Student Talk: A Better Way To Learn

A Special Project

Presented to

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Heritage University

In Partial Fulfillment

of the Requirement for the Degree of

Masters of Education

Tracy Bowen

Spring 2007

FACULTY APPROVAL

Student Talk: A Better Way

To Learn

Approved for the Faculty

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ABSTRACT

To analyze if student talk incorporated into cooperative learning through the *Connected Mathematics Project* curriculum would increase mathematic scores in students with disabilities. Eighteen special education students qualifying for mathematics and averaged three years below grade level in mathematics were tested using the Measurements of Academic Progress in September 2006 and again in February 2007. The class mirrored the general educational mathematics classroom and the *Connected Mathematics Project* curriculum was implemented. The teacher used student talk through cooperative learning strategies and maintained a daily routine that encouraged students to interact together. Research proved student talk incorporated into cooperative learning produced significant gains. Further research was needed with different variables to prove that student talk would impact student's mathematic scores significantly.

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TABLE OF CONTENTS

Page

FACULTY APPROVAL…….i

ABSTRACT…… ……. .ii

PERMISSION TO STORE……....iii

TABLE OF CONTENTS……iv

LIST OF TABLES ……vii

LIST OF FIGURES…….....viii

CHAPTER 1…….……...1

Introduction……..1

Background for the Project.....…….....…1

Statement of the Problem……..….....…2

Purpose of the Project.…….....…3

Delimitations.....…….....…3

Assumptions.....…….....4

Hypothesis…….....…….....…5

Null Hypothesis……..…5

Significance of the Project.....…….....….....5

Procedure.....…….…….....5

Definition of Terms.....……...7

Acronyms.....…….....…..8

Page

CHAPTER 2……9

Review of Selected Literature……..9

Introduction.…….…...……..……...…9

Measures of Academic Progress (MAP)…….…..10

Woodcock Johnson III – Test of Achievement……..13

Student Talk ……..…….……...13

Cooperative Learning …….……...14

Connected Mathematics Project ……...16

Students with Learning Disabilities ……..16

Summary……..……..17

CHAPTER 3……..19

Methodology and Treatment of Data…….19

Introduction……....19

Methodology……..19

Participants…….....20

Instruments…....……23

Design……25

Procedure……...25

Treatment of the Data……..…..28

Page

Summary……..……...28

CHAPTER 4…….…….29

Analysis of the Data……...29

Introduction……29

Description of the Environment…….29

Hypothesis…..….. …….…….....30

Null Hypothesis…….30

Results of the Study…….……..…31

Findings…….……32

Discussion……..34

Summary….……...34

CHAPTER 5…….35

Summary, Conclusions and Recommendations……35

Introduction……35

Summary.…….…..35

Conclusions….……...36

Recommendations…….…….37

REFERENCES ….....…….…..….38

APPENDICES …….41

LIST OF TABLES

Page

Table 1, Participants Demographic……..……..……21

Table 2, Results of the Study……..……..……..……31

Chapter 1

Introduction

Background for the Project

The movement for reform in mathematics education began in the early 1980s with the cry from educators to go "back to the basics." Mathematic educators wanted out of the "new math" from the 1960s and 1970s. There was a concerned interest in the development of problem solving as a focus to mathematics curriculum. This movement, or reform, came to a head in 1989 when the National Council of Teachers of Mathematics published *Curriculum and Evaluation Standards for School Mathematics.* Since then educators have been caught up in a transformation in mathematic education, which was more positive, persistent, and widely accepted than any change previously experienced (Van De Walle, 2001). Other concerns were implemented within the educational system, which brought about the legislation implementation of the No Child Left Behind Act. Each state was mandated to show all students would reach mastery in mathematics, even students in Special Education. The Washington Assessment of Student Learning had already been implemented in the state but exhibited students did not reach mastery in mathematics.

> "In this changing world, those who understand and can do mathematics will have significantly enhanced opportunities and options for shaping their futures. Mathematical competence opens doors to productive futures. A lack of mathematical competence keeps those doors closed…All students should have the

> opportunity and the support necessary to learn significant mathematics with depth and understanding. (NCTM, 2000, p 50)."

Traditional mathematics classrooms were ones where the teacher dominated the conversation. Rote memorization and step-by-step procedures were expected from students. The fact that students were unable to explain the thought process established when solving a problem was not important. Mathematical instruction needs to be changed in order for students to reach mastery as mandated through No Child Left Behind. Comparative studies have found that students in mathematic reform classrooms performed as well as, if not better than, students in traditional mathematic classrooms (Ross, 2005).

Statement of the Problem

Students with disabilities needed assistance with comprehension of the underlying meanings in mathematics to promote achievement, retention and generalization of many mathematics objectives. Students also recognized mathematic relationships and connections. This was based on the idea that children learned best when the teacher focused on student thinking and gave opportunity to develop an understanding of the mathematical concepts. Without conceptual understanding, mathematical instruction was memorization of meaningless facts and procedures.

Recommendations were focused on communication through student talk experienced during cooperative learning when Connected Mathematics Project

based curriculum was used in a special education classroom (Sherin, Louis, Mendez, 2000). If the focus on No Child Left Behind demanded the communication in classrooms to change, then how did students in a resource classroom, focused on mathematics, succeed?

