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Evaluating the Effects of Peer-Assisted Learning Strategies (PALS) in Mathematics Plus an Anxiety Treatment on Achievement and Anxiety of Third Grade Students

Kelly Ann Hugger
University of Southern Maine

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**EVALUATING THE EFFECTS OF PEER-ASSISTED LEARNING STRATEGIES
(PALS) IN MATHEMATICS PLUS AN ANXIETY TREATMENT
ON ACHIEVEMENT AND ANXIETY OF THIRD GRADE STUDENTS**

Kelly Ann Hugger, M.S.

B.A. Goucher College, 2008

M.S. University of Southern Maine, 2012

This manuscript represents a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Psychology (in School Psychology)

University of Southern Maine

August 2014

Advisory Committee:

Rachel Brown, Associate Professor of School Psychology, Advisor

Mark W. Steege, Professor of School Psychology

Heather Alvarez, Clinical Director of Sebago Alliance Day Treatment Program

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Dissertation Advisor: Dr. Rachel Brown, PhD

An Abstract of the Dissertation Submitted in Partial Fulfillment of the Requirements for
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University of Southern Maine

August 2014

The purpose of this study was to examine the effects of an adaptation of Peer-Assisted Learning Strategies (PALS) in mathematics on achievement and anxiety of third grade students. Four intact classrooms were randomly assigned to experimental or control condition groups. Experimental teachers implemented one of three interventions: PALS, a relaxation technique (RT), or PALS+RT twice weekly for 12 weeks. Outcome measures included AIMSweb's curriculum based measure for math computation (M-COMP) and the Revised Children's Manifest Anxiety Scale, Second Edition (RCMAS-2). Within the classrooms, baseline, pre-test, and post-test data were collected on 79 students. The study did not reveal statistically significant results, however, results indicated that students in the PALS+RT group made the greatest gains in math achievement and students in the RT group had the greatest reduction in anxiety. The results suggest that PALS can be adapted to include a brief relaxation technique and that relaxation techniques may be beneficial in reducing student anxiety symptoms.

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Chapter 1: Literature Review

Education legislation, such as No Child Left Behind (NCLB; 2001) and the Individuals with Disabilities Education Improvement Act (IDEIA; 2004), require schools to utilize empirically supported interventions and regular formative and summative assessments to enhance the learning outcomes for all students. These efforts have highlighted the utility of a tiered system of support and instruction delivery. Tier 1 addresses the whole classroom, Tier 2 includes students who are struggling in the classroom, and Tier 3 provides the most intensive intervention for those students who require individualized, high frequency, instruction. Formative assessment throughout the Tiers allows educators to identify whether students are responding and allows them better to tailor the instruction and interventions to meet the students' needs.

Best practices indicate that educators should be selecting interventions that are effective for all populations of students and that these interventions address both academics and behaviors. Many schools across the United States are well underway in addressing these two components of a Multi-Tier System of Support (MTSS). Another component of MTSS, which at present has little empirical research, is whether these evidence-based interventions have other potential positive side effects. Peer Assisted Learning Strategies (PALS) is an evidence-based intervention that is typically used for Tier 1 (Johns Hopkins University, 2012) and it can be used for both mathematics and reading. This research study examined the effects of PALS on mathematics achievement and anxiety in third grade students.

History and Background of Peer Tutoring

An early form of structured peer tutoring is known as Class-Wide Peer Tutoring (CWPT) and was developed at the Children's Project in Kansas City over twenty years ago

(Maheady, Harper, & Mallette, 2003). The original research and implementation of CWPT was developed as a way to effectively integrate students with special needs into the general education classroom. Over time, CWPT evolved into a series of intra-class peer-tutoring sessions. Other models of class-wide peer tutoring have since evolved, and include examples like Peer-Assisted Learning Strategies (PALS) and Reciprocal Peer-Tutoring (RPT).

Peer tutoring generally includes some or all of the following components: a) students are trained to use a highly structured tutoring model; b) students are divided into teams; c) students are assigned a partner; d) students follow a tutoring protocol and switch roles halfway through each session; and e) the teacher acts as supervisor and awards points based on performance (Maheady et al., 2003). Both PALS and RPT follow this model and allow for efficient and effective implementation of peer tutoring.

A vast amount of research has been conducted demonstrating the efficacy of peer tutoring for students of all ages and across all levels of achievement in mathematics, reading and spelling (Maheady et al., 2003). Most studies have been conducted using peer-learning models of instruction with the focus on students with disabilities and have found positive results (Schloss & Kobza, 1997; Calhoun & Fuchs, 2003). Menesses and Gresham (2009) found that the use of reciprocal peer-tutoring in mathematics instruction was more effective than non-reciprocal peer tutoring, but both methods of tutoring were significantly more effective than no peer-tutoring at all. In reciprocal peer-tutoring, each student acts as coach and player for equal amounts of time; and in non-reciprocal peer-tutoring, one student is the coach for the entire lesson (Menesses & Gresham, 2009).

Hawkins, Musti-Rao, Hughes, Berry, and McGuire (2009) found that when the contingencies for reinforcement were altered to include the entire class's performance (a

large deviation from traditional peer-tutoring models), that this method resulted in a significant improvement between pre- and post- test scores in math. This finding is important because it demonstrates that traditional models of peer learning can be adapted to better suit the needs of entire classrooms and that peer-based learning in and of itself was a critical element to the success of students in math.

Allsopp (1997) looked at middle school math instruction, specifically related to problem-solving and algebra, and found that the raw score demonstrated a positive trend with non-significant differences between pre-and post-test scores for students in the peer-tutoring groups as compared to students in the control group. Although these results do not suggest a significant difference, the raw scores for the peer-tutoring group still reflected the trend demonstrated in the previously discussed studies.

Peer Assisted Learning Strategies

Peer Assisted Learning Strategies (PALS) was developed by Doug and Lynn Fuchs at Vanderbilt University. The goal of the intervention was to integrate evidence-based instructional practices with peer mediation to increase academic outcomes for all learners. Fuchs, Fuchs, Hamlett, Phillips, and Bemtz (1994) compared the use of classwide curriculum-based measures (CBM) alone, to the use of CBMs plus a peer-tutoring component, and to the standard general math curriculum. The results of the study showed that peer tutoring was beneficial when implemented with CBMs for both low and average-achieving students. Fuchs, Fuchs, Hamlett, Phillips, and Karns (1995) demonstrated that PALS could be used with students with diagnosed learning disabilities and that this intervention, when combined with CBMs, was beneficial. Fuchs, Fuchs, Hamlett, Phillips, Karns, and Dutka (1997) expanded PALS' utility by demonstrating how peer-mediated

instruction with conceptual math explanations can increase achievement in students who are considered low-, average-, and high-performing.

Fuchs, Fuchs, and Karns (2001) examined the effects of PALS on mathematics development for kindergarten children who differed in achievement level. PALS student growth was greater than the control group student growth and PALS seemed to have the largest effect on medium-achieving students, nonetheless, all groups did see growth. Fuchs, Fuchs, Yazdian, and Powell (2002) examined the effects of PALS on mathematics development for first-grade children who differed in achievement level. Students' math achievement was classified as high, average, or low. Results indicated a significant effect for the PALS students at all points on the achievement spectrum, including those who had been identified with a disability, including learning disability, attention deficit hyperactivity disorder (ADHD), and speech and language difficulties. These outcomes suggest that all students can benefit from PALS, regardless of abilities or disabilities.

