Improving Problem Solving by Improving Reading Skills

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Improving Problem Solving by Improving Reading Skills

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Math in the Middle Institute Partnership
Action Research Project Report

In partial fulfillment of the MA Degree
Department of Teaching, Learning, and Teacher Education
University of Nebraska-Lincoln
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Improving Problem Solving by Improving Reading Skills

Abstract

In this study of my fifth grade mathematics class, I investigated how the use of different reading strategies impacted my students’ problem solving. I implemented various reading strategies throughout a three-month time period. Teaching my students to break down story problems, learn the steps in solving them, write their own story problems, create math dictionaries, write story problem webs, and listen to themselves reading problems created more confidence in them and increased the likelihood that they would use these strategies on their own. In this research, it was quite obvious to me through some pre-testing that my students struggled with word problems. As a result of this research, I found that I was able to help some individuals improve on their abilities to focus on and solve word problems by implementing reading strategies. As a result of my study, I plan to keep implementing these strategies into my lesson plans and keep reading strategies and problem solving a focus of my mathematics classroom.
Introduction

I taught two sections of fifth grade students. In the morning, I taught a class of 11 students, including six boys and five girls. In the afternoon, I taught a class of 10 students, including six boys and four girls. All of these students spoke English and came from predominantly middle-level income families. My only student of Hispanic origin also spoke English. I taught math, social studies, and reading to both of these sections. Each class was approximately 40 minutes in length, one right after the other with some break time in between. Mathematics skills within the entire fifth grade ranged from far below average to some above average. There was one student whom I considered at a high achievement level. Generally, students’ problem-solving skills were very low. When they got a difficult problem, they tended to ask a lot of questions about it and did not attempt it first on their own.

Just this year, our third through fifth grades changed mathematics textbooks. We were using the Saxon series; however, most of us teaching from it felt that the students were not getting enough repetition of that day’s new concept and for some reason their basic skills were falling. This was not to say that Saxon was the reason for their basic skills to be deteriorating. This could have been for a number of reasons. So we looked into some other series and we ended up going with a series called EnVisionMath, (Scott Foresman-Addison Wesley, 2008).

My colleagues and I noticed a couple of things with this textbook right from the start. One, this series started each grade at a higher level than what we were starting with in the Saxon books. For example, with Saxon we did not get into any decimal place values higher than thousandths until later in the book. With this new series, the first topic
in the fifth grade book went out to the millionths. It was a struggle at first, but I think after a few years when we get the students in our classes that have used this series in previous years it will be much smoother and the students will grasp the concepts more quickly. Second, we noticed that this series had a lot more word problems than our old text. Every lesson had a whole page or two of practice problems as well as a whole page of word problems. Even the tests were different. You could choose from about four different tests or even create your own. All of them had some word problems, and one was completely made up of word problems. The web-based test contained all word problems.

I realized, when looking at these problems in our new math books, that I was not focusing enough on word problems or problem solving because when I would assign these word problems students would moan and groan and they would not do well on them. In the first stages of my teaching career, I did not think a lot about different ways to approach word problems or even look much into problem solving. I guess I was more of the drill-and-practice type of teacher. It was a case of “that is how I was taught” and so that was how I was going to teach. Thanks to this Math in the Middle program, I had really tried to increase my awareness of and interest in problem solving, and I tried to instill this in my students as well. As I have gone along in this program, I have tried more and more to get problem solving as part of the students’ daily habits in the classroom. I started out by trying to do some problem solving at least once a week. It seemed like every time I gave my students some type of word problem, however, they always raised their hands with questions without even trying them first. So word problems were a struggle not only for me but also my students.
Right away, I noticed how my students were struggling with these word problems and at times I even tried to avoid them when giving assignments for fear of my students getting frustrated. I had a fifth grade class of 21 students with reading abilities that ranged from third grade all the way to about an eighth grade level. We did a DIBELS reading test in the fall, winter, and spring every year with our students that helped us see where our students were in terms of reading fluency and accuracy. The students were given three passages to read and one minute to read each one. While they read each passage, the instructor followed along on another sheet marking any errors. This year after the fall testing, I got the results back and I had only six that were considered “at grade level,” 11 “below reading level” who required additional intervention, and four students who scored even lower and were in need of substantial intervention. Two years ago, I had only about four or five students that fell into the substantial intervention level and had several reading above grade level. Last year, the above-grade-level group was a few less while the substantial intervention was a little larger. I knew this group of fifth graders was going to have some poor reading levels but I did not think they would be this low because when reading out loud they did not sound any worse than previous years.

With this information and knowing what our new math series entailed, I decided to try and do something about the reading levels and work on math problems. I knew that I was going to be doing an action research project in the spring of 2009, so I started thinking about how I could do something that incorporated both reading skills and word problems, because I was wondering if it was their reading skills that were making them struggle with word problems.
I did some research and found some articles on reading strategies and problem solving. Some of these articles provided me with ideas for strategies I wanted to try to use with my students. An advantage of focusing on a topic involving reading and math was that I was also teaching the fifth-grade reading as well. That was why it was easy for me to see that there might be a correlation between students’ reading abilities and their difficulties with word problems. That was how I decided on the idea of improving their reading skills in order to improve their problem solving.

In considering the NCTM principles and standards (NCTM, 2000), one of the principles was the Learning Principle. It stated that students must learn mathematics with understanding. If students were not able to read the questions accurately and understand what was being asked, then this was taking away from this principle. The students were not getting a full understanding of the math topic because their reading skills were an obstacle to comprehension. To compensate, the students tended to memorize the facts and procedures instead of fully understanding them. Within the NCTM standards, this problem may have influenced the algebra standards for grades 3-5. The standard stated that the students must express mathematical relationships using equations. If a student could not read the expression in words, he or she may have had difficulty in putting it into an algebraic equation or expression such as “five less than six times a number.” Other difficulties could arise under various standards and could even lie within reading the directions correctly. Listening to some of my students reading directions out loud really made me wonder how they were reading the questions on homework or tests. Sometimes students would not be able to pronounce a word and just skip over it, other
times they just mispronounced words and at times they would even put in different words than what was written in the directions.

Thinking about this issue of reading difficulties relating to problem solving or just plain word problems, I thought about what my ideal classroom would look like. First of all, to me, word problems were usually some math problems that were turned into problems written in words. With problem solving, the problems were written in words but were a lot more involved and it might not be immediately apparent how to solve the problem. The problems were more in-depth and had more detail to them and required the solver to think more in-depth to get to the answer. There might be several different mathematical concepts that required understanding in order to solve a problem as well. In my ideal classroom, my students would be able to solve these math word problems with little difficulty. First, I would like them to read and understand mathematical directions with at least a 95% accuracy rate. If they did not understand what the directions were asking, they might have had difficulty solving a problem. They might go in a different direction that what was needed. Second, I would like my students to be able to read a story problem and be able to pick out the numbers and information they needed to solve the problem correctly and eliminate what was not needed. Next, I would like my students to be able to recognize the problem as a basic computational problem and solve it. Seeing confidence in my students’ faces as they started a problem would be great rather than just the “aha” at the end when they finally got it.

With this in mind, I was on my way to try and find some strategies that I could use on my students in my classroom to improve not only their achievement on work, but also their confidence. I really believed that confidence bred success. Now I needed to
think about what I wanted to learn more about in my research. I really needed to understand if there might be some kind of correlation between my classes’ reading skills and their ability to solve word problems. Then if there was a connection, I needed to find a way to help my students improve their reading skills.

**Problem Statement**

Students in my mathematics classroom had trouble understanding and solving mathematical story problems. I feared their lack of reading accuracy and comprehension was hindering their ability to reach solutions to problems. I believed that anything that I could do as a teacher to help a student improve his or her chance of success in the classroom was worth looking into. If I could get one student to improve his or her work on word problems due to some strategies that I taught him or her, then I felt this was a successful research project. As a teacher I would like to see improvement by everyone, but this was most likely not going to happen. Sometimes a little trial and error was needed in the classroom. I thought that just because someone else tried something with his or her class, whether just recently or a long time ago, and it failed, that did not mean I should never try it. I might need to try several different things to get my students to understand a concept, and they might all fail; but if one worked, then it was a success. I did not give up.

In this day and age I found kids playing video games, using computers, cell phones and all kinds of electronic devices in their spare time. I did not find too many kids these days that would just sit down and read a book in their spare time. Plus, I found a lot of families that were on the go so much that they did not find time to sit down at night with a young child and read to or listen to him or her read. If things were to keep
developing the way they were then we might end up seeing reading skills deteriorating, and then all teachers would be struggling with students not being able to read nor understand something like a word problem. Did I just push students aside to the next teacher or did I need to try some things and help them? I decided to try something new.

**Literature Review**

After doing some investigating of research literature, I found some other researchers who recognized reading difficulties affecting problem solving as a trouble spot also, and they, too, felt something could be done to help students read math problems with better accuracy and comprehension. To be a good math student, one needed to have solid reading skills. Students in my mathematics classroom had trouble understanding and solving mathematical story problems. I feared their lack of reading accuracy and comprehension was hindering their ability to reach solutions to problems. Therefore, when looking at the overall student achievement level, I did not think that my students were reaching their full potential when it came to word problems. I mentioned earlier that our new math text (Scott Foresman-Addison Wesley, 2008) used a lot of word problems, especially on tests. I also noticed after doing some reading testing and listening to my students read in class, that most of my students were at a very low reading level. So this made me start focusing my search into other research studies on finding some articles that were written about problem solving and struggling readers. I was able to find many articles that offered some perspective on these types of learning insufficiencies. I found nine articles with various themes. The most common theme was student achievement, followed by learning strategies and problem solving. Some of the other themes were student vocabulary, reading comprehension, school climate, and math/reading
disabilities. There were numerous other themes indicated in these articles, but many were unfamiliar to me or were not related to my study. So I chose to focus on four major themes, including reading comprehension and math, math anxiety and what we as educators could do, such as the use of word problems and learning strategies using technology.