Purpose of the Project

The purpose of this study investigated the effectiveness of student talk used through cooperative learning activities designed in the *Connected Mathematics Project* curriculum with individualized instruction implemented as needed. In other words, the purpose of this study investigated the effects student talk had on students with disabilities in a special education classroom focused on mathematics when *Connected Mathematics Project* curriculum was used.

Delimitations

This study compared the Measures of Academic Progress assessment in mathematics scores of a special education classroom focused on mathematics with eighteen students. Student talk and a cooperative group atmosphere were established. The researcher used the Mathematics portion of the Measures of Academic Progress and tested all of the students simultaneously in the computer lab. There were no interruptions throughout the test window. All students qualified for special educational services in the area of mathematics.

The population used was composed of 1 mildly mentally retarded student, 6 health impaired students and 11 learning disabled students. The time frame was

from September of 2006 to the February of 2007 in a rural community in Eastern Washington.

The researcher taught at a middle school that housed 683 students with demographics of 49.9% Hispanic, 47.9% White, .9% Black, .7% American Indian/Alaskan Native, and .4% Asian. There were 61.2% of students on the free and reduced lunch program, which indicated a high population of low socioeconomic status students. Special educations students were at 8.7%, transitional bilingual at 13.3% and migrant students at 19.7% completed the demographics of the school's population (OSPI, 2006). Students took the Measures of Academic Progress assessment for mathematics in the fall and again in the spring.

Assumptions

In past years, the methods of instruction given to teach mathematics consisted in many different forms. Many variations in pedagogy had been formulated over the years that assisted educators in implementation of mathematical concepts. The researcher was properly trained on methods of the implementation needed to establish an environment conducive to cooperative learning, student talk and the *Connected Mathematics Project* curriculum. The students were given the Measures of Academic Process in the January and again in the spring. The teacher was consistent both times the MAPs test was given. The progress throughout the research was valid.

Hypothesis

Student talk incorporated into cooperative learning through the *Connected Mathematics Project* curriculum will increase mathematic scores in students with learning disabilities as measured by the Measurements of Academic Progress.

Null Hypothesis

Student talk incorporated into cooperative learning through the *Connected Mathematics Project* curriculum will not increase mathematic scores in students with learning disabilities as measured by the Measurements of Academic Progress.

Significance of the Project

The significance of the research was on student talk, which was based through cooperative groups and the *Connected Mathematics Project* curriculum. The academic growth of each student was measured through a scientifically based assessment, Measures of Academic Progress. Surveys were used to acquisition student interests and opinion of mathematics.

Procedure

The population used for this study was eighteen students in a special education classroom focused on mathematics. The students were from all three grade levels in the middle school. The average deficiency in mathematics was three years below grade level expectation. The generalization of the classroom expectations was mirrored with the general educational classroom in regards to

notebooks, entry task and curriculum. All students had a binder. Binders contained five sections and were used everyday for assignments, notes, homework and organization. Daily entry tasks consisted of two different grade levels but addressed the same mathematic concepts. The daily entry tasks reviewed and introduced mathematical concepts and also reinforced calculation skills.

The focus was active involvement in a cooperative learning environment and discussion centered on student talk. Students were placed in groups of three. A class period consisted of 53 minute on Monday, Tuesday, Thursday, Friday and 43 minutes on Wednesday. The first 20 minutes of class students did a three-minute multiplication facts timing followed by a daily entry task. The next 33 minutes was spent in cooperative learning groups. Twice a month Wednesdays would be used as a refresher or catch up type day for groups struggling. Students talked in the groups prior to whole group discussion. The length of discussion depended on homework assignment or type of question an answer was sought after. There were set rules each group had to follow. Everyone in the group had to agree that help from the teacher was needed before a group was allowed to ask for help. Students were to politely listen to what each student had to say.

Connect Mathematics Project curriculum was used and each unit mapped out in a time frame of 8 weeks. The time frame would vary based off individual needs of the students. The two units used were Prime Time and Shapes and Design.

Measures of Academic Progress assessment was administered to all students in the computer lab. Students were allowed paper and pencil. No time frame was set. The test was administered twice over the time frame of the research. Each student sat at the same computer and the procedure was the same each testing time.

The instructor developed a parallel survey for students and parents. The survey was given before the study began and again after it was completed. The survey asked opinions about comfort working in groups to help from the teacher. Three students were randomly selected to interview.

Definition of Terms

cooperative learning. A strategy designed to involve students in the learning process.

curriculum. The content and concepts taught in an academic area.

health impaired. A person diagnosed with a medical condition.

instruction. Teaching method used to present the curriculum.

learning disability. A general term used to describe specific kinds of learning problems.

mildly mentally retarded. Person diagnosed with an IQ between 67 & 70

reform. The focuses developed in the understanding of mathematical concepts involved in problem solving.

