The Effects of Peer Tutoring on Fifth-Grade Students’ Motivation and Learning in Math

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The Effects of Peer Tutoring on Fifth-Grade Students' Motivation and Learning in Math

Problem-Solving

By

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Master of Science in Education
The Effects of Peer Tutoring on Fifth-Grade Students’ Motivation and Learning in Math

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Chapter 1

Introduction

Schools across the country are adopting and using student centered instruction rather than the traditional teacher-directed instructional setting. This method of teaching has increased student achievement in all subjects of the elementary classroom, as well as the use of mathematics in everyday life (Topping, Campbell, Douglas & Smith, 2003). According to research on same-age and cross-age peer tutoring, significant gains were made in learners of all backgrounds (Cairo & Craig, 2005).

One essential component of mathematics in everyday life is the ability to problem solve. Therefore, students need to be able to master problem-solving skills. One way to achieve this goal is through peer-assisted learning (also known as peer tutoring), which, according to Calhoon (2003), is defined as students working together to teach one another. According to Summers (2006), this style of learning is correlated to social constructivism because students use their own knowledge to assist each other with assignments and class assessments.

Topping, et al. (2003), conducted a study in which students participated in a cross-age peer tutoring program to discover ways of enhancing achievement in mathematics with regards to overcoming the barriers of mathematical discontinuity, motivation and other factors. The researchers found that peer tutoring showed significant gains in the use of mathematical language and self-confidence in both tutors and students being tutored. Classroom teachers, of both tutors and students
being tutored, noticed improvements in attitudes, elaborate explanations during class discussions (not just giving procedures) and focus on the task at-hand.

Motivation was an additional benefit of using peer assisted learning to promote student learning in the mathematics classroom. Results have also indicated that learners were motivated in achieving their own success in mathematics (McMaster, Fuchs and Fuchs, 2006). Research on peer-assisted learning and its effects on students in mathematics, has proven to be a beneficial way in achieving success (McMaster et al., (2006); Nesselrodt & Alger, (2005); Robinson, (2005); Spencer, (2006)).

Statement of the Problem

People struggle with problem-solving skills in every day life. As a fifth-grade math teacher I am constantly looking for ways to increase my students’ mastery of math problem solving skills and strategies. Most of the students in my classroom are coming in below grade level in mathematics. Not only do I need to instill basic mathematical skills, but I also am accountable for meeting the fifth grade New York State standards.

The focus of this action research paper was to determine whether or not peer-tutoring affects student learning and motivation in mathematics.

Significance of the Problem

Students from my school come from various types of settings from over 50 different schools within the city of Rochester, and, they have mastered a variety of skills. These skills range from barely knowing multiplication facts to successfully
being able to complete multi-step word problems. Therefore, I need to make sure that the teaching within my classroom fits their learning needs.

My school holds high academic standards for both teachers and learners. In order to meet these standards, I need to research best practices that will assist my students’ learning. The purpose of my research was to determine the effects that peer tutoring may have on student motivation and learning in fifth grade math problem-solving. I wanted to find ways to assist students in learning and achievement, allowing them to have greater success in school and beyond. Math problem-solving is not limited to classroom assignments and assessments, but is also used in real-world settings. Therefore, students need to be able to master problem-solving skills. Hence, I am pursuing research regarding such skills so my fifth-grade students experience success in mathematics.

**Rationale**

Studies conducted by Robinson, Schofield and Steers-Wentzell (2005), concluded that peer tutoring increased academic achievement and motivation in tutors and students being tutored. In this study I created mathematical intervention focusing on problem-solving skills. This intervention was used in peer tutoring situations as I attempted to assist learners with mathematical skills and motivation for learning and classroom participation.

This study was important to me because I work in a school environment which has a strict code of conduct, believing that students learn better when they are seated in quiet rows, receiving teacher-directed instruction, rather than working with one another. Students can share their ideas with the class as a whole; however,
sharing and learning with partners are strongly discouraged. Understanding these policies and strict guidelines, I still wanted to pursue research in regards to students learning from one another, not just the traditional way of learning from the teacher.

As a teacher I need to be able to understand and provide multiple ways of teaching so my students may have success and achieve great results in mathematics. I do not want to limit my classroom to just teacher-directed instruction. For this reason, I have conducted research on student-to-student learning and the impact that it may have on student achievement. With all of the research supporting student-to-student learning, I planned to shift my teaching focus to student-directed lessons with hopes of building student success in learning and increase motivation in mathematics.

**Definition of Key Terms**

**Peer Tutoring/Peer-Assisted Learning:** Students assisting one another in learning by sharing ideas regarding the topic at hand.

**Cross-Age Peer Tutoring:** Students of different age groups and/or grade levels, assisting one another in learning by sharing ideas regarding the topic at hand.

**Same-Age Peer Tutoring:** Students of the same age groups and/or grade levels, assisting one another in learning by sharing ideas regarding the topic at hand.

**Mathematical Discontinuity:** The comparison between mathematic school curriculum and mathematics in everyday life.

**Motivation:** Students’ desire to participate in math class as well as completing assignments punctually.
Social Constructivism: A philosophical belief that students need socialization to learn and grow with each other. Students learn by sharing with one another.
Peer tutoring seems to be a common trend, with regards to social constructivism, in teaching and learning mathematics. Social constructivism is a philosophical belief that students need socialization to learn and grow with each other, meaning that students learn by sharing with one another (Summers, 2006).

Research has unveiled results regarding peer tutoring in other subjects, such as reading, which are commonly weaved into the mathematics classroom (McMaster, Fuchs and Fuchs, 2006). Several researchers conducted studies related to different forms of peer tutoring such as: cross-age (an older learner paired with a younger learner), same-age and reciprocal (students take turns being tutor and tutee) tutoring which showed significant gains in learners at the elementary, middle and high school level (Spencer, 2006). Students who were placed at-risk and/or had learning difficulties, benefited from peer tutoring, as well as other learners without difficulties, according to Witzel, Mercer and Miller (2003).

Within every classroom there are students who learn on various levels and at different paces. Educators try to find ways to assist these learners in the classroom while continuing to keep the faster learners above the standards of academic success. When it comes to assisting teachers in increasing achievement in all learners, peer tutoring may have major benefits.

