.

Section 3:

Methodology

Introduction to Methodology

This section includes an examination of the methodology used in the quasi-experimental quantitative gender based study addressing math anxiety related to the use of cooperative groups. The elementary school at which this study was conducted has been confronted with the problem of math anxiety, demonstrated by student attitudes and low standardized test scores. The purpose of this study was to discover if cooperative groups, male students, and female students, the independent variables, effectively altered levels of math anxiety, the dependent variable, in Grade 5 students.

This study addressed whether or not cooperative groups had any effect on math anxiety levels among Grade 5 students. The gender based study used the MASC Instrument (Henry & Chiu, 1990) to obtain data to evaluate the mean difference of the MASC between the genders. The instrument established the math anxiety level of the students participating in this study. The initial MASC served as a baseline to begin the analysis. Student names were omitted and letters, such as “A, B, C” were used to ensure confidentiality. The gender of the student was also noted as “1” for male or “2” for female. This section includes the design of the study, the participants, the treatment, the instruction and the materials, the procedures for collecting and organizing the data, and role of the researcher.

Research Questions and Hypotheses

The following research questions were addressed in this study:

1. Will there be a significant difference between Grade 5 students in a cooperative group and Grade 5 students in a noncooperative group setting on math anxiety as measured by the MASC?

$H_{0:}$ There will be no significant difference between students in a cooperative group and students in a noncooperative group setting on math anxiety as measured by the MASC.

$Ha_{1:}$ There will be a significant difference between students in the cooperative group setting and students in the noncooperative group setting on math anxiety as measured by the MASC.

2. Will there be a significant difference between girls in a cooperative group and girls in a noncooperative group setting on math anxiety as measured by the MASC?

$H_{0:}$ There will be no significant difference between girls in the cooperative group setting and girls in the noncooperative group setting on math anxiety as measured by the MASC.

$Ha_{1:}$ There will be a significant difference between girls in the cooperative group setting and girls in the noncooperative group setting on math anxiety as measured by the MASC.

3. Will there be a significant difference between boys in a cooperative group and boys in the noncooperative group setting on math anxiety as measured by the MASC?

$H_{0:}$ There will be no significant difference between boys in the cooperative group setting and boys in the noncooperative group setting on math anxiety as measured by the MASC.

$Ha_{1:}$ There will be a significant difference between boys in the cooperative group setting and boys in the noncooperative group setting on math anxiety as measured by the MASC.

Design of the Study

This study was a quasi-experimental design. This study was a pretest and posttest with the independent variable being cooperative learning, male students, and female students, the dependent variable being math anxiety which was measured by the MASC inventory. A nongraded math test was administered to follow the educational structure of the classroom. All Grade 5 students were accustomed to receiving two math instruments during each testing session. When students received the MASC they were already prepared for the second instrument. MASC, a math anxiety instrument was administered to students to measure the level of math anxiety before treatment and after treatment.

Setting and Sample

This school is located in the southeastern part of the United States in a rural community. Of the 9 million people who live in this state, the rural town and county contains approximately 28,000 people. Financially, 28.2 % of the county makes less than $15,000 per year. More than 73 % of the county is identified as economically disadvantaged. Academically, the Grade 5 students in this county perform below the state average on the standardized tests. By 12th grade, approximately 50 % of the county's students have dropped out of school.

The principal used the standardized test scores to place the students into the reading and math classes for Grade 5. If a student exceeded the minimum state score

requirements on the standardized test, the student was placed into an average or above average reading or math class. If a student scored below the minimum requirement, the student was placed into a below average math or reading class. Currently, with the 2009 standardized testing session, more students failed the math content than the reading content.

The groups were normal groups for the school's academic population. The groups were closely balanced by gender across the grade. The principal at this rural elementary school gave permission to use the Grade 5 students in this study. Detailed language was used to discuss the setting and behaviors of the participants.

Academically the students were matched based on standardized test performance from the 2009 testing session. Sixty-four Grade 5 students participated in this study. The aim of this study was to have an equal number of males and females in the control and experimental groups. Students were selected based on similar math performance, gender, and availability of students to the researcher. The treatment group and control group of 64 students were considered academically below average in mathematics based on the standardized test scores in math from April 2009. All Grade 5 students had the principal's permission to participate in this study (Appendix A).

Experimental Treatment

In the experimental group, 32 students participated. After study approval, (IRB approval # is 02-19-10-0308434), the students' names were given a number by a process of drawing names from a bowl in order to identify students anonymously. Student confidentiality was provided, and students were labeled as A, B, C, and so forth, and

labeled as “1” for male or “2” for female, and were not otherwise identified. Students’ gender was identified since the research was collecting data comparing genders. The students received at the beginning of the study, Math Test 1, (Appendix F) and when the Math Test 1 was returned, each student received a copy of the MASC Instrument (Appendix H) to complete independently. The Math Test 1 was provided as a test from the standard curriculum. Each Grade 5 math student received two tests during each testing session a pretest for the new chapter, and a posttest for the completed chapter. In order not to cause any undue math anxiety, teachers used the same class structure of two testing instruments for this study. A script (Appendix K) was provided for the researcher to read to the students before beginning the MASC. The MASC contained the written directions the students needed in order to complete the MASC. The teacher/researcher was able to clarify a statement for the students if necessary based on guidelines of Henry and Chiu (1990). The MASC established if all students had similar math anxiety levels.

The students were not exposed to cooperative group assignments prior to obtaining study approval. The teacher used a scripted lesson to introduce the cooperative group lessons (Appendix I). For 9 weeks, the students in the experimental group worked together in small groups approximately two times per week for a total of 70 minutes. The groups consisted of mixed gender and ability. The groups worked on problem solving activities geared towards cooperative group work (Appendix J). The problem solving activities were activities that students had to use basic math skills or logic to solve. The

teacher did not assist the students in forming a conclusion to their activity. The teacher did not intervene with a group until the group used all other alternatives.

In this research study, there was no positive feedback from the teacher for an individual or small group. Positive feedback from the teachers was not given until all groups or individuals completed the assignment and discussed the results in their class, either as a small group or as a whole group. The cooperative group lessons in the experimental group were student-oriented and student discussed from the Harcourt Math Series (Maletsky & Andrews, 2007).

Control Group

The control group contained 32 students and was a noncooperative group using whole group instruction. The control group students were mixed in ability. The control group completed the Math Test 1 to follow the standard testing procedure of the Grade 5 math classes, and then received the MASC inventory to determine student math anxiety level. The students received the two instruments due to standard educational practices of the math teachers. Each testing session had two tests, the pretest covered future instruction, and the posttest covered previous instruction. The control group teacher had a script (Appendix K) to read prior to administering the MASC Instrument. Statements that were unclear to the students were clarified by the teacher (Henry & Chiu, 1990).

The whole group instruction consisted of teacher instruction, note taking, classroom management, and worksheets. The worksheets were a review of that day's lesson or a previously learned skill. The control group had the same lesson (Appendix L) as the experimental group, but completed all assignments as a whole group. The control

group teacher used a script for introducing the individual assignments. The certified peer teacher instructed each math lesson.

The control group teacher had a script to read aloud in order to guide the students with directions for completing assignments. The peer teacher read the directions to the students when the students were ready to begin working independently on assignments. The control group did not receive positive feedback from the teacher as individuals or as a group when working on assignments. Positive feedback was given when the completed assignment was discussed between the teacher and the class as a whole group.

The teachers of the control group and treatment group had a curriculum map to follow for planning the daily/weekly lessons. If the experimental group was working on graphing, the control group was working on graphing. Classroom management was necessary and was not ignored by either teacher. The teachers answered student questions after all group options had been exhausted.

Instrumentation and Materials

The instruments that were used in this quasi-experimental study were the following: (a) Math Test 1, (b) Math Test 2 and (c) MASC (Henry and Chui, 1990). The math tests were part of the Grade 5 Harcourt Math curriculum. The Grade 5 math teachers normally administered this test twice, at the beginning and end of the school term to every Grade 5 student to determine student learning of specific basic skills. However, due to this research study, the test was not administered at the normal scheduled time this school term.

Math Test 1

Math Test 1 was administered immediately to the students in the control group and the experimental group to follow normal testing procedures for Grade 5. This test was part of the Grade 5 math curriculum and teachers used it at any time during the school year for diagnostic purposes or test review. Math Test 1 was identical to Math Test 2. Math Test 1 was not used to collect student data. The Grade 5 students did not know the Math Test 1 was not graded. The Math Test 1 contained problems from the Grade 5 end-of-the-year test. The math problems were randomly selected from the Grade 5 math text, *Harcourt Math* (Maletsky & Andrews, 2007). The Math Test 1 contained two addition problems, one subtraction problem, two problems relating to number sense, six multiplication problems, one geometry problem, and two division problems. The test had a multiple-choice format with answer choices from A thru D. Students in both groups circled the best answer choice. The Grade 5 students showed their work on scrap paper, which was attached to the Math Test 1. Written permission was granted by Harcourt Math (Appendix D) to use and reproduce the test.

Math Test 2

Math Test 2 was administered to the students at the end of the 9 week study. Math Test 2 was administered to the control group and the experimental group to follow normal testing procedures in math. This test was part of the Grade 5 math curriculum. Math Test 2 was identical to Math Test 1. Math Test 2 was not used to collect student data. The Grade 5 students did not know the Math Test 2 was not graded. The Math Test 2 contained problems from the Grade 5 end-of-the-year test. The math problems were

randomly selected from the Grade 5 math text, *Harcourt Math* (Maletsky & Andrews, 2007). The Math Test 2 contained two addition problems, one subtraction problem, two problems relating to number sense, six multiplication problems, one geometry problem, and two division problems. This test was a multiple-choice format with answer choices from A thru D. The students in both groups circled the best answer choice. The Grade 5 students showed their work on scrap paper, which was attached to the Math Test 2. Written permission was granted by Harcourt Math (Appendix D) to use and reproduce the test.

Mathematics Anxiety Scale for Children

The MASC was developed by Henry and Chiu (1990) specifically for students in grades four through eight. This inventory was designed to measure student math anxiety. Each question on the MASC was numbered with a scale of 1-4. The answers were in number format of 1-Not Nervous, 2-A Little Bit Nervous, 3-Very Nervous, 4-Very, Very Nervous. The MASC had 22 questions. The MASC was designed to identify students with math anxiety so that the students could receive counseling. The other math anxiety instruments on the market were geared more towards high school and college students (Brady & Bowd, 2005; Marsh & Tapia, 2002). Those instruments included the ATMI and MAR-S.

In their research, Henry and Chiu (1990) established reliability and validity with a sample of 562 students in grades 4-8. Students from each grade level were included in the study. There were 270 boys and 292 girls. The study lasted for 2 months. Henry and Chiu (1990) stated, “Internal consistency reliability for the MASC was estimated by computing

alpha coefficients for each grade level and for the total group. These coefficients ranged from .90 to .93 with a median of .92" (p. 3).

Beasley, Long, and Natali (2001) used the MASC to test for validity. Using a sample of 278 middle-class sixth-graders from Indiana, Beasley, et al. found "The MASC had internal consistency as measured by Cronbach's alpha of 0.924….Therefore, responses to the MASC exhibited a very high degree of internal consistency" (p. 21). This denotes internal consistency according to Beasley, et al.

Data Collection

The data for this study were collected during a 9 week grading period. The Math Test 1 and Math Test 2 (Maletsky & Andrews, 2007) were a mixed review for the students and contained skills not yet taught by the math teachers. The district's math teachers normally administered this particular test at the beginning and ending of the school term. This year however, the math test was administered at the beginning of the research study and again 9 weeks later in order to accommodate the timeline of this study. The math teachers were able to administer the math test at any time during the school year at their discretion.

The administration of the MASC Instrument immediately followed the Math Tests 1 and 2. After the initial testing phase was completed, 32 students participated in the cooperative group with the researcher. The cooperative group was to function as the treatment group for a time of 9 weeks. The group characteristics for the treatment group consisted of mixed gender and math ability. The remaining 32 students participated in the control group with the peer teacher, who taught the noncooperative group.

After study approval the male and female students' names were given an alphabetical letter by a process of drawing names from a bowl in order to ensure student confidentiality. Student participants, $n = 64$, were labeled as A, B, C, and so forth, and identified as male, with "1" or female with "2". Student confidentiality was provided when collecting data from the MASC. The Math Test 1 or Math Test 2 was not graded, but was used to follow the normal testing structure of the grade level. During the 9 weeks, the experimental group worked together two times per week for 35 minutes each time. A scripted introduction accompanied the activities (Appendix I). The experimental group completed cooperative group activities that consisted of problem solving scenarios (see Appendix J) for 15-20 minutes, and then 15 minutes was spent in explanation, discussion, and reflection.

