IMPROVING BASIC MATH SKILLS USING TECHNOLOGY

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DEDICATION

This paper is dedicated to our students, parents, families, professors, and classmates.

Thank you to our students for allowing us to restructure your learning environment. Thanks for trying new things.

Thank you to all the parents that supported and encouraged our efforts to enhance the learning environment by allowing their children to participate in our research.

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Thank you to our fellow classmates (OP56) for assisting and supporting us throughout this crazy, fun-filled journey of discovery. "Always remember to K.I.S.S."

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TITLE: IMPROVING BASIC MATH SKILLS USING TECHNOLOGY

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ABSTRACT

The students of the targeted fourth, fifth, sixth, and ninth grade classes exhibited difficulties with number sense that interfered with understanding and recall of basic math facts. Evidence for the existences of the problem included teacher observation, test scores, and student and teacher surveys. The research participants included 42 children under 12 years old, 50 children over 12 years old and 20 teachers. The dates of the study were January 11, 2010 – May 07, 2010. During the course of this intervention, teacher researcher(s) attempted to enhance students' basic math skills by re-teaching basic math skills with an emphasis on number sense using computers, calculators, and other technological devices. The students accessed mathematical websites and software via computers weekly. The rationale for the action research project was to enhance basic math skills of the targeted fourth, fifth, sixth, and ninth graders.

Deficiencies in basic math skills in the classroom typically lead to inaccurate computation that created obstacles when problem solving. After a thorough review of the literature, three common probable causes were found to be lack of prior knowledge, negative attitude towards math, varied teaching methods.

After a review of the literature, the teacher researchers selected four possible solutions for the lack of retention of basic math skills from the variety of solutions proposed by researchers. These possible solution strategies included: early screening, implementing the use of manipulatives, cooperative learning, and integrating technology. The teacher researchers recommend that all mathematics teachers, regardless of grade level, take some time to reinforce basic math skills. To reinforce and explore these topics, the teacher researchers recommend using technology such as software programs, PowerPoint, Elmos, Smart Boards, projectors, calculators, internet websites, You Tube videos and DVDs, and music CDs.

Overall, targeted students in the fourth, fifth, sixth, and ninth grades improved their understanding of basic math skills by using technology. Their post intervention test scores indicated a noticeable increase in student mastery of basic mathematics. More students earned scores of 70% or higher when compared to the pre assessment scores.

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CHAPTER 1

PROBLEM STATEMENT AND CONTEXT

General Statement of the Problem

Deficiencies in basic math skills in the classroom typically lead to inaccurate computation that created obstacles when problem solving. The students of the targeted fourth, fifth, sixth, and ninth grade classes exhibited difficulties with number sense that interfered with understanding and recall of basic math facts. Evidence for the existences of the problem included teacher observation, test scores, and student and teacher surveys.

Immediate Problem Context

The action research project was conducted in four different schools within three different school districts situated in south suburban communities near a major metropolitan city in the Midwest. The four sites involved in this project consisted of three elementary schools and one high school. One teacher researcher was located at Site A with students in the sixth grade. Another teacher researcher was located at Site B with students in the ninth grade. The third teacher researcher was located at Site C with students in the fourth grade, and the fourth teacher researcher was located at Site D in the fifth grade. Site C and Site D were part of the same school district.

Site A

      Site A was a public elementary school, including grades kindergarten through sixth with a total enrollment of 317. The students' racial/ethnic background was 99.1% Black and 0.9% Hispanic. There were no students limited in English proficiency. Limited English proficient rate was defined as those students eligible for transitional bilingual programs. This site had a low income rate of 85.5%. Low income was defined as students who came from families receiving public aid, lived in institutions for neglected or delinquent children, were supported in foster homes with public funds, or were eligible to receive free or reduced-price lunches. The attendance rate was 92.5% and there was no chronic truancy rate. The mobility rate was 40% (State School Report Card, 2008a).

      The staff at Site A included one principal, one assistant principal, 27 teachers, one nurse, and one social worker, 29 of whom were female and two were male. Eighteen members of the staff were Black females, 11 were White females, and two were White males.

      The pupil to teacher ratio was 14.7, and the average years of teaching experience was 9.6 years. The average teacher salary was $48,443. The percentage of teachers with bachelor's degrees was55.8%, and the percentage of teachers with master's degrees and above was 44.2%. The percentage of classes not taught by highly qualified teachers was 1.3% (State School Report Card, 2008a).

      Site A was an older building that was built in 1928. It had three floors. The media center, gymnasium, teacher's lounge, first and second grade classrooms, two special education teachers' offices, the reading coach's office, and the main office were on the first floor. Grades three through six shared the second floor, while the third floor housed two special education classrooms. The building underwent construction this past summer. New windows and a new

roof were installed to remedy rain damage. The only co-curricular activity at Site A was Girl Scouts. It included one instructional program, 21st Century. It was an after-school program that offered homework assistance and math and reading skills building through technology intervention. Site A also had boys' and girls' basketball intramurals and girls' volleyball intramurals.

Site B

Site B was a public high school including grades 9, 10, 11, and 12 with a total student population of 1,561. The students' racial/ethnic backgrounds were 57.3% White, 27.5% Black, 11.7% Hispanic, 2.2% Asian/Pacific Islander, 0.3% Native American, and 1.0% Multi racial/Ethnic. At this building, 6.9% of the students were considered limited English proficient, and there was a low-income rate of 33.1%. The attendance rate at this site was 93.9%, and there was a chronic truancy rate of 0.5%. The school's mobility rate was 13.5%, and the high school drop out rate was 2.3% (State School Report Card, 2008b).

Teacher information reflected the school district because individual school teacher data was not available. There were 311 highly qualified teachers, and 40.3% were male while 59.7% were female. The racial/ethnic breakdown for the teachers was 88.5% White, 5.1% Black, 4.5% Hispanic, and 1.9% Asian/Pacific Islander. They had an average teaching experience of 11.6 years and 66.6% of the teachers had master's degrees or above. The average teacher salary was $72,140. The pupil to teacher ratio was 21.4, the pupil to certified staff member was 12.9, and the pupil to administrator was 180.6 (State School Report Card, 2008b).

Site B served four communities, and students attending had eight class periods a day, each meeting for 50 minutes. Students had opportunities to enroll in elective courses along with their required core classes. Students earned one unit of credit for successfully completing one

year in a given course. They were required to complete four years of English, three years of mathematics, two years of science, two and a half years of social studies, half a year of consumer education, three years of physical education, half a year of both driver's education and health, two years of selective electives (music, art, foreign languages, or vocational education), and five and a half years of general electives of their choice. Students generally followed an Advanced Placement/Honors, College Preparatory, or Transitional coursework program, but individual class placement was based on entry level test scores and teacher recommendations.

The building held most academic classes in the southern part of the building, near the Learning Resource Center (LRC). This section of the building had two floors, whereas the rest of the building was one level. A new science wing was built in 2007, and those classes were held on the north side of the building. Gym, vocational classes, and fine arts were also on the northern side of the school. The main office, student services, and cafeteria were located in the center of the building. The school also had several computer labs located around the building. A team of technology assistants were available on a daily basis for teacher and student assistance. The cafeteria provided free and reduced lunch to qualifying students and was open daily before school and during all lunch periods for food purchases.

The school had a principal, associate principal, three assistant principals, and three deans. Two of the assistant principals also served as student deans in addition to the three mentioned. There were two nurses in the building, several counselors and social workers, a speech pathologist, and a school psychologist available for student support. There was also career preparatory guidance available for students. There were a few peer tutoring programs available after school and students also had the opportunity to attend math and writing tutoring during all lunch periods. The lunchtime tutoring was operated by part time math and language arts teachers,

and they sometimes were assisted by National Honors Society student volunteers. The school also had over 40 extracurricular activities and 16 athletic programs available for students.

Site C

     Site C was a public elementary school including grades kindergarten through fifth with a total enrollment of 329. The students' racial/ethnic background was 97.6% Black, 2.1% Hispanic, and 0.3 % Asian Pacific Islander. There were no limited English proficient students. Site C had a low income rate of 74.2 %. The attendance rate of Site C was 93.1 % and there was no chronic truancy rate. Finally, the mobility rate for Site C was reported at 22.2 % (State School Report Card, 2008c).

     The professional staff at Site C included one principal, an assistant principal, 20 certified teachers, a social worker, a school nurse, a librarian, and one paraprofessional. Site C consisted of 23 females and one male. Two staff members were white; the remaining staff was black. The pupil to teacher ratio was 20.9 and the average teaching experience was 11.2 years. The percentage of teachers with bachelor's degrees was 21.3 % and the percentage with master's and above was 78.7 %. The average salary was $69,771. The preceding information was not available for the individual school; therefore the information reflects the district (State School Report Card, 2008c).

     Site C was an old rectangular building with two floors. The first floor contained kindergarten through second grade classrooms, gymnasium/cafeteria, nurse's office, computer lab, a library, a teacher's lounge, and a main office. The second floor contained grades third through fifth, an art classroom, special education classrooms, a social worker's office and a band room. Site C was equipped with two playgrounds. Some extra-curricular options were available at Site C for the students. School-sponsored activities included peer mediation, basketball, dance

troop, art club, and girls club. Site C implemented two instructional programs: they were Homework Centers, and Reading Literacy Groups.

Site D

Site D was a public elementary school that housed grades one through five. Of the 320 students that attended Site D, 95.6% Black, 2.5% were Hispanic, and 1.9% were Multi-racial. There was no incidence of a limited-English proficient rate. The percentage of students who were classified as low-income was 89.4%. The attendance rate at the site was 95.8% and there is no chronic truancy percentage rate. The mobility rate was 7.4% (State School Report Card, 2008d).

The staff at Site D was comprised of all females. The school employed a principal, 17 certified teachers, a social worker, a nurse, an administrative assistant, and a clerk. Two of the teachers at Site D were White; the remaining staff members at the site were Black.

The elementary pupil to teacher ratio was 20.9. The average teaching experience 11.2 years and the average teacher salary was $69,771. The percentage of teachers with a bachelor's degree was 21.3%, and the percentage of teachers with a master's degree and above was 78.7%. The previous information was not available for the individual school; hence, the above information reflects district information (State School Report Card, 2008d).

Site D was the second most recent addition to the large district, and was built in a circular shape with one floor. Site D had two first grade classrooms, two second grade classrooms, three third grade classrooms, three fourth grade classrooms, three fifth grade classrooms, a lunch room, an art room, a gym, a resource classroom, a Title I classroom, a nurse office, a social work office, and the administration office. The classrooms were situated around a pod office that was shared by the teachers. Site D had very few co-curricular activities. A few of the activities

included The Girls' Club, The Reading Club, and Peer Mediation. The only after-school instructional program available was Homework Centers.

<div align="center">The Surrounding Communities</div>

The four sites were part of three school districts located in four different communities.

<u>Community A</u>

Site A was part of a large school district comprised of nine schools located in community A. The student population was 2,799, of whom 97.4% were Black, 1.7% were Hispanic, 0.6% were Multi-racial, and 0.4% were White. There were 228 teachers on staff (56.4% were White, 41.8 % were Black, and 1.3% were Hispanic). The instructional setting and school district finances were previously mentioned in the Site A report (State School Report Card, 2008a).

Community A was situated 14.1 miles south of a major metropolitan city in the Midwest. Its land area was 3.6 square miles and was incorporated on March 30, 1893. It was a small community with a population of 14,277, among which 86.4% were Black, 10.2% were White Non-Hispanic, 2.4% were Hispanic, 1.1% were two or more races, and 1% were other. The estimated median household income was $43,864. The educational levels of the community were as follows: 82.3% had a high school diploma or higher, 11.7% had a bachelor's degree or higher, 2.1% had a graduate or professional degree. The unemployment rate for Community A was 12.2%, which is above the state average (City-Data.com, 2009a).

Community A housed nine churches, four public elementary schools, two public early childhood centers, three private schools six public parks, a village hall, one public library, a police station, a post office and the district office for Site A. It had a commuter train station within the community and the local bus service ran along two streets within the community.

Community A was also minutes away from three major expressways, allowing accessibility to the nearby major metropolitan city (City-Data.com, 2009a).

Community B

Site B was one of three main schools in a district in a southwest suburban area near a major Midwestern city. The district also had two other schools associated with it, including an alternative school and credit recovery building. The data for the district and its staff was previously mentioned in the description of Site B.

Community B encompassed an area of 8.60 square miles and was a middle class, working community. The population of this area was composed of 25,040 women and 28,367 men, and the median age for residents in this community was 41.5 years. In terms of racial backgrounds, this area was 89.9% White, 1.2% Black, 5.3% Hispanic, 0.7% Filipino, 1.9% Bi-racial, and 1.6% other. The area had a variety of ancestries, including 30.5% Irish, 19.6% German, 19.3% Polish, 9.8% Italian, 4.4% English, and 3.9% Arab. The residents also included 11.5% of people who were foreign born (City-Data.com, 2009b).

High school diplomas or higher were earned by 83.5% of the population, while 20.9% of people held a bachelor's degree or higher, and 6.8% of people earned a graduate or professional degree. People who lived in this area over the age of 25 had a mean travel time to work of 30.8 minutes. The median income in this area was $54,468 and the median home price was $269,564. Four percent of residents were unemployed, and 5.4% of families in this community fell below the poverty level (City-Data.com, 2009b).