Benefits of Peer Tutoring

To understand the needs of students, especially those above and below average, social constructivist theorists Fuchs and Fuchs (2005), conducted research in
which *Peer-Assisted Learning Strategies* (PALS) were applied and attempted to promote fluency, word recognition and reading comprehension in young school-age children. Douglas and Lynn Fuchs (as cited in Fuchs & Fuchs, 2005), created the PALS program which was intended to pair students according to skill level and work on math, reading and spelling class work, at the elementary level. This idea was derived from the class wide peer tutoring program (CWPT), created by Delquadri, Greenwood, Whorton, Carta, and Hall (as cited in McMaster, Fuchs and Fuchs, 2006). The use of PALS and CWPT program allowed enabled teachers to double learning time by having students simultaneously work on academic tasks.

Fuchs and Fuchs (2005) chose this method based on prior research which noted that “…PALS is to strengthen the teachers’ capacity to meet the academic needs of a broader range of children” (Fuchs and Fuchs, 2005, p. 34) These researchers examined peer mediated instruction as a means to support learning within students in grades two through six. Students were assigned to work together in pairs, combining one student from a lower performing and higher performing class. Performance was identified by the school prior to the onset of this study.

Each session included three activities using PALS; partner reading (students reading text to one another for five-minute periods), paragraph shrinking (students reading one paragraph at a time while identifying the main idea) and prediction relay (reading larger chunks of the text, requiring students to make predictions) (Fuchs and Fuchs, 2005).

As a result of this study, Fuchs and Fuchs (2005) identified PALS to be practical enough to include in everyday classroom routine. In addition to this finding,
the researchers concluded that PALS alone increased improvement in word recognition, spelling, and general reading skills. These researchers provided greater evidence that children in the primary grades, improved in reading skills when paired with another student in a cooperative learning structure.

A similar study by McMaster, Fuchs and Fuchs (2006) evaluated the effectiveness of Peer-Assisted Learning Strategies (PALS) in promoting reading fluency and comprehension. Researchers studied grades two through six, making up 40 classrooms in total, pairing high performing readers and low-performing readers. Twenty of the classrooms received PALS (experimental group) and twenty classrooms received no treatment (control group). Students, who belonged to the experimental group, significantly outperformed those of the control group on the posttest.

McMaster et al., (2006) realized that learning difficulties begin earlier than second grade and often times extend throughout the upper grade levels. Therefore, they decided to extend PALS from kindergarten through high school. This decision was also made due to the significant learning gains in the students who participated in grades two through six.

The high school students, who participated in the PALS program, significantly improved their reading comprehension scores in comparison to those who did not receive PALS. Kindergartners also made significant gains in decoding skills, using K-PALS (Kindergarten Peer Assisted Learning Strategies). Kindergarteners with disabilities from the experimental groups outperformed kindergartners with disabilities from the control group. However, researchers discovered that several
kindergarten students with disabilities from the experimental group did not improve their reading fluency skills.

This research supports social constructivism and shows great benefits of students assisting one another in learning. Although this study conducted by McMaster et al. (2006) has shown to benefit most learners in reading, similar strategies can be applied to learners in mathematics as well.

Peer Tutoring in Mathematics

Peer tutoring is a type of intervention in which one student supports or instructs another student academically (Mayfield and Vollmer, 2007). Mayfield and her colleague conducted research to evaluate the effectiveness of peer tutoring on girls who were “at-risk”, and had “deficits in mathematics” (Mayfield and Vollmer, 2007, p. 223).

Unlike the focus on reading and comprehension fluency in the study researched by McMaster, Fuchs and Fuchs (2006), both Peer-Assisted Learning Strategies (PALS) and Curriculum-Based Measurement (CBM) programs focused on math test-taking strategies as well as computational skills in this study conducted by Calhoon and Fuchs (2003). PALS/CBM is a program that was originally intended to be used in the elementary grades. CBM is a standardized test that allows teachers to track the progress of a student’s mastery in math, spelling, reading and written expression. CBM allowed teachers (and tutors) to track students’ progress as they worked towards their learning goals (Calhoon, 2003).

Calhoon and Fuchs’ (2003) study included 92 high-school students who had mild disabilities and difficulties in mastering word problem-solving and basic
mathematical computational skills. Each student was separated into two groups, experimental and control. Students in the experimental group were taught using PALS and CBM programs in mathematics. The control group was also taught basic mathematical skills, however they did not participate in PALS/CBM. The teachers of the control group taught them in a traditional setting, and assessed the students using a state-wide assessment called the Buck Down on Tennessee Mathematics. Students from the control group completed lessons and workbook pages individually and independently.

Calhoon and Fuchs (2003) identified PALS/CBM as being a viable instructional tool for providing math tutoring to high school students. PALS/CBM enhanced the students’ computational skills. However, these researchers were disappointed to find that the program did not promote student development in applications and conceptual skills on the posttest. Students with cognitive disabilities had greater difficulty with certain math problem-solving skills (i.e. word problems). Therefore, certain areas of mathematics may initially need to be teacher-directed (Calhoon and Fuchs, 2003).

In addition to the above research which involved same age peer tutoring with students with special needs, similar research was conducted by Witzel, Mercer and Miller (2003). These researchers created 34 student pairs, using a total of 68 students. Each pair of students was labeled with a type of learning disability or was significantly low in algebra. These pairs focused on a concrete-to-representational-to-abstract (CRA) instructional model, intended to assist students with the abstract notion of algebra. The CRA method was an attempt to allow these pairs of students,
to gain longer retention of algebra. CRA allowed students to use manipulatives to solve algebraic equations, and then eventually move from that concrete notion, to representations through pictures, and finally solving the abstract concepts on their own (Witzel, et al., 2003)

Researchers found that all students who participated in CRA with peers outperformed the students that received traditional instruction, and made fewer errors on algebra problems.

Along with the teachers’ assistance in group formation, Witzel et al. (2003) utilized a pretest-posttest model to assess the level at which the students performed. Both the experimental group (the 34 pairs of students that were assigned the CRA model), and the control group (students taught in a traditional setting), were given the assessments, and the objective to improve their algebra skills. Researchers noticed an overall improvement for all students who participated in the study; however, an increase on follow-up tests, in algebra, was made by the students who participated in pairs with CRA. The gains were measured by the data presented on the posttest and a follow up test, given by the researchers (Witzel, et al., 2003).