Based on the strong research evidence, PALS is endorsed by the *What Works Clearinghouse* (2007) and John Hopkins University's *Best Evidence Encyclopedia* (2009). Research on the use of PALS has primarily examined academic achievement and only a limited number of studies have studied the other potential benefits of using a peer-learning strategy for instruction. Fantuzzo, Davis, and Ginsburg (1995) examined the effects of reciprocal-peer tutoring and parental involvement on self-concept in mathematics achievement of fourth- and fifth-grade students. The results showed that students who were in the peer tutoring plus parental involvement conditions perceived themselves more socially confident, were more accurate on math CBMs, and had significantly higher scores on standardized math computation measures as compared to students in the parental

involvement only condition. Dion, Fuchs, and Fuchs (2005) examined the influence of PALS in reading on the quality of students' social relationships. Results showed modest positive effects and the largest effects were observed with students who were originally identified as unpopular before the intervention. Ginsburg-Block, Rohrbeck, and Fantuzzo (2006) conducted a meta-analysis of 36 studies and found small to moderate size effects across social, self-concept, and behavior effects with peer-assisted learning-type interventions. The study suggested that peer-learning models that focus on academics can also improve social and self-concept concurrently. The benefits of peer-tutoring were examined through a meta-analysis of single-case research (Bowman-Perrott, Davis, Vannest, Williams, Greenwood, & Parker, 2013). The study examined 26 single-case studies with students in grades 1 through 12. A moderate to large size effect was found for academic improvement. The study demonstrated that peer tutoring is beneficial regardless of dosage, grade level, or disability. The study highlighted that among students with disabilities (LD and EBD), those with emotional or behavioral disorders benefited the most. While there is much research about self-concept and self-esteem, there have been no studies that looked into whether peer-tutoring models can concurrently reduce levels of anxiety in students.

Anxiety and Academic Problems

People of all ages experience stress and anxiety. The nature of the events that elicit an anxious response vary throughout one's development. Common stressors in school settings may include specific academic subjects, testing, separation from home, bullying, and social situations. Children who experience symptoms of anxiety, clinical or non-clinical, may also have academic difficulties. A child who experiences separation anxiety may feel overwhelmed by feelings of distress and anxiety, and will not be able to work and function to

the full potential due to effects on learning and memory (Doobay, 2008). A study by Lyons and Beilock (2012) examined individuals with high levels of math anxiety. They found that the level of math anxiety increased when students anticipated an upcoming math task as demonstrated by an increase in activity in regions of the brain associated with visceral threat detection; yet, this relation was not demonstrated during math performance. These results suggested that the anticipation of a math activity is aversive for some students, thus making it more difficult to learn. Researchers (Hopko, Ashcraft, Gute, Ruggiero, & Lewis, 1998) have also demonstrated that math anxiety leads directly to the interference of critical cognitive processes, such as working memory, and therefore predicts poor math performance.

Utilizing stress and anxiety reduction techniques can be effective for people with and without anxiety disorders. Evidence-based techniques that are frequently used for anxiety reduction include progressive muscle relaxation, guided imagery, diaphragmatic breathing, and meditation, all of which share a common component of reducing the rate of breathing (Varvogli & Darviri, 2011). These techniques are often grouped together and fall under the category of “Relaxation Training.” A meta-analysis was conducted by Manzoni, Pagnini, Castelnuovo, and Molinari (2008) examining the efficacy of relaxation training in reducing anxiety. The study included multiple Relaxation Training methods, including Jacobson's progressive relaxation, autogenic training, applied relaxation, and meditation. The overall average efficacy of these relaxation techniques showed a medium-high size effect (.57) in the treatment of anxiety. Efficacy was highest in studies which included volunteers, longer treatment periods, and in studies utilizing meditation.

Tatum, Lundervold, and Ament (2006) evaluated the effect of a modified Behavioral Relaxation Training Technique (BRTT) on self-reported math related test anxiety of college-

age students. Traditional BRTT includes an upright component, which requires the participant to tense and relax muscles. The Abbreviated Math Anxiety Scale was used to measure level of anxiety. Participants in the treatment group were trained in 10 upright relaxed behaviors through direct instruction, modeling, corrective feedback and descriptive praise. A statistically significant difference was found between control and experimental groups after the one-week intervention. Anxiety scores for the experimental group were lower than the control. The psychometric properties of the anxiety scale used in this study were not reported.

Diaphragmatic breathing has been described as inhaling deep into the belly, resulting in the expansion of the abdomen (Varvogli & Darviri, 2011). The physiological response has two parts: a) a decrease in oxygen consumption, heart rate, and blood pressure; and b) increased theta wave amplitude, parasympathetic activity and alertness (Jerath, R., Edry, Barnes, & Jerath V., 2006). Busch, Magerl, Kern, Haas, Hajak, and Eichhammer (2012) conducted an experimental study, examining the effect of deep and slow breathing on pain perception, autonomic activity, and mood processing. Two techniques were examined: active breathing and inactive breathing. In the Active Breathing Condition, participants were guided to breathe using respiratory feedback, at an externally paced rate, which required a high level of concentration. In the Inactive Breathing Condition, participants were prompted to relax and focus on their breathing as the experimenter verbally prompted them to a pace similar to the Active Breathing Condition. Sixteen undergraduate students participated in the study. The results of the study suggested that relaxing with deep slow breathing influences autonomic and pain processing.

A number of additional studies have examined the effects of deep breathing with children, adolescents, and adults, demonstrating significant effects on hemodynamic changes following stressful events, reducing anxiety in children with moderate asthma, and reducing hypertension (Varvogli & Darviri, 2011). Research literature indicates that relaxation techniques have been successful with a wide range of participants in multiple settings (Manzoni, et al., 2008). Despite strong evidence for both peer-tutoring and relaxation training, very little research has been conducted to examine the relationship between these interventions in school-age children.

Purpose of the Study, Research Questions, & Hypotheses

Research has documented that PALS in mathematics has positive effects on math achievement and that it may have additional positive side effects on social relations and self-esteem (Maheady et al., 2005). Anxiety, in relation to academics, is a common experience for school age children. Research has demonstrated that students who experience math-related anxiety will exhibit an increase of activity in brain regions associated with visceral threat, thus suggesting that in addition to academics being an aversive task, it also is painful (Lyons & Beilock, 2012). This further demonstrates how anxiety negatively impacts brain functioning and can directly impact working memory (Hopko et al., 1998). Current research has identified deep breathing, or relaxation breathing as an effective technique that can be used with people of all ages to reduce anxiety symptoms. Very little research has examined the effects of school-based interventions, utilizing relaxation techniques. The current study addressed the following questions:

- 1) Does the PALS program for math affect students' level of anxiety?
- 2) Does the PALS program for math affect students' math achievement?

- 3) Does the PALS Program for math plus an embedded Relaxation Technique affect students' level of anxiety?
- 4) Does the PALS Program for math plus an embedded Relaxation Technique affect students' math achievement?
- 5) Does the Relaxation Technique affect students' level of anxiety?
- 6) Does the Relaxation Technique affect students' math achievement?

Hypotheses

1. Students in a Peer Assisted Learning Strategies plus an embedded Relaxation Technique (PALS+RT) condition will achieve higher math scores than students in a Peer Assisted Learning Strategies (PALS) condition, a Relaxation condition, and a control condition after a 12-week intervention, as measured by AIMSweb Mathematics Computation Curriculum-Based Measure (M-COMP).
2. Students in a Peer Assisted Learning Strategies plus an embedded Relaxation Technique (PALS+RT) condition will achieve lower anxiety scores than students in a Peer Assisted Learning Strategies (PALS) condition, a Relaxation condition, and a control condition after a 12-week intervention, as measured by the Revised Children's Manifest Anxiety Scale Second Edition (RCMAS-2).