Acronyms

ALT. Achievement Level Test

CMP. Connected Mathematics Project

HI. Health Impaired

LD. Learning Disabled

LRE. Least Restrictive Environment

NCLB. No Child Left Behind

NTCM. National Council of Teachers of Mathematics

MMR. mildly mentally retardation

MAP. Measures of Academic Progress

RITS. Rasch Unit

WASL. Washington Assessment of Student Learning

WJ III - ACH. Woodcock Johnson III – Tests of Achievement

Chapter 2

Review of Selected Literature

Introduction

Philosopher and educator John Dewey claimed people did not learn the basics by simply studying but also by engagement in rich activities, which required the basics (Dewey, 1938). Dewey had the idea that educators have now been implementing. There have been many reform movements in education since the early 1980s. The reforms came about from recommendations made by professional organizations such as the National Council of Teachers of Mathematics that have set standards in mathematics. The standard in mathematics has been extended further to include problem solving. Over the past decade mathematics teachers have been changing curriculum and instruction to accommodate the expectations set by NCLB.

Another concern was over the Nation's performance rating by the Third International Math and Science Study (TIMSS) done in the mid-nineties. The report stated the test performance of the nations students dropped down to a distressing level (NCTM, 2000). Considerable scrutiny was expressed within the educational system that helped bring about the implementation of NCLB. The State was mandated to show that all students would reach mastery in mathematics even those in special education. The WASL had already been implemented in the state, but assessment results exhibited that students had not reached mastery in

mathematics. Over the past decade mathematics teachers have been changing curriculum and instructions to accommodate the expectations set by NCLB.

Traditional mathematics classrooms were ones where the teacher dominated the conversation. Rote memorization and step-by-step procedures were expected from students. The fact that students were unable to explain the thought process established when solving a problem was not important. Mathematical instruction needed to change in order for students to reach mastery mandated through No Child Left Behind and assessed with the WASL. Instructional environments were designed where student learning was enhanced through student conversation and small group activities.

Measures of Academic Progress

In 1974 members from Portland, Oregon and Seattle, Washington school districts collaborated and formed a non-profit organization, Northwest Evaluation Association and were formally established in 1977 (NWEA, 2006). The main focus was to develop an assessment that measured academic growth over time, provide information that was used to individualize student needs, and provide an evaluated academic effectiveness.

NWEA was dedicated to the belief that assessment did make a difference in a student's academic achievement. In light of this NWEA developed Measures of Academic Progress. More than 2300 schools used the assessments developed by the Northwest Evaluation Association. The assessment was computerized and

uniquely designed to adapt to each student's ability. The purpose of the tests was to show growth over a period of time. The association stated the MAP test was specialized for students with learning disabilities and adapted to the student's ability and gained an accurate measurement of what the student knew and needed to learn (NWEA, 2006).

The purpose of the MAP tests was to measure a student's instructional level and focus on the area of academics in which the student could make the greatest gains. The information obtained from the test was also related back to classroom experience. The Northwest Evaluation Association maintained accuracy in both a stable scale of measurement and test design. The measurement scale used for the MAP tests was the same test theory used with the SAT, Graduate Record Exam, and Law School Admission Test. The benefit in this test theory was the alignment of student achievement levels with item difficulties on the same scale. The measurement scale used was divided into equal parts. These parts were called RITs, named after George Rasch the Danish statistician who founded the test theory. Educators were able to confidently measure the growth of students over a span of time due to the fact that the RIT scale had not changed in more than twenty years (NWEA, 2006).

Northwest Evaluation Association approached to test-retest reliability posed a more rigorous test of reliability. What NWEA referred to as test-retest reliability was a mix between test-retest reliability and a type of parallel forms

reliability, both were spread across 7 to 12 months. The second test was not the same but comparable to the first based on content and structure and different only in the difficulty of level of items. Several months separated administration and comparable tests however the only dip seen in the coefficients was below the 80% twice, both at the grade two level. Most coefficients were in the mid 80 to low 90 percentile (NWEA, 2004)

The validity of Northwest Evaluation Association tests were secured through obtainable content standards from a state or school district and placed into a test design. Test items were selected for a specific test based on a match to the content standards as well as on the difficulty level of said test being created. Most of the documented validity evident for Northwest Evaluation Association tests came in the form of congruent validity expressed by a Pearson correlation coefficient. NWEA had conducted a study where more then 1500 students were given an Achievement Level Test and the Measures of Academic Progress test in the areas of reading, language usage, and mathematics. The students took both a spring and fall test. The correlation coefficients for those tests were .85 in mathematics, .83 in reading, and .83 in language usage. Scores from the MAPs correlated very closely with scores from the ALT. Because of adaptive testing algorithm used in MAPs lower standard errors were produced and over time was slightly more stable with results (NWEA, 2004).

Woodcock Johnson III – Tests of Achievement

The Woodcock Johnson III – Tests of Achievement was a norm-referenced test. The normative samples of children and adults were selected from the United States population that addressed geographic distribution, community size, race, sex and occupational status (Woodcock, Mather, & McGrew, 2001). The Woodcock Johnson III – Tests of Achievement was designed to measure intellectual abilities and academic achievement in subjects aged 2 to 90+. The test also identified and described individual's current strengths and weaknesses.

