Fourth grade student achievement on math standardized tests in the absence of a math curriculum

Trista Manternach

Copyright ©2005 Trista Manternach

Follow this and additional works at: https://scholarworks.uni.edu/grp

Part of the Curriculum and Instruction Commons, Educational Assessment, Evaluation, and Research Commons, and the Science and Mathematics Education Commons

Let us know how access to this document benefits you

Recommended Citation

https://scholarworks.uni.edu/grp/1137

This Open Access Graduate Research Paper is brought to you for free and open access by the Student Work at UNI ScholarWorks. It has been accepted for inclusion in Graduate Research Papers by an authorized administrator of UNI ScholarWorks. For more information, please contact scholarworks@uni.edu.
Fourth grade student achievement on math standardized tests in the absence of a math curriculum

Abstract
Throughout the last few decades the importance of reading instruction has been the focus for schools and school districts across the nation. At Lincoln Elementary School in Waterloo, Iowa the focus has been no different. However, in the last two years, academic achievement in the area of math has become as important as reading with the advent of No Child Left Behind.

Although teachers were told that math was important, they lacked a required curriculum until a year after math became a focus of student achievement. The purpose of this study is to answer the following question: Did the absence of a math curriculum have an impact on student achievement at Lincoln Elementary School on three math sub-tests on the Iowa Test of Basic Skills?

This open access graduate research paper is available at UNI ScholarWorks: https://scholarworks.uni.edu/grp/1137
Fourth Grade Student Achievement on Math Standardized Tests in the Absence of a Math Curriculum

Trista Manternach

University of Northern Iowa

In partial fulfillment of the requirements for Master of Arts in Education

September 13, 2005
This Research Paper by: Trista Manternach

Entitled: Fourth Grade Student Achievement on Math Standardized Tests in the Absence of a Math Curriculum

Has been approved as meeting the research paper requirement for the degree of

Master of Arts in Education
Educational Psychology: Professional Development for Teachers

John E. Henning

Director of Paper

Victoria L. Robinson

Reader of Paper

Advisor

John K. Smith

Department Head

9/13/05
Date Approved
Table of Contents

INTRODUCTION ............................................................................................................. 3
  Purpose .......................................................................................................................... 3
  Significance .................................................................................................................. 4

REVIEW OF LITERATURE .............................................................................................. 4
  Introduction ................................................................................................................. 4
  Special Education ....................................................................................................... 5
  Teaching Strategies .................................................................................................... 5
  Professional Development .......................................................................................... 6

METHODS ........................................................................................................................ 7
  Introduction .................................................................................................................. 7
  Context ....................................................................................................................... 8
  Participants .................................................................................................................. 8
  Standardized Test ....................................................................................................... 8
  Interview ...................................................................................................................... 9
  Survey ......................................................................................................................... 10
  Classroom Assessment .............................................................................................. 10

Measures ........................................................................................................................ 10
  Standardized Test ....................................................................................................... 10
  Interview ...................................................................................................................... 10
  Survey ......................................................................................................................... 11
  Classroom Assessment .............................................................................................. 11

Procedures .................................................................................................................... 12
  Standardized Test ....................................................................................................... 12
  Interview ...................................................................................................................... 12
  Survey ......................................................................................................................... 12
  Classroom Assessment .............................................................................................. 13

FINDINGS ........................................................................................................................ 13
  Introduction .................................................................................................................. 13
  Standardized Test Findings ....................................................................................... 13
    Figure 1. Lincoln Fourth Graders Non-Proficient ..................................................... 14
  Interview Findings ...................................................................................................... 15
  Planning ....................................................................................................................... 15
  Strategies .................................................................................................................... 16
  Outcomes .................................................................................................................... 16
  Survey Findings ......................................................................................................... 17
  Classroom Findings .................................................................................................... 18

DISCUSSION .................................................................................................................... 18
  Summary of Data ........................................................................................................ 18
  Implications ................................................................................................................ 19
  Recommendations ..................................................................................................... 20

Appendix A - Interview Questions ................................................................................ 22
Appendix B - Teacher Interview Responses ................................................................... 23
Appendix C - Table 1 - Percentages of students answering each survey question ....... 24
Appendix D - Graphic Representation of Survey Questions ....................................... 25
Appendix E - Classroom Assessment Charts ............................................................... 26

REFERENCES .................................................................................................................. 27
Fourth Grade Student Achievement on Math Standardized Tests in the Absence of a Math Curriculum