The community had a variety of churches of all denominations. The residents reported that they were 69.3% Catholic, 3.1% Muslim, 2.1% Lutheran, 2.0% Evangelical, 2.0% Southern

Baptist, 1.7% United Church of Christ, 1.4% United Methodist Church, 1.2% Presbyterian, 0.9% Greek Orthodox, and 16.3% other religions (City-Data.com, 2009b).

Community B developed from a farming community that began in approximately 1842. The area experienced initial growth when a railroad was built in town in 1879, but was not incorporated until 1909. The region also experienced additional growth when migrants from a nearby major city moved to the area in the decades following World War II. The town continued to grow, gaining additional subdivisions and shopping and business areas. Additional land was added to the community in the 1950s and 60s, but expansion was disrupted in 1967 when a tornado struck, killing several people and causing millions of dollars in damage. This led Community B to replace and update many of its older buildings. In recent times, the community has focused on redevelopment of areas and almost one third of the area was commercial. It was attractive to business men and women due to its access to public transportation and relatively short commute to the major nearby city (Village Website, 2009).

This area featured a variety of schools, including nine elementary schools, two middle schools, and two high schools. It also housed five Catholic grammar schools and five Catholic high schools within one mile of the community. It included a library, children's museum, and 300 acres of public parks, which incorporated playgrounds, walking paths, sports fields, swimming pools, an ice arena, a fitness center, a theater, and a golf course. There was also a commuter train station and a large medical center and children's hospital in the community (Village Website, 2009).

Community C

The school district that included Site C and Site D consisted of five elementary schools, and one middle school. The district total enrollment was 3,331 with 174 teachers. The ethnicity

of the district was 27.6 % White, 71.8 % Black, 0.6 % Hispanic, with 8.6 % male and 91.4 %

female. The district's instructional setting and finances were previously mentioned in Site C and

Site D (State School Report Card, 2008c).

Community C was situated 15.3 miles south of a major city in the Midwest, and was

incorporated on March 30, 1893. The community land area was 4.5 square miles. The population

of the community was 24,032 with 46.4 % male, and 53.6% female. The ethnicity of the

Community C was 82.4 % Black, 13.2 % White Non-Hispanic, 3.1 % Hispanic, 1.4 % other race,

and 1.1 % two or more races. The median household income in 2007 was $54,965. The

educational level obtained by the residents of Community C was 82.6 % high school diploma or

higher, 15.4 % bachelor's degree, 3.2 % graduate or professional degree. Community C had an

unemployment rate of 7.2 %. The community had three hospitals/medical centers, seven

colleges/universities, one public high school, eight elementary/middle schools, four private

schools, 21 churches, and one library. The community was located west of the expressway

Interstate, and six miles from the nearest Amtrak station. There were two cemeteries, two lakes,

and two parks in Community C (City-Data.com, 2009c). The community was the hometown of

several professional athletics, and actors/actresses (Wikipedia, 2009).

Community D

Site D was in Community D; however Site D was located in the same school district as

Site C. All of the district information was previously included.

Community D was located 17.1 miles away from a major urban city in the Midwest. Its

land area was 7.26 square miles, with a population of 37,064. Community D was incorporated on

August, 1, 1911 (City-Data.com, 2009d).

The ethnic groups that resided in Community D were 52.9% Black, 34.4% White, 10.9% Hispanic, 0.7% American Indian, 5.4% other races, and 2.1% two or more races. The median household income was $44,529. The educational levels attained by the people of Community D were: 80.7% high school diploma or higher, 13.9% bachelor's degree or higher, and 3.8% graduate or professional degree. The unemployment rate for Community D was 8.0% (City-Data.com, 2009d).

Community D had two colleges, one public high school, three public middle schools, six public elementary schools, and four private schools. Recreational opportunities included a golf course, a shopping mall, a lake, six parks, and a historical museum. There were eight churches in Community D. Support services that were available to Community D residents were a library, a fire department, family services, and a police department. Additionally, there were two post offices and several banking facilities (City-Data.com, 2009d).

Community D was located near two interstates and bus transportation was available to its residents. In addition, there were three hospitals located near community D.

<div align="center">National Context of the Problem</div>

Compared to students around the world, America's low math performance has called educators to consider an instructional overhaul. Studies have shown that students struggle with math because of a lack of knowledge and misunderstandings of concepts (America's Choice, 2009). Chard, et al. (2008) stated that consistent findings show remediating problems became increasingly difficult the longer the problem existed and the higher the expectations increased. Because mathematics required the use of prior knowledge, misconceptions of key concepts interfered with overall mathematical achievement.

A review of the National Assessment of Educational Progress (NAEP) report indicated a decline in the recall of basic arithmetic facts in the 1990's. "Only 32% of fourth graders and 29% of eighth graders scored at or above the proficient level in math, and unfortunately this is an improvement over previous years" (Hasselbring, Lott, & Zydney, 2006, p.1). Even though there was an increase in test scores, the majority of the students were not meeting grade level expectations. This problem seemed to continue with the high school population. The American College Testing (ACT) results revealed that 59% of those who took the test did not meet college-readiness benchmarks on the math test (ACT scores rise, 2006).

There were many factors that affected student achievement in math. Reports indicated that there were achievement gaps between the races, genders and students from different socioeconomic statuses. According to the most recent NAEP report, although scores increased, a gap remained between Black, White and Hispanic students. The report also indicated that boys, on average, scored two points higher than girls. Students from low-income homes scored lower than their middle and upper class counterparts. This was a concern as their representation continued to grow in public schools (U.S. Department of Education, 2007).

In general, the United States mathematics curriculum required teachers to cover a large number of concepts. Teachers focused more on covering material instead of building conceptual understanding of basic skills. Math standards have "de-emphasized memorization in favor of 'conceptual thinking'" (Welsh, 2008, p.2). For students to perform higher level mathematics, basic skills needed to become automatic. Lack of fact recall impairs class participation, problem solving and general life skills. Also, rapid retrieval is a predictor of higher performance on standardized tests (Hasselbring, et al., 2006).

The next chapter will provide evidence that there was a need at the targeted sites for students to recall basic math skills. It will also examine possible causes for students exhibiting poor basic math skills.

CHAPTER 2

PROBLEM DOCUMENTATION

Problem Evidence

Teacher researchers at Sites A, B, C, and D decided to gather data to provide evidence that the targeted students exhibited some deficiencies in their basic math skills. Two pre intervention tests were given, one for students in fourth and fifth grades (Appendix C) and another for students in sixth and ninth grade (Appendix D). Teacher researchers also distributed pre intervention surveys by grade level to targeted students to get feedback on mathematics perceptions and overall student comfort and confidence levels (Appendix E and Appendix F). Finally, additional teacher surveys were distributed to select teachers at each of the sites (Appendix G).

Student pre intervention tests were given during class time at the beginning of the second semester and the students took about an hour to complete the assessment. The pre intervention tests were divided by grade levels. Fourth and fifth grade students took the same test, and their results were combined in Figure 1. Sixth and ninth grade students took another test, and their results were combined in Figure 2. There were 70 students that took the pre-intervention test at all four sites.

As can be seen in Figure 1, almost half of the fourth and fifth grade students scored a 59% or below on the mathematics pre intervention test. Approximately, 6% of the students

scored a 90% or higher. The remainder of the students scored in the 70-89% range on the

mathematic pre intervention test. The results from the pre intervention mathematics test seem to

support the teacher researchers' premise that the targeted fourth and fifth grade students lack
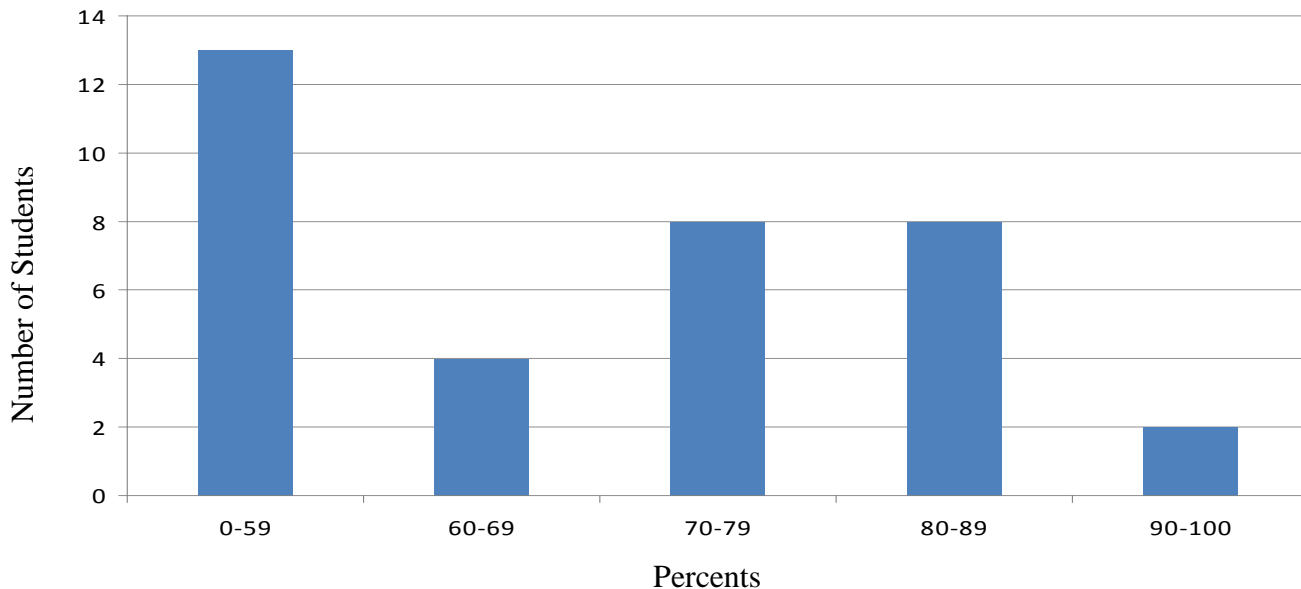
basic math skills.

Figure 1. Results of 4th and 5th grade students' mathematics pre intervention test at Site C and
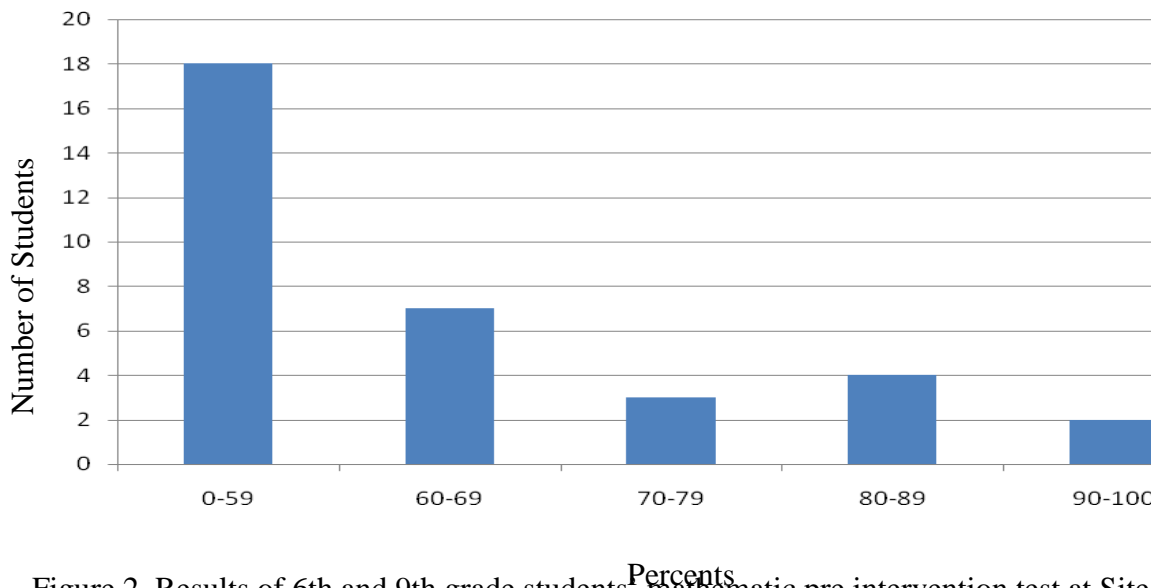Site D

Figure 2. Results of 6th and 9th grade students' mathematic pre intervention test at Site A and
Site B

Figure 2 shows that slightly more than half of the students at Sites A and B scored below 60% on the mathematics pre-intervention test. Twenty one percent scored in the 60-69% range, which is typically considered to be a grade of D at these sites. Twenty seven percent of the students tested scored above a 70%, but only 6% received scores that would be considered in the A range. Overall, the results of the pre intervention test indicate that the majority of students at these sites have not mastered basic mathematics skills at the sixth and ninth grade levels.

Students also completed the pre intervention surveys during class time at the beginning of the second semester. There were 35 fourth and fifth graders and 35 sixth and ninth graders that completed the pre intervention survey. The completion of the survey took approximately ten minutes. The results of the fourth and fifth grade surveys can be seen in Table 1 while the results of the sixth and ninth grade surveys are shown in Table 2.