Goddard, Sweetland and Hoy (2000) examined the importance of a school climate characterized by high levels of academic emphasis. Students were motivated by the respect they got from other students and teachers when they succeeded, and teachers accepted responsibility for student achievement and did not let temporary setbacks unduly frustrate them (Goddard, Sweetland & Hoy, 2000). They studied 45 elementary schools and established that their research sustained their theoretical ideas that in a school atmosphere, in which teachers set reasonable goals and believe in their students’ abilities to achieve, students worked hard to succeed and respected those who did the same, and the learning environment was, in essence, orderly and serious.

It really should be of no surprise that student achievement was the theme I found to be most common in all my articles because everyone wanted to see how students were performing, and so I tried to focus a lot on the atmosphere in my classroom. The articles must have focused on student achievement and classroom atmosphere because the authors believed having a positive atmosphere that focused on student learning was important. The most important thing I felt I did in my classroom for the atmosphere was to just be more positive with my students about word problems. This, in turn, really seemed to rub off on them. It was easy to see that if I had a negative attitude toward word problems, which at times I did, then my students had negative attitudes as well. At times,
I would even try to avoid word problems when doing sample problems or giving homework.

From my perspective, the most interesting article was one by Fuentes (1998). Fuentes examined the importance of reading comprehension in mathematics and the role of reading in mathematics. Fuentes went on to discuss why students failed when it came to comprehension. When it came to reading and comprehension, most educators tended to assume that these were things taught in English class and not in math class. This was probably one of the most misunderstood concepts today. I know I thought the same way, and this was probably the reason I tended to stay away from teaching any kind of reading skills in math. So much of the math today entailed reading accuracy and comprehension. A big stress was teaching students to problem solve, and most of these problems had lots of words. The words they were reading were intertwined with casual language and mathematical concepts. The problem then became “What do we do?” This article went on to give several ideas for increasing the comprehension of students. Whatever educators did, just remember, that they were doing all of this to get students to experience success. Mathematics teachers faced an even more difficult challenge: creating in students a love for mathematical texts—or at least teaching them not to dislike or fear them (Fuentes, 1998). I could really sense this fear with my students when it came time for word problems. My first clue of this was how they would always raise their hands to ask questions about a word problem before they had even read the problem.

What could educators do to help students reach their potential? Or in this case, what could I do to improve my students’ reading accuracy and comprehension so they could solve word problems more accurately? The articles by Petersen, Glover & Ronning
(1980); Fuentes (1998); Goddard, Sweetland & Hoy (2000); Blessman & Myszczak (2001); Goularte (2003); Jonassen (2003); Fuchs, Seethaler, Powell, Fuchs, Hamlett & Fletcher (2008); and Yan, Wiles & Yu-Ying (2008) all discussed research on learning strategies for students. These strategies ranged from mathematics vocabulary work, which we did a lot of during this research, to using a tutor for many hours a week. It did not seem to matter how old or how recent the article, but a lot of the strategies for improving reading and comprehension of mathematical text were very similar to strategies in the world of reading, with each adding its own little twist. Some strategies required the students writing the vocabulary words, studying them out of the textbook, or some used vocabulary cards. I chose to use the vocabulary cards that came with our textbook (Scott Foresman-Addison Wesley, 2008).

Most researchers did some kind of survey to find out what difficulties the students were having and then tried something to improve students’ ability to solve problems. Blessman and Myszczak (2001) did an action research project on a program for improving student comprehension of mathematical vocabulary. Blessman and Myszczak talked about various strategies that could be used to improve comprehension in mathematics like math journals, math dictionaries, children’s literature and graphic organizers. Math anxiety was an intricacy they found with several students in one of their surveys, and they talked about various reasons for the anxiety. Students thought of math as punishment. Their parents did not like math or felt it was just a source of stress. Unlike Fuentes, (1998), who just listed various methods that could be used, Blessman and Myszczak (2001) tried various methods with students and showed tables and graphs of student improvement. Many students today even tended to have a negative attitude
toward math (Blessman & Myszczak, 2001). Most of the time, their excuse was that it was too difficult. So then how could teachers make it easier for them, or get their attitudes changed? I thought that the atmosphere in the classroom would be a good start. Be positive about what one was teaching was a beginning. Showing some enthusiasm so students would get excited about math was a strategy to help them improve their mathematical understanding. The other way I went about creating a positive atmosphere was by putting up all kinds of math visuals. We made signal word charts, story webs, and reviewed the steps involved with solving word problems.

Two of the articles I read went a different route for learning strategies. Yan, Wiles, and Ye-Ying (2008) did a study to examine the effect of teaching word problem story grammar on arithmetic word problem solving that emphasized the algebraic expression of mathematical relations in conceptual models. Yan, Wiles, and Ye-Ying studied five fourth and fifth grade students with or at risk for mathematics disabilities and found varying results on each test they did ranging from no consistent increase or decrease to large (63%) increases. An article by Jonassen (2003) focused on story problems used in mathematics and science problem solving. Jonassen showed how to use technology to enhance story problem solving. These two articles focused mostly on the students’ understanding of the conceptual model (i.e. combine, compare, change) being shown in the story problem and then the authors went through the proper steps to solve the problem. In my class, we really focused on what steps to use when solving word problems. These word problems could be overwhelming for a student that did not know where to start. These charts with the step-by-step process really helped these students.
I was very surprised to see only one article (Jonassen, 2003) that did much work with learning strategies using technology. I was all the more surprised to see that his research did not use technology a tremendous amount or apply a lot to the kinds of technology that were available. To me, the presentation of the printouts he used looked very outdated. I had hoped that when I searched the literature I would find more researchers trying to use more technology. I was not quite sure if the lack of literature I found was because there was not much technology out there for improving problem solving, or if researchers were just not using it.

In my research, I used I-Pods. I had my students read into them, allowing me to check for reading accuracy. The I-Pods also allowed students to listen to themselves and how the problem was supposed to be read as I recorded the problem. Another program I used was called, “I-Speak-It.” This program allowed me to type word problems into it and then it would read the problem to the students using an I-Pod. These technology programs ensured that students who had reading difficulties could process the problem and kept the playing field equal with those who could read accurately while trying to find solutions. I did a search on the Web to see if anyone had done any research with an I-Pod and could not find any.

Problem solving was the cornerstone of school mathematics (Yan, Wiles & Yu-Ying, 2008). Therefore, teachers needed to properly show how to solve problems and make sure that the students really understood what they were doing and could explain the procedures. Fuentes (1998); Fuchs & Douglas (2002); Goularte (2003); Jonassen (2003); Fuchs, Seethaler, Powell, Fuchs, Hamlett & Fletcher (2008); and Yan, Wiles and Yu-Ying (2008) talked about problem solving in some detail. According to Fuentes (1998),
educators needed to improve students’ reading in order to improve their mathematics. Fuentes showed several ways for educators to try to improve students’ reading ability in order to develop their ability to solve word problems. Fuchs (2002) did a study to describe the mathematical problem-solving profiles of students with mathematics disabilities with and without reading disabilities. Fuchs and Fuchs studied 62 fourth-grade students and three levels of story problem tasks, including low, middle, and complex, and found that the accuracy of the students’ performance decreased across the three problem-solving tasks. It was also interesting to know that 6% to 7% of the school-age population suffered from mathematics disabilities (Fuchs & Fuchs, 2002). This problem of understanding the procedures to solve word problems was the reason I had my students make charts listing steps of problem solving.

Seethaler, Powell, Hamlett, and Fletcher (2008) along with Fuchs (2002) and an article by Dirks, Spyer and Sonneville (2008) all talked about how math and reading disabilities affected student learning. Dirks, Spyer and Sonneville (2008) did a study of 799 Dutch schoolchildren using standardized school achievement tests to assess the prevalence of combined reading and arithmetic disabilities. They found that children with combined reading and arithmetic disabilities seemed to have more generalized achievement difficulties than single-deficit groups. This article did not address how the disabilities affected problem solving like Fuchs (2002) and Fuchs, Seethaler, Powell, Fuchs, Hamlett, and Fletcher (2008) did. In my classroom, I had five students with disabilities in reading and three with disabilities in math. Three of these eight students were listed as having difficulties in both math and reading. When I looked at the difficulties these students had, I did notice how the reading difficulties were getting in the
way of their learning in math with at least two of them. With the others, it was difficult to
tell if the poor reading ability was influencing the math struggles.

So I wondered: How could I get my students to comprehend what they were
reading? Better yet, how could I get them to comprehend mathematical story problems?
discussed the importance of reading comprehension and its association with math. There
were a lot of strategies out there to use. Which one was best for my class? Good question.
That was why I tried different approaches and read about other ideas of other researchers.
Educators needed to be aware of strategies others found successful to help with
comprehension (Fuentes, 1998). These educators needed to get as involved as they could
with how their students learned and the difficulties they were having. Teachers did not
want to just “throw together a lesson.” They needed to put thought and detail into every
lesson. If something did not work, then teachers did not give up.

I really liked the idea of Immersing Students in the Language of Math (Blessman
& Myszczak, 2001). If reading comprehension was something that students were
struggling with then surround them with things that were going to help them: vocabulary
lists, dictionaries, story problems, other teachers and students that could help them, and a
positive environment with learning that has meaning. These were all things that others
had found had helped struggling students. This was something I really focused on in my
research. I did what I could to surround my students with everything students needed to
solve problems. I had them make dictionaries, signal word lists, and problem solving
steps.
Looking at how many articles and how much research there was on this issue showed me it must be important. Hopefully, my research could help out a little to improve this problem that students faced. Students did have difficulty with problem solving, and I knew that with my research, I would become a better teacher and help my students become better problem solvers.

**Purpose Statement**

The purpose of my project was to improve student achievement on all word problems through the use of various reading strategies. I examined the research themes of student achievement as measured by homework and tests, and student understanding as measured by pre- and post- student surveys (see Appendix C). The quality of student vocabulary usage with problem solving was measured by recording students reading problems with an I-Pod. I randomly chose individuals to present word problems and their solutions to the class so I could record them. I also had them read word problems to me aloud to check for errors. With this study, I wanted to answer these research questions:

- What is the relationship between reading accuracy / comprehension and mathematical thinking on problem solving? Are my students having difficulties in solving word problems because they cannot read them correctly or because they do not know what the word means?