In contrast to prior studies on same-age peer tutoring and students with special needs, Spencer (2006) conducted a review of literature on the effects of using same-age and cross-age peer tutoring in all subjects. She researched the effect that tutoring had on students with emotional and behavioral disorders at the elementary, middle-school and high school levels. At the elementary level, Spencer’s (2006) research utilized the CWPT program.
As part of this program Spencer, 2006, implemented an experimental-control design that included students with emotional and behavioral disorders as tutors and the tutors’ learners. This study included cross-age, same-age and reciprocal peer tutoring. Reciprocal tutoring is tutoring that exchanges the students’ roles as tutors and students tutored. Students worked with their peers on a variety of social and academic skills, including mathematics, reading and social studies. The most common assessment implemented within this design was the pretest posttest model.

Spencer (2006) not only found that all types of tutoring led to significant gains across all academic subjects, but that students with emotional or behavioral disorders were very successful as tutors.

Spencer’s research (2006) showed student improvement in mathematics and science for both tutors and the students being tutored. When compared to other subjects, students mostly benefited in social studies and reading:

Tutoring increases the students’ time on task, resulting in more opportunity for practice. The additional assistance and support, with frequent and immediate feedback on academic performance, provides a positive learning environment. In addition, peer tutoring includes numerous ability levels within the classroom, thus enhancing instructional time for all students (Spencer, 2006, p. 204).

Spencer (2006) suggested that peer tutoring doubles reading practice time when used as a whole class tutoring method, therefore increasing time on task as well as building reading fluency.

Nesselrodt and Alger (2005) conducted a peer tutoring study using seventh and eighth grade students enrolled an inner-city middle school. These students were considered at-risk due to the socioeconomic status (SES) of their families. Parallel to Spencer’s (2006) research, this study also included same-age, cross-age and
reciprocal peer tutoring. However, Nesselrodt and Alger concluded that students made greater statistically significant gains in mathematics and reading than any other subjects (2005). Robinson, Schofield and Steers-Wentzell (2005) created a similar study that proposed cross-age tutoring programs had a positive impact on the attitudes of the students’ with low socio-economic status.

According to Nesselrodt and Alger (2005) one-to-one adult to child learning was one of the most effective ways of teaching these students; however, hiring of such qualified teachers would be rather costly. Hence, researchers designed an alternative three-year tutoring program, called the Academic Coaching Program, which recruited and trained teacher apprentices from a local university. This program focused on vocabulary, reading comprehension, word-attack, math problem-solving and computational skills.

Students were tutored in reading and mathematics and were tested using a standardized assessment. An attitude assessment scale was also administered during years two and three, to determine the effectiveness of the program. The researchers concluded that the Academic Coaching Program raised positive attitudes in the participants in the program. However, unlike the significant gains shown in the research conducted by Spencer (2006), results of this study proved no overall statistically significant gains between the group that participated in the Academic Coaching Program and those who did not. Nonetheless, there were grade equivalent gains in students that participated in the coaching program in the first two years which were absent in the students that did not participate.
During the first two years of the study, students were prepared by tutors to take the standardized test. Academic improvements were made on the standardized math tests. In spite of this, as the coaching program continued, coaches focused on Socratic seminars in reading which did not prepare the students for the standardized reading exam. Therefore no significant gains were made in reading and comprehension during this period of time.

Robinson, Schofield and Steers-Wentzell (2005) created a study that proposed cross-age tutoring programs as positive academic outcomes for African-American and other minority students, as well as for white students, who participated as tutors, students being tutored, or both. These programs also had a positive impact on the attitudes of the students' socio-economic status, self-concepts and their values of their academic worth. This study explored specific values such as the characteristics of the students (academic level of the students prior to tutoring and gender of the tutor-tutee pairs), the level of tutor training and amount of tutoring.

This study conducted by Robinson et al. (2005), heavily focused on minority students, especially African-American students, and white students due to the wide achievement gap between the two groups, in mathematics. Researchers discovered, upon completion of this study, that peer and cross-age tutoring were useful approaches in attaining academic achievement for all students regardless of race. However, researchers noted that academic gains depended upon the initial academic achievement that a student had already accomplished. Peer and cross-age tutoring cultivated positive behaviors and attitudes, which were contributing factors to the academic success of the students that participated. Robinson and colleagues
concluded their study by noting that academic achievement was increased, and positive attitudes regarding socioeconomic status were evident in students that tutored or were being tutored. The researchers further noted, through prior research, that studies which benefited from a pre- and post-test method showed both tutors and students tutored, increased in positive attitudes towards classroom subjects.

Social constructivism has proven to be a productive learning means for students from different grades, backgrounds and gender (Timmermans, Lieshout and Verhoeven, 2007). Timmermans et al. conducted a research study to discover the effects of guided instruction (GI), teacher assisting while learners try to obtain understanding on their own, and direct instruction (DI), teachers solely instructing learners. The research involved students that were low performing in regular school settings versus students that were low performing in special schools. The students were approximately nine years of age (2007). Timmermans et al. (2007) recognized that girls who participated in GI had an increase in motivation due to GI’s constructivist approach towards learning.

Topping, Campbell, Douglas and Smith (2003) conducted a research study attempting to discover ways of enhancing achievement in mathematics with regards to overcoming the barriers of mathematical discontinuity (comparison between math school curriculum and mathematics in everyday life), motivation in mathematics and other factors. After reviewing related literature, they determined mathematical games were a helpful way to bridge the two contexts. The researchers utilized a cross-age design, using mathematical games to overcome the barriers that cause a decline in
mathematical achievement. Achievement was based on pre- and post assessments measuring academic achievement as well motivation.

These motivational assessments were known as the *Me-As-Learners Scale* (MALS) and *Behavioral Indicators of Self-esteem scales* (BIOS). MALS was a scale that measured self-concepts of learning as was only completed by the tutors. Teachers used BIOS to measure observable self-esteem within the learners. Self-esteem was defined students use of mathematical terms and knowledge with confidence. The BIOS assessment was taken by both tutors and students tutored. More recent studies on the impact of tutoring subjects showed significant gains in the attitudes of the tutors and students that were tutored after reciprocal peer teaching, according to Topping et al. (2003)

After comparison of the pre- and posttest data, as well as other observable behaviors amongst the tutors and students being tutored, Topping et al. (2003) found significant gains in the use of mathematical language, partnerships, and self-confidence in both parties. Classroom teachers of both tutors and students tutored noticed improvements in attitudes, elaborate explanations during class discussions (not just giving procedures), and focus on the task at-hand.