Student Talk

Marilyn Burns stated, "success comes from understanding" (Burns, 2005, p 6). Students needed to make sense of the mathematics taught and explain the thought process involved for a reasonable answer. Math talk needed to be implemented as an essential part of classroom routine. Student interactions helped to clarify ideas, gain feedback, and listen to different opinions (Burns, 2005). Teachers needed to encourage student talk as a daily part of mathematics class. When students were actively involved in small groups that discussed a math concept, the ability to perceive the thought process of another student was heightened. This, in turn, built on personal understandings.

With the reform in mathematics practices there was an encouragement of student-led discourse and student-to-student discourse. Both of these allowed a deeper learning to occur. Teachers recognized that students learned best from

other students and through class participation (Nathan & Knuth, 2006). Student talk in a mathematics classroom was easy, however, the challenge was on students to construct, comprehend, and expand on the ideas classmates gave. When students became fluent in "student talk," development of a deeper understanding towards personal knowledge in mathematics began. Students had a more positive feeling in mathematics and confronted obstacles in a much more meaningful way.

Cooperative Learning

Cooperative learning was one of the most pervasive changes in education in the past 20 years (Webb, Troper, & Fall, 1995). Cooperative learning was consistent with the suggestions mentioned in the NCTM's (1989) *Curriculum and Evaluation Standards* that instruction relied less on the teacher and more on small group learning. Another key element in cooperative learning was communication. Students that worked only independently limited the vast opportunities available when discussions did take place. When students were asked to explain the thought process involved in solving a problem, students were forced to organize those ideas. This was the opportunity to develop and extend understanding.

Cooperative groups allowed students the opportunity to examine different ways in which other students approached mathematical problems. When cognitive and metacognitive strategies were used to represent solutions to given story problems, students gained a broader perspective on the problem solving process and began to realize there was more than one way to solve a problem.

Students became more open minded and flexible in thinking as a result. Within these groups, students were encouraged to discuss the problems and work toward common solutions. At the same time, students gained an appreciation for the difference in approaches to solving a problem. There was also an opportunity to continue explaining and clarifying student choices.

Five basic elements were vital for cooperative learning groups to succeed. First was positive interdependence where students became dependent on group members. Second was face-to-face interaction. Here verbal interchange and interaction was promoted by positive interdependence. Third element was individual accountability in that all students within a group were responsible for learning the material. The fourth element was interpersonal skills. The classroom teacher taught all students the appropriate usage of the skills. The final element was apple time given for groups to reflect on productivity (Sutton, 1992).

Students involved in cooperative learning groups achieved many social and academic benefits. The environment was designed to make students work together and accomplish significant tasks. This enabled students to attain higher levels of achievement and enhance self-esteem. In such an environment the teacher became a facilitator that provided on going feedback to students. The effectiveness of cooperative learning was interconnected with all of this to provide a better way to educate kids (Webb, Troper & Fall, 1995).

Connected Mathematics Project

The *Connected Mathematics Project* (CMP) was developed by Glenda Lappan and others at Michigan State University and funded by the National Science foundation. The curriculum was developed with the recommendation made by the NCTM, 1989 (CMP homepage, 2006). The focus of the CMP program was student-centered exploration of mathematically rich problems and a continued assessment. The curriculum was based on research and field tested at diverse sites with over 45,000 students and 390 teachers.

The goal for CMP was that all students were able to reason and communicate proficiently in mathematics. There were three sections in a lesson: 1) Launch; Where a lesson was introduced. 2) Explore; which encouraged group work and student talk. 3) Summarize; which allowed students to share ideas and hold class discussions. The curriculum emphasized a discovery-based approach that encouraged students to select, adapt, and analyze problem-solving strategies in order to develop mathematical understanding (CMP homepage, 2006).

Students with Learning Disabilities

Federal Legislation implemented the Education of the Handicapped Act of 1975 that later was changed to the Individuals with Disabilities Education Act, or IDEA. The act mandated all disabled students had the right to an appropriate education. Through the IDEA disabled students, along with learning disabled, were placed in a least restrictive environment (LRE) where students could learn

successfully. Students with learning disabilities had difficulties in listening, reading, writing, reasoning, and/or mathematical skills. These students also had trouble retaining information, paying attention, and giving a verbal explanation for any given situation. Learning disabilities were caused by differences in how a person's brain works and how it processes information. "Researchers think that a learning disability was caused by differences in how a person's brain works and how it processes information (National Dissemination Center for Children with Disabilities, 2004)." On average most students that had been diagnosed with a learning disability had an average to low average intelligence (75 – 90 IQ).

The education reform movement held the same expectations of accountability for mastery for both students with and without disabilities. Many students with disabilities continued to struggle with an understanding of what math meant. To simply memorize facts or step-by-step procedures was not a means of understanding the concept behind the lesson taught. Instructional designed to help students understand the meaning of mathematics was very important (Miller & Hudson, 2006). Educators needed to represent concepts in multiple ways that guaranteed significant understanding of mathematical concepts.

Summary

While the law mandated that students with learning disabilities had be held to the same standards as students without, educators had run into a problem.

Research led educators down new paths in the field of mathematics and suggested improved instructional strategies to work with; however, these strategies did not always take into consideration the best methods for all student learners. With the incorporation of student talk educators had a proven method for enabling students with disabilities to achieve the same level of success as other students.