- What do I observe in my students’ mathematical understanding when I use reading strategies such as recording questions to which students can listen and students writing their own story problems? Are students having more success now that they have been taught some techniques to help themselves? Are they using these techniques?
• When receiving specific mathematical vocabulary instruction, what will happen to students’ verbal mathematical vocabulary usage around problem-solving activities? Are they using mathematical terms when they talk about a problem? Are they using words like factor, product, equivalent, etc., or do they just use words like “take a number times another number?”

• What will happen to my teaching when I approach problem solving by teaching students specific reading strategies? Will I continue to teach reading strategies as part of my math or go back to my old ways of teaching, leaving the reading skills to the Language Arts teacher?

**Method**

My research lasted from about the middle of February 2009 to the middle of April 2009 in my fifth-grade mathematics classroom. I tried various ways to collect data for my project. At times I even wondered if I was collecting too much data and not focusing enough on one area. My first step was to find out if my students were having difficulties with word problems compared to just plain computational problems. Back in February, I gave my students a pre-test (see Appendix A) that came from the worksheets in our math series. It had two parts. The first part of the test was 13 computational problems. These were problems that were all set up for them with no words other than “Solve.” The next day I gave them the second half of this test. This part was made up of the exact same problems that were in Part One except they were written as word problems. I made a spreadsheet to record all the results of each student (see Appendix B). I gave each student a number and recorded how he or she did on every problem on both parts of the test. I also recorded whether he or she chose the wrong computation to solve a problem or if he
or she used the correct computation but got the wrong answer. This was very interesting and I will tell you more about what I found in the next section.

My next step was to conduct some surveys (see Appendix C). I gave my students a survey on how they felt about math. This was a survey with various statements for the students to strongly agree, agree, disagree, or strongly disagree with. These were statements that included statements like, “Math is my favorite subject” or “Math would be easy if I did not have to read.” I put two short answer questions on the end to see how my students felt about word problems and the difficulties they were having with them, along with what they felt would help them solve these problems better. During this time, I also interviewed three random students and asked them questions about math (see Appendix D) just to see what their feelings and thoughts were toward math. I also randomly selected three students to ask questions that dealt more with reading skills (see Appendix E). I gave this survey again at the end of my research, along with one that asked questions about the reading strategies that we had worked on since February. I did three sets of the interviews, making sure I interviewed different students every time because I wanted to get comments from as many different students as I could. Some students were good at remembering what they said the first time and they just repeated what they said before, plus, I wanted to see if all the students had the same thoughts or not. If I had to interview the same student twice, I made sure that if I asked that person math questions the first time, then the second time I asked the reading questions and vice-versa. All the questions for these surveys were questions that I came up with for the purpose of this study.
My next step in the data gathering process was to collect some data from my students in the form of homework and tests. I started out by just collecting three samples of each homework assignment, including samples of high, middle, and low quality work. I soon changed my thoughts on this. Since I had all of my IRB consent forms turned in but two, I decided to collect everyone’s homework and tests. I had a paraeducator that helped in my room and she made photocopies of all the homework and tests after they were graded. This really worked out well, and I was hoping by photocopying all the assignments I could see more individual growth.

Besides the homework and tests, the other big chunk of my data gathering came from my Problems of the Week that were all word problems for my students to solve (see Appendix G). I started with a pre-test problem, recorded how many reading errors each student had, whether they got the answer right, and also looked at what students did to solve each problem. To do this, my paraeducator and I took each student out into the hallway and tested them as we did for the DIBELS testing. We each had the students’ original worksheet to mark errors and when finished we let them go into the room and solve the problem. After the pre-test, I gave them a new problem each week. I recorded the reading errors, checked the problem and then we broke them down as a class, going through each step that we had talked about with our charts in detail, and helped students learn some strategies to help solve the problems correctly. We did a total of 10 Problems of the Week in addition to the pre- and post-problems. I really liked using the Problems of the Week because they were a gradual approach to problem solving. Each problem was a little more complicated than the previous. As we went along, we would add new
strategies, such as story webs, or listening to themselves read on the I-Pods to, as I called it, their “math toolbox.”

On Fridays, I tried to do all my journaling for my research to wrap things up for the week. In the journal, I tried to give an idea of what I was going through as a researcher: telling what data I collected, calculating some numbers for the homework or tests (remembering to make my data lumpy), describing what problems I experienced while doing my research, how I collected my data, and why I collected it. I also tried to discuss what I was doing as a teacher in my classroom that week. I discussed how my day worked in some of the journal entries but for the most part my days stayed pretty much the same. I did not change the routine much because some students tended to struggle when the day’s routine had been changed. For the most part, my journals gave a pretty good picture of my teaching.

As my research time came to a close, I finished with my post Problem of the Week, final interviews, final surveys, and I even gave a post-test. This was the test I gave my students at the beginning where part one was the all-computational and part two was the all word problem test. I thought the interesting part of the data gathering was just the interaction with my students about word problems, problem solving and reading strategies. What did they like? What did they not like? What helped them the most? If one had to pick a favorite strategy, what was it? It was interesting to hear these responses as well as the discussions on why students thought they needed to be good problem solvers and why so many of their problems were in word format. The following figure shows what I collected and when. At times I felt like I was trying to collect too much
data. This was my first research project and I was not sure as to how much data I needed. I decided it was better to collect more data than I needed rather than not have enough. I also wrote in a daily journal. In this journal, I just jotted down some quick thoughts, like how many students were absent, what I was doing in class that day, and how things went. On Fridays, I would do a page write-up reflecting how I felt the week went and what I needed to work on the next week. Overall, I believed I collected the right data but I could have been more organized on when and how I did this data gathering. I probably did not add enough detailed descriptions of events that took place in my classroom and should add more of these events in the future, like more specifics on what students did and what they said, for example when I journal.

**Figure 1: Summary of Data Collected**

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 2, 2009</td>
<td>Pre math survey (See Appendix C)</td>
<td>(21 students involved)</td>
</tr>
<tr>
<td>February 2, 2009</td>
<td>Pre-test (See Appendix A)</td>
<td>(19 pre-tests part 1)</td>
</tr>
<tr>
<td>February 3, 2009</td>
<td>Pre-test (2nd part) (See Appendix A)</td>
<td>(21 pre-test part 2)</td>
</tr>
<tr>
<td>February 4, 2009</td>
<td>1st interviews (See Appendices D &amp; E)</td>
<td>(3 math &amp; 3 reading interviews)</td>
</tr>
<tr>
<td>February 4, 2009</td>
<td>1st problem of the week (then one each week) (See Appendix F)</td>
<td>(21 students involved)</td>
</tr>
<tr>
<td>February-April</td>
<td>Collected homework and tests</td>
<td>(21 students involved)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(12 homework assignments and 3 tests)</td>
</tr>
<tr>
<td>March 9, 2009</td>
<td>2nd interviews (See Appendices D &amp; E)</td>
<td>(3 math &amp; 3 reading interviews)</td>
</tr>
<tr>
<td>April 14, 2009</td>
<td>Post problem of the week (See Appendix G)</td>
<td>(21 students involved)</td>
</tr>
<tr>
<td>April 16, 2009</td>
<td>Post tests (See Appendix A)</td>
<td>(20 post-tests part 1)</td>
</tr>
<tr>
<td>April 17, 2009</td>
<td>Post surveys (See Appendix C)</td>
<td>(16 post-tests part 1)</td>
</tr>
<tr>
<td>April 17, 2009</td>
<td>Final interviews (See Appendices D &amp; E)</td>
<td>(3 math &amp; 3 reading interviews)</td>
</tr>
</tbody>
</table>
My biggest tension throughout this whole process was the stress of everything I was doing at one time. I had memos coming due. I had journaling, finishing surveys and interviews, along with giving pre- and post-tests. Coaching, teaching and Math 807T took up its share of time. Trying to get where I needed to in my classes so students were ready for next year was a high priority, and I could not forget all the family commitments I also had. I also kept worrying about whether I collected enough data or collected the right data. I had a lot of ongoing issues of late papers this semester, and my biggest issue during research was sickness in our schools. Our high school was closed down for two days due to an influenza outbreak. This put me behind on Problems of the Week. I originally planned on doing 10 of them and then the final one. The other problem this brought about was that students were constantly absent at one time or another, and I was spending a lot of my time trying to get make-up work organized, sent home to those students, and then turned in before they fell too far behind. It was difficult focusing on the research at this time.

**Findings**

For my findings, I am going to tell what a typical day in my mathematics classroom was like, including everything from when the students first arrive to when they leave. I will discuss when I collected data and how, what problems I faced and my tensions during this process.

*Typical Day*

Most mornings in my fifth grade mathematics classroom started with a quick warm-up that I put on the board for my math students to work on while I got lunch count and attendance taken. These warm-ups usually consisted of review problems and then a
little of what the new lesson was about. Students did not get a lot of time to work on this because as soon as I was finished, they headed for band and I did not see them for another 40 minutes. Once they were back in the room, I let them finish their warm-up problems, turn in their homework, get out anything they were going to need for the day’s lesson, and then I went over the warm-up problems with them. Sometimes I had the students come up to the board and show how they worked a particular problem and had different students show their work for each problem.

Once we got finished with this, and I got after them for not getting their homework finished, I started discussing the new concept for the day. Most of the time it was the same students, usually two or three, not finished with their homework and occasionally, someone else. Sometimes I liked to start out with some kind of manipulative work, especially when we started working on fractions. The students really enjoyed this and tended to help some of the lower-level students. I did not think students realized it, but I was giving them a word problem to solve when I asked them to do something with the manipulatives. They thought I was just telling them to do something with some numbers and did not think it was a word problem. For example, when we were using the fraction manipulatives, I asked them to show me six-eighths because, Tony ate six-eighths of his pizza. Then I told them to show me another fraction that was the same length as the six-eighths because Susan ate the same amount. Then I would ask how much Susan ate, three-fourths. After doing this for a while and probing with some questions, I used problems and manipulatives like this to lead into the day’s lesson.