McKinstry and Topping (2003) conducted a study that included 30 high school students ranging from 12 to 18 years of age. This study was intended to evaluate the effects that cross-age peer tutoring had on thinking skills at the high school level. The researchers predicted an increase in self-motivation and reading enjoyment, improvements in self-esteem and social skills, and an increase in reading fluency and thinking skills. The researchers of this study thought reading
comprehension gains would be evident in students only being tutored due to the large age gap between tutors and students being tutored. However, research proved reading gains were evident in all participants.

Several instruments were utilized throughout the course of this study by the researchers. McKinstery and Topping (2003) created measurement tools including norm-referenced tests, group pre- and posttests (that analyzed reading comprehension for tutored students only), pre-post subjective participant feedback of tutor and teacher analysis, as well as participant feedback through a tutor/teacher questionnaire and teacher interviews. The feedback analysis, taken by the tutors and teachers, was a written examination that identified strengths, weaknesses, opportunities and threats within the program. This exam measured the self-esteem, enjoyment and motivation aspects of the research.

Staff and students gave positive feedback with regards to the tutoring process and outcomes; however, tutors were more enthusiastic about the overall procedure than the students who were tutored. While the initial study focused on the enhancement of the tutored students’ reading skills and comprehension, the researchers found that the tutors made significant gains in reading and thinking skills as well. Confidence of the students being tutored increased. Tutors gained confidence in communication and cooperative working skills, and students being tutored became more critically aware in reading due to paired thinking skills taught during the onset of the study. The researchers wanted to explore paired thinking with other samples of tutoring such as: same-age tutoring, same-ability pairs, and other age groups with smaller age differences. Paired thinking is a comprehension strategy that
allows student pairs, tutors and students tutored, to ask one another comprehension questions about a text, before, during and after reading.

In contrast to the previously mentioned research, Topping, Kearney, McGee and Pugh (2004), conducted a research-based study using a different form of social constructivism. The researchers intended to compare the effects of math tutoring on student learning given at home, against regular classroom instruction given with no tutoring. Researchers utilized a generic tutoring program called Duolog Maths. Duolog Maths is a framework for pairs. This method creates a dialogue between the tutor and student tutored which is intended to be used on a range of mathematical problems, specifically to bridge problem-solving strategies with real-life situations. The researchers outlined an eight-step flow chart which allowed tutors to remember helpful techniques when guiding the learners in solving math problems when using Duolog Maths.

The students were split into two groups; experimental (17 students) and control group (13 students). The experimental group was tutored in math problem-solving designed to fit particular problem-solving applications at home. This group also answered questions in an interview conducted by the researchers. The control group received traditional classroom instruction, math homework, received no tutoring, and was not interviewed.

Topping et al. (2004) did not find any significant pre- to post-test differences in attitudes. However, there were statistically significant gains in the experimental group that was not evident in the control group. Interestingly, the researchers noted further gains in the male students tutored than the females although these subjects
were not originally compared in the study. Positive feedback was given during the
interviews from both tutors and students tutored that participated in the study.
Researchers concluded that the Duolog Maths method was a positive tool in the
enhancement of student learning and math retention.

Summers (2006) conducted research that investigated ways in which
collaborative learning groups within a classroom influenced individual students’
social and achievement goals. To accomplish this study, Summers (2006) used 200
sixth-grade students. Each student was surveyed to measure their social and
academic goals in their math classes.

Summers (2006) attempted to use a social-constructivist perspective to
influence individual motivation and learning goals. Individual student goals were
measured through a question and answer survey, while shared goals were measured
by determining the average student’s feelings towards working on tasks in peer
learning groups.

Based on prior research, combining student motivation and achievement,
Summers (2006) measured and analyzed several components throughout this study,
including social goals, academic achievement and motivation using the Patterns
Adaptive Learning Survey and a Friendship Quality Questionnaire. Shared social
academic goals and peer learning groups were assessed by teacher monitoring and
feedback.

Summers’ findings indicated that the students who shared achievement goals
with a group were successful in reaching their individual learning goals by the end of
the year assessments (2006). Interestingly, the girls who shared learning goals with
one another, reported higher task orientation than the boys. This finding is similar to findings in Timermans' (2007) study which revealed that girls had a higher increase in motivation. This similarity may be due to the social constructivist approach to learning, and that females tend to be more social and adapt well to shared learning.

Peer Tutoring vs. Direct Instruction

An alternative to peer tutoring is direct teaching, also known as teacher-led direct instruction, which is classroom instruction (or tutoring) only given by the teacher, according to Rivera, Al-Otaiba and Koorland (2006). Rivera et al. (2006), created a review of literature on reading instruction and students with emotional behavior disorders (EBD). The researchers’ focus was on the primary grades. One review, which focused on researching reading interventions by Coleman and Vaughn (2000) (as cited in Rivera, et al., 2006), concluded that teacher-led direct instruction and tutoring were effective instructional strategies for teaching reading to students with EBD.

Although this review of literature focused on reading intervention, teacher-led instruction was proven to have significant gains in learners. Teachers concluded that directed instruction worked well when teaching small groups of students with EBD, “Findings supported the efficacy of teacher-led direct instruction and tutoring. Because of the small number of studies found, Coleman and Vaughn also conducted a focus group with experienced teachers of students with EBD to discern which approaches teachers considered most successful” (Coleman and Vaughn, 2000, as cited in Rivera, et al., 2006, p. 3). The findings in the review of literature supported the effectiveness of both teacher-led instruction and direct tutoring.
In contrast to research supporting positive outcomes in peer-to-peer learning through evaluative measures, Cairo and Craig (2005) conducted a study to determine whether or not student-to-student tutoring had greater learning gains than non-tutored students. Based on this research, Cairo and his colleague (2005) found that tutors and students being tutored had no statistical evidence of increased learning gains in comparison to those of regular classroom instruction. This study only compared tutors versus non-tutors in learning retention. These results contrasted findings from Topping et al. (2003), where teachers and researchers noticed longer retention of mathematical reasoning and concepts in tutors and students being tutored.