Both student talk and *Cooperative Learning* allowed the student and the teacher to become facilitators of the learning process taking place in the classroom. While these methods have not been used throughout all areas of academic achievement, there continues to be a strong push for the growth seen in the classroom when students used student talk and cooperative groups. By allowing students to take a major role in the learning process, teachers gave the tools needed to continue the cooperative learning environment necessary for learning to take place.

The ability to communicate with another person has proven to be one of the greatest challenges that students have had to face. Those that have taught cooperative learning and student talk strategies have enabled these students (both learning disabled and not) to reach a new level of learning and problem solving.

CHAPTER 3

Methodology and Treatment of Data

Introduction

The NCLB mandated each student must meet state standards and has driven the need for curriculum agendas with scientific based research in order to prepare appropriate curriculum for students. This Eastern Washington middle school implemented just such a program, the *Connected Mathematics Project*, for students, staff and classroom teachers involved in the mathematic curriculum.

The students in the research group had qualified for special educational services in the academic area of mathematics prior to the experiment. The teacher and para-educator that worked with the students were adequately trained in the methodology of cooperative learning, student talk and with the ideology and relevance of the mathematics program being assessed. A daily routine was designed and followed throughout the time allowed for the study in the mathematic resource room. Also the mathematical curriculum integrated hands on learning tools to provide student's opportunities to master specific GLEs.

Methodology

The researcher was also the teacher of the students used in this study. The study was conducted in the educational setting of a middle school in Eastern Washington. The results were quantitative academic data. Growth shown was measured by a MAP pretest and posttest with the same assessment used at the

beginning and again at the end of the study. The researcher evaluated the assessment results of the students. The researcher conducted a parallel survey of students and parents at the beginning and again at the end of the study. The researcher also interviewed three students at random at the end of the study and asked questions about personal thoughts dealing with the study.

Students were grouped at random. The teacher had written the student's names on the back of a deck of playing cards. Then the cards were shuffled and the teacher read off the cards in groups of three that formed the groups. At the end of each unit lesson the teacher would take the deck of playing cards and create a new group.

Participants

Participants in this study were 18 students from the same special education resource mathematic classroom at one Eastern Washington middle school. Two-thirds of the students came from lower income families and received free and reduced lunch. Two parent households supported the majority of the families. Two students were new to the special educational program. The resource classroom in the study contained 6^{th}, 7^{th}, and 8^{th} graders averaging three years below grade level in mathematical performance.

The teacher in the resource classroom had been teaching for eight years at the school. The teacher had received extensive training in how to assimilate a variety of teaching strategies into the mathematic curriculum. The training

included a two-year No Limit Math Grant through Eastern Washington University that focused on integrating technology and tools to enhance students' understanding of mathematics.

The students' genders were predominately male, a ratio of three boys to every girl. The ethnicity was 9 Hispanic, 8 Caucasian, and 1 other. The researcher administered the MAPs assessment as a pretest and posttest and both times the procedure was the same. Table 1 provides the analysis of the student demographics in the research.

Table 1.

Participant Demographics

Research Class	
Caucasian	8
Hispanic	9
Other	1
Male	13
Female	5
Learning Disabled	11
Health Impaired	6
Mildly Mentally Retarded	1

The participants' aptitudes were equal based on an academic gap of three years as measured by the Woodcock Johnson III – Tests of Achievement, a norm-referenced test. There were no substantial discrepancies between the students statistically to determine that the group was not comparable.

Instruments

The data-gathering device used in the study was Measures of Academic Progress an assessment developed by Northwest Evaluation Association. The instrument measured academic growth over time and provided information used to individualize student needs. The assessment was computerized and uniquely designed to adapt to the individual student's ability. The purpose of the test was to show growth over a period of time. Northwest Evaluation Association stated the MAP test was specialized for students with learning disabilities and adapted to the students' ability and gained an accurate measurement of what the students knew and needed to learn (NWEA, 2006).

Northwest Evaluation Association approached to test-retest reliability posed a more rigorous test of reliability. What NWEA referred to as test-retest reliability was a mix between test-retest reliability and a type of parallel forms reliability, both were spread across 7 to 12 months. The second test was not the same but comparable to the first based on content and structure and different only in the difficulty of level of items. Several months separated administration and comparable tests however the only dip seen in the coefficients was below 80% twice, both at the grade two level. Coefficients were in the mid 80 to low 90 percentile (NWEA, 2004).

The validity of NWEA tests were secured through obtainable content standards from a state or school district and placed into a test design. Test items

were selected for a specific test based on a match to the content standards as well as on the difficulty level of said test being created. Most of the documented validity evidence for Northwest Evaluation Association tests came in the form of congruent validity expressed by a Pearson correlation coefficient. NWEA had conducted a study where more than 1500 students were given an Achievement Level Test and the Measures of Academic Progress test in the area of mathematics. The students took both a spring and fall test. The correlation coefficients for those tests were .85 in mathematics. Scores from the MAPs correlated very closely with scores from the ALT (NWEA, 2004).

The Woodcock Johnson III – Tests of Achievement was designed to identify and describe an individual's current strengths and weaknesses in the academic areas of achievement. The Woodcock Johnson III was used to determine the averaged three years below grade level in mathematical performance of the participants.