INTRODUCTION

Purpose

Throughout the last few decades the importance of reading instruction has been the focus for schools and school districts across the nation. At Lincoln Elementary School in Waterloo, Iowa the focus has been no different. Improvement of student achievement in the area of reading and reading comprehension were the main goals for the school. Teachers in the Waterloo Community School district have received many professional development opportunities to increase student achievement in the area of reading. Reading initiatives were implemented, like Every Child Reads, which required teachers to show growth in their students' abilities to read. However, in the last two years, academic achievement in the area of math has become as important as reading with the advent of No Child Left Behind. All schools are required to show growth in these areas or risk being listed as a school in need of improvement. Since math has become a focus along with reading, it has become essential to implement a math curriculum and give teachers the tools necessary to provide the best possible instruction in math. The new curriculum and teacher training were not provided immediately. Although teachers were told that math was important, they lacked a required curriculum until a year after math became a focus of student achievement. The purpose of this study is to answer the following question: Did the absence of a math curriculum have an impact on student achievement at Lincoln Elementary School on three math subtests on the Iowa Test of Basic Skills?
Significance

Professional practice and teaching strategies depends on a wide variety of factors. Findings from this study could provide useful information about the importance of professional development in mathematics teaching strategies for fourth grade teachers. In addition, findings from this study could also distinguish the relative importance of professional development in teaching techniques versus establishing a uniform curriculum.

Limitations

The validity of this study could be improved by including more grade levels in the student achievement analysis. It would also be helpful to have ITBS math scores for more than three years. The length of the study and limited number of participants could also possible be limitations.

REVIEW OF LITERATURE

Introduction

It is important for students to receive instruction based on their individual learning styles, but at the same time the skill level of the teacher is a deciding factor in the appropriateness of this instruction. In the following review of research, discussion will focus on the special needs of low achievers to determine how the impact of math instruction affects their future performance in math. Secondly, the effects of strategies used to enhance student learning will be considered. Finally, professional development and staff training that could be developed to help teachers improve instruction in math will be discussed. The teacher who has been given the tools to teach to varying degrees of student learning through professional development opportunities feels more comfortable in their instruction and is more prepared to face the challenges of today’s students.
**Special Education**

Special education has always been a topic of discussion when talking about student achievement. Although special education students sometimes score below their grade level peers, it is possible to improve their performance through the use of strategies. Special education students are able to use specific strategies in order to solve varying degrees of problems. Research shows “students with learning disabilities who are low-performing in mathematics can be taught to effectively apply schema-based instruction to correctly solve multiplication and division word problems” (Jitendra, DiPipi, & Perron-Jones, 2002). With the appropriate strategies, students performing at a lower ability level are able to learn and understand concepts that higher ability level students understand. Through the use of specific teaching and learning strategies used by both the students and the teacher, there will be a greater chance for positive student achievement.

**Teaching Strategies**

When it comes to mathematics, there are many strategies and techniques for math, e.g. direct instruction and mnemonics that could be used to raise the scores of students with disabilities. Teachers need to use multiple strategies to help students understand new concepts. According to Stodolsky (1985), teachers have mostly relied on oral presentation and textbook oriented seatwork for the students. Teaching this way today could have negative results. In the past, students have seen their role in education as primarily passive. The whole-class approach has been the dominant approach to teaching math in the elementary schools. Little time was given for work with manipulatives with the majority of the math concepts being reinforced with paper and pencil tasks (Stodolsky, 1985.)
Three strategies for creating a more active learning environment include cooperative learning, distributed curriculum, and self-monitoring. For example, data collected from Utsumi & Mendes (2000) reveals that the students in small co-operative groups participated more often, had more opportunities for exchanging information among each other, and also had an increase in positive attitudes about math. Another approach is the use of a more distributed curriculum, in which math concepts are taught in smaller doses rather than in the large group format. This approach has been shown to improve student learning and understanding (Rathmell & Gabriele, n.d.). A third approach is self-monitoring which is "frequently recommended as a strategy to enhance the acquisition and maintenance of specific skills for students..." (Allinder, et al., 2000, p. 219).

Professional Development

Although we often think of strategies as something that teachers do to help students learn, there are also strategies for teachers to improve their teaching. For example, self-monitoring has been around for sometime, but rarely have we used the term in speaking about teachers. Often considered a strategy used by students to monitor their progress, self-monitoring can also benefit teachers. As stated in this article, in order for teachers to improve their teaching skills, they should use self-monitoring both proactively and reactively. Using self-monitoring proactively, teachers could rate themselves on a checklist of variables from effectiveness of classroom arrangement to classroom management. Reactively, teachers could use self-monitoring to decrease their own behaviors that may be contributing to problems, both learning and behavioral, in the classroom (Allinder, et al., 2000).

But according to Allinder, Bolling, Oats, and Gagnon, "Despite the success of these and other strategies in remediating the learning and behavior problems of children with disabilities,
widespread adoption of many of them has been limited” (2000, p. 219). In order to provide the needed strategies, it is necessary for teachers to attend training sessions to learn best practices for their instruction. Teachers who want to monitor or change their classroom practices have access to the support and resources necessary to do so (Wimer, Ridenour, Thomas, & Place, 2001).