Chapter 2: Method

Design

This study utilized a quasi-experimental control-group comparison design. Extended pre-test assessment in the form of baseline data were collected to verify reliability of subject responses. Conditions tested included one control group and three experimental conditions (PALS, RT, and PALS+RT). Conditions were randomly assigned to intact third grade classrooms. All conditions completed the RCMAS-2 and M-COMP as baseline, pre-test, and post-test measures. In the PALS, RT, and PALS+RT conditions, the teachers implemented the intervention for 12 weeks while in the control condition; the teacher implemented the district-adopted math curriculum according to the regular school schedule. In the PALS condition, students completed the standards third grade PALS program. In the RT Condition, students completed a relaxation procedure. In the PALS+RT condition, students completed the standard third grade PALS program with an embedded relaxation technique identical to the one used in the RT condition. All study procedures were reviewed and approved by a University institutional review board.

Participants

The participants included elementary students and the classroom teachers in four third grade classes in a suburban school located in the Northeast. The school served grades 1 through 3 and had a total enrollment of 563 pupils. At the time of the study, 63.4% of the total school population qualified for free or reduced lunch, 6% of the total school population was identified as being English language learners, and 15.6% of the total school population received special education services.

After a presentation by the researcher, four teachers volunteered to participate in the study. Conditions were randomly assigned to intact classrooms. The student participants included all of the students in the four third grade classrooms who were not receiving separate instruction from special education services in mathematics. A total of 79 students initially participated in the study. The control condition contained 17 students (11 female and 6 male). The PALS condition contained 20 students (12 female and 8 male). The RT condition contained 22 students (15 female and 7 male). The PALS+RT condition contained 20 students (9 female and 11 male). A summary of student and school information is found in Table 1. The teacher participants had between 10 and 32 years of teaching experience at the elementary level. The median years of teaching experience was 20.5.

Table 1.

Participant and School Demographics

Group	Percent
Participants	
Boys	40
Girls	60
School	
English Language Learners	6
Free and Reduced Lunch	63.4
Special Education	15.6

Setting

The setting for this study was the regular education third grade classrooms. Each classroom contained approximately 17 to 22 students at a time, the homeroom teacher, and one or two graduate students who collected data on student progress and treatment fidelity. Each teacher provided the intervention (or no intervention) that had been randomly assigned to the classroom. Training sessions for the intervention teachers were provided in small groups and individually in a small office located at the school during school hours. The

control condition teacher received no training and implemented the adopted mathematic curriculum as usual.

Independent Variables

PALS. This condition involved the use of PALS for math. Students were paired and worked as teams for 30 minutes per day, two times per week. Students followed the scripted program, which covered the math computation areas of addition, subtraction, multiplication, and division. The teacher used the PALS Command Card to guide the students through the curriculum (Appendix A). PALS was implemented for 30 minutes per session in addition to the 45 minute Tier 1 core curriculum *Investigations* lessons two days per week.

Relaxation. This condition involved the use of a relaxation breathing technique. The relaxation technique was developed by the researcher based on prior research (Busch et al., 2012; Tatum et al., 2006, Varvogli & Darviri, 2011). The teacher used the RT Command Card to guide the students through the intervention (Appendix B). The scripted relaxation technique required three to five minutes to complete. The intervention included the teacher prompting the students to move into a relaxed position, close eyes, and to follow the deep breathing protocol for one minute. After a minute had passed, the teacher prompted the students to engage in a math-related timed activity for 25 minutes.

PALS + Relaxation. This condition involved the use of the standard PALS program with an additional relaxation breathing technique during each PALS session. The embedded relaxation technique occurred after the students had completed the peer training and prior to their individual timed tests. The RT component added three to five minutes onto the PALS intervention (Appendix C). The total intervention time for PALS+RT was identical to the PALS and RT conditions implemented separately.

Control. The control group followed the regular mathematics curriculum. This school used *Investigations*, a spiral-method math program, as well as supplemental activities during a daily 60-minute math block. Each *Investigations* lesson required no more than 45 minutes to complete and the teacher supplemented the lessons with additional math activities.

Dependent Variables

Level of Anxiety. The *Revised Children's Manifest Anxiety Scale - Second Edition* (RCMAS-2), developed by Reynolds and Richmond (2008), was used to measure the students' level of anxiety before and after the intervention. The test generates a total anxiety score, which was used to sort students into high, medium, or low anxiety categories. The RCMAS-2 has a normative T score mean of 50 with a standard deviation of 10. T scores ranging from 30 to 39 were considered low anxiety, scores ranging from 40 to 60 were considered average, and scores ranging between 61 and 70 were considered high anxiety. Students whose T scores fell above 71 were in the clinically significant range.

The RCMAS-2 was selected because it is a self-report measure, appropriate for ages 6 to 19, can be administered in a group format, and takes approximately 10 minutes to complete. It contains 49 yes/no response items at an elementary reading level. The RCMAS-2 utilized a standardization sample of N=3,086 individuals aged 6-19 and is representative of the U.S. population in terms of gender, socio-economic status, and ethnicity. The norms for the test are stratified into three age groups, 6-8, 9-14, and 15-19. The internal consistency reliability estimate (Cronbach's alpha) for the Total Anxiety score was .92 and test-retest was .76. The internal consistency based on students ages 9-14 for the total anxiety score was .91.

Achievement in Mathematics. AIMSweb is a curriculum-based measurement and data system that provides a framework for universal screening and progress monitoring of student academic achievement. The Mathematics Computation measure (M-COMP; NCS Pearson, 2010) is an 8-minute, paper and pencil test, that can be individually or group administered. The test is standardized and scores can be compared against national norms to determine where the student performs as compared to grade-based norms. The M-COMP for third grade students consists of column addition, basic facts, and complex computation. This measure was used to determine the students' level of math achievement before and after the interventions were implemented.

Students Scoring at High Risk on Dependent Measures

High Anxiety Score Protocol. Students whose scores fell in the clinically significant range (T score greater than 71) during the baseline and pre-test phases were referred to the school guidance counselor for further support and intervention within two weeks of administration.

Math Computation Test. M-COMP Scores falling below the 10th percentile, or significantly below grade level, during baseline and pre-test phases were referred to their classroom teacher for further support and intervention.

Materials

Math. The researcher administered the M-COMP probes as the math baseline, pre- and post-test measures in each classroom. Pencils were provided for students to complete the probes.

Anxiety. The researcher administered the RCMAS-2 as anxiety baseline, pre- and post-test measures in each classroom. Pencils were provided for the students to complete the protocol.

PALS and PALS+RT Groups. Teachers received complete sets of PALS materials for third grade (Fuchs, Fuchs, Karns, & Phillips, 2009), including the standard (PALS) or an adapted version (PALS+RT) of the Teacher's Manual, all student folders with worksheets and point sheets for the entire 12 week study, the PALS or PALS+RT Command Card, posters on the topics covered, and a binder of extra copies of materials.

RT Group. The teachers in the RT condition received the RT Training Guide and the RT Command Card.

Procedure and Schedule

Teacher Training. The teachers in the three experimental conditions (PALS, RT, and PALS+RT) received training on the interventions. The participating teachers attended three, 1 to 2 hour training sessions at the school. The length of the trainings varied depending on the condition. The first training session included a description of the intervention (PALS, RT, or PALS+RT) method and an overview of the structure of the assigned program. Materials were distributed prior to the first training to allow participants time to become familiar with the programming. The second and third trainings consisted of modeling, direct instruction, and guided and independent practice of the protocols. Each training session was conducted individually.

Baseline. In order to consider the reliability of student scores on the dependent measures, the researcher administered the M-COMP and RCMAS-2 to each participating

class during the week prior to the teacher trainings according to each measure's standardized procedures. Students who were not present that day were tested individually at a later date.

Pretest. The researcher re-administered the RCMAS-2 and M-COMP to each participating class during the week of teacher trainings. Students who were not present that day were tested individually at a later date. Together with the baseline scores, the pretest data were used to indicate if the students' pre-intervention responses were consistent over time.