Another research study supporting teacher-directed instruction was conducted by Mathes, Torgesen, Clancy-Menchetti, Santi, Nicholas, Robinson and Grek, (2003). These researchers conducted a study that compared the results of direct-teacher instruction with peer tutoring. They also used several components of peer-assisted learning strategies (PALS). Mathes et al. (2003) utilized 89 first-grade participants that were either paired with a peer or given direct-teaching in the form of small groups, from the classroom teacher. Each tutoring group worked on a variety of reading concepts such as oral reading fluency, word recognition and phonics, and reading comprehension.

Mathes and his colleagues (2003) noted that both groups of students, peer tutored and direct instructed, made gains in reading comprehension. Nonetheless, students that were led in teacher-directed instruction made higher learning gains than those who participated in peer tutoring. These researchers also concluded that regardless of peer tutoring or direct-teaching, more effective instruction is led in
small groups rather than whole class instruction. They claimed that students work at different paces, and if not careful, students can get left behind, discouraged, and distracted.

Coleman and Vaughn (2000) (as cited in Rivera, Otaiba & Koorland, 2006, noted that teacher-directed instruction is a positive means in gaining results in student learning. However, Mathes et al., (2002) found that students also made significant learning gains by assisting one another with learning, especially when teachers were pre-occupied with other students during small group instruction.

Although Robinson et al. (2005) found that peer-to-peer learning created positive academic success as previously stated; they cautioned teachers and other researchers to not solely depend upon peer and cross-age tutoring. These types of social learning heavily focused on the imminent topic being studied with little regard to other subject matter.

Summers (2006) also suggested that teachers participating in collaborative learning practice become aware of the pressures that students face. Students at sixth-grade level may compare themselves to their peers, withdraw from their group members, and resist participation to avoid being humiliated in front of their peers, especially during a time in their lives when fitting in is most important.

Conclusion

Research on peer-assisted learning and effects on students in mathematics has proven to be a beneficial way of achieving academic success (McMaster et al., 2005; Nesselrodt & Alger, 2005; Robinson, 2005; Spencer, 2006). Research has also proven peer tutoring to have significant gains in student learning in reading, which is
commonly intertwined into the math classroom on a daily basis (Fuchs & Fuchs, 2005). Whether same-age, cross-age or reciprocal peer tutoring, research has shown significant gains in learners of all backgrounds and on various levels (Cairo & Craig, 2005).

However, regardless of the teaching technique (peer tutoring or teacher-led instruction), research has shown that learning gains and academic achievement can be made in small groups especially when the learners’ difficulties are addressed first (Mathes et al., 2003).
Chapter 3

Applications and Evaluations

Introduction

The purpose of this study was to determine the effects that peer tutoring may have on fifth-grade students' motivation and learning, in math problem-solving. The primary goal of this study was to help students succeed in math class by identifying any effects that peer tutoring may have on the students' achievement. Problem-solving is not limited to classroom assignments and assessments, but is also used in real-world settings; therefore, students need to be able to master these skills in order to succeed in the real-world. The secondary goal of this research study was to find ways that students may be encouraged and motivated to do their work and participate in the classroom. This study was designed to assist students struggling in math problem-solving with academic growth and determine alternative ways to reach student achievement.

Participants

The study included thirty fifth-grade students from an urban school, located in New York. The school is made up of fifth and sixth grades, and includes approximately 150 students. Classes include three homerooms containing an average of 25 students that are grouped according to ability. The groups were formed by baseline data that was administered during the first week of school, and were separated into three ability groups.

The school is a member of a network of schools out of New York City that focus heavily on college preparation and instruction is typically teacher-directed.
Learning in these schools is done with students in rows, without assistance from one another. With permission granted from administration, my study took on a more social constructivistic approach to learning, which allowed students to learn from one another.

Procedures

While conducting this research, my role was a participant-observer, because I fully participated throughout the study. Tutors were trained on procedures prior to the start of this study. Eight tutoring sessions occurred, for a total of 30 minutes each. Tutors and students being tutored completed assignments that were previously introduced in class.

This study focused on the effects that peer tutoring has on students of the novice group. Five tutors were chosen from the proficient homeroom. The five students being tutored were chosen from the novice group. These students are low performing in math problem-solving based on their classroom scores. These groups worked together on solving one-step word problems. No students were chosen from the intermediate level. Students from the higher performing group were randomly chosen. Tutors and students tutored were known as the experimental group.

Prior to the start of the research, the motivation of the students being tutored was observed by creating a checklist; monitoring in-class student participation and “on-task” behavior (within five-minute intervals) (see Appendix A). Participation and “on-task” behavior was described as students that raised their hands to ask and answer questions related to the math topic being discussed. This same check list was
used during the intervention to gage any changes in motivation of the tutors and students being tutored.

The places/time that students cooperatively worked was in the math room, during the students' enrichment period and during their free period on Fridays. I was able to record the interactions and assist the learners in this location during these times because I monitor these periods on a daily basis.

In order to correctly assess the effects of peer tutoring on student achievement, I compared the results of the participants' pre and posttest to those of the control group. In order for the control group to be a similar make-up of the participants of the study, it consisted of ten students from each novice and proficient levels, who also completed the assessments. These students did not receive tutoring, so their skills in mastering objectives on the pre and posttest were solely based on in-class, direct teaching. Students from the control group were randomly chosen.

**Instruments for study**

I established a baseline assessment on the mathematical concepts of solving word problems (see Appendix B). The questions on this baseline (also known as pretest) were modeled after the fifth grade New York State math assessments. Taking ideas from the study conducted by Robinson, et al. (2005), who concluded that peer tutoring assisted academic achievement and motivation in tutors and students being tutored, I created mathematical problems focusing on one-step word problem-solving, modeled directly after the 2005-2007 New York State math assessments. I gave this teacher-created baseline assessment to all students involved in the study. The
baseline assessment determined the students' performance levels by dividing the number of correct answers by the total number of problems.

Each participant took the pretest which allowed me to determine their needs in the area of word problems. These areas included: addition, subtraction, multiplication, and estimation word problems. The questions were a mix of multiple choice and open response. The posttest, which modeled the initial pretest, was given following the intervention (see Appendix C).