Show teachers how to let children work together in small groups rather than passively listen, to use simple everyday materials like soap bubbles and beads to illustrate basic principles, to move from textbooks and rote memorization to hands-on, activity-based learning. In short, to take the drudgery out of math and science and relate these subject to children’s lives (McAuliffe & Liepke, 1993, p. 63).

Without the proper training, teachers are unable to provide the needed strategies to make learning effective. “Maybe the most important aspect of professional development for teachers is that administrators must be willing to provide time, fiscal resources and moral support for those teachers…” (Lumpkins, Parker, & Hall, 1991).

**METHODS**

*Introduction*

As the emphasis on Data Driven Decision making rises, it has become important that we analyze data to determine whether our teaching has been worthwhile. This study includes four sources of data. The first is ITBS student achievement in which data from the Iowa Test of Basic Skills test is analyzed to determine growth from the first test to the second. A second source of data is teacher interviews in which three teachers were interviewed on their teaching practices and preparation for lessons to determine similarities and differences in curriculum. The third source of data is student surveys in which students were given a survey to determine attitudes toward math and math curriculum. The last area of research was classroom
achievement in which teachers used strategies on the classroom level to determine achievement results. All of these areas were used to answer the question: Did the absence of a math curriculum positively impact student achievement at Lincoln Elementary School on three math subtests on the Iowa Test of Basic Skills?

**Context**

Lincoln Elementary School is located in Waterloo, Iowa. It is one of 13 elementary schools in Waterloo, which has a population of 68,747. Waterloo’s population can be broken down into the following three major races: Caucasian 81%, African American 13%, and Hispanic 2%. The student population of Lincoln is different than the city with 44% Caucasian, 46% African American, and 7% Hispanic. 73% of Lincoln students qualify for Free or Reduced lunch while the district average is 54%.

Lincoln Elementary School opened in the fall of 2004 and has a total of 482 students in grades Pre-Kindergarten to Fifth grade. Mobility rate has been a concern for our students. According to data from 2003-2004, 22% of Lincoln students either entered after August 31 or left before May 30.

**Participants**

*Standardized Test*

For the 2003 - 2004 school year students in the Waterloo Community School District were given the state standardized test, the Iowa Test of Basic Skills, twice. The first test was given in the Fall of 2003, and the second test was given in the Spring of 2004. At Lincoln Elementary School 50 students took the Fall test and 47 students took the Spring test. Of the 50 students who took the Fall test, five moved from Lincoln to attend other buildings within the
district. In the Spring, two students who had not previously attended Lincoln were in attendance to take the ITBS for the second time.

_**Interview**_

Three teachers were interviewed for this research. Mrs. Deb Hudson was the first teacher interviewed for this study. She has been teaching at Lincoln for six years and was a substitute teacher for the Waterloo School District for one year prior to starting at Lincoln. She taught second grade for two years, third grade for one year and is now in her third year of teaching fourth grade. Mrs. Hudson is currently working towards her Master’s in Elementary Education and has already received her Reading Endorsement. Mrs. Hudson was interviewed in her classroom while her students were out of the room.

Mrs. Kendall LaFontaine was the second teacher interviewed for this study. She has taught fourth grade for five years all of which have been at Lincoln. She is currently working toward her Master’s in Elementary Education. Mrs. LaFontaine was interviewed during her half hour lunch period.

Mrs. Trista Manternach was the third teacher interviewed for this study. She is a special education resource teacher at Lincoln where she has been since beginning teaching four and half years ago. She holds her Reading Endorsement and Special Education Instructional Strategist I Endorsement. Mrs. Manternach is currently working towards her Master’s in Educational Leadership, which she will complete in August 2005. Mrs. Manternach was interviewed in a classroom without students present.
Survey

The survey was given to a total of 64 fifth graders at Lincoln Elementary School to determine student attitudes toward math and math strategies based on the math instruction they received during the 2003-2004 school year as fourth graders.

Classroom Assessment

For the classroom assessment five fifth grade students were taught in a small group during math instructional time. The fifth graders are all members of the special education resource room.

Measures

Standardized Test

Teachers of fourth grade math use a variety of assessment instruction including timed tests, section review, chapter tests, all from the new Scott Foresman / Addison Wesley math curriculum, teacher created tests, and the Iowa Test of Basic Skills. For this study student performance on three Iowa Test of Basic Skills subtests will be compared. The tests to be analyzed were Math Problem Solving, Math Concepts and Estimation, and Math Total without Computation from Fall 2002, Fall 2003 and Spring 2004.

Interview

The purpose of the interviews was to determine if teachers at Lincoln Elementary School used similar teaching strategies and curriculum in their math instruction from October 2003 to April 2004. Three questions were written to determine what curriculum, strategies, materials, resources, and professional training the three teachers used in the teaching of math. Three more questions were devised to better understand the outcomes of using specific strategies, math
goals, and planning lessons. Two follow up questions were designed to illuminate current and future teaching strategies. See Appendix A, “Teacher Interview Questions.”

Survey

A survey was given to 64 fifth grade students at Lincoln Elementary School. Prior to determining survey questions, interviews were completed with the fourth grade teachers who taught math during the 2003-2004 school year at Lincoln. Based on the information gathered, student surveys were developed to discover student attitudes toward math and math teaching strategies. Thirteen questions asked were used to determine student attitudes while seven of the questions were used to determine strategies used by the classroom teacher during the students’ fourth grade year. See Appendix C for Survey Questions.

Classroom Assessment

When teaching multiplication and division, strategies are often used to help students remember their facts. One popular strategy is the use of skip counting to reinforce multiplication facts. Skip counting is used to count by a certain number. For example, skip counting by 4’s saying every fourth number: 4, 8, 12, 16, 20, 24, 28, 32, 26, 40 etc. This teaches the students the order of the multiplying by that number. The teacher used the skip counting technique for 2’s, 3’s, 4’s, and 5’s. This strategy was used because the students had previous knowledge of how the strategy worked and required less reteaching than other strategies. For 9’s the students used their fingers to figure out each 9 problem. The student places their hands with fingers spread out on the table. From left to right, each finger is given a number 1-10. The number being multiplying by 9 gets tucked in. The remaining numbers give the answer. The total of fingers to the left of the one put down is the first digit of the answer and the total number of fingers to the right of the one put down is the second digit of my answer. The other strategies used by the
teacher for multiplication and division were the 0’s and the 1’s. The teacher would review and teach this strategy by saying “anything times 0 is always 0 and anything times 1 is always the other number.” The students would then repeat after the teacher.

Procedures

Standardized Test

The Iowa Test of Basic Skills was given during the second week in October for the Fall 2003 test. Most students took the test in large group settings with their classroom teacher. A few students were eligible to have the test given to them in small groups in the special education resource room. The special education gave the test to the special education students with test accommodations requiring that the test be read orally.

Interview

Three teachers were interviewed separately to determine their answers to prewritten interview questions based on their math teaching from October 2003 to April 2004. The interviews were conducted during teacher planning time.

Survey

The fifth grade teachers at Lincoln Elementary School gave the 20-question survey during math instructional time to three classes of students. The students were given directions from their classroom teachers. They were to mark only one answer for each question. Of the 64 surveys distributed, only 26 were used. If a student who did not attend Lincoln the previous year, the survey was excluded. For each of the 20 questions, the students were told to chose one of the following answers: Always, Most of the time, Sometimes, or Never. After the surveys were given, the data was analyzed to figure out which attitude and strategy questions were
chosen most often as “Always” from the students. Those with more than 50% of the students choosing “Always” were seen as the ones that made the most impact on the students.

Classroom Assessment

Students were pre and post tested using basic math facts worksheets. One included 100 multiplication problems and one included 90 division problems. The students were given six minutes to complete as many basic facts as they could. They were told to work from the top of the page to the bottom, skipping any problems they did not know right away. The tests were graded on the number of answers correct divided by the total number of questions; 100 for multiplication and 90 for division. The scores for the pre- and posttest were graphed by the students on a graph that had already been started to show their growth in basic facts. The students are then able to see the amount of growth they have made on each test and what they need to do to be able to increase their scores. Before each test, the students reviewed their scores from the last test to determine the number they needed to beat their previous score.

FINDINGS

Introduction

After analyzing the four areas of research, all aspects of this study pertaining to the impact of teaching strategies on the math achievements of fourth grade students at Lincoln show positive outcomes.

Standardized Test Findings

Using the data from the Iowa Test of Basic Skills, scores were analyzed on Math Problem Solving, Math Concepts & Estimation, and Math Total Without Computation from Fall 2002, Fall 2003, and Spring 2004. For Math Problem Solving, the collected data showed an increase in the percentage of students who scored non-proficient from 48% in Fall 2002 to 52% in Fall
2003. It then showed a decrease in percentage of students scoring non-proficient from 52% in Fall 2003 to 44% in Spring 2004. For Math Concepts & Estimation the data revealed a constant decrease in the percentage of students scoring non-proficient from 56% in Fall 2002 to 52% in Fall 2003 and 51% in Spring 2004. For Math Total Without Computation there was a consistent decrease in the percentage of students scoring non-proficient from 58% in Fall 2002 to 52% in Fall 2003 and finally 48% in Spring 2004.

Figure 1. Lincoln Fourth Graders Non-Proficient

The largest decreases in percentage of students scoring non-proficient were in Math Problem Solving from Fall 2003 to Spring 2004 when the student’s scores fell from 52% to 45% and in Math Total Without Computation from Fall 2002 to Fall 2003 when the students fell from 59% to 52% non-proficient. The Math Problem Solving test showed a decrease of 7% and the Math Total Without Computation test showed a decrease of 7%. Also important to note is the decline in the number of students scoring non-proficient in both Math Concepts & Estimation
from 56% in Fall 2002 to 52% in Fall 2003 to 51% in Spring 2004 and Math Total Without Computation from 59% in Fall 2002 to 52% in Fall 2003 to 49% in Spring 2004. A noted inconsistency was found in Math Problem Solving from Fall 2002 to Fall 2003 when the scores increased in the percentage of students scoring non-proficient from 49% to 52%.

Interview Findings

The findings for the interview data can be summarized in three categories: planning, strategies, and outcomes.

Planning

When planning math lessons, two teachers worked collaboratively to teach the same skills each week. One of the teachers stated there was no time to collaborate. These same two teachers also chose the goal of mastering basic facts for the focus of their instruction. In addition, one teacher based her lesson planning on problem solving, multiple step instructions and working backwards to get answers to problems. The special needs teacher followed her students’ Individualized Education Program (IEPs) so she did not collaborate with the regular education teachers in the area of math because she was teaching a different curriculum.

The fourth grade special education teacher used a direct instruction program called Connecting Math by SRA for teaching mathematics while the other teachers used two different methods of teaching. One used resource books and the district instructional packet entitled Thinking with Math along with other resource books, while the other used the fourth grade math textbook and Carson Delosa and Scholastic mathematics materials.

In response to the question about district support through materials, resources, and training, one regular education teacher felt that professional development in math did not meet expectations. The second regular education teacher replied that she was not given support with
materials, so she had to purchase everything on her own. In contrast, the fourth grade special education resource teacher felt very well prepared and said the *Connecting Math* program was easy to use and came with all materials necessary to teach the program. See Appendix B for individual teacher responses.

**Strategies**

Various strategies were used throughout the teaching of fourth grade mathematics during the 2003-2004 school year. These strategies included mini lessons, drilling basic facts, teaching key phrases, steps and terminology two or three days a week “distributed curriculum,” the “nines” strategy, games, skip counting, mnemonics, direct instruction, and poems. One teacher used motivational strategies and reinforced students’ work.

One teacher recorded student scores weekly while another checked student work more frequently. The special education teacher updated the Individualized Education Program files as required.

As an added strategy to increase test scores, some students were given the opportunity to attend the fourth grade extended day program, which gave students the opportunity to attend extra practice sessions after school for help with their math. Other students took advantage of tutoring opportunities at a local church.

**Outcomes**

The three teachers were asked if the outcomes of the strategies they used met their expectations. The two regular education teachers agreed there was improvement in student learning after the implementation of different strategies, but there were still students who didn’t understand. The special education resource teacher said that her students showed improvement on chapter tests after the implementation of the intervention strategies.
Some strategies the regular education teachers said they would continue to use included daily problem solving with both basic and multiple steps, giving timed tests more often and implementing organized assessment. Additional strategies they plan to use include the “nines” strategy, skip counting, mnemonics for man, poems with multiplication and division facts, division with rounding, and three-digit division.

They were also asked what strategies they would continue to use and also what strategies they would implement in the future. In the first interview, the special education resource teacher said she would use none of the same strategies she had used previously, but during the second telephone interview, she said she would continue to use the direct instruction strategy from Connecting Math for teaching story problems because it worked well for her and her students.

Strategies the teachers will implement in the future are writing in math, more structure and focus in math lessons, and fourth grade team collaboration. One regular education teacher and special education resource teacher are not sure at this point what they will use in the future because of the implementation of a new math curriculum.

Survey Findings

Of the 63 surveys distributed, only 26 were used as data in this study. One student did not answer question number 15 so that test question had only 25 total respondents instead of 26. Survey questions were put into two categories: strategies and attitudes. The separation of the questions helped to analyze which strategies and activities the students enjoyed the most. Questions with more than 50% of students responding to the questions with an “Always” answer were considered to be the most influential in math strategies and the student’s attitude toward math. There were three survey questions in the strategies category in which 50% or more of the students chose “Always” as their answer. Those questions were 7; I liked playing math games,
We did daily math review every day. Those attitude questions receiving more than 50% of "Always" answers were 4; I liked to solve math problems, 6; I liked to keep trying even when I didn’t understand something right away, 10; I asked questions when I was confused, 15; I learned from my mistakes in math, and 17; When I didn’t understand a problem, my teacher could explain it so I did. See appendices C and D for student survey results. Two attitude questions had exactly 50% of the students choosing "Always" as their answer. Question 19; My teacher made math fun and 20; I was good in math.

The survey questions with the majority of the students answering "Never" were 5; I liked to make up number stories or problems for others to solve and 9; I liked working on math projects that took more than a day to complete.

Classroom Findings

As shown by the attached graphs (see Appendix E), every student in the math group made progress from the pre- to the posttest. On both multiplication and division tests, the number of correct answers in six minutes increased by an average of 11 from the pretest to the posttest.

DISCUSSION

Summary of Data

This research was conducted in an effort to find the answer to the following question: Did the absence of a math curriculum have an impact on student achievement at Lincoln Elementary School on three math subtests on the Iowa Test of Basic Skills? According to the data collected from the Iowa Test of Basic Skills, teacher interviews and student surveys, there was a positive impact in student achievement. Through collaborative processes and an increased knowledge of
both content and best practices for teaching mathematics, it is possible to raise test scores without a set curriculum.

The data analyzed from the three math sections of the Iowa Test of Basic Skills; Math Problem Solving, Math Concepts & Estimation, and Math Total Without Computation from Fall 2002, Fall 2003 and Spring 2004 showed an overall decrease in the percentage of students scoring non-proficient in each area over the three testing periods with the exception of an increase from Fall 2002 to Fall 2003 in the area of Math Problem Solving. This data is an indication of proper teaching and understanding of the strategies and instructional practices of the fourth grade teachers. Teachers from Lincoln Elementary School taught the concepts of mathematics during the 2003-2004 school year by using multiple sources of curriculum and various teaching strategies. This indicates that a set curriculum may not be completely necessary to increase student achievement.

According to the student survey findings, most students said they were good in math and their teacher made math fun. If students like math and feel they are good at it, they have a better chance of being successful. The survey illustrated that students kept trying even when they didn’t understand right away which signifies that they believe they are capable of completing the tasks presented and are willing to persist until they understand. This also shows us that teachers, even with the absence of a math curriculum, were able to make math enjoyable for students.

**Implications**

Teachers interviewed were open to discussion and realized the importance of varied strategies, curriculum, and materials to meet the needs of all learners. They have tried multiple strategies including: daily problem solving with both basic and multiple steps, giving timed tests more often and implementing organized assessment, direct instruction, the “nines” strategy,
counting by tens, mnemonics for math, and math poetry. “Strategies that have been found to have notable effectiveness include techniques such as mnemonic strategies, behavior modification, and direct instruction” (Allinder, et al., 2000, p 223). The use of these strategies helped to increase student achievement stated in this study. In addition to teaching strategies in the classroom, Lincoln used many other instructional techniques to improve test scores. Mentors, one on one tutoring, and participation in the extended day program were all part of the plan that was developed and implemented to directly help the students achieve.

Learning a new skill doesn’t always happen on the first try, especially in math. Many times, teachers use repetition and drill and practice to help students learn new skills. In this study, the teacher used skip counting and the “nines” trick to help students learn their facts. Clearly, the strategies used to help students with their multiplication and division facts increased their basic facts scores. Students need to realize that math is not always difficult and if patterns and strategies are learned, it can be much easier. According to Watanbe (2003) “… solid understanding of multiplication in elementary school is essential for a student’s success in middle school” (p. 112). Without the basis of multiplication facts taught early on, our students will fall behind. Also important is the ability for students to “… freely choose which strategy they will use to solve each item” (Torbeyns, Verschaffel, & Ghesquiere, 2004).

Recommendations

In order for teachers to work more collaboratively with one another curriculum should be similar. Even though it is not necessary for student achievement, teaching the same curriculum would allow for ease of planning and preparation and similarities in teaching. Grade level teachers would be able to administer a pre-test before teaching a shared math concept and a post test after a unit is taught to assess student learning not only in their own classrooms, but across
the grade level. This would help them plan and adjust their teaching to their students’ needs.

Additional learning opportunities could be offered during an extended day program that focused on one similar topic rather than the scattered topics of three separate teachers.

To further strengthen teaching, the fourth grade teaching team could collaborate to create a data wall display to be used to share math results with other grade level teams. This data would be reliable because all the teachers will be following the same curriculum. Collaboration would allow them time to discuss and reflect on the results of their own students’ achievements and needs as well as the fourth grade students as a whole. The opportunity to see which instructional strategies were working and which might need some reformatting would also be a possibility.