Table 1

Responses to Pre Intervention Student Survey (Grades 4 and 5) During the 2009 – 2010 School Year

Statements:	Responses			
I can solve the following problems.	Always	Most of the Time	Sometimes	Never
A. 90 + 20=	29	2	3	1
B. 4,002 – 3,987=	14	10	9	2
C. 6 X 7=	21	8	5	1
D. Order the following decimals. 0.54,	11	5	9	10
E. Compare the fractions using <, >, or =.	25	4	4	2
1. I use a number line or ruler to solve	5	7	21	2
2. I use my fingers to solve math	5	8	11	11
3. I solve math problems in my head.	15	9	9	2
4. I use a calculator correctly.	21	4	7	3

Note. n = 35

The results of a pre intervention survey taken by the targeted students at Site C and Site D are shown in Table 2. In responding to questions about finding the sum of ninety and twenty, about 83% of students indicated that they were able to solve an addition problem of the same caliber; however 69% of students surveyed specified they were able to find the difference between two four digit numbers. In comparison, about 69% of the surveyed students indicated that they were able to solve math problems in their heads and 37% of students revealed they use their fingers to solve math problems. There are several possible reasons why the students at Site C and Site D preferred solving math problems mentally or with the use of their fingers. The researchers will discuss these possibilities in another section of this document. Comparing the survey results to the test results, it appears the students believe they are much better in basic math skills than they actually are.

Students at Sites A and B were given class time to complete a pre intervention mathematics survey. The results of part of this survey are displayed in Table 2.

Table 2

Responses to Pre Intervention Student Survey (Grades 6 and 9) During the 2009-2010 School

Year

I Can Solve Problems Like These:	Always	Most of the Time	Sometimes	Never
List the numbers in increasing order: 1.345, 0.345, 1.34	15	10	8	2
List the numbers in increasing order: $\frac{3}{5}, \frac{1}{5}, \frac{4}{5}$	11	8	12	4
List the numbers in increasing order: $\frac{1}{3}, \frac{3}{4}, \frac{5}{6}$	9	10	11	4
Write ¾ as a decimal.	11	12	9	2
Write 0.25 as a fraction.	14	9	10	2
Write 1/5 as a percentage.	9	7	13	6
Write 40% as a fraction.	5	9	13	7
Write 85% as a decimal.	15	11	6	3
Write 1.35 as a percent.	4	7	16	8
List the numbers in increasing order: 5, -8, 8, 0, -3, 4	21	3	4	7
Simplify: $3 - 5 + (-2)$	17	7	7	3
Simplify: $\frac{2}{3} \div \frac{4}{5}$	9	12	12	2
You answer 73 out of 100 questions on a test correctly. What percent of the questions did you get right?	13	10	9	3
Two left over pieces of string measure $3\frac{1}{3}$ feet and $2\frac{2}{3}$ feet. What is the total length of the strings together?	14	10	5	6
A hamburger costs $3.25. How much would it cost to buy 5 hamburgers?	26	3	6	0
A recipe calls for 1.5 cups of sugar to make 25 cookies. How many cups of sugar would you need to make 50 cookies?	15	10	8	2

Note: n = 35. Not all students responded to each question.

As shown in Table 2, a majority of the targeted sixth and ninth grade students felt confident in their ability when it came to ordering numbers. Seventy-one percent stated that they could order decimals most of the time while 69% indicated they could order integers. Seventy-two percent of students also indicated that they felt confident in their ability to solve word problems. Results show that a majority of students did not believe that they could successfully convert between fractions, decimals, and percentages. Survey participants were almost equally divided when responding to questions that involved ordering fractions and operations with fractions. It seems the sixth and ninth grade students' opinions of their basic math skills paralleled their results on the pre intervention test.

Table 3 is a continuation of the sixth and ninth grade student pre intervention survey at Sites A and B. In this portion of the survey, students were asked about their general comfort level when solving math problems.

Table 3

Continued Responses to Pre Intervention Student Survey (Grades 6 and 9) During the 2009-2010 School Year

Questions	Always	Most of the Time	Sometimes	Never
Do you use a number line or ruler to solve math problems?	2	5	24	4
Do you use your fingers to solve math problems?	6	8	16	5
Can you solve math problems in your head?	9	16	10	0
Can you use a calculator correctly?	28	5	2	0
Are you comfortable solving addition, subtraction, multiplication, and division problems without the use of a calculator?	8	16	7	4

Note. n = 35

Table 3 shows that an overwhelming majority of students indicated that they can solve problems without the use of aides, such as number lines, rulers, their fingers, and calculators. Also, 92% responded that they can properly use a calculator. These responses do not line up with the results of the pre intervention test, indicating that students believe they have an understanding of basic math skills when in fact the results of their tests indicate existing deficiencies in these areas.

In addition to gathering data from the targeted students, the teacher researchers surveyed teachers at each site. At the fourth, fifth and sixth grade levels, surveys were distributed to other teachers who taught the same grade level. At the ninth grade level, surveys were distributed to every mathematics teacher in the building. There were 24 pre intervention teacher surveys distributed and returned. All surveys were personally returned to the teacher researcher. The results of the teacher surveys from each site were combined and the gathered data is presented in Table 4.

The results of a pre intervention survey taken by selected teachers at Sites A, B, C, and D are revealed in Table 4. About 83% of the surveyed teachers indicate that their students struggle to recall basic math facts. Approximately 83% of teachers surveyed reveal that they have to reteach basic skills due to a lack of retention. In addition, nearly 75% of the surveyed teachers pointed out that a lack of basic skills interferes with their students' progress.

Table 4

Responses to Pre Intervention Teacher Survey during the 2009 – 2010 School Year

Questions	Responses			
	Strongly Agree	Agree	Disagree	Strongly Disagree
1. My students struggle to recall basic math facts.	9	11	4	0
2. My students use their fingers to count when solving basic math problems.	8	10	6	0
3. My students have the ability to apply mathematical concepts to real world problems.	0	8	9	7
4. Lack of basic skills interferes with my students' progress.	11	7	6	0
5. My students successfully solve problems with the use of a calculator.	1	19	3	1
6. I have to re – teach basic skills due to a lack of retention.	12	8	4	0
7. My students understand relationships between numbers.	0	10	11	3
8. There is an increase in students with a lack of basic math skills.	9	10	4	1

Note. n = 24

Seventy-nine percent of the educators that were surveyed believe that there is an increase in the number of students who lack basic math skills. Overall, teacher responses to the survey seem to support the teacher researchers' initial hypothesis that students lack basic math skills.

Probable Causes

After a thorough review of the literature, the teacher researchers identified three probable causes for the lack of retention of basic math skills. These causes were students' lack of prior knowledge, negative attitudes towards math, and varied teaching methods.

Many students have difficulty retaining basic math skills because they lack the prior

knowledge necessary to master new concepts. Number sense is the foundation for mastering new math concepts during the early elementary school years and beyond. Students who enter school with higher levels of performance in number sense are generally associated with higher levels of performance when learning new math concepts. Therefore, "early number sense is a reliable and powerful predictor of math achievement" (Jordan, Kaplan, Locuniak, & Ramineni, 2007, p 42).

Many teachers are unsure about how to help their students develop number sense because it has never been clearly defined for them. Teachers often present math as a set of disconnected procedures rather than a set of related principals. Many teachers were taught mathematics by following a set of procedures. To truly teach with an emphasis on number sense, they must break the pattern of how they were taught. The characteristics of good number sense include proficiency in estimating and comparing magnitudes, the ability to recognize an unreasonable result, the ability to represent an answer in various forms, and the ability to perform mental calculations with flexibility (Faulkner, 2009).

Memorization of basic facts is a valid way of learning because it creates a connection between an expression and its solution. Memorizing basic facts involves creating a well structured and connected body of knowledge and putting in an adequate amount of practice with the given topic. Part of creating this background of connected knowledge comes from number sense that is developed during the early schooling years. If students are able to memorize the basics, they will be able to recall and use numbers both in everyday life and when striving to learn higher levels of mathematics. Memorization frees up brain power, which can allow most of the students' attention to focus on the more complex task at hand. Despite the importance of this, many students struggle with this task. An untimed mental arithmetic test given in California in 2008 to first grade students yielded a 22% success rate. Students who do not go on to achieve

mastery with things like single digit operations cannot continue on to multi-digit operations with a high degree of efficiency. This cycle continues as mathematics increases in difficulty, which can lead to student failure and frustration. "Meaningful memorization of basic combinations can reduce the amount of time and practice needed to achieve mastery, maintain efficiency (e.g. reduce forgetting and retrieval errors), and facilitate application of extant knowledge to unknown or unpracticed combinations" (Baroody, Bajwa, & Eiland, 2009, p 71).

Another probable cause that prevents students from developing the skills needed to retain basic math facts is negative attitudes. Four causes for negative attitudes frequently mentioned in the literature were lack of confidence, mathematical concepts not connected to the real world, negative influences of family members and society deeming math to be difficult.

According to the article by Ashby (2009), mathematics was consistently associated with cleverness. Students viewed mathematics to be more difficult than the language arts. In order to be clever, one had to be good at numeracy. If a student struggled with a mathematical concept this implied a lack of cleverness in students' minds, which ultimately lowered the students' confidence. The idea that cleverness is measured according to one's strength in numeracy is supported by society's view of math. Many Americans have deemed math to be difficult. In fact, "according to Stevenson, (as cited in Olson, 1998, p. 16) Americans believe one is either born with mathematical ability or one is not." In other words, the difficult challenges mathematics presents can only be solved by those born with special mathematical abilities. Students who have been influenced by this mindset, feel defeated before they begin.

Negative attitudes toward math tend to arise when students are unable to see the connection of learning to real world situations. Children often ask, "If I don't need to find the value for the variable in the real world, then why do I need to do it now?" Students with negative

attitudes toward math find it difficult to see the purpose in learning math beyond adding, subtracting, multiplying and dividing. This negative attitude is commonly supported and influenced by family members who view math in a negative light. A research study conducted in the mid-50's focused on the fear of math that high school student's displayed. Poofenberger and Norton mention, "…we would logically assume that the basic attitudes toward mathematics would tend to develop within the confines of the nuclear family and that the school would build upon what had already begun." The authors of the article insist that students' perceptions of math are shaped by the beliefs of their family members. Learning begins at home with the family; one's beliefs, values, etc. are shaped by what is learned prior to attending an educational facility. (Poofenberger & Norton, 1959, p. 1).

Another cause for low achievement in basic math skills is varied teaching methods. Some teachers teach the way they were taught and others try every new trend developed. Instruction may be very different from what they had as students. The combination of new instructional methods and new accountability pressures teachers in math instruction (Nelson & Sassi, 2007).

The inconsistency in methods can affect students understanding. According to Benbow, the nature of teachers' belief about the subject matter and about its teaching and learning may play a significant role in shaping their instructional practices. Benbow also believes students often have conception about the subject matter they study and themselves that effect the decisions they make in learning mathematics and ultimately in their mathematical achievement. (Benbow, 1993)

Rote memorization is a teaching method that has faded out with the new math trends. However, the lack of rote memorization has affected students' ability to recall basic addition, subtraction and multiplication facts. Memorization of chain numerals for short term retention is a

simple, common process for most adults, but for children throughout the school years, committing information to memory is integral to education at all levels. Memorization is an important role in the learning process (Scott & Geotz, 1978).

When some groups of students were taught, a chain of digits numbers using rote learning verses game procedures. Students trained with rote memorization made fewer errors and retained information longer than those trained with game procedures (Scott & Geotz, 1978).

CHAPTER 3

SOLUTION STRATEGIES

Review of Literature

After a review of the literature, the teacher researchers selected four possible solutions for the lack of retention of basic math skills from the variety of solutions proposed by researchers. These possible solution strategies included: early screening, implementing the use of manipulatives, cooperative learning, and integrating technology.

Math performance is associated with the educational level attained in adulthood and increases the likelihood of full time employment. Achieving literacy in this content area is essential for today's constantly evolving technological world, as well as for traditional occupations such as nursing and carpentry. Therefore, it is essential to identify students who may have difficulty in this area at an early age in an effort to address their needs for both individual and societal benefits. Students who are considered poor achievers in mathematics generally perform below grade level in math accuracy, strategy use, or both (Mazzocco & Thompson, 2005).

Research in the field of psychology indicates that even infants demonstrate early number sense skills. It follows that pre-K and kindergarten instruction should be designed to build upon these emerging skills and focus on helping students who may be at a disadvantage in this area. This may include students with learning disabilities or those from homes where number sense is not developed because "while children may be born with a predisposition for making quantitative distinctions, an

inability to develop a refined understanding of numbers has been implicated as a key predictor of later mathematics difficulties" (Chard, Baker, Clarke, Jungjohann, Davis, & Smolkowski, 2008, p. 12). Consistent findings indicate that addressing academic problems becomes increasingly difficult the longer the problem goes untreated and as the content expectations become more demanding in later grades, so early identification is key (Chard, Baker, Clarke, Jungjohann, Davis, & Smolkowski, 2008).

Many students with math difficulties are not identified early and therefore are underserved (Jordan, Kaplan, Locuniak, & Ramineni, 2007). Currently, many schools do not identify math difficulties until after the fourth grade. Students need to be screened several times throughout the year at an early age to identify and deal with the issues students may be experiencing. A number sense screening test has been developed to help younger students that covers "counting skills and principles, number knowledge and comparison, nonverbal calculation, story problems, and number calculations with no object references" (Jordan, 2007, p. 64-65). Early on in the schooling experience, students should receive help representing, comparing, and ordering numbers. They should work with manipulatives, imagine operations in their heads (ex: if you have four pennies and give me one, how many will you have left?) Games that involve using numbers may also help learners. Helping students to increase number sense early in life will help them to be able to perform more advanced calculations as they grow up. This may also help to decrease math anxiety since students can begin to experience success instead of frustration as they progress through the content (Jordan 2007).