The researcher had an experimental group of 32 students participating in cooperative groups. This teacher/researcher was certified for mathematics and had received training from the Harcourt Math textbook company (Maletsky & Andrews, 2007) for teaching and implementing the curriculum. The experimental group worked in small groups of four students each of mixed gender and math ability. The activities contained problem solving scenarios.

The control group did not work together cooperatively. The control group completed the same assignments as the experimental group; however, these students worked as a whole group, and the peer teacher had scripted instructions that accompanied the lessons for the students. The assignments did not contain the experimental group assignments of timekeeper, recorder, reader, or presenter.

The certified teacher for the control group had 32 students. This peer teacher was certified for mathematics and had received training from the Harcourt Math textbook company (Maletsky & Andrews, 2007) for teaching and implementing the curriculum. This control group worked in a whole group setting that included note taking, teacher instruction, and teacher-directed instruction with worksheet driven activities. It was the desire of this study to gain the different perspectives on math anxiety and try to alleviate the math anxiety if possible.

The Grade 5 end-of-the-year test was the same Math Test 1 and 2. Since there were 9 weeks between the two tests, the memory effect should not have been a factor (Mehrens & Lehmenn, 1978). However, under normal procedures, the test would not normally be administered again until the end of the school year. For the sole purpose of this research study, the test was administered a second time at the end of the 9 week study. The math teachers controlled the timing of this math test. All documents were kept anonymous for student privacy.

The MASC Instrument established the initial math anxiety level of each student after the Math Test 1. The scores from the MASC, after the Math Test 1, were used to determine that students were equivalent in anxiety levels. The scores of the Math Test 1 were not used for data. The quantitative research study statistically noted any differences and similarities as it emerged between the genders in the treatment and control groups.

After 9 weeks, students received the Math Test 2 followed by hearing the script containing the directions for completing the MASC. The Math Test 2 was used to follow the normal testing procedures of the Grade 5 math classes. After the Math Test 2, the

MASC was administered to the students to determine their level of math anxiety. Since a positive outcome was determined from this study using cooperative groups to lessen the effects of math anxiety, the control group received the same positive treatment with cooperative grouping as the experimental group for the remainder of the school year.

Data Analysis

The Grade 5 students received the MASC Instrument that included scripted instructions read by the teachers and additional directions for completing the MASC. The teachers had example statements written on the board or overhead for additional clarification and practice for the students before beginning the MASC. All 64 students were instructed verbally that they should read the instructions before beginning the MASC Instrument. The MASC scores were used to identify the level of math anxiety for each Grade 5 student. The teachers stressed the importance of answering honestly. The teachers reminded the students there was no right or wrong answers to the statements. The teachers had the ability to clarify statements for the students that were unclear (Henry & Chiu, 1990). No student in the control or experimental groups required statement clarification. The MASC provided insight into student perceptions of mathematics, math anxiety, and cooperative groups. The data from the MASC Instrument were analyzed using a repeated-measure ANOVA.

The independent variable for this study was cooperative groups, Grade 5 male students, and Grade 5 female students, the dependent variable was the student anxiety level, and the preMASC and the postMASC inventories measured the anxiety level of the students in the study. To investigate the effectiveness of cooperative groups, a repeated

ANOVA was used to compare the mean of the overall MASC pretest scores for each group. To determine if the groups were not equivalent in math anxiety after the treatment, an ANOVA was used to compare the mean of the overall MASC posttest scores for each group. An alpha level less than .05 would reject the null hypothesis.

The Role of the Researcher

The teacher/researcher was a 6 year math teacher for this rural project setting where the study was conducted. Plans were made daily/weekly with the peer teacher to ensure understanding of the lessons and the presentation method. A time for questions and answers were provided for the peer teacher in order to address any concerns that arose.

The students were identified as male or female for the project. The researcher established the cooperative groups based on mixed gender and mixed ability. During the 9 week study, an accurate accounting of the findings were kept on a personal laptop computer that was password protected as well as locked in a closet when not in use. The role of researcher was of one who collected and analyzed the data. Hatch (2002) stated it was a way to display the gathered data to others who were interested in the results. The researcher worked closely with the peer teacher to clarify questions and alleviate her concerns.

Threats to Validity

I identified any known biases. Possible threats included researcher effect since the researcher was teaching one of the math classes. The research effect is when the researcher becomes more interested in obtaining evidence to support the hypotheses than

in discovering the truth of the research (Borg & Gall, 1983). Threats included the possibility of the researcher becoming emotionally involved in the topic and unintentionally slanting the research findings to produce a predetermined result (Borg & Gall). In order to reduce these potential threats, the researcher was aware of the body language, tone of voice, or change in behavior of the students. The researcher did not attempt to influence this study nor its findings. Furthermore, students did not know if they were in the control group or the treatment group.

Another threat was selection effect because of the control and experimental groups were not randomly assigned. As noted earlier in this section, the control group and the experimental group were deemed academically equal based on their standardized test scores in 2009. However, according to Cook and Campbell (1979), groups selected may actually be unequal prior to any given treatment. It should also be taken into consideration that specific threats may have developed from the use of two groups with two teachers.

Another possible threat for the study was the treatment of males and females for the gender comparisons. Both genders were called on equally during the class instruction. Additional threats to skew the data pertained to how students responded if angry with the teacher or wished to please the teacher, hence the concern of the halo effect on the students participating in this study (Borg & Gall, 1978). The Hawthorne effect (Rosenzweig, 2007) was another threat to validity since participants may have altered their performance knowing that they were participating in an experiment. Observer bias was limited since all information was scored in like fashion. It was believed that

cooperative groups effectively reduced the feelings of math anxiety in Grade 5 students (Borg & Gall, 1979).

Connecting Data to the Research Questions

The data findings of the impact of cooperative groups on math anxiety were used to determine the effectiveness of using cooperative groups in the upper elementary classroom. As stated in the literature review, cooperative groups had many benefits for students when used in the primary classrooms (Gillies & Ashman, 2000); (Khoo, 2003). Benefits included an increase in standardized test scores and social relationships improved among the different socioeconomic groups. The use of cooperative groups reduced a student's math anxiety. It was anticipated that the students involved in the cooperative groups rated their math anxiety as lowered. There was a possibility that students rated their math anxiety as heightened from the use of cooperative groups. The repeated-measure ANOVA compared the mean difference, standard deviation, and an alpha level of .05 of males and females and the control group and the treatment group. The ANOVA determined equivalency between the two groups. The null hypothesis was rejected with a significance of <0.05.

Ethical Considerations

Merriam (2002) claimed the best study was an ethical study. When the research study was approved, 64 male and female students participated in the study. The students completed the Math Test 1 as a nongraded assignment, and then completed the MASC to rate the math anxiety. It was part of the students' educational structure to receive the two separate instruments during a testing session in math.

Students participating in this study did not receive compensation of any type such as monetary, grades, or gifts. Students who do not participate were not be penalized in any form. The names of students were kept confidential and anonymous. The information collected from this study was kept in a locked closet, and documents kept on the computer were password protected. The researcher's personal computer was used for typing protected documents. All information pertaining to this study was password protected. The findings were available by request to parents of participating students, and a copy of the results was sent by first class mail to Harcourt Math per their request.

Summary

Sixty-four students were eligible to participate in the study; n=64. The 64 students were given the Math Test 1 and Math Test 2 (Maletsky & Andrews, 2007) and completed the MASC. These tests were not graded nor used in the analysis of determining student math anxiety. All students completed the math tests regardless of study participation since this is part of the Grade 5 math curriculum. The students who did not participate in the study completed the same assignments as the control group, but the data were not analyzed. The preMASC was given following Math Test 1 and the post MASC followed Math Test 2 (Maletsky & Andrews, 2007) 9 weeks later. All MASC data were analyzed using an ANOVA. The quasi-experimental quantitative study looked for similarities and differences between the two groups of students. The results of the data analysis determined if there was any effect of cooperative groups on math anxiety. In Section 4, an analysis of the data was discussed and six tables with the figures demonstrated the

results of the preMASC for all students, boys and girls, and postMASC for all students, boys and girls. Section 5 will discuss the implications, recommendations, and the conclusion of the study.

Section 4:

Results of the Study

Introduction

The purpose of this quasi-experimental study was to examine the effects of using cooperative groups on Grade 5 students with math anxiety. The study was conducted from February through April for a total of 9 weeks. This section discusses the following sections: research tools, data analysis, and findings. Three major research questions were investigated.

1. Will there be a significant difference between Grade 5 students in a cooperative group and Grade 5 students in a noncooperative group setting on math anxiety as measured by the MASC?

$H_{0:}$ There will be no significant difference between students in a cooperative group and students in a noncooperative group setting on math anxiety as measured by the MASC.

$Ha_{1:}$ There will be a significant difference between students in the cooperative group setting and students in the noncooperative group setting on math anxiety as measured by the MASC.

2. Will there be a significant difference between girls in a cooperative group and girls in a noncooperative group setting on math anxiety as measured by the MASC?

$H_{0:}$ There will be no significant difference between girls in the cooperative group setting and girls in the noncooperative group setting on math anxiety as measured by the MASC.

Ha_1: There will be a significant difference between girls in the cooperative group setting and girls in the noncooperative group setting on math anxiety as measured by the MASC.

3. Will there be a significant difference between boys in a cooperative group and boys in the noncooperative group setting on math anxiety as measured by the MASC?

H_0: There will be no significant difference between boys in the cooperative group setting and boys in the noncooperative group setting on math anxiety as measured by the MASC.

Ha_1: There will be a significant difference between boys in the cooperative group setting and boys in the noncooperative group setting on math anxiety as measured by the MASC.

Research Tools

Data Procedure

Sixty-four Grade 5 students participated in this research study. The control group contained 32 students and the experimental group contained 32 students. Each group had 16 males and 16 females, for a total *n*= 64. All students in Grade 5 participated. Students in the researcher's classroom were participants in the experimental group and the peer teacher's students were participants in the control group. Math groups were selected for convenience. The school's principal provided written permission for all students to participate in the study since the activities and math tests were part of the district's curriculum. The students were not exposed to cooperative group assignments prior to obtaining study approval from the IRB. Students were placed in cooperative groups

determined by their math performance and gender. Each cooperative group contained two males and two females of mixed ability. The independent variable was the cooperative group and the dependent variable was the students' math anxiety.

Data Collection

Math Tests 1 and 2 (Maletsky & Andrews, 2007) were used as part of the assessment procedures for the math classrooms. Each time students received the Math Test 1 or Math Test 2, they were asked to complete the MASC (Maletsky & Andrews, 2007). An analysis of the data was performed using the Statistical Package for Social Sciences (SPSS), version 14. Each statistical analysis used a significance level of < 0.05. The study was conducted for 9 weeks from February to April. The study began with 64 students receiving the Math Test 1 followed by the MASC to identify the math anxiety levels of each student. The teacher for the control group and the teacher for the experimental group read a script prior to allowing the students to begin the MASC. The script was used to maintain consistency between the researcher and the peer math teacher for explaining the MASC process. The teachers knew the Math Test 1 would not be graded; therefore, test scores were not included in this study. Scores from the MASC were tabulated for each student. The students in the experimental group worked together two times per week for a total of 70 minutes. The control classroom did not work in cooperative groups, but instead worked as a whole group or as an individual.

Math Test 1

Sixty-four Grade 5 students were administered the Math Test 1 as part of the grade level's standardized classroom practice. Both teachers assigned a pretest and

posttest during each chapter's testing session, since students are already accustomed to receiving two testing instruments in a testing session. The Math Test 1 contained two addition problems, one subtraction problem, two problems relating to number sense, six multiplication problems, one geometry problem, and two division problems. The 14 math problems were randomly selected from the Grade 5 math text, *Harcourt Math* (Maletsky & Andrews, 2007). The Math Test 1 was a nongraded instrument. The students were not aware the test would not be graded. At the end of the study the same math test was administered and labeled as Math Test 2.

(Pre)MASC

Following the Math Test 1 all Grade 5 students were administered a MASC inventory to rate themselves for math anxiety. The teacher and peer teacher read a script to maintain consistency of the MASC prior to students' completion of the MASC. Two sentences were placed on the board to show students examples on how to mark the MASC inventory. Students were informed that statements from the MASC could be explained by the teacher if a statement was not clear. No students required any statement clarification. All students answered each of the 22 questions.