Participants kept journals to record if the tutoring sessions were helpful as well as any changes in feelings towards math class. Journals included a Likert scale and journal prompts to assist students with topics to write (see Appendix D). These journals were completed during the conclusion of the study. Students’ answers were qualitatively examined for motivation, seeing how well they perceive themselves as successful math students.
Chapter 4

Results

Student achievement

Throughout this study, students participated in tutoring groups to assist one another in solving one-step word problems. The students were assessed using a triangulation of assessments throughout the study. The data of correct/incorrect answers to the word problems were collected using a pre and posttest, created by the researcher. The post data was compared to the initial word problems test. Anecdotal records were recorded by the researcher as a second form of data. This data was gathered at the beginning and end of the study and was quantitatively analyzed to show any changes in the students’ motivation throughout the study. One last piece of data was collected using journal prompts. Students were given these journal prompts to complete at the end of the study. This piece of data was qualitatively analyzed to determine the attitudes of the students’ towards math.

Table 1 compares the pre and posttest scores of the experimental and control groups. Column one of the table displays the number of students in each group. The second column shows the range of the pretest scores for each group. The pretests mean score (out of 100%) can be found in the third column. Columns four and five show the posttest range and the posttests mean score (out of 100%) for the experimental and control group. The final column shows the difference in the mean score percentages from the pretest to the posttest.
Comparing the mean scores of the experimental and control groups in Table 1 above data shows that both groups increased from the pretest to the posttest. The experimental group had a wider range in test scores for both pretest and posttest assessments. However, the control group seemed to have a larger increase between the pretest and posttest.

After collecting the data, individual student scores were also compared. Out of the 20 students belonging to the control group, 12 of them increased in scores from the pretest to the posttest. This means that 60% of the individual students, belonging to the control group, made gains. Out of the ten students in the experimental group, four actually increased their scores. This means 40% of these students showed growth from the pretest to the posttest.

*Students' attitudes toward math*

The students who participated in the experimental group were also assessed to determine the impact of peer tutoring on their motivation and their feelings toward math. The students completed journal prompts at the conclusion of the study. The journals were qualitatively measured by grouping similar responses together, then

<table>
<thead>
<tr>
<th></th>
<th># of Students</th>
<th>Pretest Range (%)</th>
<th>Pretest Mean Score (%)</th>
<th>Posttest Range (%)</th>
<th>Posttest Mean Score (%)</th>
<th>Difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>10</td>
<td>40-100</td>
<td>73.50</td>
<td>40-100</td>
<td>79.00</td>
<td>5.5</td>
</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>50-100</td>
<td>79.25</td>
<td>55-100</td>
<td>81.00</td>
<td>1.25</td>
</tr>
</tbody>
</table>

Table 1  Comparison of the Experimental and the Control Group-Pretest/Posttest
determining the overall consensus of the students’ feelings towards tutoring and math in general.

Tutors and students tutored answered the journal questions with various, yet similar, responses. Question one asked students what they thought about tutoring and question two asked students to explain their feelings in regards to tutoring. Nine of the ten students gave positive responses to both questions one and two saying they felt “great” about tutoring because they were either able to learn more or because they were able to help another person learn. One of the students tutored replied, “I felt this way because it (tutoring) taught me more about math.” Another form of a positive response was reflected in one student’s answer which read, “I feel this way about tutoring, because it helped me not go so fast and get answers wrong.” There was one tutor whose response was measured as neither positive nor negative because she could not explain how she felt about tutoring so she gave no response.

The students’ positive responses continued throughout the last three questions of the journal prompts. Question three asked students if peer tutoring changed how they felt about math. Although this question could have been answered with a simple “yes” or “no,” students were asked to elaborate their reasoning for their choice. Interestingly, nine of the ten students still gave positive responses about tutoring. One of the students tutored explained, “Yes, because it made me feel more confident about math because I understand it more.”

Of the nine students mentioned above, one of the tutors said that peer tutoring did not change how he felt about math, however his response deemed positive because he stated, “Nothing changed, I still love math.” Therefore, tutoring
did not have a negative effect on his feelings; it just gave him another way to show how much he loved math. This same student continued to ask if there were going to be more tutoring sessions after the study was complete. He asked, “Mrs. Austin, can we go back to the tutoring groups and help more students? Maybe we can pair our whole class with other students and the whole class can help one another.” He was very eager to participate and give help where math was concerned.

The tutor who had difficulty answering questions one and two stated that she felt the “same way” about math as a response to question three. When she elaborated on her response she stated, “I just think math is hard, but I liked working with others.” The source of this student’s difficulties is hard to detect. However, as a result of her explanation, the assumption was made that math overall is challenging for her regardless of the peer tutoring groups. Math did not become easier for her after the study was complete so her response was measured as neither positive nor negative. Furthermore in question four: “What helped you in tutoring?” this same tutor also replied that finding her mistakes was most helpful. This response was measured as positive.

In question five, “What didn’t help you in tutoring?” the tutor mentioned above explained that everything in tutoring helped her. Surprisingly, all ten of the students in the experimental group also replied to question five with a positive statement. They said that everything helped; and there was nothing that was not helpful during tutoring.

The final collection of data in regards to motivation was the anecdotal records of students being “on-task” in math class (“on task” was defined as students raising
hands to ask and answer questions related to math). The students belonging to the experimental group were observed in five-minute intervals, totaling 20 minutes prior to and concluding the study. Individual student totals are displayed in column two of Table 2. These numbers represent the total times students participated prior to the start of the intervention. Column three represents the students' participation totals at the end of the study. The tutored students are labeled one through five, while the tutors are numbers six through ten. Lastly, column four displays the difference between the pre and post observation. Negative numbers show a decrease in participation while positive numbers show an increase in the students' participation. Table 2 shows the results of the pre and post evaluation of “on-task” behavior on the following page.
Table 2  
“On-task” Behavior- Pre and Post Observation

<table>
<thead>
<tr>
<th>Student</th>
<th>Participation Totals (Pre-)</th>
<th>Participation Totals (Post)</th>
<th>Difference in Participation Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>8</td>
<td>-2</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>7</td>
<td>-2</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>10</td>
<td>-2</td>
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<tr>
<td>6</td>
<td>13</td>
<td>12</td>
<td>-1</td>
</tr>
<tr>
<td>7</td>
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</tr>
<tr>
<td>8</td>
<td>10</td>
<td>9</td>
<td>-1</td>
</tr>
<tr>
<td>9</td>
<td>14</td>
<td>12</td>
<td>-2</td>
</tr>
<tr>
<td>10</td>
<td>9</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Mean Score</td>
<td><strong>10.3</strong></td>
<td><strong>10.1</strong></td>
<td><strong>-0.2</strong></td>
</tr>
</tbody>
</table>

When the pre-observation mean score was compared with the post-observation mean, participation scores decreased slightly overall. Only four out of the ten students increased their participation rates, while six students decreased their participation rates. The students who were tutored seemed to have lower rates of participation when compared to the tutors. Also, tutored students had more difficulty following along in class, regardless of how much they attempted to participate.