Many children are influenced and motivated by the use of manipulatives. Incorporating manipulatives during instruction can increase academic achievement in math (Battle, 2007). Hands-on activities engage students in creative thinking as they work to discover mathematical principles (Waite-Stupiansky & Stupiansky 1999). Guided discovery is a process where students

can develop meaning by doing something. Words and actions are fused together to create a meaningful situation that students can later remember when trying to recall what they have learned. Using hands-on activities during math instruction can help students construct meaning regarding number systems while providing a learning experience that becomes multi-sensory. Incorporating the use of manipulatives creates an experience that is more likely to reach a wider range of students. Many times, mnemonic devices are used to remember math facts, but when they are separate from understanding and meaning, students often have a difficult time recalling the information. The skills developed with the use of manipulatives help to enable "pupils to remember what they have done, rather than forcing them to recall what they have tried to memorize" (Simpson 1998, p.148). If students are involved in guided discovery that uses a manipulative (either hands on or just on paper), they are more likely to notice patterns and relationships. Students will have more success if teachers meet students at their current level of understanding and work with the learners' perspective in mind.

Incorporating the use of cooperative learning strategies can often be used to motivate students to work on improving their math skills. Through the use of cooperative learning, students practice and develop social skills needed to successfully accomplish given tasks and projects. Cooperative learning encourages group interaction with assigned roles, with each member sharing responsibility for the group and the work produced. According to Bernero (2000), the use of cooperative learning generates more interest in math and makes it more enjoyable for both student and teacher.

Collaboration allows individuals to learn from others so that overall knowledge can improve. The action research document by Adami-Bunyard, Gummow, & Milazzo–Licklider (1998) inspects a curriculum which develops students' mathematical skills. The student

researchers documented the behaviors of the primary grade students on self-made tests and rubrics. Some of the solutions the student researchers suggested were peer tutoring, cross-age tutoring, and mentoring. They also suggested that instruction be student-centered with teacher working as a facilitator. Students who participated in the study appeared to enjoy the peer-centered learning experiences. Allowing students to work together created a bond that enhanced social and educational relationships, while increasing academic success (Adami-Bunyard, Gummow, & Milazzo – Licklider, 1998).

Over the years, students learn a number of things. Although it may be difficult to recall concepts, theories, etc. quickly, one may remember eventually through the use of revisiting their long – term memory. Bednar, Coughlin, Evans, and Sievers implemented interventions to "improve student motivation and achievement in mathematics through teaching to the multiple intelligences," (Bednar, Coughlin, Evans, & Sievers, 2002, p. i). Their findings suggest students have difficulty with mathematical concepts because of their negative attitudes and their inability to make connections between math and the real world. According to Sweet, (as cited in Bednar, Coughlin, Evans, & Sievers, 2002), Allowing the student to use prior knowledge creates a sense of ownership in the educational experience, which will improve overall attitudes toward math (Bednar, Coughlin, Evans, & Sievers, 2002).

Curricula are improved by implementing the use of technological advancements. Mathematics is a core subject, which means that a large portion of the day is spent on content. Technology can be used to enhance what students learn by allowing a hands - on approach to learning. Western (2003) affirms "math is such a large part of the school day – and technology can enhance what you're already doing," (Western, 2003, p. 1). Western also provides examples of varied uses of technology, as well as work sheets and interactive Web sites.

Technology can serve a number of roles in increasing knowledge of basic skills in mathematics. For example, the use of calculators can increase a student's ability to problem solve. Bowes explores technology's place in the mathematics curriculum. In the article, Bowes states, "Technology supports achievement, enabling learners to be independent, competent and creative thinkers, as well as effective communicators and problem solvers," (Bowes, 2010, p. 1). Bowes also states, "Technology is essential in teaching and learning mathematics, it influences the mathematics that is taught and enhance students' learning," (Bowes, 2010, p. 2). The article also reveals technology can assist students with relating concepts to real world experiences, assists in accurately computing solutions, and enhances math state standards, (Bowes, 2010).

In modern society, technological advances are used more frequently. Today's students have access to the Internet, which allows them to research and use websites that enhance their knowledge and satisfy their leisure times. The U.S. Department of Education created a document that examines how parents/guardians can assist their child (ren) with math concepts learned in primary grades through intermediate grades. The document provides a number of activities for parents/guardians to use to enhance their child (ren)'s math abilities. The document states that parents/guardians should stimulate your child's interest in technology. Help your child learn how to use calculators – but don't let him rely solely on them to solve math problems. Encourage him to learn to use computers to extend what he is learning and to find math games and math – related Web sites that will increase his interest in math (Spellings, 2002, p. 64).

Project Objectives and Processes

As a result of re-teaching basic math skills with the use of technology, during the period of

January 2010 to May 2010, the fourth, fifth, sixth, and ninth grade students will increase their

knowledge of basic math facts and concepts, as measured by the pre- and post- basic math tests.

In order to accomplish the project objective, the following processes are necessary:

1. Create and administer teacher and student surveys.

2. Create and administer a pre- and post test.

3. Incorporate technology with instructional lessons.

4. Re-teach basic math skills with an emphasis on number sense using computers, calculators, and other technological devices.

Methods of Assessment

In order to assess the effects of the intervention, a survey will be administered to

students. This information will be obtained for data purposes. In addition, students will be

administered a pre- and post test. The purpose for the pre- and post test is to establish students

knowledge regarding number sense. Teachers will incorporate technology with instructional

lessons and re-teach basic math skills with an emphasis on number sense. The previous methods

are designed to improve students' mathematical skills.

Project Action Plan

When	Strategy	Participants	Why
January	- Administer student and teacher surveys - Administer basic math skills pre-test	- Students and teachers at Site A, Site B, Site C, and Site D - Students at Site A, Site B, Site C, and Site D	- To determine how basic math skills are perceived by students and teachers - To determine students mathematical abilities
February	- Re-teach basic math skills - Incorporate various technological devices	- Students at Site A, Site B, Site C, and Site D - Students at Site A, Site B, Site C, and Site D	- To reinforce and review basic math skills - To allow students the opportunity to practice learned skills.
March	- Re-teach basic math skills - Incorporate various technological devices	- Students at Site A, Site B, Site C, and Site D - Students at Site A, Site B, Site C, and Site D	- To reinforce and review basic math skills - To allow students the opportunity to practice learned skills.
April	- Re-teach basic math skills - Incorporate various technological devices	- Students at Site A, Site B, Site C, and Site D - Students at Site A, Site B, Site C, and Site D	- To reinforce and review basic math skills - To allow students the opportunity to practice learned skills.

When	Strategy	Participants	Why
May	• Administer student post-survey • Administer basic math skills post-test	• Students at Site A, Site B, Site C, and Site D • Students at Site A, Site B, Site C, and Site D	• To determine how basic math skills are perceived after participating in the intervention • To determine students mathematical growth after the intervention.

CHAPTER 4

PROJECT RESULTS

Historical Description of the Intervention

The objective of this action research project was to increase basic math skills with the use of technology. In order to accomplish the targeted objective, the researchers administered teacher and student surveys, pre intervention and post intervention test, incorporated technology with instructional lessons and re-taught basic math skills with an emphasis on number sense using computers, calculators, and other technological devices. The following paragraphs will provide a detailed, chronological summary of the action research plan.

Week One: Sites A, B, C, and D

In order to begin the action research project it was necessary to explain to the parents and students the purpose of the intervention. The teacher researchers sent home letters via student couriers explaining the project and requesting parental consent. The teacher researcher at Site A distributed 21 letters, of which 18 were returned. The teacher researcher at Site B distributed 28 letters, of which 19 were returned. The teacher researcher at Site C distributed 10 letters, of which all were returned. The teacher researcher at Site D distributed 25 letters, of which all were returned. All the students participated in the intervention. In addition, to parental permission, students at Site A and Site B were required to sign a letter of assent. The students at Site C and Site D were not required to sign assent letters, due to their age.

<u>Week Two: Sites A, B, C, and D</u>

Particular attention was given to exploring students' and teachers' attitudes towards basic math skills. Pre intervention surveys were used (see Table 1, Table 2, Table 3 and Table 4). Within each classroom setting, the participating students were given the age-appropriate student surveys. Students at Site A, Site B, Site C, and Site D were allowed time to complete the surveys independently. The teacher researchers at Site A, Site B, Site C, and Site D distributed a total of 70 student surveys; not all of the student participants at Site A and Site B responded to each question. All of the surveys were returned. The teacher researchers then compiled the data that was presented.

Teacher surveys were also distributed at all sites to staff members who were in direct contact with the participating students. Surveys were delivered via direct contact, and also placed in the teachers' mailboxes, along with a letter explaining the purpose of the project. The teacher researchers at Site A, Site B, Site C, Site D distributed a total of 24 teacher surveys. Upon completion of the surveys, the teachers were asked to return them to the teacher researchers' mailboxes. All of the surveys were returned. Similar to the student surveys, anonymity was ensured by the teacher researchers who asked that all names be left off surveys. Once the surveys were returned, the teacher researchers compiled the data.

<u>Week Three: Sites A, B, C, and D</u>

During Week Three, each site administered the pre intervention test. The researcher at Site A distributed 21 pretests; the researcher at Site B distributed 28 pretests; the researcher at Site C distributed 10 pretest, while the researcher at Site D distributed 25 pretests. The students were given the entire length of the period to complete the tests at each site. All students at each site completed the distributed tests.

Weeks Four - Fourteen at Site A

During Weeks Four - Fourteen at Site A, the researcher visited the sixth grade classroom for one hour twice each week. During the first visit of the week, the researcher gave a lesson on the week's focus skill. She explained and modeled how to compute various problems relating to the focus skill using the paper/pencil method. Upon observing the class's general understanding of the concept during guided practice, the researcher instructed the students on how to compute using their calculators. The students spent the rest of the period practicing the paper/pencil method and checking their answers using their calculators.

During the second visit of the week, the researcher led a 15-minute review of the lesson from the first visit of the week. Afterwards, the students visited the site, studyisland.com and completed lessons related to the week's focus skill. The students were allowed to use their calculators while working on their assigned Study Island lessons.

The researcher at Site A began her first week (Week Four) of interventions teaching and reviewing place value for whole numbers and decimals. This first focus skill (place value for whole numbers and decimals) laid the foundation necessary to navigate the students through the more complex problems they would encounter during the later weeks of the intervention process. The researcher covered the following focus skills during the remaining weeks of the intervention: changing decimals to percents and changing percents to decimals during Week Five, changing fractions to decimals during Week Six, changing decimals to fractions during Week Seven, adding and subtracting fractions with like denominators/simplifying fractions using GCF during Week Eight, least common multiples during Week Nine, adding and subtracting fractions with unlike denominators during Week Ten, multiplying fractions during Week Eleven, dividing fractions during Weeks Twelve and Thirteen. The researcher also practiced solving

word problems with the students during Weeks Six, Eight, Ten and Thirteen. During Week

Fourteen, the researcher led the students through a review of the focus skills covered during the

intervention process.

Week Four-Fourteen at Site B

Throughout the length of the intervention, students used the Key Train software once a

month in the computer lab. This software pre-assessed student readiness and placed them at an

appropriate starting point somewhere between levels 3 and 7. Students worked at their own pace

through lessons on basic skills and number sense. These lessons also included word problem

applications like those found on the Work Keys portion of the PSAE test. At the end of each

level, students were required to pass a quiz on the computer by demonstrating 80% mastery on a

randomly generated list of multiple choice questions.

During Week Four, the students at Site B focused on using a number line to order

numbers from least to greatest and to compare integers by visiting the following website:

http://www.mathsisfun.com/number-line.html. The students had received instruction on this

topic earlier in the school year, and many were familiar with the concept of a number line and

how it could be used to order and compare numbers. Some students had trouble when comparing

numbers beyond the hundredths place, like 1.243 vs 1.24. Students commented that they

sometimes or rarely use a number line to solve math problems. The teacher researcher had

noticed that students struggled with positive and negative numbers without the use of a

calculator, so this opportunity was used to show students how to use a number line for addition

and subtraction of signed numbers. The class participated in an interactive game projected from

the following website: http://www.mathsisfun.com/numbers/skip-counting-game.html. They also

completed a multiple choice worksheet on ordering and comparing numbers and using the

number line to solve problems.

Students at Site B really struggled with fractions, and they practiced finding common

denominators and began to compare fractions during Week Five. When they come across a

problem with a fraction in it, they basically shut down even though they understood the solving

process. Their trouble with fractions was impeding their success with certain algebra problems.

Many of the interventions were based on helping students increase their understanding of

fractions and allowed them to become more comfortable performing operations with calculators.

For this lesson on finding common denominators, the teacher researcher first facilitated a

discussion about what the numerators and denominators of fractions really represent. This helped

students see why it is necessary to have a common denominator before two or more fractions can

be distributed. Some students were comparing fractions just based on the size of the

denominators, so it was important to take the time to go back to the basics. After they discussed

the importance of common denominators for comparing fractions, students explored the process

of using the least common multiple to find a common denominator for a set of fractions. Most

students seemed to be comfortable with this idea and were able to quickly convert and accurately

compare fractions. The following interactive website,

http://www.xpmath.com/forums/arcade.php?do=play&gameid=8, was projected on the screen

and students recorded their solutions on individual mini white boards. The teacher researcher

was able to quickly assess the level of mastery based on the student responses. Students also

completed an exit slip on comparing fractions.