Math Test 2

At the end of the study, 64 Grade 5 students were administered the Math Test 2 as part of the grade level's standard classroom assessment procedure. Standard instructions were provided by the students' teachers for completing the math test. The students were not aware the math test would not be graded. The Math Test 2 contained the same 14 math problems as the Math Test 1.

(Post)MASC

The MASC (Henry & Chiu, 1990) was administered to the 64 Grade 5 students following the Math Test 2. Students were instructed by their teacher to listen to the instructions prior to starting the survey for rating their math feelings. Two sentences were placed on the overhead to demonstrate how the students were to rate the statements. Students rated each of the 22 statements according to their personal feelings for math. None of the 64 students needed a statement to be clarified for better understanding. The MASC was collected by the teachers and the researcher totaled each standard score.

Data Analysis

This study answered three research questions and hypotheses for statistical analysis. To investigate the effectiveness of cooperative groups, three repeated-measures ANOVAs were conducted, one for the total sample followed by separate analyses for the boys and girls. Significance was measured at the .05 level.

The means and standard deviation of the students' standard MASC scores for both testing sessions are shown in Table 1 for the total sample. For the cooperative group, pretest MASC scores averaged 41.44 (SD = 10.93), while posttest MASC scores averaged 35.06 (SD = 8.41). For the noncooperative group, the students averaged 38.28 (SD = 9.09) on the pretest MASC assessment and 37.53 (SD = 10.74) on the posttest MASC assessment.

Table 1

Descriptive Statistics for MASC Scores as a Function of Time and Group (N = 64)

	Cooperative Group (n = 32)		NonCooperative Group (n = 32)	
	M	*SD*	*M*	*SD*
Pretest	41.44	10.93	38.28	9.09
Posttest	35.06	8.41	37.53	10.74

The first null hypothesis of this study was:

H_o: There was no significant difference between students in a cooperative group and students in a noncooperative group setting on math anxiety as measured by the MASC.

Table 2 shows the results of the repeated-measures ANOVA conducted using data from the complete sample. The main effect for treatment was not statistically significant, $F(1, 62) = .02$, $p = .879$, indicating that overall (combining pretest and posttest assessments), the students in the cooperative group did not differ from the students in the noncooperative group. The main effect for time was statistically significant, $F(1, 62) = 12.24$, $p = .001$, indicating that across groups (combining the cooperative and non-cooperative groups), posttest scores were lower than pretest scores.

Table 2

Results of Repeated-Measures ANOVA for the Complete Sample (N = 64)

Effect	Sum of Squares	*df*	Mean Squares	*F*	*p*
Treatment	3.78	1	3.78	.02	.879
Error (Treatment)	9,980.438	62	160.975		
Time	406.13	1	406.13	12.24	.001
Treatment X Time	253.13	1	253.13	7.63	.008
Error (Time)	2,057.75	62	33.19		

The primary effect of interest in this ANOVA was the treatment by time interaction. This effect was statistically significant, $F(1, 62) = 7.63$, $p = .008$. This indicated that the change from pretest to posttest was not the same for the cooperative and noncooperative groups. Figure 1 shows the nature of this interaction. For students in the cooperative group, MASC scores decreased dramatically from the pretest to the posttest (from an average of 41.44 to an average of 35.06), while for students in the noncooperative group, there was a small decrease (from an average of 38.28 to an average of 37.53). Based on this result, the decision for the first null hypothesis of this study was fail to reject, and it was concluded that the decrease in MASC scores for students in the cooperative group was significantly larger than the decrease in MASC scores for students in the noncooperative group.

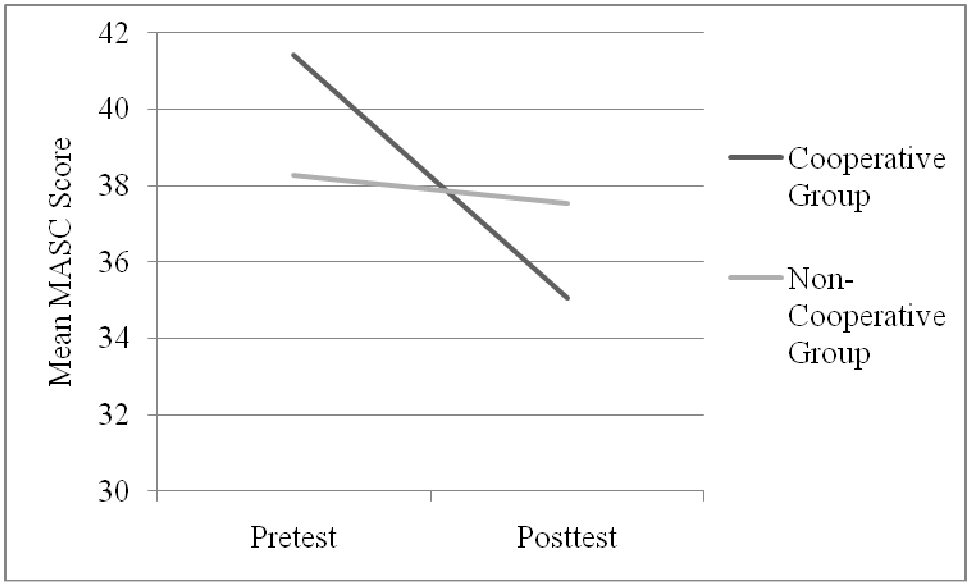

Figure 1. MASC scores as a function of time and treatment for all participants.

The second null hypothesis of this study was:

H_o: There was no significant difference between girls in the cooperative group setting and girls in the noncooperative group setting on math anxiety as measured by the MASC.

Table 3 shows the mean and standard deviation for the pretest and posttest MASC assessments for girls in the cooperative group and girls in the noncooperative group. Girls in the cooperative group averaged 43.13 (*SD* = 12.69) on the pretest MASC assessment and 37.25 (*SD* = 9.70) on the posttest MASC assessment, while girls in the non-cooperative group averaged 38.06 (*SD* = 9.45) on the pretest MASC assessment and 38.06 (*SD* = 11.76) on the posttest MASC assessment.

Table 3

*Descriptive Statistics for MASC Scores as a Function of Time and Group for Girls (*n = *32)*

	Cooperative Group (*n* = 16)		NonCooperative Group (*n* = 16)	
	M	*SD*	*M*	*SD*
Pretest	43.13	12.69	38.06	9.45
Posttest	37.25	9.70	38.06	11.76

Table 4 shows the results from the repeated-measures ANOVA comparing MASC scores at the pretest and the posttest for girls in the cooperative group and girls in the noncooperative group. The main effect for treatment was not statistically significant, $F(1, 30) = .34$, $p = .564$, indicating that the girls in the cooperative group did not differ from the girls in the noncooperative group when examined across pretest and posttest scores. The main effect for time was statistically significant, $F(1, 30) = 4.75$, $p = .037$. This indicated that pretest scores were higher than posttest scores (when examined across treatment group).

Table 4

*Results of Repeated-Measures ANOVA for the Girl Sample (*n = *32)*

Effect	Sum of Squares	*df*	Mean Squares	*F*	*p*
Treatment	72.25	1	72.25	.34	.564
Error (Treatment)	6364.75	30	212.16		
Time	138.06	1	138.06	4.75	.037
Treatment X Time	138.06	1	138.06	4.75	.037
Error (Time)	871.88	30	29.06		

The interaction between treatment and time was also statistically significant, $F(1, 30 = 4.75$, $p = .037$. Figure 2 shows the pretest and posttest MASC means as a function of the treatment group. As can be seen from this figure, the mean MASC score for the non-cooperative group was stable from the pretest to the posttest (with a mean of 38.06 at each time point) while the mean MASC score for the cooperative group decreased substantially from 43.13 to 37.25. The decision for the second null hypothesis of this study was fail to reject. For girls, the MASC scores decreased for the cooperative group but not for the noncooperative group.

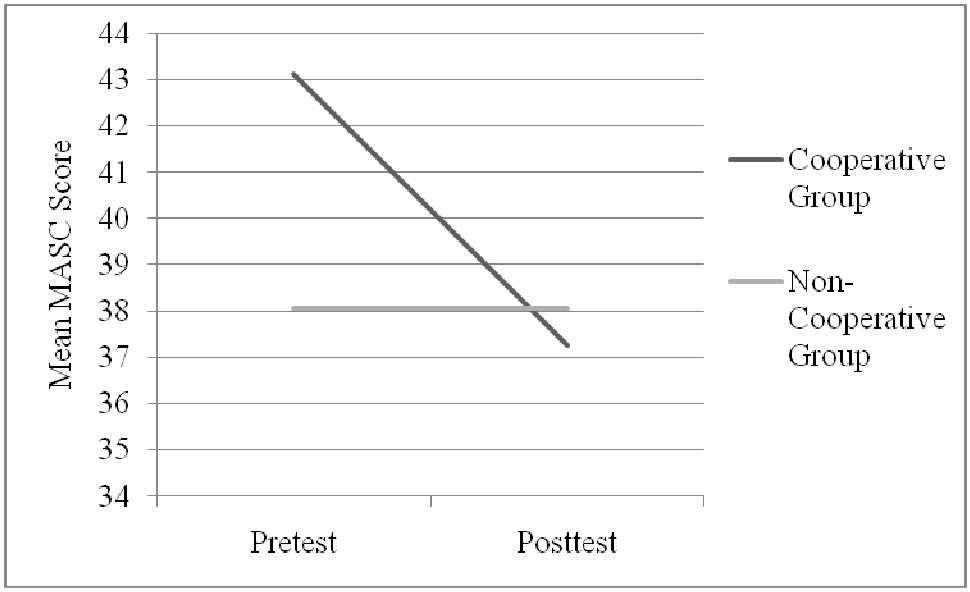

Figure 2. MASC scores as a function of time and treatment for girls.

The third null hypothesis of this study was:

H_o: There was no significant difference between boys in the cooperative group setting and boys in the noncooperative group setting on math anxiety as measured by the MASC.

The mean scores for boys in the cooperative group and boys in the noncooperative group at the pretest and posttest MASC assessments are shown in Table 5. For males in the cooperative group, MASC scores fell substantially from the pretest (M = 39.75, SD = 8.95) to the posttest (M = 32.88, SD = 6.48). For males in the noncooperative group, mean MASC scores fell less substantially from 38.50 (SD = 9.02) at the pretest to 37.00 (SD = 9.99) at the posttest.

Table 5

*Descriptive Statistics for MASC Scores as a Function of Time and Group for Boys (*n = *32)*

	Cooperative Group (n = 16)		NonCooperative Group (n = 16)	
	M	*SD*	*M*	*SD*
Pretest	39.75	8.95	38.50	9.02
Posttest	32.88	6.48	37.00	9.99

Table 6 shows the results of the repeated-measures ANOVA performed for the boy sample. The main effect for treatment group was not statistically significant, $F(1, 30) = .29$, $p = .592$. The main effect for time was statistically significant, $F(1, 30) = 7.18$, $p = .012$, indicating that boys' posttest MASC scores were lower than boys' pretest MASC scores (when combined across treatment group). The interaction between treatment and time was not statistically significant, $F(1, 30) = 2.96$, $p = .096$. This indicated that the difference in pretest means and posttest means for boys in the cooperative group and the noncooperative groups did not differ.

Table 6

Results of Repeated-Measures ANOVA for the Boy Sample (n = 32)

Effect	Sum of Squares	*df*	Mean Squares	*F*	*p*
Treatment	33.06	1	33.06	.29	.592
Error (Treatment)	3373.88	30	112.46		
Time	280.56	1	280.56	7.18	.012
Treatment X Time	115.56	1	115.56	2.96	.096
Error (Time)	1172.88	30	39.10		

Figure 3 shows the mean MASC score at the pretest and posttest for the cooperative and noncooperative groups. While the same general pattern is evident for boys as was the case for the girl sample and the complete sample, in this case the interaction was not statistically significant. The decision for the third null hypothesis was fail to reject, indicating that there was no significant difference between boys in the cooperative group setting and boys in the noncooperative group setting on math anxiety as measured by the MASC.