Student Pairing. Students in the PALS and PALS+RT conditions were paired with partners for the math intervention based on the M-COMP results. Students were rank ordered based on their M-COMP scores and categorized as high or low. The median score was used to divide the students into two equal groups. The students were then paired for the PALS activities from highest to lowest within the respective categories.

Student Training. Once all teacher trainings were complete and baseline and pre-test data were collected, the teachers in the PALS and PALS+RT conditions began the five session training schedule for students. Each training session lasted for approximately 30 minutes. The teachers followed the scripted guide for training the students and the researcher was present to ensure treatment fidelity. The last day of training, "Day #5," was the first day of the intervention. The trainings took no longer than two weeks to complete. During the same time as the PALS student trainings, the teachers in the RT and PALS+RT conditions provided four scripted trainings of the RT method, which lasted approximately 10 minutes each. During the 2 week training period, the control condition continued providing the regular *Investigations* curriculum.

PALS & PALS+RT Interventions.

The PALS and PALS+RT interventions ran for 12 school weeks. They occurred two times per week for 30 minutes in addition to the daily 45 minutes of *Investigations*. During each PALS session, pairs of students followed the procedures in their folder, which contained their work materials for 2 weeks of sessions. The researcher replaced the folders every 2 weeks with new materials. The teacher and students were responsible for keeping the folders in a safe place during the two weeks. Each pair of students completed two activities: Coaching Activities and Practice Activities.

Coaching. During Coaching Activities, each pair of students took turns being the Coach and the Player. The stronger student, as determined by M-COMP, was assigned the role of Coach for the first half of each PALS session. The Coach used the Coach's Question Sheet to guide the Player (or second Coach) through each math problem on the Coaching Sheet. The Coach made corrections and used the Coaching Answer Sheet to check the player's work. The Coach drew a circle around each correct digit and the coach provided an explanation if there was an incorrect digit. When an error was corrected, the coach then drew a triangle around the corrected digit. The Coach used the question sheet for the first row of problems. After that point, the Coach allowed the player to work independently. The Player explained each of the operations that he or she was performing and the Coach only corrected the Player if she or he had any errors, as guided by the coach's question and answer sheets. When the Player finished the second row, the students switched roles and follow the same protocol. The Coaching portion of the intervention lasted 15 to 20 minutes.

Practice. The PALS Practice Activities involved the students independently completing a Practice Sheet of mixed math problems. The Practice Activity lasted for

approximately 5 minutes. The students exchanged completed Practice Sheets and scored each other's work using the Practice Answer Sheet.

Relaxation Training

In the RT only condition, the teacher used the following relaxation protocol two times per week prior to a testing activity during mathematics time.

1. Sit down in your seat and get into a relaxed and comfortable position – sit quietly.
2. Close your eyes and focus on breathing; draw in deep, full breaths, let them out slowly, and feel yourself relax as you breathe out. Let your worries go.
3. Continue to breathe in and out in deep, slow breaths.
4. Think about all of the hard work you have done this week, all of the math strategies you have learned, and the progress you have made.
5. *(The teacher counted to 60 slowly.)*
6. I want you to slowly open your eyes.

In the PALS+RT condition, the teacher guided students through the above relaxation technique prior to completing the PALS Practice Activities. Each pair of students in the PALS and PALS+RT conditions also shared a Point Sheet. During Coaching, the classroom teacher awarded points to students who were working cooperatively and following the rules. Points were awarded by marking a slash across the numbers on the Points Sheet. After the students graded the practice sheets, they awarded themselves one point for each correct problem. The teacher then asked the students to report out on their cumulative points for the day. Students in the RT-only condition did not have a points sheet.

Control group. During math block, the control group utilized the *Investigations* curriculum for the full 60 minute block. During this time, the teacher did not utilize

strategies that resembled those modeled in the PALS or the RT. All students completed the same daily *Investigations* curriculum, however those in the PALS and PALS+RT conditions finished it in 45 minutes and then completed the additional PALS programming.

Treatment Fidelity

A four-part checklist adapted from the Heartland Agency's PALS fidelity checklist (see Appendix D) was used to determine whether the PALS and PALS+RT, conditions were implemented with fidelity. A fidelity checklist was developed for the RT condition (see Appendix E), based on the PALS-RT Condition Protocol. Twenty percent of sessions were observed by the researcher, paraprofessional, or another graduate student. Interobserver Agreement (IOA) was as calculated by dividing observer agreements by agreements plus disagreements. Anecdotal observations were conducted during 20% of control conditions to ensure that *Investigations* was the primary curriculum being delivered and that methods similar to PALS and/or RT were not integrated (See Appendix F).

Chapter 3: Results

PALS Group Discontinuation

Due to an emergency in the teacher's family, the PALS group discontinued participation in the PALS intervention after completing teacher trainings, classroom trainings, and four student lessons. The classroom teacher had to take an unexpected family leave and could not continue the PALS intervention as planned. A trained substitute was not available so this classroom discontinued the study. Data and results from the PALS condition are not included in the analysis of the results.

Treatment Integrity

Table 2 presents the treatment integrity data for the RT, PALS+RT, and Control group session observations. Treatment integrity ranged from 83.3% to 100% compliance, with an average of 96.1% compliance for the PALS+RT group. One hundred percent integrity was maintained for the RT and Control conditions.

Table 2.

Treatment Integrity Data

	Observed Sessions						Average
	1	2	3	4	5	6	
RT	100%	100%	100%	100%	100%	100%	100%
PALS-RT	100%	96.7%	83.3%	96.7%	100%	100%	96.1%
Control	100%	100%	100%	100%	100%	100%	100%

Table 3 displays the percent of inter-observer agreement between two observers. Fifty percent of the observed sessions included a second observer. Inter-observer agreement stayed consistently at 100% for the RT, PALS+RT, and Control Groups.

Table 3.

Inter-Observer Agreement of Treatment Integrity

	Co-Observed Sessions			Average
	1	2	3	
RT	100%	100%	100%	100%
PALS-RT	100%	100%	100%	100%
Control	100%	100%	100%	100%

M-COMP Effects

A one-way analysis of variance (ANOVA) was conducted to compare the mean baseline M-COMP scores of participants in the RT, PALS+RT, and Control groups. No significant differences were found [$F_{(2,56)} = 1.021, p \geq .05, p = .367$]. The mean baseline M-COMP scores of the participants in the RT Group ($m = 48.59, SD = 15.11$), the PALS-RT Group ($m = 46.20, SD = 15.04$), and the Control Group ($m = 53.41, SD = 16.46$) were not significantly different from each other.