During Week Six, students at Site B built on the Week Five interventions. They extended

the Week Five lesson to include ordering fractions, comparing fractions with like and unlike

denominators, and comparing mixed numbers and improper fractions. Students viewed a You

Tube video on the idea of common denominators and verbally communicated why common

denominators are necessary for comparison. This week also covered converting mixed numbers

to improper fractions and vice versa. Again, some students knew how to do this, but there were

several who had no recollection of the process. They were all able to perform the conversions

after some direct instruction took place.

In Week Seven, the teacher introduced conversions between fractions, decimals, and

percents. This section of the pre intervention test was particularly troublesome for the students.

There were very few students who were able to convert numbers in all directions. Most were

able to convert fractions to decimals and decimals to percents. Students had trouble converting

from decimals to fractions and percentages to fractions. There were even a few students who

seemed to have no understanding of how to do any of the conversions (ex: ¼ is 14%). The

teacher researcher showed the students how to convert between the forms by hand using direct

instruction, but spent the majority of this lesson helping students understand how they could use

the TI-30XIIS calculator to perform the conversions. Surprisingly, many students were entering

fractions into the calculator differently than what would be expected at the high school level. The

teacher researcher at Site B assumed that the students knew how to enter fractions correctly and

never took the time to talk about this specifically with the kids. It was also discovered that the

students were not aware of several keys on the calculator that were useful for converting between

fractions and decimals. The students were really excited by this new discovery, and they seemed

to take great pleasure in practicing problems using their newfound calculator knowledge.

Students at Site B had experience performing the basic operations of addition,

subtraction, multiplication, and division with positive and negative numbers from lessons at the

beginning of the school year. During a review in Week Eight, the class discussed how a number line could be used to help combine signed numbers. Since most students did well on this topic on the pre intervention assessment, this lesson was just a quick refresher. Students practiced a few problems at the board to demonstrate mastery of the topic.

In Week Nine, students were engaged in a PowerPoint presentation based on the Key Train software on the mechanics of multiplying and dividing fractions. This presentation highlighted key information that students need to know about multiplying and dividing fractions and offered several opportunities for independent practice. The teacher researcher also highlighted how to enter fractions into the TI-30XIIS calculator correctly so students could check their work using this technology tool. Students practiced simplifying answers as well by hand and on the calculator. They completed a problem packet to practice the skills they learned.

In Week Ten, the students were engaged in a PowerPoint presentation based on the Key Train software on adding and subtracting fractions. This presentation highlighted key information that students need to know about adding and subtracting fractions and offered several opportunities for independent practice. The teacher researcher also highlighted how to enter fractions into the TI-30XIIS calculator correctly so students could check their work using this technology tool. The class practiced simplifying answers as well by hand and on the calculator.

During Week Eleven of the intervention, students completed a review in class based on the topics covered up to this point. They were allowed to work in pairs, and could ask the teacher researcher questions if they could not figure something out on their own. The reviews were corrected and any misunderstandings were discussed and clarified.

Students at Site B had the most trouble with word problems on their pre intervention test, so the teacher researcher focused on this area during Weeks Twelve and Thirteen. Students definitely had prior knowledge experiences with fractions and decimals from their work in the previous weeks, so the teacher researcher was able to build on this knowledge and help the students apply their skills. Students solved problems that were similar in nature to the ones on the pre intervention test. Some students had a bit of trouble determining what the question was asking, so the class had to spend some time carefully reading the questions and highlighting key information. Once students were able to understand the question, they were able to apply the skills they had acquired to correctly solve the problem. The teacher researcher chose to spend a little more time on the word problems involving percentages due to the fact that most of the students answered all of the percentage questions incorrectly on the pre intervention test.

In Week Fourteen, the teacher researcher at Site B created a review packet similar to the post intervention test. Using the Elmo, the students went through the packet in class. The teacher researcher presented some problems and students volunteered to come up to the Elmo and present problems for the class to see. Listening to students explain the problems gave the teacher researcher a clear assessment of their level understanding and enhanced the learning experience for students in the class.

Week Four-Fourteen at Site C

During Week Four through Fourteen students were re-taught basic math skills with an emphasis on number sense using computers and other technological devices. The teacher researcher at Site C reintroduced addition and subtraction with regrouping with the use of a computer software program called Heartsoft during Week Four through Seven. In Week Eight through Ten the teacher researcher re-taught multiplication and division by using a rap CD. The

teacher researcher also re-taught, reviewed and modeled place value, patterns, and comparing and ordering numbers in Week Eleven through Fourteen. The teacher researcher at Site C used a computer program called Quarter Mile to re-enforce the basic math skills previously mentioned. These interventions and lessons were conducted once a week at Site C.

Weeks Four - Fourteen at Site D

Beginning in Week Four and continuing through Week Fourteen, the students at Site D were asked to use the specified technologies to participate with the lessons that were presented. The technologies that were used were the computers, internet, overhead projector, and the radio. The computers and the internet were used to allow the students to practice skills that were taught throughout the week. The overhead projector was used to allow learners to observe manipulatives, or objects, to provide examples related to the weekly lessons. The radio was used to deliver an audio of how to multiply and divide. Lessons were presented in conjunction with the school's curriculum daily; technologies were implemented twice a week at Site D. Assignments that related to the lessons were given throughout the weeks at all of the sites. The goal was to assess whether the students understood the mathematical concepts that were taught throughout the intervention sessions. The lessons that were taught and modeled at Site D were: ordering numbers, greater than, less than, or equal to, place value, addition, subtraction, multiplication, division, counting money and making change, and fractions. Various mathematical related websites were used in conjunction with teacher presented lessons at Site D. The teacher researcher at Site D explained the topics and objectives of the math intervention sessions prior to presenting the lessons. Following the brief introductions, the teacher researcher presented and modeled the lessons by providing the steps needed to accurately discover the

correct answers. Then, the pupils actively participated, asked questions, and worked collaboratively using the specified technology. After the intervention, the class discussed in detail what was learned.

<u>Week Fifteen: Sites A, B, C, and D</u>

The survey students completed at the beginning of the action research project was distributed again, and students used class time to re-evaluate their responses (Appendix H and Appendix I). The surveys were submitted to the teachers at Sites A, B, C, and D and the responses were tallied. Teachers made special note of the students who returned their permission slips to be sure to report only approved data. Site A distributed a total of 18 surveys, Site B distributed a total of 24 surveys, Site C distributed a total of 10 surveys, and Site D distributed a total of 25 surveys. All of the surveys were completed. Once the surveys were returned, the teacher researchers compiled the data.

<u>Week Sixteen: Sites A, B, C, and D</u>

The post intervention test was distributed to students in class (Appendix J and Appendix K). They had an entire class period to complete the exam, and calculators were allowed. Again, all students in the classes at the sites took the post intervention test, but data was only recorded for those who had returned a permission slip at the beginning of the project. Site A distributed a total of 18 exams, site B distributed a total of 24 exams, site C distributed a total of 10 exams, and site D distributed a total of 25 exams.

<div align="center">Presentation and Analysis of Results</div>

As can be seen in Figure 3, most of the fourth and fifth grade students improved their understandings of basic mathematical concepts as a result of the intervention. Approximately, 74% of the students scored a 70% or higher. The remainder of the students scored in the 0-69%

range on the mathematic post intervention test. The results from the post intervention

mathematics test seem to support the teacher researchers' premise that the targeted fourth and

fifth grade students could enhance basic math skills by implementing the intervention.
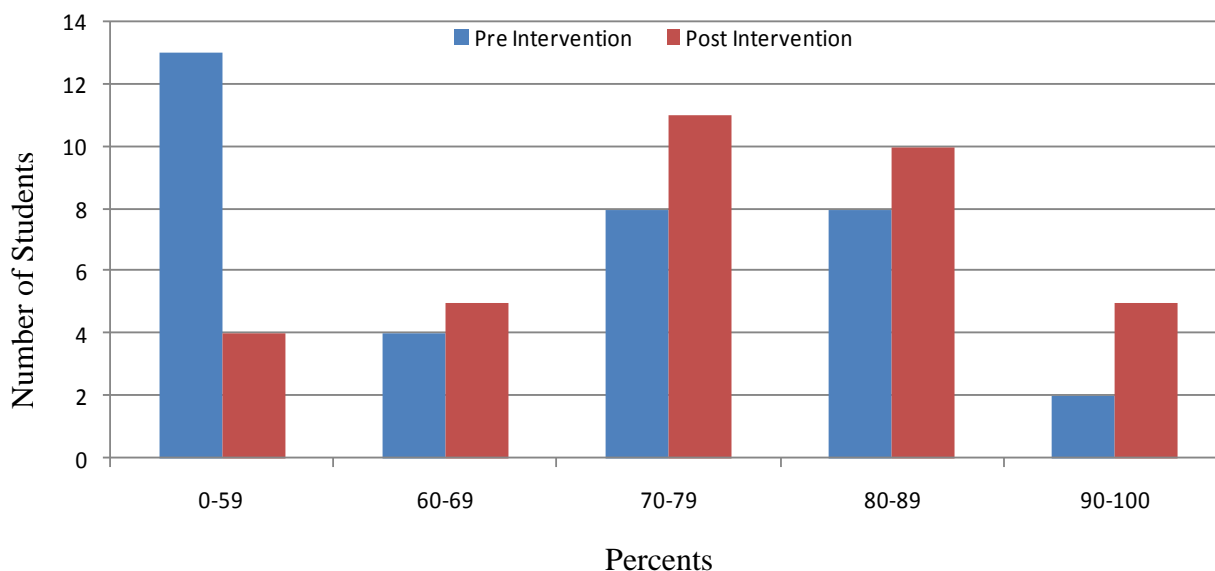
Figure 3. Results of 4th and 5th grade students' mathematics pre and post intervention test at Site
C and Site D

The sixth and ninth graders at Sites A and B showed improvements in their test scores as

a result of the intervention. As indicated by the results displayed in Figure 4, nearly 82% of the

students tested after the intervention scored a 70% or higher compared to the pre intervention

results of less than 10%. Less than 10% of the students who took the post intervention test scored

59% or lower compared to over 50% of the student who took the pre intervention test.
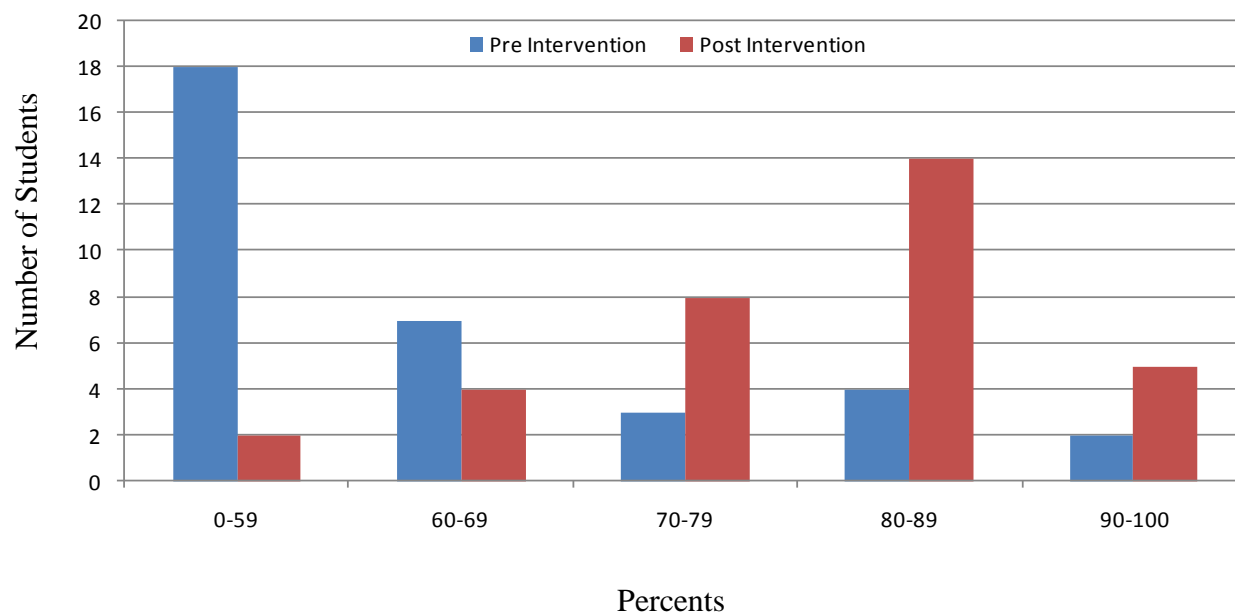
Figure 4. Results of 6th and 9th grade students' mathematics pre and post intervention test at Site A and Site B

Table 5 provides the results of the pre and post intervention student survey at Site C and Site D. The results of the post intervention survey indicated no change in responses in comparison to the pre intervention survey. Questions A, B, C, E, one, two and four had the same percentages as the pre intervention results. However, there was an increase in the student's ability to solve ordering problems. At the pre intervention stage only 50% of the students felt they could solve the problem. After, the intervention 95% of the students felt that they could solve the ordering problem. The table also shows that there was a noticeable change in the student's ability to solve math problems in their head. After the intervention, there was a decrease in student's abilities. The percentages went from 69% to 50%. Overall, students demonstrated little growth in their mathematic thought patterns.