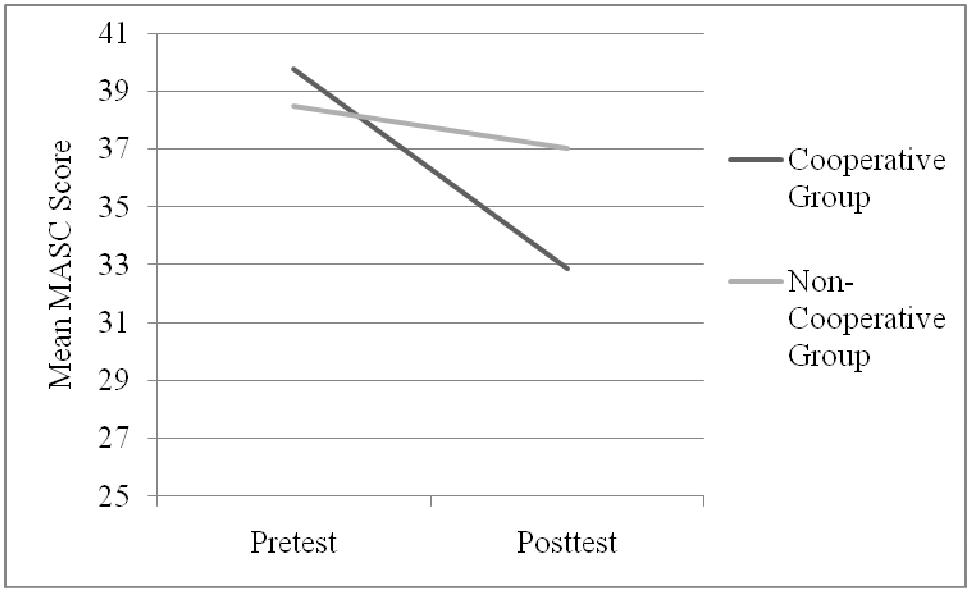

Figure 3. MASC scores as a function of time and treatment for boys.

Summary of Findings

There were three null hypotheses in this study. There are three conclusions from this study corresponding to the three null hypotheses. The first conclusion of this study is that the decrease in MASC scores for students in the cooperative group was significantly larger than the decrease in MASC scores for students in the noncooperative group. Thus, the cooperative intervention was successful in reducing math anxiety for the combined sample of boys and girls. The second conclusion is that for girls, MASC scores decreased for the cooperative group but not for the noncooperative group. Thus, the cooperative intervention was successful in reducing math anxiety for girls. The third conclusion from this study is that for boys, there was no significant difference between the change in MASC scores from the pretest to the posttest in the cooperative group setting and the noncooperative group setting. Thus, for boys the cooperative intervention did not result in a larger decrease in math anxiety when compared to the noncooperative group. While the

same trend was observed for boys as was the case for girls and for the combined sample, the effect of the cooperative intervention on MASC scores was not statistically significant for boys. Section 5 will discuss the implications, recommendations, and conclusions of the study.

Section 5:

Summary, Conclusions, and Recommendations

Introduction

The purpose of this study was to determine the effectiveness that cooperative groups had on Grade 5 male and female students with math anxiety. As a result of the data collected from the MASC (Henry & Chiu, 1990), the research confirmed that the use of cooperative groups does in fact have an impact on math anxiety in Grade 5 male and female students. The teachers in both classrooms worked collaboratively to complete the activities and assignments on schedule, while maintaining either a cooperative classroom or a noncooperative classroom.

A 9 week quantitative research study was conducted to investigate the following research questions:

1. Will there be a significant difference between Grade 5 students in a cooperative group and Grade 5 students in a noncooperative group setting on math anxiety as measured by the MASC?

2. Will there be a significant difference between girls in a cooperative group and girls in a noncooperative group setting on math anxiety as measured by the MASC?

3. Will there be a significant difference between boys in a cooperative group and boys in the noncooperative group setting on math anxiety as measured by the MASC? Sixty-four Grade 5 students participated in this study, with the data collected from a preMASC and postMASC survey. The experimental group (Group 1) contained 32

students and the control group (Group 2) contained 32 students, and both groups contained an equal number of boys and girls.

Participants in the experimental group and the control group completed the Math Test 1 and MASC on the first day of the 9 week study and at the conclusion of the study, the students completed the Math Test 2 and MASC. For the duration of the study, students in the experimental group received mathematics instruction in a cooperative group setting of four students of mixed ability and mixed gender. Students in the control group received mathematics instruction in a noncooperative group setting. Students in the experimental group worked two times per week in a cooperative group completing assignments, while students in the control group received whole group instruction and completed assignments individually.

An ANOVA revealed that MASC scores for students in the cooperative group decreased more than MASC scores for students in the noncooperative group. The ANOVA for the female students revealed that females in the cooperative groups had a decrease in MASC scores when compared to the female students in the noncooperative group. The ANOVA for the male students in the cooperative group and male students in the noncooperative group showed no change in math anxiety ratings.

Interpretation of Findings

Findings of the quantitative analysis were conducted using three repeated-measures ANOVAs to determine the effectiveness of cooperative groups. The first null hypothesis of this study was rejected, and it was determined that Grade 5 students in the cooperative groups had a larger decrease in MASC scores when compared to Grade 5

students in the noncooperative groups. The second null hypothesis of this study was rejected, and it was determined that the female students in the cooperative groups had a larger decrease in MASC scores when compared to female MASC scores in the noncooperative groups. The third null hypothesis was not rejected which indicated there was no significant difference between males in the cooperative group setting when compared to males in the noncooperative group setting on math anxiety measured by the MASC. The 64 participants in this study were broken into an experimental group of 32 students and a control group of 32 students. Each group had an equal number of females and males. The students were taught using the same lesson plans and activities in order to cover the same curriculum content during the 9 week study.

The only difference between the cooperative group and the noncooperative group was the completion of the student activities. The cooperative group students completed the assignments together whereas the noncooperative groups completed the assignments independently. The cooperative group strategy consisted of Johnson and Johnson's (1994) "Learning Together" model. The students had responsibilities particular to their group and those responsibilities rotated with each activity. Within the cooperative group, students received immediate feedback, and the students were able to verbalize thoughts and ask questions of their peers. With the noncooperative groups, students did not have the advantage of working with others and, therefore, lacked peer support and being able to interact socially with their peers. When the cooperative group students were compared statistically to the noncoopeative group students, the cooperative group students had a

considerable decrease in math anxiety levels based on the collected data from the preMASC when compared to the post MASC.

The information obtained from the literature review was consistent with results of this study. For example, I found that female students benefitted more from the use of cooperative groups than male students (Mulryan, 1992). Results also agreed with the study of Promerantz, et al. (2002) that showed that female students displayed more math anxiety than the male students, and that male students did not concern themselves with attempting to perform better than their female classmates. Muzzatti and Agnoli (2007) found that males in elementary school seldom display math anxiety. Their findings are consistent with the results of the male students in this study, their gains and losses did not change significantly regardless of the group. The use of cooperative groups was an effective strategy to use with the Grade 5 students and this study supported the cooperative group work of researchers such as Khoo (2003); Kocak (2008); Olivera and Straus (2004); Panitz (1997); Slavin and Lake (2008); Williams and Sheridan (2006). Researchers supporting the use of cooperative groups are extensive.

The study presented the theoretical framework of Vygotsky (1978) and Piaget and Inhelder (1969). Vygotsky and Piaget found that learners, regardless of ability, benefitted from cooperative groups. As applied to this study, the social cognitive theory held that the use of cooperative groups influenced the math anxiety, because according to the research; cooperative groupings appeared to have a positive effect on how a student learned (Malmgren, 1998).

Vygotsky (1978) found that in cooperative groups, students would learn to think more academically and as well as in ways that were more appropriate for their learning. Townsend and Hicks (1997) agreed with Vygotsky that students who enjoyed the peer interaction would benefit the most from the use of cooperative groups. Vygotsky's social cognitive theory reflected the structure of the cooperative group.

Piaget and Inhelder (1969) found that children needed to discuss their findings and outcomes as well as have a stimulating environment in which to learn. Piaget and Inhelder found that children needed to be active learners, have hands-on opportunities, and not become the listless passive learner that is too often the case. Piaget and Inhelder identified the outcome necessary for success in cooperative groups as being active participants. They believed the use of cooperative groups were effective and beneficial for everyone who participated because they became active supporters and participants with one another. Each group member shared equally in the responsibility for learning and reaching mastery of the lesson or unit. The entire group depended on one another in order for each group member to have success.

This current study found that there were significant differences between the experimental group females in cooperative groups and the control group females in the noncooperative group when compared on the MASC. The females in the experimental group had lowered their levels of math anxiety after undergoing the cooperative group treatment. It is concluded that cooperative groups do affect students with math anxiety and aids those students in lowering their math anxiety levels.

For educators who currently have little to no gain in their mathematics classroom, the use of cooperative groups may help their students reach their greatest math potential. Although males did not have the same gains as females when comparing the postMASC scores, educators should not ignore the difference the use of cooperative groups can have socially and academically. When students work together on meaningful assignments, relationships form, trust grows, and students take on the responsibility for their own learning. As this study shows, the benefits of cooperative groups should not be disregarded.

Implications for Social Change

From the researcher's perspective, the students began in this class with noted tendencies of math anxiety. Frequently, several female students wanted to visit the nurse due to stomachaches, or to call home for various reasons. Others did not like to volunteer answers or explanations. The students began the school year working in a traditional fashion of whole group work, whole group practice, independent practice, and homework. Students were not accustomed to working together to problem solve, but were excited when the small group formations began. Students, who lacked involvement when involved in a whole group, suddenly became involved in the small group and wanted to participate in the activities. The study brought about a social change by having the students work together and build friendships and trust within their groups. The students came into class excited to work in their small groups, and that excitement filtered into their assignments. The students became more math-oriented and open to studying mathematics that challenged them at various levels. As Alsup (2005) pointed out, that

when students were more involved in the math class they had a more enjoyable experience. On occasion minor conflicts did arise, and those were dealt with as needed. No student groups were changed due to conflicts since all conflicts were resolved quickly. These students have learned a strategy that they can carry into any classroom or workplace. This will in turn create working members of society who give back to their community when these students reach adulthood. This research project may be replicated in other schools using cooperative group work.

Recommendations for Action

The research from this study indicated that the students in the experimental group had a decrease in math anxiety levels when compared to the equivalent control group. The study also demonstrated that female students in the experimental group had a decrease in math anxiety levels when compared to the equivalent control group of female students. However, based on the data from this study, the male students from the experimental group showed no change in math anxiety levels when compared to male students in the equivalent control group. Based on the information gained from this study, I first need to share the results with the principal and math colleagues to determine if the cooperative group strategy is worth pursuing through a staff development workshop. If colleagues determine that they are interested in learning more about cooperative groups based on the information obtained through this research study, staff development options can be discussed and planned. Activities for the purpose of incorporating cooperative groups can be designed and tailored for any grade level in the school. Hancock (2004)

recommended that students involved in cooperative groups consist of mixed ability and gender in order to be the most effective.

Recommendations for Future Research

The following are recommendations for possible areas of study:

1. A mixed methods study, which incorporates qualitative and quantitative data, would assist in showing the depth of math anxiety of each student. This would include student scores, surveys and interviews to gain a better insight into the problem, as well as how and when math anxiety began. This would assist in determining the effectiveness of cooperative groups as well.

2. This study was conducted over a 9 week period of time. It would be productive to collect data over the course of one school year to determine if cooperative groups could provide more extensive data when using cooperative groups for a longer period of time.

3. This quantitative study can also be conducted in the areas of science, social studies, and reading. Using the other academic areas, the effects of cooperative groups could be compared to those from the mathematics study. A study of this magnitude would give a better understanding of how effective cooperative groups can be when used in any classroom.

4. Future research may include using cooperative groups in different content areas, such as science and the ELL classrooms.

5. Future research may include a study pertaining to teachers who teach math even though they lack comfort in doing so.

Closing Statement

I examined the effectiveness of cooperative groups on the math anxiety levels of Grade 5 males and females. The quantitative data were collected from a preMASC and postMASC survey. The results showed:

1. MASC scores decreased for Grade 5 students in the cooperative group when compared to Grade 5 students in the noncooperative group.
2. MASC scores decreased for Grade 5 females in the cooperative group but not for Grade 5 females in the noncooperative group.
3. MASC scores for the cooperative group males were the same as the MASC scores for the noncooperative group; no difference between the two groups was noted.

This study provided evidence that showed a decrease in math anxiety for the students in the Grade 5 classroom when involved in a mixed gender, mixed ability cooperative group. The data demonstrated that cooperative groups were an effective teaching strategy for use in the mathematics classroom. The data showed a decrease in the math anxiety levels of the female students and students in general. Evidence supports cooperative groups can be implemented into each Grade 5 classroom to effectively eliminate any anxiety, regardless of the subject matter. To effectively use cooperative groups, assignments and activities will be changed.

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Appendix A

Letter of Permission to Conduct the Research Study

The Letter of Permission to Conduct the Research Study is on the following page.

Dr. Sabrina Calhoun, Principal *Learning Unconditionally for Every Student"*

January 29, 2010

To Whom It May Concern:

This is an amendment letter stating that the fifth grade end of the year math test can be given at anytime of the year. It is up to the teacher's discretion to determine if the test is used in a graded or non-graded format during the school year. Melissa Batton will give the fifth grade students a math test that is part of our standard classroom curriculum and procedures for purposes of diagnostic, pretest, posttest, or benchmark, or for indicating areas of strengths or weaknesses in mathematics.

Thank you,

Sabrina Calhoun

Dr. Sabrina Calhoun
Principal

Appendix B

DATA USE AGREEMENT

This Data Use Agreement, effective as of January 20, 2010, is entered into by and between Melissa Batton, Researcher, and Sabrina Calhoun, Principal. The purpose of this Agreement is to provide Melissa Batton with access to a Limited Data Set ("LDS"), (math and anxiety scores for research purposes) for use in research in accord with the HIPAA and FERPA Regulations.

1. Definitions. Unless otherwise specified in this Agreement, all capitalized terms used in this Agreement not otherwise defined have the meaning established for purposes of the "HIPAA Regulations" codified at Title 45 parts 160 through 164 of the United States Code of Federal Regulations, as amended from time to time.

2. Preparation of the LDS. Data Provider, Sabrina Calhoun shall prepare and furnish to Data Recipient, Melissa Batton a LDS in accord with any applicable HIPAA or FERPA Regulations

3. Data Fields in the LDS. No direct identifiers such as names may be included in the Limited Data Set (LDS). In preparing the LDS, Sabrina Calhoun shall include the **data fields specified as follows**, which are the minimum necessary to accomplish the research: standardized test scores.

4. Responsibilities of Data Recipient. Data Recipient agrees to:

    a. Use or disclose the LDS only as permitted by this Agreement or as required by law;

    b. Use appropriate safeguards to prevent use or disclosure of the LDS other than as permitted by this Agreement or required by law;

    c. Report to Data Provider any use or disclosure of the LDS of which it becomes aware that is not permitted by this Agreement or required by law;

    d. Require any of its subcontractors or agents that receive or have access to the LDS to agree to the same restrictions and conditions on the use and/or disclosure of the LDS that apply to Data Recipient under this Agreement; and

    e. Not use the information in the LDS to identify or contact the individuals who are data subjects.

5. Permitted Uses and Disclosures of the LDS. Data Recipient may use and/or disclose the LDS for its Research activities only.

6. Term and Termination.

   a. Term. The term of this Agreement shall commence as of the Effective Date and shall continue for so long as Data Recipient retains the LDS, unless sooner terminated as set forth in this Agreement.

   b. Termination by Data Recipient. Data Recipient may terminate this agreement at any time by notifying the Data Provider and returning or destroying the LDS.

   c. Termination by Data Provider. Data Provider may terminate this agreement at any time by providing thirty (30) days prior written notice to Data Recipient.

   d. For Breach. Data Provider shall provide written notice to Data Recipient within ten (10) days of any determination that Data Recipient has breached a material term of this Agreement. Data Provider shall afford Data Recipient an opportunity to cure said alleged material breach upon mutually agreeable terms. Failure to agree on mutually agreeable terms for cure within thirty (30) days shall be grounds for the immediate termination of this Agreement by Data Provider.

   e. Effect of Termination. Sections 1, 4, 5, 6(e) and 7 of this Agreement shall survive any termination of this Agreement under subsections c or d.

7. Miscellaneous.

   a. Change in Law. The parties agree to negotiate in good faith to amend this Agreement to comport with changes in federal law that materially alter either or both parties' obligations under this Agreement. Provided however, that if the parties are unable to agree to mutually acceptable amendment(s) by the compliance date of the change in applicable law or regulations, either Party may terminate this Agreement as provided in section 6.

   b. Construction of Terms. The terms of this Agreement shall be construed to give effect to applicable federal interpretative guidance regarding the HIPAA Regulations.

   c. No Third Party Beneficiaries. Nothing in this Agreement shall confer upon any person other than the parties and their respective successors or assigns, any rights, remedies, obligations, or liabilities whatsoever.

   d. Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

e. Headings. The headings and other captions in this Agreement are for convenience and reference only and shall not be used in interpreting, construing or enforcing any of the provisions of this Agreement.

IN WITNESS WHEREOF, each of the undersigned has caused this Agreement to be duly executed in its name and on its behalf.

DATA PROVIDER

Signed: Sabrina Calhoun

Print Name: Sabrina Calhoun

Print Title: Principal

DATA RECIPIENT

Signed: Melissa Batton

Print Name: Melissa Batton

Print Title: Researcher

Appendix C

Amendment Letter

The Amendment Letter is on the following page.

Dr. Sabrina Calhoun, Principal *Learning Unconditionally for Every Student"*

January 29, 2010

To Whom It May Concern:

This is an amendment letter stating that the fifth grade end of the year math test can be given at anytime of the year. It is up to the teacher's discretion to determine if the test is used in a graded or non-graded format during the school year. Melissa Batton will give the fifth grade students a math test that is part of our standard classroom curriculum and procedures for purposes of diagnostic, pretest, posttest, or benchmark, or for indicating areas of strengths or weaknesses in mathematics.

Thank you,

Sabrina Calhoun

Dr. Sabrina Calhoun
Principal

Appendix D

The following page is the Letter of Permission from Harcourt Math to use and reproduce the cooperative group activities and math tests for the study.

HOUGHTON MIFFLIN HARCOURT

9400 South Park Center Loop
Orlando, Florida 32819

June 30, 2009

Mrs. Melissa Batton

Dear Mrs. Batton:

Thank you for your request of June 11 requesting permission to reproduce and administer in classrooms select pages PA12, PA22, PA30, PA31, AP39, and PA48, from our HOUGHTON MIFFLIN H*ARCOURT MATH*, Georgia, *Performance Assessment*, Grade 5, and fourteen (14) problems from the *Georgia Assessment* on CD-ROM to be used as pre/posttest in connection with your doctoral program for Walden University.

We have no objection to your request as stated. We understand that you will include the results of the assessment in your dissertation to be published thru Walden University and posted to their server. You agree not to portray Houghton Mifflin Harcourt material in a negative manner. Please include the following notice:

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Please provide us with a final draft of your doctoral thesis for review.

We appreciate your interest in this program. Please contact me if I can provide further assistance.

Sincerely,

Nancy King

Nancy King
Manager
Contracts, Copyrights, and Licensing

NK:mr

Appendix E

Permission to use Mathematics Anxiety Survey for Children

Dear Dr. Henry,

Thank you for responding to my email and for granting permission to use the Mathematics Anxiety Scale for Children.

Respectfully,

Melissa Batton

Original E-mail
From: "Henry, Loren Lee" <lhenry@iuk.edu>
Date: 08/13/2009 08:44 AM
To: Melissa Batton <melissa.batton@waldenu.edu>
Subject: RE: Mathematics Anxiety Scale for Children

Dear Ms. Batton,

You have permission to use the MASC scale in your doctoral study. Your best source is the October 1990 issue of Measurement and Evaluation in Counseling and Development in which an article by Dr. Chiu and me was published.
I wish you success in your doctoral studies. Dr. Chiu and I are both retired and he still resides in Kokomo, In where Indiana University Kokomo is located. My wife and I both retired in May of 2006 and now reside in Bloomington, In.

Sorry that I haven't responded sooner, but we have been without access to email or sometimes even cell phone service as we have been away from home for over 5 weeks, some of which was spent camping in Shenandoah National Park where even cell phone service is iffy at best. In fact, for about 20 days of the 5 weeks we were volunteers at Camp Friendship, a camp for children with cancer, located about 1 mile down a one lane road on a horse farm near the little town of Sunshine, Md.

Loren L. Henry

From: Melissa Batton [melissa.batton@waldenu.edu]
Sent: Monday, July 27, 2009 10:20 PM
To: Henry, Loren Lee
Subject: Mathematics Anxiety Scale for Children

Dear Dr. Henry,

I am a doctoral student with Walden University in Baltimore, Maryland. I am in the process of preparing a doctoral study to determine the effect of cooperative groups on math anxiety in Grade 5 students. I would like to use and publish your Mathematics Anxiety Scale for Children with my doctoral study and final paper. Also, I am interested in how the MASC is to be scored to determine the math anxiety levels. I will cite and reference your work as required by Walden University and as APA dictates. I appreciate your consideration of this matter. If this is possible, please send an attachment of the instrument and the scoring guidelines.

Respectfully,
Melissa Batton

Appendix F

Math Test 1 and Math Test 2 (copied with permission)

Select the best answer.

1. What is the place value of the digit 4 in the number 2.43?

   A. hundreds

   B. tens

   C. tenths

   D. hundredths

2. Amy's box measures 7 cm long, 4 cm wide, and 1 cm high. What is the volume of the box?

   A. 16 cu. cm

   B. 28 cu. cm

   C. 45 cu. cm

   D. 54 cu. cm

3. Which shows the sum of $\frac{1}{7}+\frac{2}{14}$?

   A. $\frac{2}{7}$

   B. $\frac{1}{3}$

   C. $\frac{5}{8}$

   D. $\frac{3}{4}$

4. Which quadrilateral has 0 right angles and 2 pairs of congruent sides?

A. 

B. 

C. 

D. 

5. Which number is the greater multiple of 7?

A. 16

B. 28

C. 42

D. 56

6. What is the difference in simplest form?

$9\frac{7}{8} - 2\frac{3}{4}$

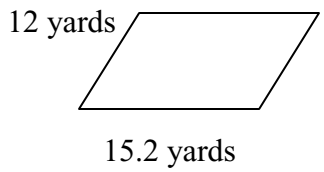
A. $7\frac{1}{8}$

B. $6\frac{3}{8}$

C. $7\frac{2}{4}$

D. $6\frac{2}{3}$

7. What is the area of the following shape?



A. 182.4 sq. yd

B. 30.4 sq. yd

C. 27.2 sq. yd

D. 54.4 sq. yd

8. What is the area of a circle that has a diameter of 12 feet? Use $\pi \approx 3.14$

A. 18.84 sq. ft.

B. 37.68 sq. ft.

C. 75.36 sq. ft.

D. 113.04 sq. ft.

9. What is the value of $(14n + 18) + 3$ if $n = 9$?

A. 126

B. 129

C. 144

D. 147

10. What is the volume of a cube where one side measures 2.5 inches?

A. 10.96 cubic inches

B. 15.625 cubic inches

C. 17.81 cubic inches

D. 180.1 cubic inches

11. Which number is not divisible by both 3 and 6 ?

A. 306

B. 603

C. 360

D. 630

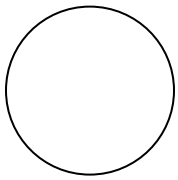
12. A circular area has a distance around it of 47 yards. About how many yards across is the running area?

A. 15 yards

B. 19 yards

C. 20 yards

D. 24 yards



13. The diameter of Mars is 4,240 miles. About how many miles is the circumference of Mars?

A. about 8,480 miles

B. about 12,720 miles

C. about 16,960 miles

D. about 20,000 miles

14. Which type graph would be the best choice for showing how you spent your day?

A. Bar Graph

B. Line Graph

C. Pictograph

D. Circle Graph

Appendix G

Script for Completing Mathematics Anxiety Scale for Children

Control Group Teacher
Experimental Group Teacher

Place the following statements on the board or on the overhead to use as an example for filling out the MASC instrument. Include the directions for better clarification.

Today you are going to complete a math paper that will ask you to rate math sentences about how you feel and think. There is no right or wrong answers. This is not a grade. It is just for me to look at. I have some examples written to show you what I want you to do. You will have to complete the paper alone; so please watch so you will know what to do. I am going to pretend I am answering some questions like you will be answering. Read the directions from the Mathematics Anxiety Scale for Children aloud for the students to hear. Allow the students to watch you complete the statements below. Show students that some numbers may be used more than once.

PLEASE USE THESE RESPONSE CODES:
1 – Not Nervous
2 – A Little Bit Nervous
3 – Very Nervous
4 – Very, Very Nervous

_____ I would watch a scary movie alone.

_____ I have to get my shots for sixth grade

Appendix H

Mathematics Anxiety Scale for Children

Henry and Chiu (1990)

Directions: This inventory consists of statements about your feelings toward mathematics. There are no correct or incorrect responses. Read each item carefully. Please think about how you feel about each item. Circle the number that most closely corresponds to how the statements best describes your feelings. Use the following response scale to respond to each item.

PLEASE USE THESE RESPONSE CODES:

1 – Not Nervous
2 – A Little Bit Nervous
3 – Very Nervous
4 – Very, Very Nervous

1. Getting a new math book 1 2 3 4
2. Reading and interpreting graphs or charts 1 2 3 4
3. Listening to another student explain a math problem 1 2 3 4
4. Watching a teacher work a mathematics problem on the chalk board 1 2 3 4
5. Walking into a math class 1 2 3 4
6. Looking through the pages in a math book 1 2 3 4
7. Starting a new chapter in a math book 1 2 3 4
8. Thinking about math outside of class 1 2 3 4
9. Picking up a math book to begin working on a homework assignment 1 2 3 4
10. Working on a mathematics problem, such as "If I spend $3.87 at the store, how much change will I get from a $5 bill?" 1 2 3 4
11. Reading a formula in science 1 2 3 4
12. Listening to the teacher in math class 1 2 3 4
13. Using the tables in the back of a math book 1 2 3 4
14. Being told how to interpret mathematical statements 1 2 3 4
15. Being given a homework assignment of many difficult math problems which is due the next time 1 2 3 4
16. Thinking about a math test one day before the test 1 2 3 4
17. Doing a long division problem 1 2 3 4
18. Taking a quiz in math 1 2 3 4
19. Getting ready to study for a math test 1 2 3 4
20. Being given a math quiz that you were not told about 1 2 3 4
21. Waiting to get a math test returned in which you expect to do well 1 2 3 4
22. Taking an important test in math class 1 2 3 4

Appendix I

Script for Treatment Activities

The following pages are the assignments for the treatment group class in this study. Assignments are copied from Harcourt Math, {Georgia Series}, the adopted math curriculum of the district. Permission to copy has been provided by Harcourt Math.

Teacher Script:

Today, we are going to begin working together in groups. I have already selected your groups, and you will remain in this group for 9 weeks. There are a few rules we need to discuss before we go over the assignment. First, everyone in the group participates and has a job to do. Jobs will rotate every time. We will do cooperative group assignments two times every week. The jobs are timekeeper, reader, writer, and presenter. You will have 15 minutes to complete today's assignment page. The timekeeper will remind you of the time and keep everyone on task. The reader will read the directions and the questions aloud for everyone in the group. The writer is responsible for writing what the group feels is necessary for solving the problem. Everyone may use scrap paper to assist in solving the problem, but only one person will write the final answer. The presenter will present your group's solution and explain how the group solved the problem. Are there any questions so far? (Teacher will answer questions as needed).

Okay, let us look at today's assignment. (Teacher passes out assignment to each group). This is your first assignment working as a group. Today's assignment is a problem-solving exercise. The reader will begin by reading aloud your directions and problem number one. When you have solved problem one, go on and read problem number two. Keep working

until all the problems are solved. Make sure the presenter is aware of the steps or methods used to solve the problems. You may need to make notes out beside the problem to remind the presenter if you added, subtracted, multiplied, or divided.

So, are there any other questions? (Teacher will answer any student questions regarding the assignment). Your group needs to decide who will do which job. The writer should write down the student name for each job. Your group needs to attempt to answer any questions you may have while working these problems. I will only assist as a last resort. I will be listening to your problem-solving conversations and monitoring your group as you work. Okay, please begin. Your 15 minutes have started. Let me know if your group finishes early, and we will look at your assignment and discuss any problem areas you encountered.

Appendix J

Problem Solving

Group Assignment

Week 1: Monday Time to Solve: 15 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

1. Juan earned $43.50 washing cars. He spent $19.95 on a new DVD. How much does he have left?

2. On Friday night, 11,000 people attended a football game, and on Saturday 16,000 people attended a football game. How many people attended the two games?

3. A total of 143 players are riding a bus to football practice. If 25 players can ride in each bus, how many buses are needed? How many students will be on the last bus if the other buses are full?

4. Bill's Doughnuts sells doughnuts by the dozen. The bakery has 230 doughnuts prepared. Does the bakery have enough doughnuts to fill 22 orders?

5. Sally has a catering business. She charges $42.00 per couple to cater wedding parties. If the wedding is planning to have 150 guests, how much will they be charged by Sally to cater the event?

Group Assignment

Week 1: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

1. Jeremy had 84 feet of string. He divided it into 4 equal pieces. How long was each piece of string?

2. Tina bought a game console on sale for $112.56 plus $6.75 for tax. The regular price for the console was $149.99, including tax. How much did Tina save?

3. Last winter it snowed 12.9 cm in December; 17.4 cm in January; 16.9 cm in February; and 8.6 cm in March. In which month did the least amount of snow fall? In which month did the most amount of snow fall?

4. The 88 acres of orange groves produced 1,534 tons of oranges this season. How many tons did each acre produce?

5. Write the standard form for three hundred twelve billion, thirty-five million, four hundred thousand, nine hundred seventy-two.

6. The LUES bought 9,000 pencils for the beginning of the school year. There are 25 pencils in each box. How many boxes of pencils did the school buy? If the pencils cost $4.75 per box, how much did LUES spend on purchasing the pencils?

Group Assignment

Week 2: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

1. Mayra wants to read her new book in 14 days. The book is 457 pages long. If she reads the same number of pages each day, how many pages will she read on the first day?

2. Susie puts 86 flowers into 7 vases, with the same number in each vase except one. How many flowers are in the vase with the least number of flowers?

3. Grace collects precious dolls. She has one that is worth $82; another is worth $73; and her favorite doll is worth $115. How much do her dolls cost altogether?

4. An ice cream shop in Pigeon Forge, Tennessee sold 10,269 single scoop cones on Monday. On Tuesday, they sold 13,008 cones. How many more cones did they sell on Tuesday than Monday? If each single scoop cone sold for 35 cents, how much money did they earn at the ice cream shop?

5. Eight people joined the soccer team. The rest joined the tennis team. There were 20 people that joined either the soccer or the tennis team. How many people joined the tennis team?

Group Assignment

Week 2: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

1. On a test, each question in part A is worth 2 points, and each question in part B is worth 5 points. Marsha got all the questions in part A correct, and her test score was 85. How many part B questions did she miss?

2. The fifth-grade classes from LUES are going on a field trip. Eight teachers will go with 175 students. If each van can hold 14 people, how many vans are needed for the field trip? How many students will be on the last van?

3. Jacob put all 522 of his sports collector cards in an album. Each page of the album holds 18 cards. How many pages did Jacob use?

4. A NASCAR race team covered 4,488 miles in a 24-hour race. If they traveled the same distance each hour, how far did they go in 1 hour?

5. Laura's piece of wire is 5 times as long as Bryan's wire. Laura's wire is 8.7 cm long. How long is Bryan's wire? Their brother Ben claims his wire is half as long as both Laura's and Bryan's wires together. How long is Ben's wire?

Group Assignment

Week 3: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

1. The sum of two numbers is 15 Their product is 56. What are the two numbers?

2. The Boy Scouts washed 9 cars one afternoon. They earned $7.50 for each car they washed. How much money did they earn?

3. Brent took $5.10 in nickels from his piggy bank to buy some soccer cards. Each card cost the same amount, between $0.70 an $1.00. He used all of his nickels paying for the cards. How many soccer cards did Brent buy, and how much did each card cost?

4. Dewey and Bryan ordered a pizza. The large pizza was cut in equal slices. Bryan said he ate twice as much pizza as Dewey. How many slices did each one eat?

5. James uses $\frac{5}{6}$ yards of butcher paper to make one football sign. How many yards of paper will be need to make three football signs?

Group Assignment

Week 3: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

1. A pizza parlor has a special offer of a personal pan pizza with one topping. Customers can choose thin or thick crust, and they have four choices of toppings: pepperoni, sausage, extra cheese, or bacon. How many choices do customers have?

2. During the week, Carrie spent $10.50 for a book. The next day her father gave her $1.25. Then she went to a movie, which cost $6.50. If she now has $10.25, how much money did she have at the beginning of the week?

3. Samantha bought 4 packets of stickers. Each packet contains 100 stickers. If she divides all of the stickers evenly among six friends and herself, how many stickers are left over?

4. Brent decorated $\frac{1}{6}$ of his sugar cookies with blue frosting, $\frac{1}{4}$ with yellow frosting, and $\frac{3}{8}$ with purple frosting. Which frosting was used the least? Which frosting was used the most?

5. Sherry saved $60.00 to spend on a party for her mother. Sherry spent $14.98 for a cake and $12 for party decorations. She spent the rest on a gift. How much did she spend on the gift?

Group Assignment

Week 4: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

1. Nancy went to the art museum and noticed that the paintings were numbered using whole numbers and decimals based on the year and month they were painted. Four painting were numbered 1887.6; 1764.11; 1878.4; and 1888.8. Which painting is the second oldest?

2. Dawson wanted to make a graph to compare the populations of Georgia's four largest cities. What graph would be the best type for Dawson to use and explain why?

3. It costs $8.65 to ride the trolley. Ms. Hart took her fifth-grade class on the trolley to the museum. There were 22 students from Ms. Hart's class that went to the museum. How much did Ms. Hart's class spend on the class and herself for the trolley?

4. Logan, Gracie, Raegan, and Hannah want to share the cost of a large pizza equally. The pizza costs $16.40, plus a $2.00 delivery charge. How much money would each need to contribute to pay for the pizza and the delivery?

5. What is the decimal equivalent of $\frac{23}{25}$?

6. A carton contains 2 quart of orange juice. How many pints of juice does it contain?

Ticket Sales

Group Assignment (copied from Harcourt Math)

Week 4: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

Two theaters sell advertising space on the back of their tickets.

Month	Number of Tickets Sold	
	Theater A	Theater B
March	200	300
April	500	50
May	150	600
June	500	500
July	450	650

a) Use the data in the table to find the mean, median, mode, and range of ticket sales for each theater.

b) Compare the ticket sales at the two theaters. Based on this data, which theater would you choose if you want to advertise?

c) Decide what kind of graph would be best to organize and display the data in the table. Make the graph. Write a question that can be answered by using the data in your graph.

Show your work.

Jewelry Store

Group Assignment (copied from Harcourt Math)

Week 5: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

Suni uses glass beads to make jewelry. The beads come in six colors. Each color is a different size.

Glass Color	Beads Size (in cm)
Red	1.2
Blue	0.5
Green	0.7
Yellow	0.4
Orange	1.3
Purple	0.6

a) Design a bracelet using no fewer than 10 and no more than 20 beads. Include beads of at least two colors. Find the length of the bracelet.

b) Suni sells her bracelets and necklaces for $0.95 per centimeter. How much would the bracelet you designed cost?

c) Suni designs a necklace of 40 beads with red, orange, and yellow colors. What could be the length of the necklace?

Show your work.

At the Fair

Group Assignment (copied from Harcourt Math)

Week 5: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

You are in charge of renting tables and buying hot dogs and hamburgers to sell at the Fall Fair. You want to have enough food, but not much left over. Use the notes from last year's fair committee to help you plan.

a) Estimate how many people will eat at the fair. You need to seat about half of the people at one time. How many tables should you rent?

b) How many packages of hot dogs and hamburgers should you buy? Explain why you think these are good estimates.

c) This year you decide to order packages of cheese slices so that half of the hamburger orders can have a slice of cheese. Cheese slices come in packages of 24. How many packages of cheese will you need?

Notes from the Fair

- 475 people ate at the fair.
- More people bought hamburgers than hot dogs. Some people bought both.
- Hot dogs: 8 per package
- Hamburgers: 12 per package
- Tables seat 10 people

Show your work.

Bake Sale

Group Assignment (copied from Harcourt Math)

Week 6: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

Ben, Bryan, and Libby baked cookies for the school bake sale.

The students want to put the cookies in bags. Each bag will contain all three kinds of cookies. All the bags will have the same number of each kind of cookie.

a) Find all the ways each kind of cookies can be divided so there is the same number in each bag.

b) What is the greatest number they can put in each bag? How many bags of cookies does this make?

Baker	Number of Cookies	Kind of Cookie
Ben	24	peanut
Bryan	18	raisin
Libby	12	oatmeal

c) Other students want to bring in cookies. Name two other numbers of cookies that can be divided in the same way.

Show your work.

Pizza Time

Group Assignment (copied from Harcourt Math)

Week 6: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

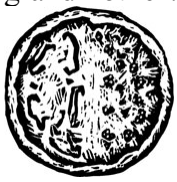
Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

Dab bought a pizza to share with Kenny. Each boy ate a different number of pieces. Dan ate the most. When the boys were finished there was one piece left for Dan to give to his grandmother.

a) Draw a diagram of the pizza. Write fractions on the diagram to show the amounts Dan and Kenny ate.

b) If the boys ate the amounts you suggested, what fraction of the pizza was left for Dan's grandmother?



c) Dan baked four strawberry tarts to share with his grandmother and Kenny. Use mixed numbers to suggest a way they could have shared the tarts if Dan ate the most and his grandmother ate the least.

Show your work.

Making Decisions

Group Assignment (copied from Harcourt Math)

Week 7: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

We make decisions every day. There are often many things to consider. Use the questions below to guide you through making decisions.

Your neighbors have invited you to go with them on Saturday. Julia's family is going to the museum and to a movie. Karl's family is going on a bakery tour and to a football game. You must decide which invitation to accept.

1. If the museum visit will cost $3.00 and the movie will cost $4.75, how much will the trip with Julia's family cost?

2. If a football ticket cost $14.50 and the bakery tour is free, how much will the trip with Karl's family cost?

3. If you had to make your decision based on total cost, which trip would you choose and why?

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4. Julia's family will start their trip at 8:30 a.m. Breakfast will take 45 minutes. They plan to stay at the museum for 2 hours. Lunch will take 45 minutes, and the movie will last 2 hours and 30 minutes. When will the trip with Julia's family end?

5. The bakery tour will take 1 hour and 30 minutes. Lunch will take 30 minutes. The football game will take 3 hours and 30 minutes, and dinner with Karl's family will take 1 hour. If this trip starts at 11:00 A.M., when will it end?

Animal Crackers

Group Assignment (copied from Harcourt Math)

Week 7: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

For questions 1-5, use the table. Solve each problem. Name the operation you used: addition, subtraction, multiplication, or division.

Type of Food	Amount (in pounds)
Rabbit Food	186.3
Hamster Food	53.1
Mouse Food	26.9
Gerbil Food	12.6

1. Ricardo and his two friends purchase animal food. They share what they buy equally. What is Ricardo's share of the rabbit food?

2. Ricardo and his friends buy the same amount of gerbil food each month for 5 months. How much gerbil food do they buy?

3. Ricardo and his friends pay $1.25 per pound for a month's worth of gerbil food. How much does the gerbil food cost in all?

4. Ricardo and his friends spent $37.17 buying hamster food. What was the cost per pound for the hamster food?

5. How much animal food do Ricardo and his friends buy in all? _____ pounds

Group Assignment

Week 8: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

Guess and check to solve each problem.

1. Libby bought 7.5 pounds of pretzels for a party. The pretzels are sold in bags that weigh between 2.0 and 3.5 pounds. Each of the bags she bought weighed the same amount. The weight is a multiple of 5. How many pounds were in each bag of pretzels?

2. Eddie cut a 30 foot 6 inch rope into smaller pieces. The pieces were between 3.0 feet and 3 feet 6 inches in length and were all the same size. The length of each smaller rope was a multiple of 2. How long was each of the smaller pieces of rope?

3. Brandon is making fudge to sell at the class fundraiser. He has 10.5 pounds of fudge. He can package the fudge in boxes that hold 0.5 pound, 1 pound, or 1.5 pounds. Brandon wants each box to weigh the same amount and he wants to use all of the fudge. How much fudge will Brandon put in each box? How many boxes will he have?

4. A company spent $100.80 to purchase flyers for their grand opening. The flyers cost between $0.50 and $0.70 each. The price was a multiple of $0.05. The company paid the same amount for each flyer. How many flyers did the company buy? How much did each flyer cost?

5. Dawson, Bryleigh, and Kassidy have pets. One of them has a turtle, one has a cat, and the other has a goldfish. Dawson's pet has 4 feet, but it cannot climb trees. Bryleigh is allergic to fur. Who has which pet?

Group Assignment

Week 8: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

Solve each problem.

1. Gene stopped at the mall for lunch. He had a $20 bill. He bought the lunch special for $7.59, a drink for $1.50, and 3 cookies for $0.85 each. How much change should he get?

2. Shelby divided her collection of 150 shells equally into *n* boxes. How many shells could she put in each box?

3. A group of rabbits and ducks has a total of 99 heads and legs among them. There are twice as many ducks as there are rabbits. How many are there of each?

4. Every fourth day, Ben waters the front yard, and every sixth day, he waters the back yard. If Ben waters the front yard on May 4 and the back yard on May 6, on which days in May will he water both the front and back yards on the same day?

5. On Sunday, the ice cream store gave every second customer a coupon for a free ice cream cone and every ninth customer a coupon for a free milkshake. If there were 50 customers in the store that day, which customers received coupons for both a cone and a milkshake?

Group Assignment

Week 9: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Pick someone to read each question. Pick someone to keep time. Pick someone to write the answers. Pick someone to present your answer when called upon to explain how you decided on an answer.

Reader: _____ Writer: _____

Timekeeper: _____ Presenter: _____

Solve the problems.

1. The sanitation department picks up trash every 5 days. The recycling center picks up bottles every 7 days. They both picked up trash and bottles today. In how many days will they both pick up trash and bottles on the same day?

2. Sheila's fish tank holds 10.2 gallons of water. Jill's tank holds 0.6 times that amount. How much water does Jill's tank hold?

3. The diameter of the moon is about 3,500 kilometers. The diameter of the sun is about 400 times the diameter of the moon. Estimate the circumference of the sun. Estimate the circumference of the moon.

4. Describe one way you could break apart a pentagon to find its area. 

5. Each can of paint covers 50 sq. ft. How many cans does Vincent need to paint a 12 ft. by 16 ft. backdrop for the play?

6. Beth said a triangle with a base of 4 feet and a height of 7 feet has an area of 28 sq. ft. James said that isn't correct. Describe and correct Beth's error.

Appendix K

Control Group Script

The following is the script for the control group when beginning independent assignments. Assignments are copied from Harcourt Math, {Georgia Series}, the adopted math curriculum of the district.

Teacher Script:

Today, you are going to work alone to complete the following assignment. There are a few rules we need to discuss before we go over the assignment. First, everyone needs to complete the assignment in class and without help. We will these problem-solving assignments two times every week. You will have 15 minutes to complete today's assignment page. I will remind you of the time and keep everyone on task. You must read the directions and the questions silently. Make sure you write down the math steps you do for solving the problem. Do not erase your work unless you make a mistake. Everyone may use scrap paper to assist in solving the problem. After your 15 minutes are over, all pages must be turned in to the assignment box. Are there any questions so far? (Teacher will answer questions as needed).

Okay, let us look at today's assignment. (Teacher passes out assignment to each group). This is your an assignment to be complete on your own. Today's assignment is a problem-solving exercise. Begin by putting your name and date on the sheet. Make sure you read the directions and questions before you begin working. When you have solved problem one, go on and read problem number two. Keep working until all the problems are solved.

You may need to make notes out beside the problem to remind yourself if you added, subtracted, multiplied, or divided.

So, are there any other questions? (Teacher will answer any student questions regarding the assignment). I will only assist as a last resort. I will be watching you as you problem-solve and monitoring you as you work. Okay, please begin. Your 15 minutes have started. Let me know if you finish early, and we will look at your assignment and discuss any problem areas you encountered.

Control Group Teacher will let the students begin work on activity independently. Please collect completed work from students.

Appendix L

Problem Solving

Individual Assignment

Name _____

Week 1: Monday Time to Solve: 15 minutes Time to Discuss: 15 minutes

1. Juan earned $43.50 washing cars. He spent $19.95 on a new DVD. How much does he have left?

2. On Friday night, 11,000 people attended a football game, and on Saturday 16,000 people attended a football game. How many people attended the two games?

3. A total of 143 players are riding a bus to football practice. If 25 players can ride in each bus, how many buses are needed? How many students will be on the last bus if the other buses are full?

4. Bill's Doughnuts sells doughnuts by the dozen. The bakery has 230 doughnuts prepared. Does the bakery have enough doughnuts to fill 22 orders?

5. Sally has a catering business. She charges $42.00 per couple to cater wedding parties. If the wedding is planning to have 150 guests, how much will they be charged by Sally to cater the event?

Individual Assignment

Week 1: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

1. Jeremy had 84 feet of string. He divided it into 4 equal pieces. How long was each piece of string?

2. Tina bought a game console on sale for $112.56 plus $6.75 for tax. The regular price for the console was $149.99, including tax. How much did Tina save?

3. Last winter it snowed 12.9 cm in December; 17.4 cm in January; 16.9 cm in February; and 8.6 cm in March. In which month did the least amount of snow fall? In which month did the most amount of snow fall?

4. The 88 acres of orange groves produced 1,534 tons of oranges this season. How many tons did each acre produce?

5. Write the standard form for three hundred twelve billion, thirty-five million, four hundred thousand, nine hundred seventy-two.

6. The LUES bought 9,000 pencils for the beginning of the school year. There are 25 pencils in each box. How many boxes of pencils did the school buy? If the pencils cost $4.75 per box, how much did LUES spend on purchasing the pencils?

Individual Assignment

Week 2: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

1. Mayra wants to read her new book in 14 days. The book is 457 pages long. If she reads the same number of pages each day, how many pages will she read on the first day?

2. Susie puts 86 flowers into 7 vases, with the same number in each vase except one. How many flowers are in the vase with the least number of flowers?

3. Grace collects precious dolls. She has one that is worth $82; another is worth $73; and her favorite doll is worth $115. How much do her dolls cost altogether?

4. An ice cream shop in Pigeon Forge, Tennessee sold 10,269 single scoop cones on Monday. On Tuesday, they sold 13,008 cones. How many more cones did they sell on Tuesday than Monday? If each single scoop cone sold for 35 cents, how much money did they earn at the ice cream shop?

5. Eight people joined the soccer team. The rest joined the tennis team. There were 20 people that joined either the soccer or the tennis team. How many people joined the tennis team?

Individual Assignment

Week 2: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

1. On a test, each question in part A is worth 2 points, and each question in part B is worth 5 points. Marsha got all the questions in part A correct, and her test score was 85. How many part B questions did she miss?

2. The fifth-grade classes from LUES are going on a field trip. Eight teachers will go with 175 students. If each van can hold 14 people, how many vans are needed for the field trip? How many students will be on the last van?

3. Jacob put all 522 of his sports collector cards in an album. Each page of the album holds 18 cards. How many pages did Jacob use?

4. A NASCAR race team covered 4,488 miles in a 24-hour race. If they traveled the same distance each hour, how far did they go in 1 hour?

5. Laura's piece of wire is 5 times as long as Bryan's wire. Laura's wire is 8.7 cm long. How long is Bryan's wire? Their brother Ben claims his wire is half as long as both Laura's and Bryan's wires together. How long is Ben's wire?

Individual Assignment

Week 3: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

1. The sum of two numbers is 15 Their product is 56. What are the two numbers?

2. The Boy Scouts washed 9 cars one afternoon. They earned $7.50 for each car they washed. How much money did they earn?

3. Brent took $5.10 in nickels from his piggy bank to buy some soccer cards. Each card cost the same amount, between $0.70 an $1.00. He used all of his nickels paying for the cards. How many soccer cards did Brent buy, and how much did each card cost?

4. Dewey and Bryan ordered a pizza. The large pizza was cut in equal slices. Bryan said he ate twice as much pizza as Dewey. How many slices did each one eat?

5. James uses $\frac{5}{6}$ yards of butcher paper to make one football sign. How many yards of paper will be need to make three football signs?

Individual Assignment

Week 3: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

1. A pizza parlor has a special offer of a personal pan pizza with one topping. Customers can choose thin or thick crust, and they have four choices of toppings: pepperoni, sausage, extra cheese, or bacon. How many choices do customers have?

2. During the week, Carrie spent $10.50 for a book. The next day her father gave her $1.25. Then she went to a movie, which cost $6.50. If she now has $10.25, how much money did she have at the beginning of the week?

3. Samantha bought 4 packets of stickers. Each packet contains 100 stickers. If she divides all of the stickers evenly among six friends and herself, how many stickers are left over?

4. Brent decorated $\frac{1}{6}$ of his sugar cookies with blue frosting, $\frac{1}{4}$ with yellow frosting, and $\frac{3}{8}$ with purple frosting. Which frosting was used the least? Which frosting was used the most?

5. Sherry saved $60.00 to spend on a party for her mother. Sherry spent $14.98 for a cake and $12 for party decorations. She spent the rest on a gift. How much did she spend on the gift?

Individual Assignment

Week 4: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

1. Nancy went to the art museum and noticed that the paintings were numbered using whole numbers and decimals based on the year and month they were painted. Four painting were numbered 1887.6; 1764.11; 1878.4; and 1888.8. Which painting is the second oldest?

2. Dawson wanted to make a graph to compare the populations of Georgia's four largest cities. What graph would be the best type for Dawson to use and explain why?

3. It costs $8.65 to ride the trolley. Ms. Hart took her fifth-grade class on the trolley to the museum. There were 22 students from Ms. Hart's class that went to the museum. How much did Ms. Hart's class spend on the class and herself for the trolley?

4. Logan, Gracie, Raegan, and Hannah want to share the cost of a large pizza equally. The pizza costs $16.40, plus a $2.00 delivery charge. How much money would each need to contribute to pay for the pizza and the delivery?

5. What is the decimal equivalent of $\frac{23}{25}$?

6. A carton contains 2 quart of orange juice. How many pints of juice does it contain?

Ticket Sales

Individual Assignment (copied from Harcourt Math)

Week 4: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

Two theaters sell advertising space on the back of their tickets.

a) Use the data in the table to find the mean, median, mode, and range of ticket sales for each theater.

b) Compare the ticket sales at the two theaters. Based on this data, which theater would you choose if you want to advertise?

c) Decide what kind of graph would be best to organize and display the data in the table. Make the graph. Write a question that can be answered by using the data in your graph.

Month	Number of Tickets Sold	
	Theater A	Theater B
March	200	300
April	500	50
May	150	600
June	500	500
July	450	650

Show your work.

Jewelry Store

Individual Assignment (copied from Harcourt Math)

Week 5: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

Suni uses glass beads to make jewelry. The beads come in six colors. Each color is a different size.

Glass Color	Beads Size (in cm)
Red	1.2
Blue	0.5
Green	0.7
Yellow	0.4
Orange	1.3
Purple	0.6

a) Design a bracelet using no fewer than 10 and no more than 20 beads. Include beads of at least two colors. Find the length of the bracelet.

b) Suni sells her bracelets and necklaces for $0.95 per centimeter. How much would the bracelet you designed cost?

c) Suni designs a necklace of 40 beads with red, orange, and yellow colors. What could be the length of the necklace?

Show your work.

At the Fair

Individual Assignment (copied from Harcourt Math)

Week 5: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

You are in charge of renting tables and buying hot dogs and hamburgers to sell at the Fall Fair. You want to have enough food, but not much left over. Use the notes from last year's fair committee to help you plan.

a) Estimate how many people will eat at the fair. You need to seat about half of the people at one time. How many tables should you rent?

b) How many packages of hot dogs and hamburgers should you buy? Explain why you think these are good estimates.

c) This year you decide to order packages of cheese slices so that half of the hamburger orders can have a slice of cheese. Cheese slices come in packages of 24. How many packages of cheese will you need?

Notes from the Fair

- 475 people ate at the fair.
- More people bought hamburgers than hot dogs. Some people bought both.
- Hot dogs: 8 per package
- Hamburgers: 12 per package
- Tables seat 10 people

Show your work.

Bake Sale

Individual Assignment (copied from Harcourt Math)

Week 6: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

Ben, Bryan, and Libby baked cookies for the school bake sale.

The students want to put the cookies in bags. Each bag will contain all three kinds of cookies. All the bags will have the same number of each kind of cookie.

a) Find all the ways each kind of cookies can be divided so there is the same number in each bag.

b) What is the greatest number they can put in each bag? How many bags of cookies does this make?

Baker	Number of Cookies	Kind of Cookie
Ben	24	peanut
Bryan	18	raisin
Libby	12	oatmeal

c) Other students want to bring in cookies. Name two other numbers of cookies that can be divided in the same way.

Show your work.

Pizza Time

Individual Assignment (copied from Harcourt Math)

Week 6: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

Dab bought a pizza to share with Kenny. Each boy ate a different number of pieces. Dan ate the most. When the boys were finished there was one piece left for Dan to give to his grandmother.

a) Draw a diagram of the pizza. Write fractions on the diagram to show the amounts Dan and Kenny ate.

b) If the boys ate the amounts you suggested, what fraction of the pizza was left for Dan's grandmother?

c) Dan baked four strawberry tarts to share with his grandmother and Kenny. Use mixed numbers to suggest a way they could have shared the tarts if Dan ate the most and his grandmother ate the least.

Show your work.

Making Decisions

Individual Assignment (copied from Harcourt Math)

Week 7: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

We make decisions every day. There are often many things to consider. Use the questions below to guide you through making decisions.

Your neighbors have invited you to go with them on Saturday. Julia's family is going to the museum and to a movie. Karl's family is going on a bakery tour and to a football game. You must decide which invitation to accept.

1. If the museum visit will cost $3.00 and the movie will cost $4.75, how much will the trip with Julia's family cost?

2. If a football ticket cost $14.50 and the bakery tour is free, how much will the trip with Karl's family cost?

3. If you had to make your decision based on total cost, which trip would you choose and why?

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4. Julia's family will start their trip at 8:30 a.m. Breakfast will take 45 minutes. They plan to stay at the museum for 2 hours. Lunch will take 45 minutes, and the movie will last 2 hours and 30 minutes. When will the trip with Julia's family end?

5. The bakery tour will take 1 hour and 30 minutes. Lunch will take 30 minutes. The football game will take 3 hours and 30 minutes, and dinner with Karl's family will take 1 hour. If this trip starts at 11:00 A.M., when will it end?

Animal Crackers

Individual Assignment (copied from Harcourt Math)

Week 7: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

For questions 1-5, use the table. Solve each problem. Name the operation you used: addition, subtraction, multiplication, or division.

Type of Food	Amount (in pounds)
Rabbit Food	186.3
Hamster Food	53.1
Mouse Food	26.9
Gerbil Food	12.6

1. Ricardo and his two friends purchase animal food. They share what they buy equally. What is Ricardo's share of the rabbit food?

2. Ricardo and his friends buy the same amount of gerbil food each month for 5 months. How much gerbil food do they buy?

3. Ricardo and his friends pay $1.25 per pound for a month's worth of gerbil food. How much does the gerbil food cost in all?

4. Ricardo and his friends spent $37.17 buying hamster food. What was the cost per pound for the hamster food?

5. How much animal food do Ricardo and his friends buy in all? _____ pounds

Individual Assignment

Week 8: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

Guess and check to solve each problem.

1. Libby bought 7.5 pounds of pretzels for a party. The pretzels are sold in bags that weigh between 2.0 and 3.5 pounds. Each of the bags she bought weighed the same amount. The weight is a multiple of 5. How many pounds were in each bag of pretzels?

2. Eddie cut a 30 foot 6 inch rope into smaller pieces. The pieces were between 3.0 feet and 3 feet 6 inches in length and were all the same size. The length of each smaller rope was a multiple of 2. How long was each of the smaller pieces of rope?

3. Brandon is making fudge to sell at the class fundraiser. He has 10.5 pounds of fudge. He can package the fudge in boxes that hold 0.5 pound, 1 pound, or 1.5 pounds. Brandon wants each box to weigh the same amount and he wants to use all of the fudge. How much fudge will Brandon put in each box? How many boxes will he have?

4. A company spent $100.80 to purchase flyers for their grand opening. The flyers cost between $0.50 and $0.70 each. The price was a multiple of $0.05. The company paid the same amount for each flyer. How many flyers did the company buy? How much did each flyer cost?

5. Dawson, Bryleigh, and Kassidy have pets. One of them has a turtle, one has a cat, and the other has a goldfish. Dawson's pet has 4 feet, but it cannot climb trees. Bryleigh is allergic to fur. Who has which pet?

Individual Assignment

Week 8: Thursday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

Solve each problem.

1. Gene stopped at the mall for lunch. He had a $20 bill. He bought the lunch special for $7.59, a drink for $1.50, and 3 cookies for $0.85 each. How much change should he get?

2. Shelby divided her collection of 150 shells equally into *n* boxes. How many shells could she put in each box?

3. A group of rabbits and ducks has a total of 99 heads and legs among them. There are twice as many ducks as there are rabbits. How many are there of each?

4. Every fourth day, Ben waters the front yard, and every sixth day, he waters the back yard. If Ben waters the front yard on May 4 and the back yard on May 6, on which days in May will he water both the front and back yards on the same day?

5. On Sunday, the ice cream store gave every second customer a coupon for a free ice cream cone and every ninth customer a coupon for a free milkshake. If there were 50 customers in the store that day, which customers received coupons for both a cone and a milkshake?

Individual Assignment

Week 9: Monday Time to Solve: 20 minutes Time to Discuss: 15 minutes

Name _____

Solve the problems.

1. The sanitation department picks up trash every 5 days. The recycling center picks up bottles every 7 days. They both picked up trash and bottles today. In how many days will they both pick up trash and bottles on the same day?

2. Sheila's fish tank holds 10.2 gallons of water. Jill's tank holds 0.6 times that amount. How much water does Jill's tank hold?

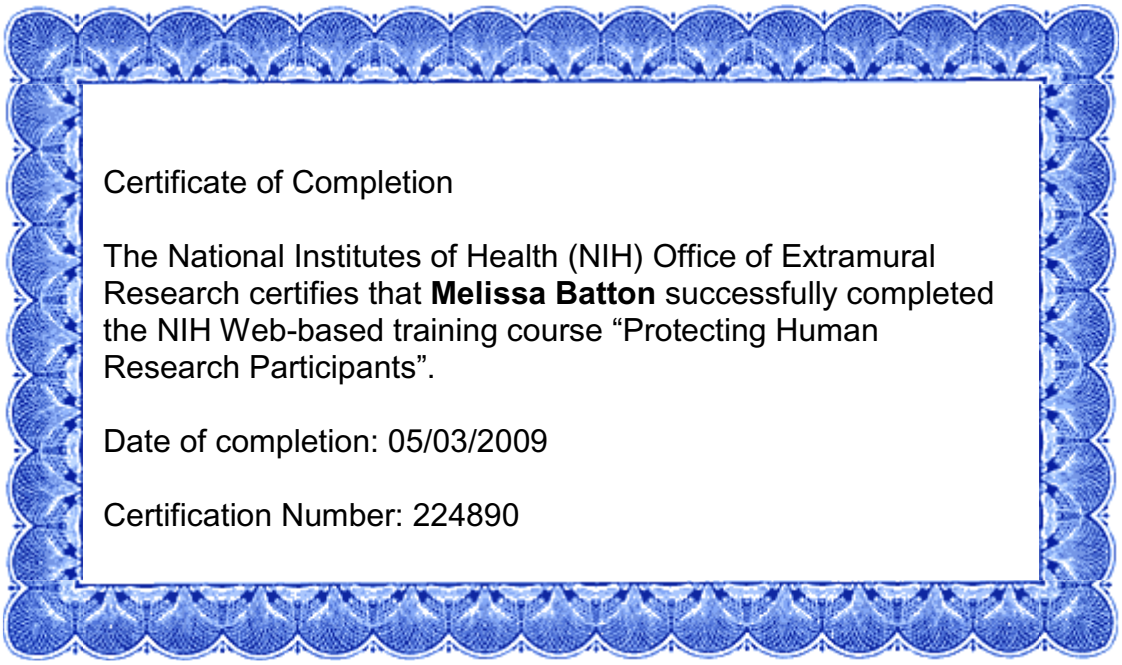
3. The diameter of the moon is about 3,500 kilometers. The diameter of the sun is about 400 times the diameter of the moon. Estimate the circumference of the sun. Estimate the circumference of the moon.

4. Describe one way you could break apart a pentagon to find its area. 

5. Each can of paint covers 50 sq. ft. How many cans does Vincent need to paint a 12 ft. by 16 ft. backdrop for the play?

6. Beth said a triangle with a base of 4 feet and a height of 7 feet has an area of 28 sq. ft. James said that isn't correct. Describe and correct Beth's error.

Appendix M



Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Melissa Batton** successfully completed the NIH Web-based training course “Protecting Human Research Participants”.

Date of completion: 05/03/2009

Certification Number: 224890

Curriculum Vita

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Education

WALDEN UNIVERSITY, Minneapolis, MN

- **Doctoral Study in Teacher Leadership (2005-Present)**
- **All but dissertation**

NOVA SOUTHEASTERN UNIVERSITY, Ft. Lauderdale, FL

- **Education Specialist in Curriculum, Instruction, & Technology (2001)**

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- **Master of Science in Education, Teaching and Learning (2000)**

BREWTON-PARKER COLLEGE, Mt. Vernon, GA

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Professional Experience

XYZ ELEMENTARY SCHOOL, XYZ, GA August 2004-Present
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- Hospital/Homebound Teacher
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