I liked to talk about the new concepts and show my students how I wanted them to work these problems up on the whiteboard. Sometimes I used our Promethean Board.
Some people may know them as Smart Boards, but we call them Promethean Boards (Smart Boards on steroids). These boards were interactive whiteboards that the teacher and students could use and write on. The boards included lots of interactive tools, such as a compass, protractor or ruler to make shapes of any size. We had online versions of our math books (Scott Foresman-Addison Wesley, 2008) that students could look at from home if they wanted or needed to. Each student had a login and password to get to his or her math book. With this software, I could project the book up on the Promethean Board, and show my students exactly what I was talking about in their book and even point to a particular problem and ask them to solve it.

With their book projected up on the whiteboard, I could go over specific directions or the questions they had in front of them. Now, I usually tried to give my students several problems to work on their personal whiteboards at their desks. If I got some students that were really grasping a new concept and were finishing each problem rather quickly, then I would have them move around when they finished their problem and help others who were struggling. This was like a snowball, one student got finished and helped another, then another finished and helped someone and this just kept growing until everyone was helping someone else or being helped. This way no one was just waiting for something else. Sometimes, everyone grasped the concept quickly and the students did not even have time to help someone else. This was the ideal situation. Once I felt that everyone was grasping the new concept rather well, I assigned the homework.

*Homework*

Homework was an area I had changed a lot. In the past, I would usually just assign the computational practice problems and maybe a word problem as a bonus. I
guess I knew how much the students would struggle with the word problems and I did not want them out of their comfort zone and struggling. While doing my research, I tried to give about half of each type of problem. If the class period was close to being over before I had assigned the homework, and I knew they would struggle with it, I sometimes waited and had them work on the homework the next day. I did this for two reasons. One, so they had more time to work on it and two, so I was there to help them.

As far as making changes in my teaching for my research, during the week of March 16th, I said, “Today in math we added some signal words to our charts that we made earlier. I just hope that the students will use them.” These signal words were to help the students identify what operation they were going to use to solve their word problems. Some students felt that they helped a lot. I think others would agree if they would just use them more.

**Problem Statement**

Reading accuracy and comprehension played an important role in students’ mathematical thinking on problem solving. My evidence of this was my collection of homework, tests, surveys, and interviews that I conducted. I collected all of my students’ work that they did in math, i.e. homework assignments and tests. For each assignment, I had a homework/test analysis sheet that I made up to help myself visualize how they did. I indicated how many computational problems there were, how many word problems, and added columns that listed how many each student got correct on the assignment (see Appendix B). I did some figuring on each when work was turned in to get some idea of how students were doing as time went along. I calculated things like the class average,
low score, high score, what the average was of correct computational problems, and what the average was of correct word problems on each assignment.

Analyzing the Data

On the very first assignment for which I did this analysis, I found that my fifth grade mathematics class got an average of 75% of the computational problems correct and only 61.2% of the word problems correct. On this assignment, students were given eight computational problems and eight word problems. I broke the information down into a table (fig. 2). I had a few students that were very low level or just very slow at doing math, and as part of their IEP’s (Individualized Educational Program) we were to shorten their assignments if needed. If I noticed they were struggling, I assigned half of the problems. If they looked like they were doing all right, then I let them do all of them; therefore, some of my numbers did not always match up to how many of each type of problems we did. When looking at the table, there were eight problems but my average was less than that. Then these were the assignments for which I reduced some numbers of problems. This occurred on all but four assignments, namely assignments 9, 13, 14 and 15.

Figure 2: Assignments and Scores

<table>
<thead>
<tr>
<th>Assignment</th>
<th># of computational problems</th>
<th>Avg. &amp; % correct</th>
<th># of word problems</th>
<th>Avg. &amp; % correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>5.55/7.4 (75%)</td>
<td>8</td>
<td>4.5/7.74 (61.2%)</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>7.52/7.76 (96.9%)</td>
<td>8</td>
<td>4.8/7.57 (63.5%)</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>8.03/9.26 (86.6%)</td>
<td>12</td>
<td>6.21/11.16 (55.7%)</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>6.36/7.62 (83.4%)</td>
<td>8</td>
<td>5.58/7.8 (71.5%)</td>
</tr>
<tr>
<td>5 (test)</td>
<td>31</td>
<td>15.4/30.2 (50.9%)</td>
<td>7</td>
<td>2.9/7 (41.8%)</td>
</tr>
</tbody>
</table>
When I looked at each assignment by itself, I was not seeing anything significant as far as improvement. It was difficult to see any improvement by looking at just one assignment, unless I could remember how each student had done on other assignments. Therefore, I tried using this table and looking at outcomes of all assignments together. For the most part, I still was not able to see much as far as any significant improvement by my students in the area of solving word problems. When I went back and found the differences between the average of computational problems they got correct and the average of word problems that they got correct, I was able to see some improvement. According to the graph (Figure 3), I plotted the differences on a table. If I was to show any progress of improvement of solving word problems, I would see a steady decline with all my points as the arrow on this graph shows. A decline would signal a decrease in the difference between the percent of word problems that were incorrect compared to the percent of computational problems that were incorrect. If there was no improvement, the
Reading Strategies 27

points would all be either straight across or maybe upward meaning the percentage differences were getting farther apart (this would not be good as this would mean they were getting worse) or all the points could just be scattered everywhere showing no pattern of improvement. For the most part, the numbers tended to drop over time (Figure 3). I would not say significantly, but a little. There were several points along the way that tended to jump around. Something that I felt might have skewed this data or caused some of these jumps was the fact that some of these assignments were calculated with some assignments that were not done and the students chose to turn it in for a grade instead of finishing it. This would include assignment number 3 (30.9), 4 (11.9), 9 (24), and 12 (24.7). As you can see, these numbers are large due to the incomplete work and low scores. The numbers in parentheses indicate the difference between the average of computational problems they got correct and the average of word problems that they got correct.

I was not quite sure if this was showing a decline in the two types of problems so I created another graph, except this time I used two arrows (Figure 4). I drew one that followed the pattern of the high points and one that followed more of the pattern of the low points. With this I was able to see more of a gradual decline suggesting more of an improvement with word problems. If I took out assignments 9 (24%) and 12 (24.7%), the decrease in the difference from word to computational problems was more apparent.

If I looked at both scores and graphed them I got a different perspective on what was happening. I was trying different graphs to see if any of the results were more visible than the others. I went ahead and put both the percent correct of the computational problems (red) as well as the percent correct of the word problems (blue). With this type
of graph the pattern that I was looking for was for the red to stay pretty level across the top of the graph, and the blue line to be lower at the left side and going up as the arrows

Figure 3: Word vs. Computational-Slope

Figure 4: Word vs. Computational-High and Low Points
show in Figure 5. This was a graph with made up numbers to give an idea of what shape I was looking for in these graphs. With this graph, I was looking for the red numbers

**Figure 5: Computation Compared to Word Problems-Example Graph**

(percent of computational problems correct) to stay high up on the graph and the blue numbers (percent of word problems correct) to get higher as time went on until those scores were as high as the red ones. It was more complicated to find these patterns and some could be deceiving if one did not look at the numbers on the Y-axis. Not all of the graphs started with zero because of the program that created these graphs. It tried to eliminate unneeded graph space. If they all started with zero, it would be easier to compare them and see the increase in scores. Some started as high as 80%. With a graph like this, at first glance you might not see that this individual did improve or did have high word problem percentages. In figure 6, this was as close to the pattern I was looking
for that I could find when looking at the pattern of every student’s graph. Everyone had some kind of spikes or dips somewhere along the way. This one was one that it was important to notice that started at 80%. What looked like some pretty big drops were not really falling very far.

**Figure 6: Computation Compared to Word Problems-Good Pattern**

Therefore, I would have to say this was my best example of how a student improved throughout the research. On some of the graphs, I started with a grade of zero just to make sure that the graph started at zero like the others. Figure 7 (each graph represented one student) was an example of what I felt was fair improvement. There was a little more spiking and dipping than I would like, especially since this graph started at zero, but, I felt this student showed some pretty good improvement. Finally, in Figure 8, one can see an example of a graph that was just not consistent at all with numbers or patterns. The red
line jumped around just as much as the blue line did. In fact, the lines mirrored each other at times. This told me that this student must struggle with all types of math problems, not just specifically word problems. When I thought about my research, I wanted my students to stay consistent at solving computational problems at a high-efficiency level, and I wanted their word problem-solving skills to keep improving.

**Figure 7: Computation Compared to Word Problems-Fair Improvement**

![Graph showing comparison between computational and word problems with fair improvement.](image1)

**Figure 8: Computation Compared to Word Problems-Not Consistent**

![Graph showing comparison between computational and word problems with inconsistent performance.](image2)
Problems of the Week

Another way for me to see if reading accuracy and comprehension played an important role in students’ mathematical thinking on problem solving was with one of my reading strategies, Problems of the Week. These were a great way to work as a class to discuss strategies and the problems would gradually get longer and more complicated. As time went on, I was able to let students do more Problems of the Week on their own. I started with a pre-test problem, then eight Problems of the Week given out each Monday. At the beginning of the week, I would check for reading accuracy at this time by listening to each student read the problem aloud to me as I marked down anything they read incorrectly. As the week went on, I had them solve the problem on their own, sometimes they would write their own problem like that one, then we would break down the problem and discuss how to solve it correctly and what the answer was. As we did this, we used other reading strategies including visuals. We made posters that listed the steps involved in solving word problems and posters that had different signal words on them indicating what operation students were to use (Figure 9).

Figure 9: Signal words)
We even made a poster on how to make a story web as they did in reading class. We started with the computational problem in the middle and built a web around it with different parts they wanted to add to their problem such as who would be in their problem, what they would label the problem with, and anything else they needed to build their story problem.