Table 5

Responses to Pre and Post Intervention Student Survey (Grades 4 and 5) During the 2009 – 2010

School Year

I can solve the following problems:	Always		Most of the Time		Some-times		Never	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
A. 90 + 20=	29	26	2	4	3	4	1	1
B. 4,002 – 3,987=	14	10	10	10	9	10	2	5
C. 6 X 7=	21	23	8	6	5	4	1	2
D. Order the following decimals. 0.54, 0.95, 0.10, 0.56, 1.30	11	16	5	12	9	2	10	5
E. Compare the fractions using <, >, or =. ½ ⅜	25	17	4	6	4	9	2	3
1. I use a number line or ruler to solve math problems.	5	3	7	3	21	21	2	8
2. I use my fingers to solve math problems.	5	9	8	6	11	16	11	4
3. I solve math problems in my head.	15	4	9	15	9	12	2	4
4. I use a calculator correctly.	21	24	4	3	7	6	3	2

Note. n = 35

Table 6 provides the results of the pre and post intervention student surveys at Sites A

and B. The results indicate that after the intervention most students at both sites reported to be

more confident about solving basic math problems. Almost 95% of the students reported that

they could list decimals and fractions in increasing order at least some of the times. Over 60% of

the students reported that they could write decimals and percents as fractions, fractions and

percents as decimals and fractions and decimals as percents all of the time compared to less than

30% of those surveyed before the intervention was implemented. The results regarding ordering

positive and negative numbers in increasing order showed some change, about 17%. About 74%

of the students who took the post intervention survey reported they were able to solve

expressions most of the time compared to the 64% reported on the pre intervention survey. Over

80% of the students indicated that they could solve the word problems given most of the time.

Table 6

Responses to Pre Intervention Student Survey (Grades 6 & 9) During the 2009-2010 School Year

I Can Solve Problems Like These:	Always		Most of the Time		Sometimes		Never	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
List the numbers in increasing order: 1.345, 0.345, 1.34	15	13	10	20	8	1	2	1
List the numbers in increasing order: $\frac{3}{5}, \frac{1}{5}, \frac{4}{5}$	11	12	8	17	12	5	4	1
List the numbers in increasing order: $\frac{1}{3}, \frac{3}{4}, \frac{5}{6}$	9	14	10	12	11	9	4	0
Write ¾ as a decimal.	11	31	12	3	9	1	2	0
Write 0.25 as a fraction.	14	17	9	14	10	3	2	0
Write 1/5 as a percentage.	9	14	7	14	13	7	6	0
Write 40% as a fraction.	5	23	9	7	13	4	7	1
Write 85% as a decimal.	15	14	11	19	6	2	3	0
Write 1.35 as a percent.	4	10	7	10	16	14	8	1
List the numbers in increasing order: 5, -8, 8, 0, -3, 4	21	23	3	7	4	2	7	3
Simplify: 3 – 5 + (-2)	17	15	7	14	7	5	3	1
Simplify: $\frac{2}{3} \div \frac{4}{5}$	9	12	12	11	12	11	2	1
You answer 73 out of 100 questions on a test correctly. What percent of the questions did you get right?	13	27	10	5	9	3	3	0
Two left over pieces of string measure $3\frac{1}{3}$ feet and $2\frac{2}{3}$ feet. What is the total length of the strings together?	14	19	10	11	5	5	6	0
A hamburger costs $3.25. How much would it cost to buy 5 hamburgers?	26	18	3	11	6	2	0	0
A recipe calls for 1.5 cups of sugar to make 25 cookies. How many cups of sugar would you need to make 50 cookies?	15	11	10	18	8	3	2	0

Note: Pre: n = 35. Not all students responded to each question. Post: n = 35. Not all students responded to each question.

Table 7

Continued Responses to Pre Intervention Student Survey (Grades 6 and 9) During the 2009-2010

School Year

Questions	Always		Most of the Time		Sometimes		Never	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Do you use a number line or ruler to solve math problems?	2	3	5	2	24	2	4	18
Do you use your fingers to solve math problems?	6	4	8	9	16	15	5	3
Can you solve math problems in your head?	9	6	16	13	10	10	0	2
Can you use a calculator correctly?	28	25	5	2	2	0	0	0
Are you comfortable solving addition, subtraction, multiplication, and division problems without the use of a calculator?	8	8	16	16	7	8	4	3

Note. Pre: n = 35. Post: n = 35: Note: Not all students responded to each question.

Table 7 provides the results of what students reported concerning their problem solving

strategies on the pre and post intervention student surveys at Sites A and B. As the results in

Table 7 indicate, fewer students reported they use a ruler or number line to solve math problems.

Over half reported never in the post intervention survey while almost 70% of the students

reported that they did use a ruler or number line to solve math problems. There were little to no

changes in the results about students using their fingers to solve math problems. Eighty percent

of the students reported they used their fingers at least some of the time while solving math

problems in both surveys. Students indicated they were less confident to solve problems in their

heads after the intervention compared to their responses before the intervention. No students reported that they never could solve math problems in their head in the pre intervention survey, while 2 reported never in the post intervention survey. More students reported that they could use a calculator correctly in the pre intervention survey than reported in the post intervention survey. The students reported similar results in both surveys about their being comfortable solving addition, subtraction, multiplication, and division problems without the use of a calculator. One less student reported never in the post intervention survey.

Conclusions and Recommendations

In an effort to increase retention of basic math skills, the teacher researchers chose to implement technology to re-teach a variety of skills. Based on an analysis of the data, the results indicated an increase in test scores from the pre intervention test to the post intervention test for the targeted fourth, fifth, sixth, and nine grades. The targeted fourth and fifth grade students improved from 51% to 74% of students receiving a 70% or better after the intervention. The targeted sixth and ninth grade students also made considerable gains after participating in the intervention activities. At Sites A and B, 26% of students received a grade of 70% or better on the pre intervention test, while 82% of students achieved this standard on the post intervention test. The teacher researchers understood that some of this increase could occur after the natural maturation and development of the students, but also believed that re-teaching with technology was a key factor for the increase of students showing mastery of basic skill problems.

The teacher researchers encouraged using a variety of methods to solve problems and continually provided tools and aids allowing students to easily access the material according to their individual learning styles and preferences. The teacher researchers helped students understand how to utilize technology to aide in the problem solving process.

Based on the results of this research project, the teacher researchers believe that it is important to help students work on their basic math skills at every grade level. Often, teachers assume that students know and understand the basic facts, but this is sometimes not the case. They discovered that all students could benefit from reinforcement and re-teaching of essential topics, including but not limited to fractions, percentages, and decimals. Students at Sites A, B, C, and D were grateful for the extra practice and made discoveries through the use of manipulatives and technological aides that strengthened their understanding of mathematics. Students were able to take the skills they practiced during the intervention activities and apply them to new topics covered in the various grade level curriculums. This lead the researches to truly see the value in the time they spent covering these topics since it gave the students the skills they needed to be successful in their current courses.

According to the post intervention student survey, the students' attitude towards math changed. After the intervention, the students felt more comfortable and confident in their math abilities. The re-teaching, modeling and technological aids enhanced the student's abilities, which increased their confidence.

The teacher researchers recommend that all mathematics teachers, regardless of grade level, take some time to reinforce basic math skills. Teachers surveyed at the beginning of the research project indicated that students' lack of skills were a definite problem and barrier to success in the classroom. Teachers must take responsibility for helping their students acquire the skills they need in order to be successful. Taking a few minutes each week to talk about concepts that students are struggling with helps to alleviate stress and frustration on the part of the teacher and allows students to attack higher level problems without being held back by questions on how to deal with a component of the solving process. To reinforce and explore these topics, the

teacher researchers recommend using technology such as software programs, PowerPoint, Elmos, Smart Boards, projectors, calculators, internet websites, You Tube videos, DVDs, and CDs. Introducing old topics in new and exciting ways hooks students' interest and allows them to see things in a new light. Teachers should strive to present mathematics concepts in a variety of settings and use a diverse collection of teaching methods in order to reach the widest possible range of students. The teacher researchers believe that many students are coming to our classrooms with deficiencies in their basic math skills, however with the use of technology and re-teaching, today's students are capable of improving their math abilities. The researchers will share the results of the interventions with others in their respective buildings, and are hopeful that this dissemination of information will make a difference in students' mastery of mathematics far beyond their own classroom doors.

<div align="center">Reflections</div>

As the pre intervention tests and surveys indicated, the students at Sites A, B, C, and D lacked necessary, basic math skills. The researchers were thus prepared with the appropriate intervention tools and methods to meet the students' needs. There were few, if any, surprises during the intervention process because the researchers were well aware of their students' math deficiencies. One surprise worth mentioning however was the students' inability to correctly use calculators. This was particularly surprising for the researcher working with the ninth grade students. When the researchers considered and reflected upon this deficiency, they reasoned that without a basic understanding of necessary math skills, a calculator is useless. The familiar adage, "garbage in, garbage out", proved to be true. As students' basic math understanding increased through the intervention, their calculator use became more accurate.

During the intervention process, the researchers modeled the skills they wanted their students to eventually master. They also offered support as the students practiced the modeled skills. Through questioning and discussion the researchers were able to help their students make connections between the skills and the technology used. The researchers observed that through this process the students began to develop their abstract thinking. For example, the students were able to identify when to use appropriate operations with a given problem. It would be interesting to continue the study of integrating technology to improve abstract mathematical thinking.

The researchers chose to collaborate for this action research project to address a common problem, low proficiency in basic math skills. The time spent together researching, planning and reflecting helped to establish a good working relationship among the researchers. Each researcher drew upon the strengths of the others which resulted in success. The students at each site were able to learn in a meaningful way which helped to greatly increase their scores, and most of all their understanding. These results were achieved because each researcher was dedicated to and concerned about the success of their students.

This action research experience allowed the researchers to discover which strategies and technology integration benefitted their students. Instead of depending solely on the research and practice of others, this process provided an opportunity where they became their own experts, leading their own research and reporting their findings to improve their teaching practice to increase student learning. Their findings will do more than improve the researchers' teaching practices, however. By making their action research available for others, teachers who have noted the same problems regarding students' lack of basic math skills will be able to refer to this research to improve their practice as well. Upon reflection, the researchers feel their research is valid and can be added to the ongoing professional discussion to improve best practices.

REFERENCE LIST

ACT scores rise, but many not ready for college. (2006, October). *American School Board Journal*, Retrieved July 8, 2009, from Professional Development Collection database.

Adami – Bunyard, E., Gummow, M., & Milazzo – Licklider, N. (1998). Improving primary student motivation and achievement in mathematics. (Ch. 3). Retrieved Jan. 7, 2010, from http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/15/c5/4a.pdf

America's Choice. (2009). Great solutions for top student performance: Mathematics (paragraph 1). Retrieved July 7, 2009, from http://www.americaschoice.org/mathematics

Ashby, B. (2009). Exploring children's attitudes towards mathematics. *Proceedings of the British Society for Research into Learning Mathematics,* 29(1), 7-12. Retrieved January 6, 2010 from ERIC database.

Baroody, A., Bajwa, N., & Eiland, M. (2009). Why can't Johnny remember the basic facts? *Developmental Disabilities Research Reviews*, *15*(1), 69-79. Retrieved January 6, 2010, from ERIC database.

Battle, T. (2007). Infusing math manipulatives: The key to an increase in academic achievement in the mathematics classroom. Final research proposal. Online Submission, Retrieved January 6, 2010, from ERIC database.

Bednar, J., Coughlin, J., Evans, E., & Sievers, T. (2002). Improving student motivation and achievement in mathematics through teaching to the multiple intelligences. (Ch. 3). Retrieved Jan. 7, 2010, from http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1a/31/35.pdf

Benbow, R. (1993). Tracing mathematical beliefs of preservice teachers through integrated content-methods courses. Retrieved January 6, 2010, from ERIC database.

Bernero, J. (2000). Motivating students in math using cooperative learning. Retrieved January 6, 2010, from ERIC database.

Bowes, K. (2010). Technology: Its Place in math Standards and Getting It There. Retrieved January 25, 2010, from http://www-users.math.umd.edu/~dac/650/bowespaper.html#National Council of Teachers of

Chard, D., Baker, S., Clarke, B., Jungjohann, K., Davis, K., & Smolkowski, K. (2008, December 1). Preventing early mathematics difficulties: The feasibility of a rigorous kindergarten mathematics curriculum. *Learning Disability Quarterly*, *31*(1), 11-20. (ERIC Document Reproduction Service No. EJ786224) Retrieved July 7, 2009, from ERIC database.

City-Data.com. (2009a). Riverdale, IL. Retrieved July 6, 2009, from http://www.city-data.com/city/Riverdale-Illinios.html.

City-Data.com. (2009b). Oak Lawn, IL. Retrieved July 6, 2009, from http://www.city-data.com/city/Oak- Lawn-Illinios.html

City-Data.com. (2009c). Dolton, IL. Retrieved July 6, 2009, from http://www.city-data.com/city/Dolton-Illinois.html.

City-Data.com. (2009d). Calumet City, IL. Retrieved July 6, 2009, from http://www.city-data.com/city/Calumet-City-Illinois.html

Faulkner, V. (2009). The components of number sense: An instructional model for teachers. *Teaching Exceptional Children*, *41*(5), 24-30. Retrieved January 6, 2010, from ERIC database.

Hasselbring, T.S. Lott, A.C., & Zydney, J.M. (2006). *Technology-supported math instruction for students with disabilities: Two decades of research and development*. Retrieved July 01 2009, from LD Online Web Site: http://www.ldonline.org/article/6291

Jordan, N. (2007). The need for number sense. *Educational Leadership*, *65*(2), 63-66. Retrieved January 6, 2010, from ERIC database.