The median reliability coefficient for all age groups and battery tests 1 through 12 ranged from .81 to .94. The extended battery tests coefficients ranged from .76 to .91. Based off the coefficients the Woodcock Johnson III – Tests of Achievement met or exceeded standards (Woodcock, Mather, & McGrew, 2001).

The content pertained in the Woodcock Johnson III – Tests of Achievement was similar to other achievement tests in subject areas that were established practices in schools nation wide. The internal correlations of the

entire battery of tests were consistent with relations between areas of achievement and between areas of ability clusters (Woodcock, Mather, & McGrew, 2001).

Design

The Measures of Academic Progress assessment was used in this research. The pretest data was collected from the Measures of Academic Progress assessment in September 2006 and the posttest data was collected from the Measures of Academic Progress assessment in February 2007. The researcher dispensed both assessments to the students and used identical methods and time frames for each assessment. The assessments were computerized and given in the computer lab. Students took a survey before and after the study and a parallel survey went home to the parents. The researcher also administered random interviews of three students. A routine was established and lessons were directed the same by the teacher and the para-educator.

Procedure

The classroom teacher was highly trained in the strategies and curriculum used. As the year progressed, the teacher integrated a variety of mathematical tools and teaching manipulatives into the curriculum. The teacher also used a document camera to project both teacher and student work on the board. Students were randomly called to display the group's work and then explain the reasoning behind the answer.

Eighteen students in a special education classroom were used as the population in this research along with the researcher and one para-educator. The students were from all three-grade levels in the middle school. The average deficiency in mathematics of the students was three years below grade level expectation. The generalization of the classroom expectations was mirrored with the general educational classroom in regards to notebooks, daily entry task and curriculum. All students had a binder and each binder contained five sections: 1. Notes. 2. Problem solving strategies. 3. Daily entry task. 4. Homework. 5. Graded assignments. The binders were used everyday. Daily entry tasks consisted of third and fourth grade levels but addressed the same mathematic concepts. The daily entry tasks reviewed and introduced mathematical concepts and also reinforced calculation skills.

The focus was active involvement in a cooperative learning environment and discussion centered on student talk. The *Connected Mathematics Project* was the curriculum used. Students were placed in groups of three. The groups changed periodically throughout the year. The teacher selected new groups by shuffling a deck of cards that held each student's name.

A class period consisted of 53 minutes on Monday, Tuesday, Thursday, Friday and 43 minutes on Wednesday. The first 20 minutes of class students did a three-minute multiplication fact timing followed by a daily entry task. The next 33 minutes was spent in cooperative learning groups. Twice a month,

Wednesdays would be used as a refresher or catch up type day for groups struggling with the mathematical concept taught for that time frame.

Students talked in the groups prior to whole group discussion. The group needed to all agree before answers to problems were shared. The length of discussion depended on homework assignment or type of question and answers sought. The teacher and para-educator monitored by walking from group to group. There were set rules each group had to follow: 1. Make sure all students participated. 2. Listen to student talk. 3. State a reason for thought. 4. Ask for different opinions. 5. Help students without providing answers.

A parallel survey was given to students and parents before the study began and again after the study was competed. The teacher told the students to answer honestly. All 18 students filled out the survey but only 9 of the parent surveys were brought back. One question with a 100% yes was "I get help from the teacher when I need it" (Surveys; see Appendices). However, on the parent survey there was one parent did not feel, "that their child got help from the teacher when needed" (Surveys; see Appendices). The question about taking homework home was split 9 yes and 9 no. The surveys were conducted again at the conclusion of the research and parent response increased by three. The researcher also randomly interviewed three students to get an insight into mathematics. When asked, what do you like about working in different groups?

One of the students responded, “I like it because you get to work with other people instead of just yourself” (Interviews; see Appendices, p 45).

Treatment of the Data

The data for analysis consisted of the scores acquired by the pretest of the MAPs given in September, 2006 and the post-test of the MAPs given in February, 2007. The teacher used identical methods and time frames for each assessment.

The classroom routine maintained consistency throughout the year with the arrangement and presentation of mathematic concepts. Only the teaching style changed.

A *t*-test was used to compare the assessment scores from the fall with the spring. The surveys and interview questions were examined for commonalities.

Summary

The students demonstrated a sense of control and self-confidence in mathematic ability because of experience with the learning format and how the information was presented. The students understood that there were different ways to learn and appreciated that the teacher implemented a variety of teaching strategies to reach the students.

The students discovered that working in groups was beneficial. With the use of student talk and *Cooperative Learning* both the student and the teacher become facilitators of the learning process taking place in the classroom.

CHAPTER 4

Analysis of the Data

Introduction

This study compared the Measures of Academic Progress assessment gains within a resource mathematical classroom. The researcher used 18 students from the same special education resource mathematics classroom. The time frame of the study was from September 2006 to February 2007 in a rural Eastern Washington middle school. The *Connected Mathematic Project* curriculum was used. *Prime Time* and *Shapes and Design* were the two units covered during the research period. The students were placed in groups of three and group members would randomly be changed throughout the study.

The teacher, also the researcher, and para-educator that worked with the students were adequately trained in the methodology of cooperative learning, student talk and with the ideology and relevance of the mathematics program being assessed. A daily routine was established and maintained throughout the research.