The motivation journals and anecdotal notes showed that students mostly had positive feelings towards peer tutoring as well as math in general. Overall, the students shared positive attitudes towards math and many showed an increase in motivation when working with peers and in whole class instruction.
Chapter 5

Conclusions and Recommendations

This investigation focused on the effects that peer tutoring may have on fifth-grade learners in math problem-solving. The study was also designed to determine any impact that peer tutoring may have on student motivation. I designed this intervention to be a realistic tool in weekly tutoring sessions. I have drawn several conclusions as a result of this study.

Both control and experimental groups were assessed on their knowledge of solving one-step word problems. The experimental group worked cooperatively on one-step word problems during the tutoring sessions, and was assessed using a pretest at the onset of the study and posttest at the conclusion of the study. When the data was compared, both the experimental and control groups increased their mean score, however the experimental group had a greater increase. The summary of this analysis led me to believe that the tutoring groups seemed to have positive effects on the students' growth in solving word problems. I have drawn other conclusions about the effectiveness of peer tutoring in mathematics as a result of this study.

First, the students who participated in this study belong to a school that is framed around a philosophy of direct instruction. Unlike the research conducted, this philosophy supports teacher-centered instruction rather than student-centered learning. Therefore, most students desire to communicate with other learners when given the chance, resulting in a willingness to participate in the study.

I believe that learning was easier due to the students' eagerness to participate in the tutoring groups because of the need to communicate with one another. Students
within the experimental group were so eager to learn from one another because it rarely occurred in the school. With this said the knowledge that the students shared may not have happened in a typical classroom where students do not share thoughts with their peers.

I began analyzing this study by evaluating the pre and posttest mean score, and compared individual student scores from the experimental group. Interestingly, a larger percentage of the students within the control group made gains from the pretest to the posttest, than students of the experimental group. However, this information does not mean cooperative learning is less effective that direct instruction.

I believe that there may have been other contributing factors to the greater increase of the individual students belonging to the control group. One factor may be that the experimental group incidentally contained several students, tutors and students tutored, who performed lowest in their classes. The control and experimental groups were derived from the highest and lowest performing ability groups within the school. However, these ability groups also contain a range of learners who perform at the top and bottom of their individual classes. Therefore, the control group may have included the top performers from both homerooms, allowing greater gains to be made. Results of the participants individual performance level, prior to the start of the study, were not taken into consideration for this study.

In addition to the pre and posttest, students of the experimental group completed motivational assessments to determine any impact that peer tutoring had on their feelings towards math. Students demonstrated positive attitudes towards math throughout the study. I can not conclude motivation increased over a period of
time; however peer tutoring definitely had a positive impact according to the journal responses.

After analyzing the responses, 90 percent of the overall statements regarding tutoring were positive. I needed to rely on 90 percent of the group for an accurate depiction of feelings in regards to peer tutoring and motivation, due to the vagueness of one tutor's responses. This tutor completed the survey, but had difficulty explaining her responses. I omitted most of her explanations in the final analysis of data.

One of the students tutored replied, “I learned more when I was in the group, because I get lost in class, and it is hard for me to follow along.” This same student admitted to being “scared” to answer questions during whole group instruction and forgetting his questions because he would often be intimidated by his peers in the classroom. He also said that he “freezes up” when he wants to ask questions because he does not want to look “silly” in front of his peers. Many of the tutors and students who were tutored reported similar thoughts in regards to the tutoring groups. The small and intimate collaborative groups had a positive impact on the students learning because students were able to be free and express their concerns and mistakes without judgment from a large body of peers.

Another student thought that tutoring was “okay,” because she enjoyed her dance class at the end of the day and she wanted to attend. However, she never withdrew from the study and she did not complain about participating. She provided some additional support to her idea of feeling “okay” about the study. She said, “I talked about the tutoring groups with my mom and she said that it was great to help
others learn." I asked her how she felt about that comment from her mother. With a grin she replied, “I was happy because I like to help others.” This explanation was needed to understand her point of view in regards to trading enrichment for helping a peer. Her response proved that her motivation was intrinsic and tutoring a classmate was very beneficial to her learning.

Motivation of the experimental group was assessed and analyzed by observing the students’ participation. The observation took place in the mathematics classroom. The observations showed an increase of participation in four out of the ten students. Participation was measured by students raising their hands to ask/answer questions related to math. The tutored students had a lower rate of participation when compared to the tutors, therefore resulting in a slight decrease in participation totals from pre- to post observation.

The students who were tutored had greater difficulty following along in class and answering questions regularly. These students were from the lowest performing homeroom in the school. Therefore, their score did not increase as much as the tutors, who completed class work and assignments with less difficulty. In addition to this data, the students tutored gave more wrong answers than the tutors, although this data was not included in the study. With this in mind, these students may have had some feeling of embarrassment due to their failed responses which may have made them more reluctant to answer frequently.

After completing the study I have a few recommendations for future studies of similar interests. First, it may be helpful to allow other teachers to provide anecdotal records regarding the students’ participation. Teachers may even enter my math
room to take notes of participation while I teach. A longer observation time, paired with other teachers’ points of view, may provide more accurate data of the students’ involvement in the classroom, as well as any gains in motivation.

A future study may also include a tally of wrong versus correct answers given during the in-class observations. If students’ raising their hands to ask or answer math questions is a beneficial way to track active participation, then correct responses will be a better way to gauge learning.

Overall, I have found peer tutoring to be a beneficial way to support and improve student motivation with regards to mathematics. It is very practical for classroom teachers needing to assist struggling learners. Students from an environment where teacher-directed instruction is prevalent are willing to participate and eager to share their thoughts. The teaching focus is taken from the teacher and placed on the student. Collaborative learning allows students to be in charge of their own learning. I plan to share my results of this intervention with other teachers at my school, so they can build student motivation and learning within their individual classrooms.
References


Appendices
Appendix A: Data Observation Sheet

<table>
<thead>
<tr>
<th>Participant</th>
<th>Voluntary Participation in Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(hand-raised, tracking the speaker, asking and answering questions)</td>
</tr>
</tbody>
</table>
Appendix B: Student Pre-test

Directions: Read each word problem carefully. Follow the directions given for each problem.