These strategies, such as vocabulary, following the story problem-solving steps, story webs, writing their own word problems and others were built into the Problem of the Week lesson. We gradually added one each week as time passed. With the Problems of the Week, I kept track of how many errors each student was making on each problem. After looking at the number of errors, I tried to pick out three samples of student work on Problems of the Week. I picked a good, fair and a poor example of improvement from week one to the final week. The best one I could find was by a student who did have trouble reading (Figure 10), and looking at this graph I would say he or she has worked on improving reading accuracy and answered all three questions correctly on the final problem. The next one I found was an example of a middle of the road student (Figure 11). This student’s reading errors stayed fairly even throughout all the problems, and the student got two out of the three final questions correct on the final problem. I did not find any student whose reading errors increased. This was a good thing; therefore, my last example was of a student whose reading errors remained fairly constant and actually improved, however, this student missed all three questions on the last problem (Figure 12). This was one of those examples of a student who did not have any difficulty in reading the problem. This student’s difficulty was in the solving of the problem. In this case, the student was not even close to solving the problem correctly. The difficulty could
have been in understanding some of the words, but I did not ask this student if he or she knew what every word meant. I just kept reminding this student that if he or she did not

Figure 10: Student A Reading Errors On Problems of the Week

![Figure 10: Student A Reading Errors On Problems of the Week](image)

Figure 11: Student B Reading Errors On Problems of the Week

![Figure 11: Student B Reading Errors On Problems of the Week](image)
know a word they were to go back to one of our reading strategies, the math dictionaries, and look it up to see what it meant. In Figure 13, I showed the reading errors that were made by the students represented in Figure 10 (student A), Figure 11 (student B), and Figure 12 (student C). Next to each, I indicated how many reading errors each student had on each Problem of the Week along with whether he or she had the answer correct. Student A was an example of a student that could throw the data off a little. This student had difficulty in reading, as indicated by all the errors. However, he worked very hard at math because it was difficult for him. He focused very hard on getting the correct answers so even though he may have had a lot of errors, many times he still had the correct answer. As time went on, he did start to focus more on his reading and cut down on his reading errors, which was good to see. I took a lot of time this year with this research and tried several different strategies to help my students understand and solve word problems. I found some that worked better than others, some I was going to keep
using and some things I probably would not use again, at least not right away. Through research and observations, I was able to see some things that worked and some things that did not work as well. I really believed my students would not only become better problem solvers, but also through these learning strategies I used in my classroom, they would become better readers and would grow from there. In Figure 13 A-Z, one could see the errors (the circles and cross-outs in the reading) that students A, B and C made on their Problems of the Week and whether they got the correct answer. Notice how with student A his number of errors decreased considerably over time. Student A started out getting incorrect answers for the first two and then was able to get the correct answer on all but one of the rest. At the beginning, this student was making several reading errors, still getting a considerable amount of the answers correct. Student A worked very hard at math despite his reading difficulties. These Problems of the Week made him more aware of his reading difficulties and he worked very hard at focusing on what the problems were asking. Looking at the final Problem of the Week, he only had two reading errors and was able to get all three answers correct. This student showed great improvement by learning to apply the strategies that were taught throughout the research project and he channeled his thoughts toward the mathematical process.

Figure 13: A-Z Reading Errors
The Barley Sheaf Elementary School has held a clothing drive for the last few years. In 2005, they collected 1,896 pounds of clothing. In 2006, they collected 1,922 pounds of clothing. In 2007, they collected 2,352 pounds of clothing. How many pounds of clothing did the school collect in the three years altogether?

Student A - 8 Reading Errors. Wrong answer.

Four people each shake 4 people’s hands. Each of those people then shake 4 more people’s hands. If the pattern continues for five rounds, 4^5 people will have shaken hands. What is the value of 4^5 written without an exponent?

Student A - 8 Reading Errors. Correct answer.

The Art Department received 552 pounds of modeling clay to be used the entire school year. The clay was placed into six boxes to be stored, each box with the same amount of clay. How many pounds of clay were in each box?

Student A - 6 Reading Errors. Correct answer.

Margo is trying to estimate how long it will take her family to drive to their vacation home. She knows that their home is about 450 miles away. She figures her family will average 50 miles per hour. How many hours will it take Margo’s family to reach their vacation home?

Student A - 4 Reading Errors. Correct answer.

Tom, Alaya, Mark, and Maria have a total of $48 to spend at the fair. They each spent $8, so $24 total on tickets for rides. They agree to spend the rest on face painting and dinner. They plan to spend twice as much on dinner as on face painting. How much do they plan to spend on dinner?

Student A - 3 Reading Errors. Correct answer.

The table shows the population of certain cities in California according to the 2002 U.S. census. Which city has about 3.8 times as many people as Anaheim?

Student A - 1 Reading Error. Wrong answer.
Student B never had more than two reading errors and was correct on all answers except for one on the final Problem of the Week. This student was an average to above-average reader who liked math and was good at problem solving. If one noticed the reading errors, they were not errors that should make a difference in solving the problem.
Four people each shake 4 people's hands. Each of those people then shake 4
d more people's hands. If the pattern continues for five rounds, 4^5 people will have
shaken hands. What is the value of 4^5 written without an exponent?

Student B - 2 Reading Errors. Correct answer.

Marge is trying to estimate how long it will take her family to drive to their
vacation home. She knows that their home is about 450 miles away. She figures
her family will average 50 miles per hour. How many hours will it take Marge's
family to reach their vacation home?

Student B - 0 Reading Errors. Correct answer.

Tom, Alaya, Mark, and Maria have a total of $48 to spend at the fair. They each
spent $6. or $24 total on tickets for rides. They agree to spend the rest on face
painting and dinner. They plan to spend twice as much on dinner as on face
painting. How much do they plan to spend on dinner?

Student B - 2 Reading Errors. Correct answer.

The table shows the population of certain cities in California according to the
2002 U.S. census. Which city has about 3.8 times as many people as Anaheim?

Student B - 1 Reading Error. Correct answer.

Tomas's map of Lexington shows three streets that are vertical and parallel. The
map also showed one street perpendicular to the three parallel streets. Show the
arrangement of the streets Tomas saw on the map?

Student B - 0 Reading Errors. Correct answer.

Your neighbors (Mr. Jones and Mrs. Smith) each have a pile of 750 bricks to move. Mr.
Jones says he will pay you by the hour at $4.00 an hour, and Mrs. Smith says she will pay
you $0.04 per brick. It takes you 1 minute to move 2 bricks and return for more. You
only have time to move one pile of bricks so you must decide which is the better deal for
you.

How much will you make from Mr. Jones?

How much will you make from Mrs. Smith?

What is the better deal for you?

Student B - 0 Reading Errors. 2/3 correct answers.
Student C is a student who did improve on the amount of reading errors and did not miss any problems until the final Problem of the Week. Unfortunately, on this one they missed all three questions. This could show different things. One theory could be that they were too worried about reading the problem correctly, and they made some mathematical mistakes. Another theory could have been that they got in a hurry and did not use the new reading and problem solving strategies effectively; therefore, they did not successfully solve the problem. My personal theory behind this error was that it was due to the fact that this was a multiple step problem and this student struggled when there were more than one or two steps.
Results of Surveys

I gave a pre- and post-math survey to my students. The results were shown in the following table (Figure 14). The first number in each box represented the survey in February, and the second number represented the post-survey in April.
## Figure 14: Math Survey Results

<table>
<thead>
<tr>
<th>Statement</th>
<th>Standard Deviation</th>
<th>Pre</th>
<th>Post</th>
<th>Pre</th>
<th>Post</th>
<th>Pre</th>
<th>Post</th>
<th>Pre</th>
<th>Post</th>
<th>Pre</th>
<th>Post</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math is my favorite subject.</td>
<td>Pre=3.81</td>
<td>8</td>
<td>10</td>
<td>8</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Post=5.62</td>
<td>40%</td>
<td>48%</td>
<td>40%</td>
<td>52%</td>
<td>15%</td>
<td>0%</td>
<td>5%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The area I struggle with the most in math is solving word problems.</td>
<td>Pre=5.05</td>
<td>2</td>
<td>3</td>
<td>12</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Post=6.10</td>
<td>10%</td>
<td>17%</td>
<td>60%</td>
<td>44%</td>
<td>15%</td>
<td>28%</td>
<td>15%</td>
<td>11%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I need help in explaining how I solved problems.</td>
<td>Pre=2.74</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Post=3.54</td>
<td>20%</td>
<td>22%</td>
<td>35%</td>
<td>50%</td>
<td>30%</td>
<td>17%</td>
<td>15%</td>
<td>11%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math would be easy if I did not have to read.</td>
<td>Pre=3</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Post=3.04</td>
<td>15%</td>
<td>11%</td>
<td>35%</td>
<td>33%</td>
<td>15%</td>
<td>17%</td>
<td>35%</td>
<td>39%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sometimes in math, I feel nervous, like I cannot do the work.</td>
<td>Pre=2.96</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Post=2.65</td>
<td>35%</td>
<td>17%</td>
<td>15%</td>
<td>33%</td>
<td>40%</td>
<td>17%</td>
<td>20%</td>
<td>33%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like to use technology when doing math.</td>
<td>Pre=3.80</td>
<td>10</td>
<td>7</td>
<td>6</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Post=4.32</td>
<td>50%</td>
<td>38%</td>
<td>35%</td>
<td>50%</td>
<td>10%</td>
<td>6%</td>
<td>15%</td>
<td>6%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Using the bar graphs it was easier to see changes in the percents on each statement.

According to this survey, my students’ interest in math increased over time (Figure 15),

**Figure 15: Favorite Subject**

![Graph showing favorite subject](image)

and the area they struggled with the most in math was word problems (Figure 16). For the

**Figure 16: Solving Word Problems**

![Graph showing area struggled with most](image)

most part, none of the statement results really changed much from the first survey. This lack of change could have been for various reasons. For example, it was toward the end of the school year and the students wanted to get the surveys over with. They did not put as much thought into them as they could have, or their opinions just might not have changed. Another possibility was that there was not enough time during this research to see much change in their thoughts. Some things that did surprise me from the pre-test to the post-test was one, on the pre-test only 10% said that the area that they struggled with was word problems. Then on the post-test it had gone up to 17%. This might be because they did not realize that they were having difficulties with word problems until we started
working on them. The other big change was on whether students said they needed help explaining how they solved word problems (Figure 17).