Description of the Environment

The research was conducted with 18 special education students at an Eastern Washington middle school. All students that participated qualified for special educational services in the area of mathematics and averaged three years below grade level. The school had approximately 683 students attending of

which 61% received free and reduced lunch. The demographics of the school included; 49.9% Hispanic, 47.9% White, .9% Black, .7% American Indian/Alaskan Native, and .4% Asian. The searcher maintained consistent structure throughout the time frames of the study. The researcher was properly trained on methods of the implementation needed to establish an environment conducive to cooperative learning, student talk and the *Connected Mathematics Project* curriculum.

Hypothesis

Student talk incorporated into cooperative learning through the *Connected Mathematics Project* curriculum will increase mathematic scores in students with learning disabilities as measured by the Measurements of Academic Progress.

Null Hypothesis

Student talk incorporated into cooperative learning through the *Connected Mathematics Project* curriculum will not increase mathematic scores in students with learning disabilities as measured by the Measurements of Academic Progress.

Results of the Study

Table 2.

t-test of pre and post Measurements of Academic Progress

Test	N	M	SD
Pre	18	194.94	9.39
Post	18	200.39	8.30

df = 17 $t = 4.43$ p. < .001

After reviewing the Measurements of Academic Progress scores from the pretest and posttest for this study group Table 2 indicated the results of the analysis, the null hypothesis was rejected. The answer to the research question is yes; the use of student talk through cooperative learning did benefit students in a special education resource classroom. There were significant differences in the MAPs assessment scores from the September 2006 assessment to the February 2007 assessment.

Findings

The results indicated student talk through cooperative learning lead to increased MAPs scores by students, as measured by the pretest and posttest taken by all participants of the study. The students' abilities in mathematic concepts, calculation skills, organization and confidence improved significantly. The participants in the study appeared to make significant progress in the areas of mathematics from September to February as indicated by the Measurements of Academic Progress assessment.

The surveys taken also concurred with the results that student talk used in cooperative learning environments improved growth in mathematics. The surveys addressed enjoyment of the mathematic class, homework, received help when needed, group work and level of self-confident with mathematics. Each participant filled out a survey before and again after the study. The pre and post surveys were examined and six of the seven questions showed an increase. The question that inquired whether the student enjoyed the math class showed a 28% increase in yes responses. Homework brought home by the student increased by 33% and understanding the homework increased by 22%. Students able to get help from the teacher showed a 17% increase. The comfort working in small groups showed a 16% increase followed by an 11% increase in confidence regarding math ability.

A parallel survey was given to the parents of the participants. On the survey before the study began only 9 parents responded, however, the survey after the study 12 parents gave input. The pre and post surveys were examined and three of the seven questions showed an increase. The question that inquired whether the student enjoyed the mathematic class showed a 17% increase in yes responses. Homework brought home by the student increased by 34% and understanding the homework increased by 17%. The question regarding the student obtaining help from the teacher when needed had a 100% agreement in both surveys.

The researcher held random interviews with three of the participants, 1 girl and 2 boys. The same questions were asked. When asked about working in different groups the one boy commented, “They can help you a lot more than working by yourself” (Interviews, see appendices, p 46). Both boys felt good about working in different groups. According to the two boys there was a benefit working with other students. The female student that was interviewed saw working in groups differently. “It wasn’t’ good because you get use to the first group then move to the other group and you don’t know them” (Interviews, see appendices, p 47). Even the level of confidence and comfort in the math classroom appeared to have increased with these two of the three students interviewed.

Discussion

The results supported the claims stated by Marilyn Burns, “success comes from understanding” (Burns, 2005, p 6). Burns went on to state that mathematic talk needed to be implemented as an essential part of classroom routine. Students needed to make sense of the mathematics taught and explain the thought process involved for a reasonable answer. Student interactions helped to clarify ideas, gain feedback, and listen to different opinions (Burns, 2005). The participants did improve dramatically when this concept was implemented through student talk and a cooperative learning environment.

Summary

The research was conducted with 18 special education students all of whom averaged three years below grade level in mathematics. The researcher wanted to examine whether the use of student talk through cooperative learning benefited students with a learning disability. The study revealed that the use of student talk through cooperative learning did benefit the participants. There were significant differences in the MAPs assessment scores from September 2006 to February 2007.

CHAPTER 5

Summary, Conclusions and Recommendations

Introduction

Legislation implemented NCLB, which in turn has placed the responsibility on districts to ensure that all students must meet the standards and progress was expected. Districts adopted curriculum that was scientific and researched based in order to accommodate the demand. The curricula were just tools utilized by the classroom teachers, which wasn't enough teachers needed variety of techniques and strategies for success in student learning (Knuth, 2006). John Dewey claimed that people did not learn the basics simply by studying but also by engagement in rich activities that required the basics (Dewey, 1938). Student talk used in the cooperative learning environment were the techniques and strategies this researcher used and found successful in mathematical gains for students with learning disabilities.