1. Mr. McBride has decided to organize his history books that he never uses. He needs 45 shelves. He puts 4 books on each shelf. How many books does he have to organize altogether?

Show your work.

Answer: ______________________ books

2. The owner of Greece Ridge Mall and decided that he needed to buy some presents. He bought his mother a nice sweater for $464. He bought his sister a purse for $95. He found a watch for his best friend for $239. What is the total amount of money that the owner spent on the sweater and the watch?

Show your work.

Answer: ________________________
3. The librarian of the school has decided to organize the books on his bookshelf. He has 3,458 books. As he is organizing, he decides to give away 245 of his books. How many books does he have left for his shelf?

*Show your work.*

*Answer* __________________________ *books*

4. Nine students from Frederick Douglass High School entered a science fair competition. Four students received eight ribbons each for participating. Which of these number sentences tells the total number of ribbons presented to the students from Frederick Douglass?

A. $9 \times 8 =$

B. $9 + 8 =$

C. $4 \times 8 =$

D. $4 + 8 =$

5. Both Sharon and Anita traveled to Washington, D.C by train. Sharon spent $106 for her train ticket. Anita spent $194 for her ticket. How much more money did Anita spend than Sharon for the ticket?

A. $300

B. $98

C. $92

D. $88
6. Ms. Shells received $439 for her birthday. Her mother gave her $261 the next day. 
Estimate the total amount of money that Ms. Shells received. 

Show your work!

Answer $__________________

7. Mr. McCue has 43 boxes of crayons. There are 6 crayons per box. 
How many crayons does he have in all? 

Show your work.

Answer _____________________ crayons

8. Forty-nine Prepsters entered a free throw contest. Twenty-six prepsters won 10 medals each. What is the number sentence that shows the amount of medals earned by the Prepsters?

A. 49 x 10 = 
B. 49 x 26 = 
C. 26 x 10 = 
D. 26 + 10 =

46
9. Jarrod has decided to buy different flavors of Jelly Belly jellybeans. He buys 629 lemon flavored jellybeans. He also buys 794 chocolate flavored ones. How many jelly beans did he buy in all?

*Show your work.*

**Answer** _____________ jellybeans

10. Jarrod has decided to buy different flavors of Jelly Belly jellybeans. He buys 629 lemon flavored jellybeans. He also buys 794 chocolate flavored ones. How many more chocolate jelly beans did he buy than lemon flavored jelly beans?

*Show your work.*

**Answer** _________________ chocolate jellybeans
1. Twelve students swam 9 laps each during a swimming competition. How many laps did they swim in all?

A. 81
B. 144
C. 108
D. 21

2. Mrs. Austin bought 126 binders to donate to the school’s reading classes. Mr. Pastore purchased 318 binders for the Ms. Brillante’s and Ms. Coverson’s writing classes. How many more binders did Mr. Pastore buy than Mrs. Austin?

E. 212
F. 282
G. 292
H. 192

3. Nine people from the YMCA participated in a cooking contest. Six of the participants who entered the contest won 12 ribbons each. Which of these tells the total number of ribbons presented to the participants of the YMCA?

A. 9 x 12
B. 9 x 6
C. 12 + 9
D. 6 x 12
4. Rochester Prep students want to sell granola bars to raise money for their class trip to Washington, D.C. There are 162 students at Rochester Prep. Each student needs to sell 39 granola bars. How many granola bars will be sold in all, if each student sells their share of granola bars.

_Show your work_

Answer ___________________________ granola bars

5. Fourteen joggers from the Rochester, NY area entered the U.S. Olympics last summer. Upon completion of the Olympics, seven of the runners won 4 gold medals each. Which of these tells the total number of gold medals given to the joggers from Rochester, NY?

A. 14 x 7
B. 7 x 4
C. 14 + 4
D. 14 x 4

6. The store manager of TOPS wanted to buy turkeys for a local charity. When he arrived he saw many things on sale that would assist the charity for the holidays. He spent $5,875 on turkeys and $6,492 on condiments and side dishes. How much money did the manager spend in all?

_Show your work._

Answer $ ___________________________
7. Mr. Thompson spent $748 at the mall on Thursday and $356 at the bowling alley on Friday. He decided to go out with some friends to dinner on Saturday. At dinner Mr. Thompson spent $119. How much money did Mr. Thompson spend at the bowling alley and at dinner?

*Show your work.*

*Answer* $__________

8. Mr. Pastore drove 239 miles in his car in November. In December, he decided to take another road trip and drove 740 miles. How many more miles did Mr. Pastore drive in December than November?

*Show your work.*

*Answer* _________________ miles
9. Mr. Melon has decided to buy different flavors of Jelly Belly jellybeans. He buys 629 lemon flavored jellybeans. He also buys 794 chocolate flavored ones. How many jelly beans did he buy in all?

*Show your work.*

*Answer* ________________  jellybeans

10. Ms. Kelly has also decided to buy different flavors of Jelly Belly jellybeans. She buys 629 lemon flavored jellybeans. She also buys 794 chocolate flavored ones. How many more chocolate jelly beans did she buy than lemon flavored jelly beans?

*Show your work.*

*Answer* ________________  chocolate jellybeans
Appendix D: Student Journal Prompts

Name ________________ Date ___________

1. How was tutoring? (Circle the number that describes your feelings.)

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Great</td>
</tr>
<tr>
<td>2</td>
<td>Okay</td>
</tr>
<tr>
<td>1</td>
<td>Not Good</td>
</tr>
<tr>
<td>0</td>
<td>Not Sure</td>
</tr>
</tbody>
</table>

2. Why did you feel this way about tutoring?

________________________________________________________________________
________________________________________________________________________

3. Has peer tutoring changed how you feel about math? How?

________________________________________________________________________
________________________________________________________________________

4. What helped you in tutoring?

________________________________________________________________________
________________________________________________________________________

5. What didn't help during tutoring?

________________________________________________________________________
________________________________________________________________________