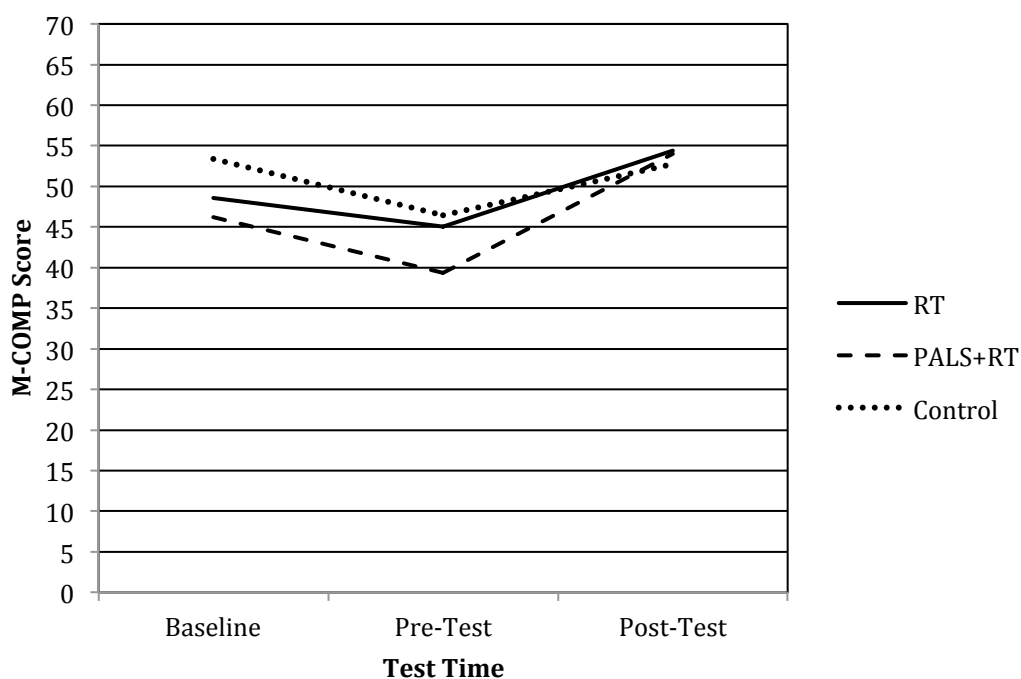
A one-way ANOVA was conducted to compare the pre-test M-COMP scores of participants in the RT, PALS+RT, and Control groups, replicating the procedure conducted with baseline data. No significant differences were found [$F_{(2,56)} = 1.174, p \geq .05, p = .317$]. The mean pre-test M-COMP scores of participants in the RT Group ($m = 45.05, SD = 14.766$), the PALS+RT Group ($m = 39.35, SD = 14.46$), and the Control Group ($m = 46.41, SD = 16.51$) were not significantly different from each other. Information about the average of the M-COMP Scores by group at Baseline, Pre-Test, and Post-Test is displayed in Table 4 and Figure 1.

Table 4.

M-COMP Scores

	Class Average of M-COMP Scores		
	Baseline	Pre-Test	Post-Test
RT (n=22)	48.59 (SD=15.11)	45.05 (SD=14.77)	54.41 (SD=10.50)
PALS-RT (n=20)	46.20 (SD=15.04)	39.35 (SD=14.45)	54.05 (SD=14.10)
Control (n=17)	53.41 (SD=16.46)	46.41 (SD=16.51)	49.00 (SD=14.95)
All Participants (n=59)	49.17 (SD=15.49)	43.51 (SD=15.22)	52.73 (SD=13.13)

Figure 1.

M-COMP Scores by Condition over Time

A Repeated Measures Analysis of Variance (RMANOVA) was conducted to examine M-COMP scores between baseline and pre-test. A statistically significant main effect for M-COMP was found [$F_{(1,56)} = 21.968, p \leq .05, p = .000$]. Non-significant differences were found for the interaction between Group and M-COMP score. Post Hoc Analyses did not

reveal significant differences when comparing groups. Given that all the groups showed a decrease in scores from baseline to pre-test, the differences were interpreted to be the result of regression to the mean.

A RMANOVA was conducted to examine M-COMP scores between pre-test and post-test. A statistically significant main effect for M-COMP was found [$F_{(1,56)} = 52.369, p \leq .05, p = .000$] as was a statistically significant main effect for M-COMP by Group [$F_{(2,56)} = 7.670, p \leq .05, p = .001$]. Post Hoc Analyses did not reveal significant differences when comparing groups, thus the score differences appear to have been the result of changes over time, and not in relation to which group the students were assigned.

RCMAS-2 Effects

When the RCMAS-2 assessments were scored, two students were referred to the guidance counselor for high scores. A one-way ANOVA was conducted to compare the mean baseline RCMAS-2 score of participants in the RT, PALS+RT, and Control groups. No significant differences were found [$F_{(2,56)} = .135, p \geq .05, p = .874$]. The mean baseline RCMAS-2 T scores of the participants in the RT Group ($m = 48.00, SD = 11.51$), the PALS+RT Group ($m = 47.20, SD = 11.464$), and the Control Group ($m = 46.12, SD = 10.51$) were not significantly different from each other.

A one-way ANOVA was conducted to compare the mean pre-test RCMAS-2 scores of participants in the RT, PALS+RT, and Control groups. No significant differences were found [$F_{(2,56)} = .668, p \geq .05, p = .517$]. This means the pre-test RCMAS-2 T scores of the participants in the RT Group ($m = 47.86, SD = 12.852$), the PALS+RT Group ($m = 46.65, SD = 13.816$), and the Control Group ($m = 43.18, SD = 11.518$) were not significantly different from each other (Table 5).

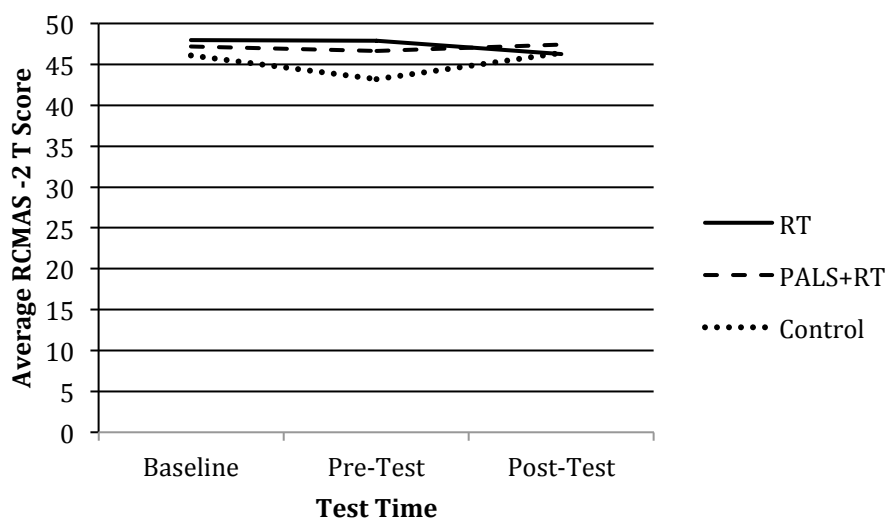
Table 5.

RCMAS-2 Scores

	Class Average of RCMAS-2 T-Scores		
	Baseline	Pre-Test	Post-Test
RT (n=22)	48.00 (SD=11.510)	47.86 (SD=12.852)	46.27 (SD=11.042)
PALS-RT (n=20)	47.20 (SD=11.464)	46.65 (SD=13.816)	47.40 (SD=15.541)
Control (n=17)	46.12 (SD=10.511)	43.18 (SD=11.518)	46.41 (SD=13.412)
All Participants (n=59)	47.19 (SD=11.049)	46.10 (SD=12.756)	46.69 (SD=13.159)

A RMANOVA was conducted to examine RCMAS-2 scores between baseline and pre-test. No significant main effects were found for the RCMAS-2 scores [$F_{(1,56)} = 1.182, p \geq .05, p = .282$] or for the interaction between Group and RCMAS-2 score [$F_{(2,56)} = .583, p \geq .05, p = .562$]. RMANOVA also was conducted to examine RCMAS-2 scores between pre-test and post-test. No significant main effects were found for the RCMAS-2 scores [$F_{(1,56)} = .571, p \geq .05, p = .453$] and no significant effect was found for RCMAS-2 and Group [$F_{(2,56)} = 1.722, p \geq .05, p = .188$]. See Figure 2.

Figure 2.