Summary

Most students found mathematics difficult and meaningless especially students with learning disabilities. The researcher believed that given meaning applicable to real life and allowing inquiry would help any student gain a better understanding and enjoyment of mathematics. Marilyn Burns said, "success comes from understanding" (Burns, 2005, p 6). Students needed to make sense of and the use of mathematics in everyday life. When student talk was used,

students developed a deeper understanding and positive outlook towards mathematics.

Research has shown that cooperative learning and student talk have changed the way instruction was seen in the classroom. The researcher of this study also has demonstrated the significant gain students had in the MAPs after student talk and cooperative learning was implemented in the *Connected Mathematics Project* curriculum. Parallel surveys given before and after the study showed increase in self-confidence in mathematic ability, taking homework home and understanding the mathematic. The author concluded the study with interviews of three students

Conclusions

In conclusion, student talk and cooperative learning incorporated in the *Connected Mathematic Project* curriculum were effective in increasing middle school special education students' mathematics achievement in this study. This conclusion was based on the results of the Measurements of Academic Progress assessment scores, parallel surveys and student interviews. The participants in the study showed quite significant gains and self confidence could be seen as the daily routine developed. Student talk became second nature to the students as meanings flourished. The researcher observed a transformation in the students from accepting what the teacher said, to scrutinizing each other's work for clarification to a problem.

Recommendations

Future research needs to be done to obtain more data on the growth of student mathematic scores as a result of implementing student talk and cooperative learning. The future research would need to contain a wider range of participants, a different curriculum and time restriction. With more research one could obtain more applicable data to be used when demonstrating to future teachers the outcome that student talk and cooperative learning has on student growth in mathematics.

The research conducted in this study proved that the use of student talk implemented through cooperative learning as incorporated in the *Connected Mathematics Project* curriculum shows significant gains in student mathematics. The researcher strongly believes that real life meaning and inquiry are key elements for students to gain a better understanding and enjoyment of mathematics. For a student to learn new information that information needs to make sense in the surrounding life of that student.

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Appendices

Figure 1

Measurement of Academic Progress Score Data from Pre-Post Assessment

Student	Pre-test	Post-test	
1	205	208	+ 3
2	204	211	+ 7
3	180	191	+ 11
4	221	219	- 2
5	196	209	+ 13
6	192	202	+ 10
7	179	184	+ 5
8	195	195	0
9	201	199	- 2
10	200	206	+ 6
11	188	192	+ 4
12	194	206	+ 12
13	198	193	- 5
14	194	197	+ 3
15	188	199	+ 11
16	194	202	+ 7
17	193	201	+8
18	187	193	+6

Figure 2

Student Survey

Results of student surveys

Question	Pre Yes	Post Yes	Pre No	Post No
1. I enjoy my math class.	12	17	6	1
2. I bring homework home.	9	15	9	3
3. I understand the homework.	11	15	7	3
4. If I need help I can ask the teacher	13	16	5	2
5. I get help from the teacher when I need it.	18	18	0	0
6. I feel comfortable doing small group activities	13	16	5	2
7. I feel confident in my math class.	15	17	3	1

Figure 3

Parent Survey

Results of parent surveys

Question	Pre Yes	Post Yes	Pre No	Post No
1. My student enjoys his/her math class	6	10	3	2
2. My student brings homework home with them	6	12	3	0
3. My student understands the homework	6	10	3	2
4. If I need help I can call the teacher	8	10	1	2
5. My student gets help from the teacher when they need it.	9	12	0	0
6. My student feels comfortable in the classroom activities	9	11	0	1
7. My student feels confident in their math class	9	11	0	1

Figure 4

Interview Student No. 1

1. How did you like doing the different math this year?

   Just fine

2. What was one thing you liked doing?

   In the groups? Um, one thing I liked doing, I don't know. I really don't know the answer to that one.

3. What was one thing you did not like doing?

   Can't say as much of anything, I liked it all. It was pretty fun.

4. What did you like about working in different groups?

   I liked it because you get to work with other people instead of just yourself.

5. How did you feel working in the different groups?

   I liked it. You don't stay with the same person all the time. You get to go work with different people.

6. How confident or comfortable do you feel about doing math?

   I like it. I like math. It's easy, pretty easy. That's it.

Figure 5

Interview Student No. 2

1. How did you like doing the different math this year?

   Ah, the different math I think it was okay. Ah ya, it was alright.

2. What was one thing you liked doing?

   Um, I think it was working in groups.

3. What was one thing you did not like doing?

   Ah, the math book.

4. What did you like about working in different groups?

   They can help you a lot more than working by yourself. I think it helps you a lot better than working by yourself.

5. How did you feel working in the different groups?

   Um, think it was um, good cause you get to talk with other kids in the class and get to know them better.

6. How confident or comfortable do you feel about doing math?

   Um, it's fun. Ya, I guess that's it.

Figure 6

Interview Student No. 3

1. How did you like doing the different math this year?

   Easier

2. What was one thing you liked doing?

   Um, it was things like cutting out strips of grid paper and putting them on paper.

3. What was one thing you did not like doing?

   The figures.

4. What did you like about working in different groups?

   I don't like working in groups.

5. How did you feel working in the different groups?

   It wasn't good because you get use to the first group then move to the other group and you don't know them.

6. How confident or comfortable do you feel about doing math?

   How confident in math? I just don't like math.