**Figure 17: Needing Help Explaining Answers**

![Figure 17: Needing Help Explaining Answers](image)

On the pre-test 35% said they agreed they needed help explaining answers and then 50% said that they agreed they needed help on the post-test. I think this research project, and the work on explaining answers, opened the eyes of several of my students and showed them it was going to take some more practice to be able to write and talk about how they solved problems. It also looked like their nervousness dropped a little as shown by 35% strongly agreeing on the pre-test and only 17% strongly agreeing on the post-test (Figure 18). The percentages did not change on their attitudes on math being easy if they did not have to read (Figure 19).

**Figure 18: Nervousness**

![Figure 18: Nervousness](image)

The statement that seemed to represent some mixed feelings was about feeling nervous in math (Figure 18). I was not quite sure why except maybe students did not realize they were nervous when they got math work or when they worked on
tests. I knew I was someone who got very nervous before tests, so I was a little surprised not to see more agrees or strongly agrees. The area that got the most positive feedback, and not really a big surprise, was the idea of using technology (Figure 20). This group of fifth-graders loved to use the computers and any other technology they could. Using technology would be something to keep in mind in further work to improve reading and math skills.

Figure 20: Technology With Math

Something I also found out on this survey was that on a scale from one to 10, with 10 being the most difficult, the average score on the pre-test was 5.7 and then dropped to a 3.6 on the post-test when asking the students to rate how difficult math was for them. I looked at this as telling me that something I was doing (hopefully the reading strategies I was teaching), was making math a little easier. It was very interesting to read the comment part of the survey. I asked them what the most difficult thing was when solving word problems and I got a wide variety of answers ranging from reading the problems to
sharing out loud. Other areas students felt were the most difficult for them included, “the
solving part,” “the difficult words,” the vocabulary,” “telling what I did” and “keeping up
in class.” My other question was to find out what students thought would help them
become better problem solvers. Again, I got a wide array of answers including reading
better to practicing more. One student even said, “I need to pay more attention when Mr.
Hite’s teaching and not be messing around.” Others had suggestions like, “we could start
with easier problems,” “write more word problems,” “do not have problems with words,”
“slow down,” “study,” and “keep doing the same stuff we are doing now.” This wide
array of responses gave me the idea that they really did not know what would help them
the most. It also told me that everyone was different and had his or her own way of
learning.

*Applying Reading Strategies*

My students’ mathematical understanding changed after applying reading
strategies in my classroom. My evidence of this was the results of the homework and
tests that I shared earlier. With my reading survey I was mostly interested in finding out
which reading strategies they felt helped them and which ones did not. In these graphs,
the bar represents the number of students that responded with strongly agree to strongly
disagree and not percentages. With this information I wanted to see the exact numbers
since I did not have a very large research population. The majority of the class did agree
that the strategies were helping them in math and that they needed to continue to improve
their reading skills to help them in math (Figure 21). According to the survey, the math
dictionaries helped them a lot and so did the creating of their own word problems;
however, the one that had the most positive feedback was the re-reading strategy
Figure 21: Reading Strategies Helping in Math

(Figure 22). I was a little surprised with this one because I felt this one was the easiest. I just had them read the problem, and before they did anything else, I told them they needed to read it again. The use of the I-Pods and I-Speak-It to listen to themselves read problems along with listening to how it was supposed to be read was a popular choice for those who got to do this (Figure 23). I did not get as much time to do this strategy or get

Figure 22: Helpfulness of Re-Reading Strategies

Figure 23: Using the Read-Aloud Strategy
as many students to use this strategy as I would have liked. One reason for this was because I got started a little late in using them and so I chose students who had more difficulty in their reading skills to go first with them. I hoped to use this again at a later date. Other survey results for the reading strategy survey were shown in Figures 24, 25, 26, and 27. At the end of the survey I had them rate on a scale from one to five how they felt about some other strategies we worked on, and the making of the signal word posters was the favorite. The story web was the least liked of them all. There was a little more thinking involved with this strategy. Therefore, some of the students did not like this one.

**Figure 24: Keep Improving Reading Skills**

![Bar chart showing student ratings]

**Figure 25: Reading Strategies and Explaining Answers**

![Bar chart showing student ratings]

**Figure 26: Math Vocabulary Work**

![Bar chart showing student ratings]
as well. Taking in what I have learned as a classroom teacher, most students wanted the quickest and easiest way out. With the last part of this survey, I asked the students to rate three other strategies that we had used on a scale from one to five with five being the most helpful to them (fig. 28). The use of a story web was the least used according to the student responses. It received an average score of 1.9. The other two strategies we used were almost identical in average scores. Problems of the Week had an average score of 3.6 and the signal word charts received an average score of 3.7. This helped me in deciding what strategies to use in the future and maybe which one(s) not to use. That did
not mean the web strategy was a bad strategy. This could just be a strategy that did not work well with this class or at this time. I could use it again in the future with different classes.

I also started having students come to the front of the room and present their Problem of the Week. Each week, I saw signs of improvement, such as a decrease in the number of errors on Problems of the Week and an increase in the number of correct answers on assignments. I recorded these with the I-Pod and could hear little improvements each week with presenters. At first, for the students, they wanted to get up in front of the class, hurry through what they did to solve the problem and then sit back down. With these early presentations, I had to do a lot of prompting with phrases like, “tell what you did to solve this problem,” “why did you do this?” “tell what steps you used,” and “show your work on the board.” Here was part of a presentation that took place on March 25, 2009. This student started out reading the problem to the class and then discussed it.

Student (after a long pause): “Uh.”

Teacher: “Just tell them what you did.”

Student: “Uh.”

Teacher: “You can show whatever you need to on the board.”

Student: “I didn’t really cross anything out or circle anything.”

Teacher (after another long pause): “Talk through it. Tell them what you’re doing so they know.”

Student: “I had 48 dollars to spend on the fair and I minused 48 by 30.”

Teacher: “Why?”
Student: “Cause 24 adds 24 and six which makes 30.”

Teacher: “OK, why did you add those together?”

Student: “Cause that’s how much they spent on that stuff.”

Teacher: “OK.”

Student: “So, and I got 18 dollars.” “They spent 18 dollars on dinner and they spent six dollars on face painting.”

Teacher: “OK, tell them not me.”

Student: “So, umm, I came up with 18 dollars on uh, dinner and six dollars on face painting.”

Teacher: “OK.” “Done?”

Student: “Yes.”

Teacher: “Good job.”

The further along we got, the more each student started adding little things, like stating what step in the problem-solving process he or she was on, and even stating why he or she did certain things. I did very little prompting on these presentations. Students were more fluent, more detailed in their explanations, and said “umm” a lot less. Here was an excerpt from a presentation on April 15, 2009. This student started out by reading the problem to the class.

Student: “Umm, you can re-read it. Find information that you don’t know. So if don’t know what perpendicular means then you can look it up in your math dictionary. And the arrangement I did it is I drew the three parallel streets, the three vertical parallel streets and then it said show one perpendicular street. And if
you didn’t know what it means then you would look it up and then you could
know what to do.”

Teacher: “What does perpendicular mean?”

Student: “Have a right angle.”

Teacher: “OK.”

Student: “And you can cross out information that you don’t need. So you get, so
you can show it.”

Teacher: “Is there anything in there that you could have gotten rid of?”

Student: “Umm, not really. You can get rid of the name if you wanted.”

Teacher: “What about key information to circle?”

Student: “Circle umm, three streets that are vertical and parallel and one street
perpendicular to the three parallel streets. And then you have to show it and that’s
all that I did.”

Teacher: “OK, good job.”

The students who presented were then allowed to listen to themselves. One
student who presented a Problem of the Week on March 19, 2009, finished listening to
herself and told another student, “I do not like the way I presented my problem. I sounded
choppy.” Hopefully she would work to improve her reading fluency for the next time she
had to do a presentation. They seemed to learn from each other from previous weeks and
eventually even started using some more mathematical terms like “product” or “the sum.”
I hoped to see more of this kind of improvement in the future with this class as well as
others. By recording students and letting them listen to themselves, I hoped to improve
their verbal skills. Listening to some of the presentations on the I-Pod, I noticed students
just going through the steps but not telling the class what they were doing. Early in March, they would read the problem, then they would say “next I” and tell what they did and kept going in this manner without much detail. Then later in April, students said things like, “after reading the problem you can re-read it, find information that you do not know, so if you do not know what perpendicular means you can look it up in your math dictionary.”

My students’ verbal mathematical vocabulary usage around problem solving changed when receiving specific mathematical vocabulary instruction. My evidence of this was found mostly in the presentations of the students. If you noticed in the second presentation excerpt from earlier, this student used more vocabulary that I was looking for. For example, she used some of our strategies that we had been working on such as, re-read the problem, use your math dictionary, and look up terms you did not know. She still used the word “umm” a few times but I thought over time these would disappear as her confidence grew. I was hoping to find more evidence of this in the interviews that I conducted over the four-month time span, but interviews with my fifth grade students were very short answers. It seemed as though it was difficult for students to explain why they felt a certain way. Most of the answers they responded to with “yes” or “no” answers. I recorded the interviews on the I-Pods to listen to them later, and I did not gain much evidence of improvement from them. At times they acted nervous about being interviewed, fidgeting with their hands, giving short answers or looking around the room. Others were not nervous at all but more in a hurry to get going to their next class also showing by quick or short answers with no explanation. If they did have some reasoning, it was very short. I felt like I was doing too much prompting along with the questions I
had in my interview but I was getting short, sometimes one-word answers from them, even when asked to explain. I was having to ask “why” a lot or other times I noticed when I asked about the reading strategies I had to remind them of what the strategies were “problem of the week, math dictionaries, signal words or story webs. Do you feel any of those are helping you?” After this prompting, I would then get a “Yes.” Therefore, I would need to prompt again with “Which ones?” Then, after prompting so much to get something out of them I felt as if I was just leading them toward the answers I was looking for. Here is an excerpt from an interview with a student on February 12, 2009.