Average RCMAS-2 T-Score Across Conditions

Chapter 4: Discussion

Hypothesis #1

This study tested the hypothesis that the PALS+RT group would achieve significantly higher scores on the M-COMP compared to the RT, and Control groups at post-test (*due to the PALS group discontinuation, an analysis examining the effects of the PALS condition was not conducted*). To test this hypothesis, pre-test and post-test M-COMP scores were compared across conditions. A statistically significant main effect was found for M-COMP and for M-COMP by group, however post hoc analysis did not reveal statistically significant differences when comparing groups. This suggests that changes in the M-COMP scores were likely due to expected changes over time and not by the assigned condition.

The hypothesis that students in the PALS+RT condition would achieve significantly higher scores on the M-COMP as compared to students in the RT, and Control conditions was not supported. Nonetheless, although statistical significance was not observed, the pattern of results was consistent with the hypothesis. Specifically, the greatest improvement between pre- and post-test M-COMP scores was observed in the PALS+RT group (+14.7 points). The second greatest improvement between pre- and post-test M-COMP scores was observed in the RT group (+9.36 points), followed by the Control group (+6.32 points). The finding that the PALS+RT group and RT group achieved greater growth on the M-COMP as compared to Control group suggests that the relaxation technique may be a variable that positively impacts math achievement.

The results of this study show a positive trend for math achievement in the PALS+RT group as compared to the control. This finding partially conforms with previous studies (e.g., Allsopp, 1997; Calhoun & Fuchs, 2003; Fuchs et al., 1997; Fuchs et al., 2001; Fuchs et al.,

2002; Maheady et al., 2005), which showed improvements in students' math scores after using PALS for math. Nevertheless, the RT GROUP also showed improved math scores and suggests that the relaxation technique alone may be effective in increasing math achievement. The current study is consistent with previous research examining the adaptability of PALS (Hawkins et al., 2009); specifically, PALS was adapted to include a relaxation technique and training materials and intervention was modified to reflect the adaptation. Non-significant differences between pre- and post-test M-COMP scores may be attributed to one of the several limitations associated with this study, such as the sensitivity to change of the M-COMP and sample size. Limitations are discussed below.

Hypothesis #2

This study tested the hypothesis that the PALS+RT group would achieve significantly lower scores on the RCMAS-2 compared to the RT and Control groups at post-test (*due to the PALS group discontinuation, an analysis examining the effects of the PALS condition was not conducted*). To test this hypothesis, RCMAS-2 scores were compared across conditions. No statistically significant main or interaction effects were found. The non-significant changes were likely due to maturation or practice over time.

The hypothesis that students in the PALS+RT condition would achieve significantly lower scores on the RCMAS-2 as compared to students in the RT and Control conditions was not supported. The current study utilized a psychometrically sound anxiety scale that may not have been sensitive to significant differences in students' anxiety about math performance. Non-significant differences between pre- and post-test RCMAS-2 scores may be attributed to one of the several limitations associated with this study, such as loss of the PALS group, sensitivity to change of the RCMAS-2, and sample size.

Still, the current study adds to the research base on relaxation techniques. Previous research has shown that relaxation techniques can be used with a wide range of participants in a variety of settings (Manzoni et al., 2008). The relaxation technique studied here was used in two different classrooms, one embedded in the PALS curriculum and the other delivered as a stand-alone intervention. Teachers in both conditions reported that the students were responsive to the technique and appeared to be relaxed and better suited to focus on classwork after completing the technique. Previous research measuring the impact of relaxation techniques has used scales measuring test anxiety for math, heart rate, blood pressure, and pain perception (Busch et al., 2012; Tatum, Lundervold, & Ament, 2006; Varvogli & Darviri, 2011). The current study utilized a psychometrically sound anxiety scale that may not have been sensitive to significant differences in students' anxiety about math performance. Specifically, the items on the RCMAS-2 may have been too broad and not specific enough to math anxiety to detect changes in the students' math-related emotional states.

Treatment Fidelity

The teachers in the intervention conditions received substantial training and feedback throughout the intervention process. In addition, materials were developed to create nearly identical experiences for teacher and students. The careful detail that was used in the study is a strength and could be a framework for future studies.

Limitations

Several major limitations should be considered when interpreting the results of this study, including the discontinuation of the PALS group, group-design, sample size,

frequency of intervention and duration of intervention, and the sensitivity of the measures utilized in the study.

The PALS group discontinued participation after completing teacher trainings, classrooms trainings, and four student lessons. The teacher providing the lessons had to take an unexpected family leave and the long-term substitute teacher was not able to receive training and complete the PALS curriculum. The absence of data from the PALS classroom was a major limitation because it made it impossible to determine the relative contributions of PALS and RT separately.

This study utilized a quasi-experimental control-group comparison design. The four teachers who volunteered to participate in the study were not randomly selected from the pool of existing teachers. The study included intact classrooms, with random assignment of condition. Therefore, the individual differences of the teachers volunteering to participate may differ from the general population of teachers, thus making the results less generalizable to the greater population. In addition, the total number of participants was relatively small, possibly contributing to lack of power.

The study utilized the PALS Manual in developing a schedule for intervention implementation for the PALS, RT, and PALS+RT groups. In each of these conditions, the intervention was implemented two times per week. Many of the prior studies of PALS have used a more frequent intervention, (i.e., three or more times per week). The lower frequency of PALS used in this study may have contributed to the non-significant differences between pre- and post-test M-COMP scores (Dion et al., 2005; Fuchs et al., 2002; Menesses & Gresham, 2009). Similarly, research on relaxation techniques suggests that increasing the

frequency and duration of relaxation positively affects level of anxiety (Manzoni et al., 2008); thus, more frequent RT sessions may have resulted in different outcomes as well.

The students in this study received intervention for 12 weeks, whereas students in previous studies received the PALS interventions for 11-weeks (Fuchs et al., 2005), 15-weeks (Calhoun & Fuchs, 2003; Fuchs et al., 2001), 16 weeks (Fuchs et al., 2002; Menesses & Gresham, 2009), and 18-weeks (Fuchs et al., 1997). Providing a richer schedule of intervention may have resulted in greater achievement in the PALS+RT group.

The non-significant differences between pre- and post-test M-COMP scores also may be attributed to the measure. The M-COMP measures a broad range of computation abilities, such as addition, subtraction, multiplication, and division. If any digit in the response is incorrect, the entire problem is marked wrong. The M-COMP may over-report wrong responses; utilizing a measure that accounts for digits correct may be more sensitive to change in students' math gains from the specific interventions.

The non-significant differences between pre- and post-test RCMAS-2 scores also may be attributed to the measure. The RCMAS-2 measures a broad range of anxiety symptoms and may not be sensitive to small changes over a relatively short period of time, or math-specific anxiety. The RCMAS-2 includes subscales that measure anxiety symptoms falling in three categories: physical, worry, and social, but not specifically academic. Changes in the symptoms of anxiety, specifically test anxiety, may not have been detected on the test. Perhaps due to a perception of non-relevance, it was noted by the researcher during post-test data collection, that some of the students may not have taken the RCMAS-2 as seriously as the previous two administrations. The length of the questionnaire may have contributed to some of the students rushing through their responses.

During the first week of intervention, it was brought to the researchers attention that the teacher in the RT condition was using the relaxation technique more frequently than was intended as part of the study. The researcher informed the teacher that the intervention was only to be used at the designated times outlined in the research proposal. The teacher apologized, informed the researcher that the intervention had been run twice after returning from recess and that it would only be implemented during the designated times from that point forward.

Future Research

Future research efforts are needed to develop an evidence base for academic interventions that incorporate therapeutic components. Future research should replicate this study with a larger sample to investigate the impact of the PALS, RT, and PALS+RT interventions. Increasing the number of conditions and expanding the research across grades and schools within a district would provide greater generalizability. Research should also examine whether increasing the frequency and duration of the intervention would result in greater math achievement and lower anxiety. In addition, starting teacher trainings at the beginning of the school year would allow a greater span of time to conduct the interventions.