Teachers should definitely continue to use multiple strategies to teach math as well as pursuing more professional development in learning to teach mathematics. Apparently, according to McAuliffe & Liepke (1993), “most teachers are used to just standing at the board and imparting facts to their students…” (p. 64). But we now know that students should be taught in many different ways and teachers should be given many more opportunities to learn new strategies and attend professional development sessions to increase their knowledge of math concepts. New strategies could include writing in math, the use of manipulatives, small cooperative groupings, and using a distributed curriculum approach to teaching.

Future research could help us learn if student achievement increases as teachers become more knowledgeable in content areas of instruction and teaching strategies. Also, will the use of a more data based decision making model to assess student achievement help teachers to better plan and prepare according to individual student needs?
Appendix A – Interview Questions

Teacher Interview Questions

1. What did you base your math instructional curriculum on from October 2003 to April 2004?

2. What specific strategies did you use in teaching 4th grade math last year?

3. Were you given enough support through materials, resources and training while teaching 4th grade math last year? Why or why not?

4. Did the outcome of the strategies meet your expectations? Why or why not?

5. What were your math goals for improving math scores?

6. When planning math lesson, did you collaborate with other 4th grade math teachers?

7. What strategies will you continue to use in your current teaching?

8. What future strategies will you implement or change?

Teacher: ___________________
## Appendix B – Teacher Interview Responses

<table>
<thead>
<tr>
<th>Interview Question</th>
<th>Teacher Response</th>
</tr>
</thead>
</table>
| 1. What did you base your math instructional curriculum on from October 2003 to April 2004? | Mrs. H: Problem Solving (which was lower on the ITBS), Multi step, working backward, district packet, Basic facts drilling. Key Phrases, steps to problems.  
Mrs. L: Textbook, own teacher resource books, Carson Delosa, Scholastic.  
Mrs. M: 4th grade special needs students used SRA “Connecting Math” series, Level C. Three students used it from October through April. And three others used it from January through April. |
| 2. What specific strategies did you use in teaching 4th grade math last year?        | Mrs. H: Drilling facts, terminology, daily 2-3 days, 4th grade extended day, Thinking with math, resource books  
Mrs. L: Nines strategies, games (count by 10’s) Mnemonics for math, poems, problem solving strategies  
Mrs. M: The program taught the students how to work story problems very well. They were taught to use algebra to figure out word problems. Children also used skip counting to figure out multiplication facts. |
| 3. Were you given enough support through materials, resources and training while teaching 4th grade math last year? Why or why not? | Mrs. H: Yes, provided if requested. Professional development is lacking which is why we are behind in math.  
Mrs. L: No. Not with materials. I didn’t have any. I had to purchase everything on my own.  
Mrs. M: Our curriculum was direct instruction. I do feel we were well prepared because the program was very easy to use and came with everything we needed. |
| 4. Did the outcome of the strategies meet your expectations? Why or why not?         | Mrs. H: Yes and No. Some growth on ITBS. Teachers learning and adapting  
Mrs. L: Yes, but there were still kids that didn’t get it.  
Mrs. M: Yes – the students showed improvement on chapter tests and their ability to solve word problems. |
| 5. What were your math goals for improving math scores?                              | Mrs. H: Mini math, Daily problem solving, math facts (proficient at 60% or higher) More motivational strategy. Recording, reinforcing. Non proficiency improved in the spring (less kids)  
Mrs. L: Master basic facts because once basic facts are Mastered, then everything else is easier.  
Mrs. M: Math goals were the students individual IEP goals and goals set by the school. |
| 6. When planning math lessons, did you collaborate with other 4th grade math teachers? | Mrs. H: Yes, staying on the skill weekly. 4th grade pace, we met once a week to discuss progress. We did not plan with the special needs teachers.  
Mrs. L: Yes – Mrs. Hudson – but we didn’t have a whole lot of time.  
Mrs. M: No – I would give benchmark tests as needed but my 4th grade curriculum was different than that of the general education teachers. |
| 7. What strategies will you continue to use in your current teaching?               | Mrs. H: Daily problem solving, in depth start problem solving skill basic to multiple steps. Did timed tests more often, organized assessment.  
Mrs. L: Same. Division with rounding, 3 digit division, multiplication and division facts.  
Mrs. M: I will definitely use strategies from the new math curriculum, and some from the direct instruction program. Skip counting and word problem strategies. |
| 8. What future strategies will you implement or change?                              | Mrs. H: Writing in math, open-ended structure & focus. 4th grade team cooperation / building uniformity. Vertical alignment between grades, future contact. We did extended day with the third graders at the end of the year to get them ready for fourth grade.  
Mrs. L: It’ll take a good year to know exactly what to use with this new math curriculum.  
Mrs. M: None – I don’t know enough about the new math program to say. |
## Appendix C - Table 1 - Percentages of students answering each survey question.