Teacher: “What do you think about problems that have a lot of words? Like word problems that we do or story problems. What do you think about those?”

Student: “Um, I kind of don’t like those but kind of do.”

Teacher: “OK, why not?”

Student: “Because it’s kind of hard for me.”

Teacher: “Ok, because…”

Student: “Reading ’em wrong and all that.”

Teacher: “OK.”

A later interview on April 22, 2009, went like this.

Teacher: “Do you like math?”

Student: “Yes.”

Teacher: “Ok, why? What do you like about it?”

Student: “It’s fun and easy.”

Teacher: “It’s easy?”

Student: “Yes.”
Teacher: “What do you think about word problems that we’ve been doing?”

Student: “They’re ok.”

Teacher: “What makes math difficult for you?”

Student: “Umm, probably the reading.”

Teacher: “Reading, ok. What do you think teachers, not just this year but other years down the road, what can they do to make math easier for you?”

Student: “Make you do reading problems.”

Looking for improvements I looked at the students’ homework, tests, problems of the week, and pre- and post-tests. I was seeing signs of improvement as I did on the pre-

Figure 29: Student Pre- and Post-Test Examples-Good Improvement
and post-tests (fig. 29). On the pre-tests students were not choosing the correct computation and getting the incorrect answers, and then on the post-tests they chose the correct computation and had the correct answer. Some students were now choosing the correct computation but not working the problem completely right (Figure 30). At least choosing the correct computation was getting them on the right track toward getting to the correct answers. There were also the students who were choosing the correct computation but forgetting numbers (Figure 31).
computation but forgetting some of the numbers (Figure 31). The students I needed to focus on the most right now were the ones who were still not choosing the correct computation for the word problem (Figure 32). If one looked at Figure 32, one could see how this student should have used division to solve this problem but instead chose to use multiplication. I needed to get these students reading the problems correctly and choosing the correct computation.

Figure 32: Student Pre- and Post-Test Examples-Wrong Computation

Conclusions

My research lasted from early February to mid-April. I gave pre- and post-math surveys. I also used a pre- and post-math test along with interviews and Problems of the Week. I gathered all of my students’ homework and tests, and they created posters and other visuals to help them. Not once did I ever hear one of my students complain about helping me out with this research. I would like to commend them for this because I know for a fifth grader extra work was the last thing on his or her to-do list.

When looking back on all this research, the first thing that it told me was that there was a problem with reading skills, and it could be connected to my students’ problem solving skills. This was one of those things that it was difficult to work on improving if one did not know the problem existed. If I recognized that a problem existed
and had evidence of it, then I could focus more attention on that one specific skill to help improve it.

I had evidence that the reading strategies helped my fifth grade mathematics class. I believed each student took something from this process and used it in his or her own way to improve his or her math and reading skills. By the end of this research, I observed my students were more focused on the reading of the questions and taking more time in reading them. However, I saw evidence that a lot of their errors were in their computation and so they needed to continue working on their basic computational skills. Also, for the most part, after looking at worksheets, tests and Problems of the Week, the students were getting better at choosing the correct computation, but just not computing everything correctly. Mistakes like subtracting wrong, forgetting to add what they carried, or dividing wrong were made (Figure 27). These situations indicated that reading problems were some of the difficulties but did not account entirely for students’ performance in math. Reading was still an important part of mathematics, and I needed to continue to focus on student-reading skills as part of my mathematics curriculum.

There were things I, as well as other teachers, needed to keep telling students. We needed to keep reminding them that they cannot solve the problem if they cannot read it correctly. They needed to use their resources to make sure they know what everything means. If they did not know, ask. They needed to take their time and pay attention to details and keep working on their math facts. I think a lot can be learned from the student who said, “I need to pay more attention to when Mr. Hite’s teaching and not messing around.” I needed to make sure my students were on task, and my students needed to learn that they must put forward a solid effort toward their math. We can learn as well
from the student who said, “I do not like the way I sounded when I listened to myself present.” I needed to visit with this student and listen to what they felt was bad and discuss how to improve their presentation.

There were definitely things the students could learn from one another, not just from me. Having the students listen to math presentations brought about questions and comments that we used to help improve all presentations (comments such as, “I could not hear them,” or “They did not explain the problem enough”). I am going to keep these recordings on the I-Pods and let students listen to them to hear examples of how to read and work problems, as well as record new ones to listen to. If I told them ahead of time which recording represented a good presentation and which one was an average or below-average presentation, then the students could listen and hear the differences. They could even listen to both without any prompting and tell me which one was the better presentation and why. I really believe there is more to be learned with the I-Pods and having students listening and learning from themselves.

Through all the surveys, it was clear that the students were aware that knowing the vocabulary and reading were important in word problems, and being aware of this was the first step. Now, I need to just keep building on this and keep looking for more ways to help them. As Fuentes (1998), said, “educators need to improve students’ reading in order to improve their mathematics because so much of our math today involves reading.” My students are always asking why they need to do story problems, and I am sure every other teacher’s students ask the same thing. I believe that the textbooks’ use of word problems is their way of showing students where they were going to use mathematics out in the real world. Telling my students this seems to help them
understand when they can see the actual application of what they are working on is. We are building toward better problem solvers, and to get there they need to become better readers. As I stated earlier, reading problems were some of the difficulties my students were experiencing but does not account entirely for their performance in math.

**Implications**

As a result of this study I am now very aware of the relationship between reading skills and problem solving. I am also more aware of what types of reading strategies there are. I have found that some worked better than others, but this is something that may change from class to class. I have found strategies that are more interesting for the students than others and know that sometimes it can be the simplest idea that helps them the most. For example, the charts we made with signal words (Figure 9) on them were very easy to make and we could keep building on them as the year went on, and, according to the reading survey (Figure 25), this was a popular reading strategy for them. Teachers need to keep their minds open to new ideas. They need to try to convince their students to keep their minds open to ideas that could help them become better problem solvers.

What is my next step? I need to continue to work on improving my students’ reading skills as well as their math skills. As Blessman & Myszczak (2001) said, “we need to improve our student’s mathematical language.” Mathematics has its own language, and we need to be teaching it to our students. I plan on implementing several of the strategies that I tested out next fall in my classroom. I may even try some of the ones that did not work as well. One thing that I am going to have to keep in mind is that I will be teaching the same group next year as I did this year when they are sixth graders. This
means I am going to have to get creative and either come up with some new strategies or find ways to put a twist on some they have already seen and used. For example, our school is now going to a one-to-one laptop program. If I record students’ presentations with an I-Pod then they can download it onto their computer and listen to it. The other option is for them to turn their laptops toward themselves and record their presentation as a video so they can watch and learn from themselves for future presentations.

The last thing I want to focus on as a result of this study is to present to or visit with other teachers in my school system to make them more aware of using reading strategies in the mathematics classroom. Some may not be aware of this or maybe some are and could have some new ideas for me to try. If they are unaware of this problem or they are aware of it but do not know what to do, then I hope I can give them some suggestions or tell them about some of my experiences. I know my principal has already asked to hear about the findings of this research and is hoping I have found some new insight on this topic. I hope to share insights from my project about such things as about how reading difficulties sometimes have a major role in how well students solve word problems, as well as the reading strategies that worked and that maybe did not work with my students.
 References


Appendix A: Pre and Post Computational Test

Name: __________________ Class: __________________ Date: 

Pre/Post Test (Computational)

Solve each problem. Show all your work.

1.) What is the smallest number?
   31,820
   23,435
   29,482
   23,767

2.) 59 + 143 + 17 =

3.) 1,896 + 1,922 + 2,352 =

4.) 4 x 4 x 4 x 4 x 4 =

5.) 128 x 7 =

6.) 1,458 / 3 =

7.) $1,512 / $3 =

8.) 35,000 / 70 =

9.) 825 / 25 =

10.) Write the expression “a number minus 30”?

11.) How many sides does a pentagon have?

12.) 1,250 x 365 =

13.) 36 x 45 =
Pre/Post Test (word problems)

Solve each problem. Show all of your work.

** 1. A middle school held a raffle to raise money for the Drama Club. Jose drew ticket number 31,820, Amaya drew ticket number 23,435, Phil drew ticket number 29,482, and Leah drew ticket number 23,767. Whose ticket number was the least?
   a. Jose's
   b. Amaya's
   c. Phil's
   d. Leah's

** 2. Marta, Jon, and Dianne are taking pictures at the pep rally for the school yearbook. Marta takes 59 pictures, Jon takes 143 pictures, and Dianne takes 17 pictures. What is the total number of pictures they took at the pep rally?
   a. 216 pictures
   b. 219 pictures
   c. 316 pictures
   d. 319 pictures

** 3. The Barley Sheaf Elementary School has held a clothing drive for the last few years. In 2005, they collected 1,866 pounds of clothing. In 2006, they collected 1,922 pounds of clothing. In 2007, they collected 2,352 pounds of clothing. How many pounds of clothing did the school collect in the three years altogether?
   a. 4,080 pounds
   b. 5,782 pounds
   c. 6,170 pounds
   d. 7,158 pounds

** 4. Four people each shake 4 people's hands. Each of those people then shake 4 more people's hands. If the pattern continues for five rounds, how many people will have shaken hands. What is the value of $4^5$ written without an exponent?
   a. 20
   b. 256
   c. 625
   d. 1,024
5. A restaurant ordered 7 gallons of milk. If each gallon holds 128 ounces, what was the total number of ounces of milk in the order?
   a. 135 ounces
   b. 536 ounces
   c. 726 ounces
   d. 896 ounces

6. The County Fair collected 1,458 cans of food as admission. Admission for each person was 3 cans of food. How many people attended the County Fair?
   a. 508 people
   b. 493 people
   c. 486 people
   d. 463 people

7. Super Style Hot Dog stand earned $1,512 in one month. Each hot dog costs $3. How many hot dogs did the stand sell that month?
   a. 54 hot dogs
   b. 504 hot dogs
   c. 540 hot dogs
   d. 5,400 hot dogs

8. A bookstore ordered 35,000 books over a 70 week period. If they ordered the same number of books each week, how many books did they order per week?
   a. 5 books
   b. 50 books
   c. 500 books
   d. 5,000 books

9. A super-mega mart needs to place 825 cartons of orange juice on their shelves. If there are 25 rows, how many cartons will be in each row?
   a. 25 cartons
   b. 27 cartons
   c. 33 cartons
   d. 35 cartons
10. Sylvia is spending 30 dollars of her savings to purchase a concert ticket. If \( n \) represents the amount of money Sylvia has before buying the concert ticket, what expression shows how much money Sylvia will have left?

a. \( n + 30 \)

b. \( n - 30 \)

c. \( 30 \times n \)

d. \( n + 30 \)

11. Tomas’s map of Lexington shows three streets that are vertical and parallel. The map also showed one street perpendicular to the three parallel streets. Which choice shows the arrangement of the streets Tomas saw on the map?

a. 

b. 

c. 

d. 