Chapter 5: Summary

The current study adds further support to the research base documenting the positive effects of Peer Assisted Learning Strategies in mathematics (Allsopp, 1997; Calhoun & Fuchs, 2003; Fuchs et al., 1997; Fuchs et al., 2001; Fuchs et al., 2002; Maheady et al., 2005) and the potential positive effects of relaxation/deep breathing techniques (Busch et al., 2012; Tatum, Lundervold, & Ament, 2006; Varvogli & Darviri, 2011). The hypothesis that students in the PALS+RT condition would achieve significantly higher scores on the M-COMP as compared to students in the PALS, RT, and Control conditions was not supported, however the pattern of results was consistent with the hypothesis: students in the PALS+RT group had the greatest gain in M-COMP scores between pre- and post-test. The hypothesis that students in the PALS+RT condition would achieve significantly lower scores on the RCMAS-2 as compared to students in the PALS, RT, and Control conditions was not supported. But, students in the RT group experienced the greatest decrease in total anxiety score between pre- and post-test. Although significant results were not achieved, teacher report indicated that students benefited from the practice. The current study provides evidence of the feasibility of adapting PALS, an evidence-based math curriculum, and integrating a brief relaxation technique.

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Appendix A

PALS Command Card

(Fuchs, et al., 2009)

1. **It's time for Coaching.**
2. **The list of coaching pairs is posted on the board. Are any partners absent?**
3. **Second Coaches, stand and get the folders.**
4. **Second Coaches, sit with your partner.**
5. **Second Coaches, take the Player folder.**
6. **First Coaches, take the Coach folder.**
7. **Second Coaches, take out the Coaching Sheet. write your name, your partner's name, and the date at the top.**
8. **First Coaches, take out the Point Sheet and put it on your desk so I can mark points. Also, make sure you have the Coaching Answer Sheet.**
9. (Wait until students have names and dates written. Review correction procedures and Coach's Question sheet, if necessary.) **First Coaches, you are the Coach on rows one and two. Second Coaches, you are the Player on rows one and two. Remember, after the first row of problems, the coach will stop asking the player questions. The Player will self-talk through row two.**

After the first two rows of problem, when you get to row three, STOP. It will be time to change materials and jobs. (If you want all pairs to switch at the same time, instruct them to wait at the end of row two. Then, half way through the allotted Coaching time, instruct students to switch jobs.) **Second Coaches, it will be your turn to Coach. At that time, get the Coach's Question Sheet and Coaching Answer Sheet from your partner. First Coaches, you will be the Player and you'll get the Coaching Sheet from your partner.**

Begin. (Monitor for correct PALS procedures and for understanding of assigned skills. Provide help as needed and award extra points on the Point Sheet when warranted.)
10. (when most students are finished or after 15-20 minutes) **Stop.** (Award bonus points and point out good PALS behaviors you observed.)
11. **Second coaches, make sure your name, your partner's name, and the date is on the Coaching Sheet.**
12. **Second coaches, get the Player folder. Place the Coaching Sheet in the back of the Coaching pocket.**
13. **First coaches, get the Coach folder. Place the coaching Answer sheet in the back of Coaching pocket. It's time for Practice. Pull one Practice sheet out of your folder and write your name and today's date of the top of the practice sheet. When you've finished, turn your sheet face down**

14. **Begin.**
15. (When most students are finished, or after approximately 5 minutes:) **Stop.**
16. **Exchange Practice Sheets with your partner.**
17. **Write your name beside "scored by" to show that you are the one scoring the Practice Sheet.**
18. **First coaches, pull the Practice Answer sheet out of the Coach folder. Share the Answer Sheet and score each other's paper. Circle all of the correct problems, leave incorrect problems the way they are, and skip problems that have no answer. (Remind students that they do not have to correct their mistakes on practice Sheets.)**
19. **Count the number of correct answers. Write that number at the top and circle it. This answer will be the number of points each of you earned.**
20. **Give the Practice Sheet back to your partner.**
21. **Each of you should check the number of points you earned by counting the number of circles on your practice Sheet.**
22. **Second Coaches, mark off the number of points you earned.**
23. **First Coaches, mark off your points.**
24. **Put your practice sheets in the back of the practice pocket.**
25. **First coaches, put the Practice Answer sheet back in the *Practice* pocket**
26. **Circle the last number on your Point Sheet that has a slash through it. How many pairs had 5 or more points? Keep your hand up if your pair had 10 or more points. (Continue until you have a winning pair.)**
27. **Let's give _____ and _____ a round of applause. First Coaches, put the Point Sheet back in the Coach folder. Now, _____ and _____ may collect folders.**
28. (After materials are collected) **Second Coaches, return to your seats.**

Appendix B RT-Command Card

1. **It's time for Relaxation Break.**
Sit down in your seat in a relaxed and comfortable position. [prompt to put materials away] Make sure your feet are on the floor and your hands are by your sides. Let your mind and body relax.
2. **Now, close your eyes and focus on your breathing.**
Together, let's draw in a deep full breath [count aloud 1..2..3..4] hold it [count aloud 1..2..] and slowly let it out as quietly as you can. Continue breathing slowly and feel your body and mind relax.
3. **I am going to time the class for 60 seconds. Continue to breathe in and out**

slowly. Let your worries go while you think about all of the good things you've done this week. (*Name activities that the students did successfully*)

4. (*Silently time students for 60 seconds/monitor good behavior*)

5. (*After 60 seconds*) **I want you to slowly open your eyes and without talking, begin....** [assessment/quiz/etc]

Appendix C
(Adapted from Fuchs, et al., 2009)

1. **It's time for Coaching.**
2. **The list of coaching pairs is posted on the board. Are any partners absent?**
3. **Second Coaches, stand and get the folders.**
4. **Second Coaches, sit with your partner.**
5. **Second Coaches, take the Player folder.**
6. **First Coaches, take the Coach folder.**
7. **Second Coaches, take out the Coaching Sheet. write your name, your partner's name, and the date at the top.**
8. **First Coaches, take out the Point Sheet and put it on your desk so I can mark points. Also, make sure you have the Coaching Answer Sheet.**
9. (Wait until students have names and dates written. Review correction procedures and Coach's Question sheet, if necessary.) **First Coaches, you are the Coach on rows one and two. Second Coaches, you are the Player on rows one and two. Remember, after the first row of problems, the coach will stop asking the player questions. The Player will self-talk through row two.**

After the first two rows of problem, when you get to row three, STOP. It will be time to change materials and jobs. (If you want all pairs to switch at the same time, instruct them to wait at the end of row two. Then, half way through the allotted Coaching time, instruct students to switch jobs.) **Second Coaches, it will be your turn to Coach. At that time, get the Coach's Question Sheet and Coaching Answer Sheet from your partner. First Coaches, you will be the Player and you'll get the Coaching Sheet from your partner.**

Begin. (Monitor for correct PALS procedures and for understanding of assigned skills. Provide help as needed and award extra points on the Point Sheet when warranted.)

10. (when most students are finished or after 15-20 minutes) **Stop.** (Award bonus points and point out good PALS behaviors you observed.)
11. **Second coaches, make sure your name, your partner's name, and the date is on the Coaching Sheet.**
12. **Second coaches, get the Player folder. Place the Coaching Sheet in the back of the Coaching pocket.**
13. **First coaches, get the Coach folder. Place the coaching Answer sheet in the back of Coaching pocket.**
14. **It's time for Relaxation Break.**
Sit down in your seat in a relaxed and comfortable position. Make sure your feet

are on the floor and your hands are by your sides. Let your mind and body relax.

Now, close your eyes and focus on your breathing.