Jordan, N., Kaplan, D., Locuniak, M., & Ramineni, C. (2007). Predicting first-grade math achievement from developmental number sense trajectories. *Learning Disabilities Research & Practice*, *22*(1), 36-46. Retrieved January 6, 2010, from ERIC database.

Mazzocco, M., & Thompson, R. (2005). Kindergarten predictors of math learning disability. *Learning Disabilities Research & Practice (Blackwell Publishing Limited)*, *20*(3), 142-155. Retrieved January 16, 2010, from Education Research Complete database.

Nelson, B., & Sassi, A. (2007). What math teachers need most. *Education Digest: Essential Readings Condensed for Quick Review*, 72(6), 54-56. Retrieved January 6, 2010, from ERIC database.

Olson, K.A. (1998). Improving student attitudes and performance in mathematics. (Ch. 2). Retrieved Jan. 7, 2010, from ERIC database.

Poofenberger, T. & Norton, D. (1959). Factors in the formation of attitudes toward mathematics. *Journal of Educational Research,* 52(5). 171-176. Retrieved January 7, 2010 from ERIC database.

Scott, L. & Geotz, E. (1978). Memorization tasks: Rote vs. "fun" learning. Retrieved January 7, 2010 from ERIC database.

Simpson, J. (1998). Getting unstuck in maths: Building mathematical memory with rapid reconstruction. Retrieved on January 6, 2010 from ERIC database.

Spellings, M. (2002). Helping your child learn mathematics with activities for children in preschool through grade 5. U.S. Department of Education Office of Communications and Outreach. Retrieved on Jan. 7, 2010 from http://www.ed.gov/parents/academic/help/hyc.html

State School Report Card. (2008a). School District 148. Riverdale, IL. Washington School. Illinois Board of Education. Springfield, IL. Retrieved on July 6, 2009, from www.isbe.net.

State School Report Card. (2008b). School District 218. Oak Lawn, IL. H L Richards High School. Illinois Board of Education. Springfield, IL. Retrieved on July 6, 2009, from www.chsd218.org

State School Report Card. (2008c). School District 149. Calumet City, IL. Berger Vandenberg School. Illinois Board of Education. Springfield, IL. Retrieved on July 6, 2009 from www.isbe.net.

State School Report Card. (2008d). School District 149. Calumet City, IL. Carol Moseley Braun School. Illinois Board of Education. Springfield, IL. Retrieved on July 6, 2009, from www.isbe.net.

U.S. Department of Education. (2007). The nation's report card mathematics 2007: National assessment of educational progress at grades 4 and 8. Retrieved on July 7, 2009, from http://nces.ed.gov/nationsreportcard/pdf/main2007/2007494.pdf.

Village Website. (2009) Oak Lawn, IL. Retrieved July 6, 2009, from http://www.oaklawn-il.gov/Home.aspx.

Waite-Stupiansky, S., & Stupiansky, N. (1998). Math in action: Hands-on, minds-on math. *Instructor*, 108(3), 85. Retrieved January 6, 2010, from ERIC database.

Welsh, P. (2008). Math meltdown. *USA Today*, Retrieved July 7, 2009, from Academic Search Complete database.

Western, M. (2003). Math Instruction Can Be Enhanced by the Techie Teacher. Retrieved January 25, 2010, from http://www.edzone.net/~mwestern/elemath.html

Wikipedia.org. (2009). Dolton, IL. Retrieved July 6, 2009, from http://en.wikipedia.org/wiki/Dolton,_Illinois.

APPENDICES

Appendix A

SAINT•XAVIER•UNIVERSITY
Institutional Review Board

Consent to Participate in a Research Study
Improving Basic Math Skills Using Technology

Dear Parent or Guardian,

I am currently enrolled in a master's degree program at Saint Xavier University. This program requires me to design and implement a project on an issue that directly affects my instruction. I have chosen to focus on improving basic math skills.

The purpose of this project is to improve basic math skills using technology. It will help your student develop number sense to improve his/her math skills.

I will be conducting my project from January, 2010 through May, 2010. The activities related to the project will take place during regular instructional delivery. All students will participate in the activities. The nature of the study is to improve basic math skills using technology. This study will be conducted over a 5 month period. In the beginning of the study, students will take a survey and pretest to determine their perceptions about math and to assess their mathematical abilities. Students will receive instruction on basic math skills with an emphasis on number sense. Technology will be implemented during this instruction. The gathering of information for my project during these activities offers no risks of any kind to your child.

Your permission allows me to include your student in the reporting of information for my project. All information gathered will be kept completely confidential, and information included in the project report will be grouped so that no individual can be identified. All data will be stored in a locked desk drawer or cabinet that is accessible only to the researcher(s). The report will be used to share what I have learned as a result of this project with other professionals in the field of education.

Participation in this study is completely voluntary. You may choose to withdraw from the study at any time. If you choose not to participate, information gathered about your student will not be included in the report.

If you have any questions or would like further information about my project, please contact me at (708) 868-9470, extension 352.

If you agree to have your student participate in the project, please sign the attached statement and return it to me by January 8, 2010 I will be happy to provide you with a copy of the statement if you wish.

Sincerely,

Ms. Hudson

Appendix B

SAINT·XAVIER·UNIVERSITY
Institutional Review Board

Consent to Participate in a Research Study
Improving Basic Math Skills Using Technology

I, _____, the parent/legal guardian of the minor named below, acknowledge that the researcher has explained to me the purpose of this research, identified any risks involved, and offered to answer any questions I may have about the nature of my child's participation. I freely and voluntarily consent to my child's participation in this project. I understand all information gathered during this project will be completely confidential and will remain anonymous. I also understand that I may keep a copy of this consent form for my own information.

Name of Minor Participant:_____

_____   _____
Signature of Parent/Legal Guardian   Date

Student Assent

I understand why this research is being done. I understand how it may help me or other children and any discomforts it may cause me. I have been told that I don't have to give an answer if I do not want to and that I can stop the interview at any time for any reason. All the questions I had about this study have been answered. I would like to take part in this study.

Name of Minor Participant:_____

_____   _____
Signature of Participant   Date

3700 West 103rd Street • Chicago, Illinois • (773) 298-3000 • FAX (773) 779-9061

Appendix C

Mathematics Pre Intervention Test (Grades 4 and 5)

Directions: Find the sum or difference.

1)   19
     + 20

2) 1,604
    − 243

3)   0.61
     + 0.84

4) 1,004
    − 909

5) $8.56
    - $7.69

6) $0.43
     + $9.99

7)   347
     + 415

8)   623
     − 285

9)   12
     + 57

10)   402
     − 339

11)   623
     + 285

Appendix C Continued

Directions: Find the product or the quotient.

12) 4 x 0 = _____
13) 36 ÷ 6 = _____
14) 9 x 9 = _____
15) 10 x 10 = _____
16) 49 ÷ 7 = _____
17) 121 ÷ 11 = _____
18) 6 x 3 = _____
19) 49 ÷ 7 = _____
20) 9 x 8 = _____
21) 40 ÷ 8 = _____
22) 6 x 7 = _____
23) 60 ÷ 5 = _____
24) 50 x 4 = _____
25) 8 x 8 = _____

Directions: Use <, >, or = to compare the numbers.
26) $4.62 _____ $46.20
27) $3.45 _____ $3.54
28) 8,214 _____ 8,235
29) 6,626 _____ 6,662

Directions: Solve the equation to find the number value of the variable.
30) 14 - n = 11   n = _____
31) 21 – x = 14   x = _____
32) 2 + m = 9   m = _____

Directions: Complete the pattern.
33) 1, 3, 2, 4, 3, _____, _____, _____
34) 4, 8, 12, _____, 20, _____, _____
35) 3, 6, 9, 12, _____, 18, _____, _____

Directions: Order the numbers from least to greatest. Write the correct order on the blank lines provided.
36) 621; 421; 301; 621.5; 251; 801   _____, _____, _____, _____, _____
37) 159; 1,059; 1,195; 195   _____, _____, _____, _____, _____

Directions: Read the below statements and write the correct response on the line provided.
38) Write 643 in expanded form. _____
39) Write the word name for 1,001.

_____
_____
40) Write 1,000 + 900 + 70 + 8 in standard form. _____

Appendix D

Mathematics Pre Intervention Test (Grades 6 and 9)

You may **not** use a calculator to complete this exam. Try your best! Good Luck!

List the decimals from least to greatest.

1. 0.389, 0.38, 0.26	**2.** 1.243, 0.243, 1.24

List the fractions from least to greatest.

3. $\dfrac{7}{17}$, $\dfrac{4}{17}$, $\dfrac{12}{17}$	**4.** $\dfrac{5}{6}$, $\dfrac{1}{3}$, $\dfrac{3}{4}$	**5.** $3\dfrac{1}{5}$, $\dfrac{12}{15}$, $\dfrac{20}{15}$

Compare the fractions using an inequality symbol. Write <, >, or = for each.

6. $\dfrac{5}{7}$ ☐ $\dfrac{3}{7}$	**7.** $\dfrac{7}{20}$ ☐ $\dfrac{3}{4}$	**8.** $2\dfrac{2}{5}$ ☐ $\dfrac{12}{5}$

Fill in the missing boxes with the equivalent form of the number.

	Fraction	Decimal	Percent
9.	$\dfrac{1}{4}$		
10.			50%
11.		.75	
12.	$\dfrac{3}{10}$		

List the numbers from least to greatest.

13. 2, -3, -8, 1, -2	**14.** -1.5, $\frac{1}{3}$, -3, 2.5, 0, -1

Appendix D Continued

Compare the numbers using an inequality symbol. Write <, >, or = for each.

15.	16.	17.
$\boxed{}$ **-7**	-1 $\boxed{}$ -3	$-\frac{1}{3}\boxed{}$ $-\frac{1}{4}$

Perform the indicated operation.

18. -12 + 7	19. -1 - 10	20. –2(-5)(7)
21. $-24 \div 4$	22. $\frac{7}{8} - \frac{3}{8}$	23. $\frac{3}{4} + \frac{2}{3}$
24. $2\frac{1}{5} + 4\frac{2}{5}$	25. $\frac{4}{7} \cdot \frac{1}{3}$	26. $3\frac{1}{4} \cdot 2\frac{3}{5}$
27. $\left(-\frac{1}{3}\right) \div \left(-\frac{2}{9}\right)$	28. $2\frac{2}{5} \div 1\frac{1}{3}$	29. $13.7 + 3.2$
30. 5(6.35)		

Solve the following word problems.

31. The lumber yard sells you two boards, measuring $12\frac{1}{2}$ feet and $4\frac{1}{4}$ feet. What is the total length of the two boards?

Appendix D Continued

32. A sales associate at a nearby clothing store earns $10 per hour. If the associate works $4\frac{1}{5}$ hours on Monday, $5\frac{2}{5}$ on Wednesday, and $5\frac{2}{5}$ hours on Friday, how much money will the associate earn that week?

33. A recipe for marinara sauce calls for $1\frac{3}{4}$ teaspoons of oregano, $1\frac{1}{2}$ teaspoons of parsley, $1\frac{1}{3}$ teaspoons of pepper, and $1\frac{1}{4}$ teaspoons of basil. A cook will need the least amount of which herb?

34. Kim's scores in the diving competition were 7.2, 6.975, 8.0, and 6.96. What is her total score?

35. A yard of fabric costs $5.00. How much will you pay if you need to buy 12.4 yards?

36. Your weekly paycheck is $485.12. However, money is deducted for various reasons. How much do you take home each week after deductions are made for federal income tax of $82.13, state tax of $9.74, social security and Medicare tax of $31.75, and retirement plan deduction of $41.50?

37. 12 out of 48 shirts are old. What percent of the shirts are old?

38.   The electronics store where you work is having a 10% off sale. A customer asks you the sale price for an item that is normally $30. What should you tell them, excluding tax?

39. The machine you are operating produces 50 items per day. On Monday, you produced 5 defective items. What percent of your items were defective?

40. You are having 20 guests over for dinner. If a cake recipe calls for 3 sticks of butter and will serve 5 people, how many sticks of butter will you need to make enough cake for your 20 guests?

Appendix E

Student Pre Intervention Survey (Grades 4 and 5)

Directions: Read the statements below, and then look at the sample problems. Circle the

response that best fits your math ability.

I can solve the following problems.

A. $90 + 20=$ Always   Most of the Time   Sometimes   Never

B. $4,002 - 3,987=$ Always   Most of the Time   Sometimes   Never

C. $6 \times 7=$ Always   Most of the Time   Sometimes   Never

D.   Order the following decimals. 0.54, 0.95, 0.10, 0.56, 1.30

                              Always   Most of the Time   Sometimes   Never

E. Compare the fractions using $<$, $>$, or $=$.

   ½◯ ⅜   Always   Most of the Time   Sometimes   Never

Directions: Read the statements below. Circle the response that best fits your math ability.

1. I use a number line or ruler to solve math problems.

      Always   Most of the Time   Sometimes   Never

2. I use my fingers to solve math problems.

      Always   Most of the Time   Sometimes   Never

3. I solve math problems in my head.

      Always   Most of the Time   Sometimes   Never

4. I use a calculator correctly.

      Always   Most of the Time   Sometimes   Never

<u>Appendix F</u>

Student Pre Intervention Survey (Grades 6 and 9)

Rate yourself on your current ability to solve the following problems without a calculator. Circle the response that best fits your comfort level with the given problem. You do not need to solve the problems.

I can solve problems like these:

List the numbers in increasing order: 1.345, 0.345, 1.34	Always	Most of the Time	Sometimes	Never
List the numbers in increasing order: $\dfrac{3}{5}, \dfrac{1}{5}, \dfrac{4}{5}$	Always	Most of the Time	Sometimes	Never
List the numbers in increasing order: $\dfrac{1}{3}, \dfrac{3}{4}, \dfrac{5}{6}$	Always	Most of the Time	Sometimes	Never
Write $\dfrac{3}{4}$ as a decimal.	Always	Most of the Time	Sometimes	Never
Write 0.25 as a fraction.	Always	Most of the Time	Sometimes	Never
Write $\dfrac{1}{5}$ as a percentage.	Always	Most of the Time	Sometimes	Never
Write 40% as a fraction.	Always	Most of the Time	Sometimes	Never
Write 85% as a decimal.	Always	Most of the Time	Sometimes	Never
Write 1.35 as a percent.	Always	Most of the Time	Sometimes	Never
List the numbers in increasing order: 5, -8, 8, 0, -3, 4	Always	Most of the Time	Sometimes	Never
Simplify: $3 – 5 + (-2)$	Always	Most of the Time	Sometimes	Never
Simplify: $\dfrac{2}{3} \div \dfrac{4}{5}$	Always	Most of the Time	Sometimes	Never
You answer 73 out of 100 questions on a test correctly. What percent of the questions did you get right?	Always	Most of the Time	Sometimes	Never
Two left over pieces of string measure $3\dfrac{1}{3}$ feet and $2\dfrac{2}{3}$ feet. What is the total length of the strings together?	Always	Most of the Time	Sometimes	Never
A hamburger costs $3.25. How much would it cost to buy 5 hamburgers?	Always	Most of the Time	Sometimes	Never
A recipe calls for 1.5 cups of sugar to make 25 cookies. How many cups of sugar would you need to make 50 cookies?	Always	Most of the Time	Sometimes	Never

Student Pre Intervention Survey Continued (Grades 6 and 9)

<u>Read the questions below. Circle the response that best fits you.</u>

1. Do you use a number line or ruler to solve math problems?

Always   Most of the Time   Sometimes   Never

2. Do you use your fingers to solve math problems?

Always   Most of the Time   Sometimes   Never

3. Can you solve math problems in your head?

Always   Most of the Time   Sometimes   Never

4. Can you use a calculator correctly?

Always   Most of the Time   Sometimes   Never

5. Are you comfortable solving addition, subtraction, multiplication and division problems without the use of a calculator?

Always   Most of the Time   Sometimes   Never

Appendix G

Pre Intervention Teacher Survey

Directions: Read the statements below. Circle the response that best fits your students' math

abilities.

1. **My students struggle to recall basic math facts.**

   Strongly Agree   Agree   Disagree   Strongly Disagree

2. **My students use their fingers to count when solving basic math problems.**

   Strongly Agree   Agree   Disagree   Strongly Disagree

3. **My students have the ability to apply mathematical concepts to real world**

   problems.

   Strongly Agree   Agree   Disagree   Strongly Disagree

4. **Lack of basic math skills interferes with my students' progress.**

   Strongly Agree   Agree   Disagree   Strongly Disagree

5. **My students successfully solve problems with the use of a calculator.**

   Strongly Agree   Agree   Disagree   Strongly Disagree

6. **I have to re-teach basic skills due to a lack of retention.**

   Strongly Agree   Agree   Disagree   Strongly Disagree

7. **My students understand relationships between numbers.**

   Strongly Agree   Agree   Disagree   Strongly Disagree

8. **There is an increase in students with a lack of basic math skills.**

   Strongly Agree   Agree   Disagree   Strongly Disagree

Thank you!

Appendix H

Student Post Intervention Survey (Grades 4 and 5)

Directions: Read the statements below, and then look at the sample problems. Circle the

response that best fits your math ability.

I can solve the following problems.

E.	90 + 20=	Always	Most of the Time	Sometimes	Never
F.	4,002 – 3,987=	Always	Most of the Time	Sometimes	Never
G.	6 X 7=	Always	Most of the Time	Sometimes	Never

H. Order the following decimals. 0.54, 0.95, 0.10, 0.56, 1.30

Always   Most of the Time   Sometimes   Never

E. Compare the fractions using <, >, or =.

½ ◯ ⅜   Always   Most of the Time   Sometimes   Never

Directions: Read the statements below. Circle the response that best fits your math ability.

5. I use a number line or ruler to solve math problems.

Always   Most of the Time   Sometimes   Never

6. I use my fingers to solve math problems.

Always   Most of the Time   Sometimes   Never

7. I solve math problems in my head.

Always   Most of the Time   Sometimes   Never

8. I use a calculator correctly.

Always   Most of the Time   Sometimes   Never

Appendix I

Student Post Intervention Survey (Grades 6 and 9)

Rate yourself on your current ability to solve the following problems without a calculator. Circle the response that best fits your comfort level with the given problem. You do not need to solve the problems.

I can solve problems like these:

List the numbers in increasing order: 1.345, 0.345, 1.34	Always	Most of the Time	Sometimes	Never
List the numbers in increasing order: $\frac{3}{5}, \frac{1}{5}, \frac{4}{5}$	Always	Most of the Time	Sometimes	Never
List the numbers in increasing order: $\frac{1}{3}, \frac{3}{4}, \frac{5}{6}$	Always	Most of the Time	Sometimes	Never
Write $\frac{3}{4}$ as a decimal.	Always	Most of the Time	Sometimes	Never
Write 0.25 as a fraction.	Always	Most of the Time	Sometimes	Never
Write $\frac{1}{5}$ as a percentage.	Always	Most of the Time	Sometimes	Never
Write 40% as a fraction.	Always	Most of the Time	Sometimes	Never
Write 85% as a decimal.	Always	Most of the Time	Sometimes	Never
Write 1.35 as a percent.	Always	Most of the Time	Sometimes	Never
List the numbers in increasing order: 5, -8, 8, 0, -3, 4	Always	Most of the Time	Sometimes	Never
Simplify: 3 – 5 + (-2)	Always	Most of the Time	Sometimes	Never
Simplify: $\frac{2}{3} \div \frac{4}{5}$	Always	Most of the Time	Sometimes	Never
You answer 73 out of 100 questions on a test correctly. What percent of the questions did you get right?	Always	Most of the Time	Sometimes	Never
Two left over pieces of string measure $3\frac{1}{3}$ feet and $2\frac{2}{3}$ feet. What is the total length of the strings together?	Always	Most of the Time	Sometimes	Never
A hamburger costs $3.25. How much would it cost to buy 5 hamburgers?	Always	Most of the Time	Sometimes	Never
A recipe calls for 1.5 cups of sugar to make 25 cookies. How many cups of sugar would you need to make 50 cookies?	Always	Most of the Time	Sometimes	Never

Student Post Intervention Survey Continued (Grades 6 and 9)

<u>Read the questions below. Circle the response that best fits you.</u>

1. Do you use a number line or ruler to solve math problems?
Always   Most of the Time   Sometimes   Never

2. Do you use your fingers to solve math problems?
Always   Most of the Time   Sometimes   Never

3. Can you solve math problems in your head?
Always   Most of the Time   Sometimes   Never

4. Can you use a calculator correctly?
Always   Most of the Time   Sometimes   Never

5. Are you comfortable solving addition, subtraction, multiplication and division problems without the use of a calculator?

Always   Most of the Time   Sometimes   Never

<u>Appendix J</u>

Mathematics Post Intervention Test (Grades 4 and 5)

<u>Directions:</u> Find the sum or difference.

1)   19
    + 20

2) 1,604
    – 243

3)   0.61
    + 0.84

4) 1,004
    – 909

5) $8.56
   - $7.69

6) $0.43
    + $9.99

7)   347
    + 415

8)   623
    – 285

9)   12
    + 57

10) 402
    – 339

11) 623
    + 285

Appendix J Continued

Directions: Find the product or the quotient.

12) 4 x 0 = _____
13) 36 ÷ 6 = _____
14) 9 x 9 = _____
15) 10 x 10 = _____
16) 49 ÷ 7 = _____
17) 121 ÷ 11 = _____
18) 6 x 3 = _____
19) 49 ÷ 7 = _____
20) 9 x 8 = _____
21) 40 ÷ 8 = _____
22) 6 x 7 = _____
23) 60 ÷ 5 = _____
24) 50 x 4 = _____
25) 8 x 8 = _____

Directions: Use <, >, or = to compare the numbers.
26) $4.62 _____ $46.20
27) $3.45 _____ $3.54
28) 8,214 _____ 8,235
29) 6,626 _____ 6,662

Directions: Solve the equation to find the number value of the variable.
30) 14 - n = 11   n = _____
31) 21 – x = 14   x = _____
32) 2 + m = 9   m = _____

Directions: Complete the pattern.
33) 1, 3, 2, 4, 3, _____, _____, _____
34) 4, 8, 12, _____, 20, _____, _____
35) 3, 6, 9, 12, _____, 18, _____, _____

Directions: Order the numbers from least to greatest. Write the correct order on the blank lines provided.
36) 621; 421; 301; 621.5; 251; 801   _____, _____, _____, _____, _____
37) 159; 1,059; 1,195; 195   _____, _____, _____, _____, _____

Directions: Read the below statements and write the correct response on the line provided.
38) Write 643 in expanded form. _____
39) Write the word name for 1,001.

_____

_____

40) Write 1,000 + 900 + 70 + 8 in standard form. _____

<u>Appendix K</u>

Mathematics Post Intervention Test (Grades 6 and 9)

You may **not** use a calculator to complete this exam. Try your best! Good Luck!

List the decimals from least to greatest.

1. 0.389, 0.38, 0.26	**2.** 1.243, 0.243, 1.24

List the fractions from least to greatest.

3. $\dfrac{7}{17}, \dfrac{4}{17}, \dfrac{12}{17}$	**4.** $\dfrac{5}{6}, \dfrac{1}{3}, \dfrac{3}{4}$	**5.** $3\dfrac{1}{5}, \dfrac{12}{15}, \dfrac{20}{15}$

Compare the fractions using an inequality symbol. Write <, >, or = for each.

6. $\dfrac{5}{7}$ ☐ $\dfrac{3}{7}$	**7.** $\dfrac{7}{20}$ ☐ $\dfrac{3}{4}$	**8.** $2\dfrac{2}{5}$ ☐ $\dfrac{12}{5}$

Fill in the missing boxes with the equivalent form of the number.

	Fraction	Decimal	Percent
9.	$\dfrac{1}{4}$		
10.			50%
11.		.75	
12.	$\dfrac{3}{10}$		

List the numbers from least to greatest.

13. 2, -3, -8, 1, -2	**14.** $-1.5, \; \dfrac{1}{3}, \; -3, \; 2.5, \; 0, \; -1$

Appendix K Continued

Compare the numbers using an inequality symbol. Write <, >, or = for each.

15.	**16.**	**17.**
☐ **-7**	-1 ☐ -3	$-\frac{1}{3}$ ☐ $-\frac{1}{4}$

Perform the indicated operation.

18. -12 + 7	**19.** -1 - 10	**20.** –2(-5)(7)
21. -24 ÷ 4	**22.** $\dfrac{7}{8} - \dfrac{3}{8}$	**23.** $\dfrac{3}{4} + \dfrac{2}{3}$
24. $2\dfrac{1}{5} + 4\dfrac{2}{5}$	**25.** $\dfrac{4}{7} \bullet \dfrac{1}{3}$	**26.** $3\dfrac{1}{4} \bullet 2\dfrac{3}{5}$
27. $\left(-\dfrac{1}{3}\right) \div \left(-\dfrac{2}{9}\right)$	**28.** $2\dfrac{2}{5} \div 1\dfrac{1}{3}$	**29.** 13.7 + 3.2
30. 5(6.35)		

Solve the following word problems.

31. The lumber yard sells you two boards, measuring $12\frac{1}{2}$ feet and $4\frac{1}{4}$ feet. What is the total length of the two boards?

Appendix K Continued

32. A sales associate at a nearby clothing store earns $10 per hour. If the associate works $4\frac{1}{5}$ hours on Monday, $5\frac{2}{5}$ on Wednesday, and $5\frac{2}{5}$ hours on Friday, how much money will the associate earn that week?

33. A recipe for marinara sauce calls for $1\frac{3}{4}$ teaspoons of oregano, $1\frac{1}{2}$ teaspoons of parsley, $1\frac{1}{3}$ teaspoons of pepper, and $1\frac{1}{4}$ teaspoons of basil. A cook will need the least amount of which herb?

34. Kim's scores in the diving competition were 7.2, 6.975, 8.0, and 6.96. What is her total score?

35. A yard of fabric costs $5.00. How much will you pay if you need to buy 12.4 yards?

36. Your weekly paycheck is $485.12. However, money is deducted for various reasons. How much do you take home each week after deductions are made for federal income tax of $82.13, state tax of $9.74, social security and Medicare tax of $31.75, and retirement plan deduction of $41.50?

37. 12 out of 48 shirts are old. What percent of the shirts are old?

38. The electronics store where you work is having a 10% off sale. A customer asks you the sale price for an item that is normally $30. What should you tell them, excluding tax?

39. The machine you are operating produces 50 items per day. On Monday, you produced 5 defective items. What percent of your items were defective?

40. You are having 20 guests over for dinner. If a cake recipe calls for 3 sticks of butter and will serve 5 people, how many sticks of butter will you need to make enough cake for your 20 guests?