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Always</th>
<th>Most of the Time</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I liked math in 4th grade.</td>
<td>35%</td>
<td>42%</td>
<td>19%</td>
<td>4%</td>
</tr>
<tr>
<td>2. I liked working with a partner or group.</td>
<td>23%</td>
<td>35%</td>
<td>27%</td>
<td>15%</td>
</tr>
<tr>
<td>3. I liked working alone.</td>
<td>35%</td>
<td>15%</td>
<td>38%</td>
<td>12%</td>
</tr>
<tr>
<td>4. I liked to solve math problems.</td>
<td>54%</td>
<td>27%</td>
<td>19%</td>
<td>0%</td>
</tr>
<tr>
<td>5. I liked to make up number stories or problems for others to solve.</td>
<td>12%</td>
<td>19%</td>
<td>34%</td>
<td>35%</td>
</tr>
<tr>
<td>6. I liked to keep trying even when I didn't understand something right away.</td>
<td>69%</td>
<td>19%</td>
<td>12%</td>
<td>0%</td>
</tr>
<tr>
<td>7. I liked playing math games.</td>
<td>66%</td>
<td>15%</td>
<td>19%</td>
<td>0%</td>
</tr>
<tr>
<td>8. I liked working on math homework.</td>
<td>27%</td>
<td>27%</td>
<td>38%</td>
<td>8%</td>
</tr>
<tr>
<td>9. I liked working on math project that took more than a day to complete.</td>
<td>12%</td>
<td>19%</td>
<td>34%</td>
<td>35%</td>
</tr>
<tr>
<td>10. I asked questions when I was confused.</td>
<td>57%</td>
<td>23%</td>
<td>12%</td>
<td>8%</td>
</tr>
<tr>
<td>11. I liked using manipulative like base 10 blocks, unifix cubes, fraction bars,</td>
<td>27%</td>
<td>15%</td>
<td>23%</td>
<td>35%</td>
</tr>
<tr>
<td>&amp; flash cards when doing math.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. I liked to take practice tests.</td>
<td>50%</td>
<td>19%</td>
<td>23%</td>
<td>8%</td>
</tr>
<tr>
<td>13. I liked using math journals</td>
<td>35%</td>
<td>42%</td>
<td>23%</td>
<td>0%</td>
</tr>
<tr>
<td>14. It was okay to make mistakes in math.</td>
<td>42%</td>
<td>12%</td>
<td>46%</td>
<td>0%</td>
</tr>
<tr>
<td>15. I learned from my mistakes in math.</td>
<td>60%</td>
<td>36%</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>16. I could explain my math answers in words or writing.</td>
<td>23%</td>
<td>23%</td>
<td>39%</td>
<td>15%</td>
</tr>
<tr>
<td>17. When I didn't understand a problem, my teacher could explain it so I did.</td>
<td>61%</td>
<td>27%</td>
<td>8%</td>
<td>4%</td>
</tr>
<tr>
<td>18. We did Daily Math Review every day.</td>
<td>54%</td>
<td>23%</td>
<td>19%</td>
<td>4%</td>
</tr>
<tr>
<td>19. My teacher made math fun.</td>
<td>50%</td>
<td>23%</td>
<td>23%</td>
<td>4%</td>
</tr>
<tr>
<td>20. I was good in math.</td>
<td>50%</td>
<td>31%</td>
<td>15%</td>
<td>4%</td>
</tr>
</tbody>
</table>
Appendix D - Graphic Representation of Survey Questions
Attitudes and Strategies

7. I liked playing math games.

- Always: 60%
- Most of the Time: 23%
- Sometimes: 15%
- Never: 12%

10. I asked questions when I was confused.

- Always: 57%
- Most of the Time: 23%
- Sometimes: 8%
- Never: 4%

12. When I didn't understand a problem, my teacher could explain it so I did.

- Always: 36%
- Most of the Time: 41%
- Sometimes: 8%
- Never: 5%

15. I learned from my mistakes in math.

- Always: 60%
- Most of the Time: 36%
- Sometimes: 4%
- Never: 0%
Appendix E - Classroom Assessment Charts

### Multiplication Facts

- Student 1: Pre-Test 45, Post-Test 63
- Student 2: Pre-Test 76, Post-Test 88
- Student 3: Pre-Test 82, Post-Test 87
- Student 4: Pre-Test 11, Post-Test 17
- Student 5: Pre-Test 70, Post-Test 92

### Division Facts

- Student 1: Pre-Test 19, Post-Test 33
- Student 2: Pre-Test 4, Post-Test 14
- Student 3: Pre-Test 61, Post-Test 75
- Student 4: Pre-Test 0, Post-Test 12
- Student 5: Pre-Test 37, Post-Test 43
REFERENCES