Together, let's draw in a deep full breath [count aloud 1..2..3..4] hold it [count aloud 1..2..] and slowly let it out as quietly as you can. Continue breathing slowly and feel your body and mind relax.

I am going to time the class for 60 seconds. Continue to breathe in and out slowly. Let your worries go while you think about all of the good things you've done this week. (*Name activities that the students did successfully*)

(*Silently time students for 60 seconds/monitor good behavior*)

(*After 60 seconds*) I want you to slowly open your eyes and without talking, pull one Practice Sheet from your folder and write your name and today's date at the top of the practice sheet. When you've finished, turn your sheet face down.

15. You may begin your Practice Sheets.
16. (When most students are finished, or after approximately 5 minutes:) Stop.
17. Exchange Practice Sheets with your partner.
18. Write your name beside "scored by" to show that you are the one scoring the Practice Sheet.
19. First coaches, pull the Practice Answer sheet out of the Coach folder. Share the Answer Sheet and score each other's paper. Circle all of the correct problems, leave incorrect problems the way they are, and skip problems that have no answer. (Remind students that they do not have to correct their mistakes on practice Sheets.)
20. Count the number of correct answers. Write that number at the top and circle it. This answer will be the number of points each of you earned.
21. Give the Practice Sheet back to your partner.
22. Each of you should check the number of points you earned by counting the number of circles on your practice Sheet.
23. Second Coaches, mark off the number of points you earned.
24. First Coaches, mark off your points.
25. Put your practice sheets in the back of the practice pocket.
26. First coaches, put the Practice Answer sheet back in the *Practice* pocket
27. Circle the last number on your Point Sheet that has a slash through it. How many pairs had 5 or more points? Keep your hand up if your pair had 10 or more points. (Continue until you have a winning pair.)
28. Let's give _____ and _____ a round of applause. First Coaches, put the Point Sheet back in the Coach folder. Now, _____ and _____ may

collect folders.

29. (After materials are collected) **Second Coaches, return to your seats.**

Appendix D

Implementation Integrity Direct Observation Checklist PALS - PALS+RT

Teacher: _____ Observer: _____
Lesson #: _____ Start Time: _____ End Time: _____

Directions: During the observation, place a checkmark in the “+” (or “-”) column for each step observed (or not observed). Tally the number of “+” and calculate integrity for each lesson part and overall integrity (see summary form at end of this sheet).

Note: If the step is not applicable, place checkmark in “+” column.

Part I: Introduction or Review of PALS Lesson

+	-	Step	Checklist
		1	Teacher review PALS rules with class (if necessary)
		2	Teacher reviews/demonstrates Coach’s and Player’s job (if necessary)
		3	Teacher reviews/demonstrates Question Sheet and Correction Procedure (if necessary)
		4	Teacher reminds students when to switch roles
		5	Teacher reminds students when to quit using Question Sheet and begin self-talk

Number of +/5 = _____ % Introduction/Review Fidelity

Part II: PALS Coaching Activity

Pair A		Step	Checklist
+	-		
		1	First Coach draws circle around correct digits
		2	First Coach uses correct error correction procedure when applicable <i>(Coach tells Player the digit is incorrect and helps him/her correct mistake by providing an explanation but not telling the answer. Coach puts a triangle around that digit.)</i>
		3	First Coach uses Question Sheet for Row 1
		4	First Coach listens to Player Self-Talk for Row 2
		5	Pairs switch roles
		6	Second Coach draws circles around correct digits
		7	Second Coach uses correct error correction procedure when applicable
		8	Second Coach uses Question Sheet for Row 3
		9	Second Coach listens to Player self-talk for Row 4

Number of +/9 = _____ % PALS Activity Fidelity

Part III: Relaxation Technique (PALS-RT)

+	-	Step	Checklist
		1	Teacher announces relaxation break
		2	Teacher prompts students to move into a comfortable position
		3	Teacher models process for deep breathing
		4	Teacher prompts students to close eyes and to follow the deep breathing technique for 60 seconds
		5	Teacher prompts students to open eyes and begin practice sheets after 60 seconds.

Number of +/5 = _____ % PALS Activity Fidelity

Part IV: Practice and Wrap-Up

Pair B			
+	-	Step	Checklist
		1	Students work individually on practice sheets
		2	Students exchange papers
		3	During scoring, students circle correct problems, count number of correct answers, write at top of Practice Sheet, and return to partner
		4	Each partner marks 1 point on point sheet for each correct problem (mark individual points)
		5	Student pairs circle total number of points earned

Number of +/5 = _____ % Practice and Wrap-Up Time Fidelity

Part V: General Teacher Behaviors throughout PALS

+	-	Step	Checklist
		1	Teacher awards extra points to individual and/or large group for good PALS behavior
		2	Provides positive feedback to individuals and/or large group
		3	Provides corrective feedback to individuals and/or large group (as needed)
		4	Coaching lasts no more than 15 minutes
		5	Teacher prompts students through Relaxation Technique; lasts no longer than 5 minutes (if applicable)
		6	Practice lasts no longer than 5 minutes

Number of +/6 = _____ % General Teacher Behaviors Fidelity

Summary

Activity	Number of +	Total Number Possible	%
Introduction/Review		5	
Coaching Activity		9	
Relaxation Technique		5	
Practice & Wrap-Up		5	
General Teacher Behaviors		6	
Overall Integrity		30	

Appendix E

Implementation Integrity Direct Observation Checklist RT

Teacher: **Observer:** **Date:**
Observation #: **Start Time:** **End Time:**

Directions: During the observation, place a checkmark in the “+” (or “-“) column for each step observed (or not observed). Tally the number of “+” and calculate integrity for lesson.

Relaxation Technique

+	-	Step	Checklist
		1	Teacher announces relaxation time
		2	Teacher prompts students to move into a comfortable position
		3	Teacher models process for deep breathing
		4	Teacher prompts students to close eyes and to follow the deep breathing technique for 60 seconds
		5	Teacher prompts students to open eyes and begin practice sheets after 60 seconds.

Number of +/5 = _____ % PALS Activity Fidelity

Appendix F

Implementation Integrity Direct Observation Checklist

Control Group

Teacher: _____ School: _____ Observer: _____
 Observation #: _____ Start Time: _____ End Time: _____

Directions: During the observation, place a checkmark in the “+” (or “-“) column for each step observed (or not observed). Tally the number of “+” and calculate integrity for each lesson part and overall integrity (see summary form at end of this sheet).

+	-	Step	Checklist
		1	Students Work On: homework, make-up work, worksheet
		2	Students Work Independently
		3	Duration of math activities: 15 – 30 minutes

Number of +/3 = _____ % of Math Activity Fidelity

BIOGRAPHY OF THE AUTHOR

Kelly A. Hugger was born in Traverse City, Michigan. She was raised in Cape Elizabeth, Maine and received her high school diploma from Cape Elizabeth High School in 2004. In 2008, Ms. Hugger graduated from Goucher College in Towson, Maryland with a B.A. in Psychology. In 2009, she moved back to Maine and enrolled in the University of Southern Maine graduate program in School Psychology. During her graduate education, Ms. Hugger held graduate assistantships in research support, systems-level data analysis, academic consultation, and technology support. She was also elected into several nationally recognized school psychology graduate student positions: Student Affiliates of School Psychology convention chair (2010-2011) and Student Development Workshop member (2011-2013). In 2012, she earned her M.S. in Educational Psychology from the University of Southern Maine. Currently, Ms. Hugger is finishing her pre-doctoral internship in the RSU14 Windham Raymond School District. Her areas of interest include empirically-based interventions for students with emotional and behavioral disorders and systems level data analysis. She is a candidate for the Psy.D. degree in School Psychology from the University of Southern Maine in August, 2014.