12. The fifth-grade class is designing a new stage to give students a better view of the school play. Below is one of the designs they are considering. What is the name of the polygon?

a. quadrilateral

b. octagon

c. pentagon

d. hexagon
13. A cardboard box company is able to produce 1,250 per day. How many boxes can the company produce in one year (365 days)?
   a. 422,050 boxes
   b. 450,250 boxes
   c. 540,975 boxes
   d. 1,250,365 boxes

14. A case of hamburgers holds 36 patties. How many patties are in 45 cases of hamburgers?
   a. 270 patties
   b. 810 patties
   c. 1,420 patties
   d. 1,620 patties

15. I am a four-digit number. The numeral in my tens place is three times the numeral in my hundreds place. The numeral in my ones place is two more than the numeral in my hundreds place. The numeral in my thousands place is three less than the number in my tens place. The number in my hundreds place is 3. What is my number?
### Homework and Test Analysis Sheet

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</tbody>
</table>

Notes:
Appendix C: Student Math & Reading Surveys

**Math Survey – Student**

Please rank the following statements (1-5) using the following scale:

SA = Strongly Agree A=Agree D=Disagree SD=Strongly Disagree

1. Math is my favorite subject.
   SA  A  D  SD

2. The area I struggle with the most in math is solving word problems.
   SA  A  D  SD

3. I need help in explaining how I solved problems.
   SA  A  D  SD

4. Math would be easy if I did not have to read
   SA  A  D  SD

5. Sometimes in math, I feel nervous, like I cannot do the work.
   SA  A  D  SD

6. I like to use technology when doing math.
   SA  A  D  SD

On a scale from 1 to 10 with 10 being the most difficult, rate how difficult math is for you right now.

1 2 3 4 5 6 7 8 9 10

What is the most difficult thing for you when we solve word problems (problem solving)?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What do you think would help you become a better problem solver?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

pre-survey = Feb. 2
post-survey = Apr. 17
Reading Strategies Survey – Student

Please rank the following statements (1-5) using the following scale:
SA = Strongly Agree A=Agree D=Disagree SD=Strongly Disagree

1. Reading strategies we have worked on in class are helping me in math.
   SA   A   D   SD

2. I need to continue improving my reading skills to help me in math.
   SA   A   D   SD

3. Reading strategies have helped me to explain my answers.
   SA   A   D   SD

4. The math vocabulary strategy has helped me with word problems.
   SA   A   D   SD

5. The read-aloud strategy (ipod) has helped me with word problems.
   SA   A   D   SD

6. The creating my own word problem strategy has helped me with word problems.
   SA   A   D   SD

7. The re-reading strategy has helped me with word problems.
   SA   A   D   SD

survey = Apr. 17
Appendix D: Student Math Interview Questions

**Student Interviews**
(Difficulties with word problems)

**Reminders:**
Please answer the following questions as honestly and completely as you can.
The only person who will see this information is me.

Do you like math?

If you like math, why? If you do not like math, why?

What do you think about word problems?

What makes math hard for you?

What do you think teachers could do in math to make it easier for you to understand?

1\(^{st}\) interviews– Feb. 2
2\(^{nd}\) interviews– Mar. 9
3\(^{rd}\) interviews– Apr. 17
Appendix E: Student Reading Interview Questions

Student Interviews

(Reading Strategies)

Reminders:
Please answer the following questions as honestly and completely as you can. The only person who will see this information is me.

Does your reading ability have anything to do with how well you solve word problems?

Why? Or why not?

Are the reading strategies we are working on helping you?

If not, what do you think would help you solve word problems?

Which reading strategy is helping you the most?

1st interviews—Feb. 2
2nd interviews—Mar. 9
3rd interviews—Apr. 17
Appendix F: Teacher Journal Prompts

TEAC 888
Personal weekly journal prompts/set up
Spring 2008
Shayne Hite

Date:______________________

This week’s topic(s):
• _______________________________________________________________________
  • _______________________________________________________________________

Overview of this week’s lesson(s):
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

What reading strategies did I apply this week?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

How do I feel they worked?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

What mathematical vocabulary work did I apply this week?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

How much problem solving did the students do this week?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Do I feel the students are improving in this area?
________________________________________________________________________
________________________________________________________________________

What kinds of errors am I seeing?
________________________________________________________________________
________________________________________________________________________

What are two questions I have from this week’s lessons?
________________________________________________________________________
5th Grade Weekly Verbal Mathematical Vocabulary Practice
Pre-test Problem

Bob the Baker decorated a square anniversary cake that measured 40 cm on a side. He placed roses around the edge 8 cm apart. Cathy the Cook decorated a birthday cake in the shape of a pentagon for her friend in the military. This cake measured 32 cm on a side. She placed roses around the edge 8 cm apart. Use pictures, numbers, and words to explain your process.

How many roses did Bob use?  __________
How many roses did Cathy use? __________
Who used more? __________

Student Work:

Student Answer: ____________________________________________________________

Reading Accuracy Errors: _________
Mark determined that there are 2 outcomes for tossing 1 coin, heads and tails. He determined that when he tosses 2 coins, there are 4 outcomes. He recorded the number of outcomes for tossing different numbers of coins in the table below. How many outcomes are there for tossing 5 coins?

<table>
<thead>
<tr>
<th>Number of Coins</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Outcomes</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>

Student Work:

Student Answer: __________________________________________

Reading Accuracy Errors: __________

Answer:
The Barley Sheaf Elementary School has held a clothing drive for the last few years. In 2005, they collected 1,896 pounds of clothing. In 2006, they collected 1,922 pounds of clothing. In 2007, they collected 2,352 pounds of clothing. How many pounds of clothing did the school collect in the three years altogether?

Student Work:

Student Answer: ___________________________________________________

Reading Accuracy Errors: __________

Answer: __________________________________________
5th Grade Weekly Verbal Mathematical Vocabulary Practice
Week 3 Practice Problem

Four people each shake 4 people’s hands. Each of those people then shake 4 more people’s hands. If the pattern continues for five rounds, $4^5$ people will have shaken hands. What is the value of $4^5$ written without an exponent?

Student Work:

Student Answer: ____________________________

Reading Accuracy Errors: __________

Answer:
5th Grade Weekly Verbal Mathematical Vocabulary Practice
Week 4 Practice Problem

The Art Department received 552 pounds of molding clay to be used the entire school year. The clay was placed into six boxes to be stored, each box with the same amount of clay. How many pounds of clay were in each box?

Student Work:

Student Answer: ___________________________________________________________

Reading Accuracy Errors: __________
Answer: __________________________
Margo is trying to estimate how long it will take her family to drive to their vacation home. She knows that their home is about 450 miles away. She figures her family will average 50 miles per hour. How many hours will it take Margo’s family to reach their vacation home?

Student Answer: ____________________________________________

Reading Accuracy Errors: __________

Answer:
Tom, Alaya, Mark, and Maria have a total of $48 to spend at the fair. They each spent $6, or $24 total, on tickets for rides. They agree to spend the rest on face painting and dinner. They plan to spend twice as much on dinner as on face painting. How much do they plan to spend on dinner?

Student Answer: __________________________________________

Reading Accuracy Errors: __________

Answer:
5th Grade Weekly Verbal Mathematical Vocabulary Practice
Week 7 Practice Problem

The table shows the population of certain cities in California according to the 2002 U.S. census. Which city has about 3.8 times as many people as Anaheim?

<table>
<thead>
<tr>
<th>Approximate Population (in thousands)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaheim</td>
<td>332.6</td>
</tr>
<tr>
<td>Fremont</td>
<td>206.9</td>
</tr>
<tr>
<td>Fresno</td>
<td>445.2</td>
</tr>
<tr>
<td>San Diego</td>
<td>1259.5</td>
</tr>
<tr>
<td>San Jose</td>
<td>900.4</td>
</tr>
</tbody>
</table>

Student Work:

Student Answer: ____________________________________________

Reading Accuracy Errors: __________
Answer: __________
Tomas's map of Lexington shows three streets that are vertical and parallel. The map also showed one street perpendicular to the three parallel streets. Show the arrangement of the streets Tomas saw on the map?

Student Work:

Student Answer: __________________________________________________________

Reading Accuracy Errors: __________

Answer:
Your neighbors (Mr. Jones and Mrs. Smith) each have a pile of 750 bricks to move. Mr. Jones says he will pay you by the hour at $4.00 an hour, and Mrs. Smith says she will pay you $0.04 per brick. It takes you 1 minute to move 2 bricks and return for more. You only have time to move one pile of bricks so you must decide which is the better deal for you.

How much will you make from Mr. Jones?

How much will you make from Mrs. Smith?

What is the better deal for you?

Reading Accuracy Errors: __________

Student Work:

Answer: