Word Problems

Capstone B

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Content Area: Math and Science

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Abstract

This study focused on how to help students translate word problems so that they understand how to solve them, and so they are successful with word problems. I have created three research questions to focus on during this research project. First, how will direct instruction of word meaning help clarify the operation needed, affect the achievement when solving word problems? Second, how will using word meaning to decrease frustration affect the amount of work competed? Third, how will reading word problems aloud before students start the work affect completion? The data collection instruments that I used were pre/posttests on vocabulary, weekly quizzes, teacher observations, student surveys, student journals, and checklist. This research project was completed at Rosemore Middle School in Whitehall City Schools District, from March 2009 to June 2009. The focus was on my third period math class that meets everyday for forty-five minutes. This sixth grade math class has 23 students total.

Introduction

Whitehall is a city in Franklin County, Ohio. Whitehall started as a small rural area that developed into a city over time. The population of the area was gradually growing due to the Columbus Depot that established in 1918 and the Norton Airfield that established 1925. Another main reason for the increase in students was because of the new law requiring students to attend school. The three new schools only taught children in the first through the eighth grades, because the area was still mainly rural. In 1947 Whitehall became a village and then a city in 1950. In 1954, Whitehall finally opened their first High School. Currently, Whitehall City Schools serves about 3,000 students. There is one early childhood center, three elementary schools, one middle school, and

one high school. Whitehall City Schools is in the process of creating blue prints for all new buildings. Whitehall's population is 18,124 and the current median household income is $35,829.

Rosemore Middle School serves grades sixth through eighth. Rosemore currently has 648 students and about 27 students per class. Many students are on free and reduced lunch because 68% of the students are economically disadvantaged. Rosemore is a very diverse community, 52% Caucasian, 30% Black, 10% Hispanic, and 8% Multi-racial. Out of those students 10% are limited English and 20% are students with disabilities.

This is my second year teaching sixth grade at Rosemore Middle School. The classes are heterogeneously grouped and my team contains the majority of the IEP students. I team with two other teachers and we see 85 of the 220 sixth graders. I teach math, enrichment, and one science class. I also have an Intervention Specialist that is in my room during two math periods.

As a sixth grade math teacher, I have noticed that many students come into my class not understanding story problems. Many of the students still struggle with the basic vocabulary of operations. I have also noticed that many students rush through the story problems and do not answer the entire question. I believe that the students are not taking the time to read the entire question and that is why parts are always missing. About half of the students I see have bluntly stated that they do not like story problems because they do not understand what the question is asking.

My proposed intervention is that I will incorporate student participation in the meaning of the vocabulary and reading aloud word problems before completing them. If I focus on the meaning of the vocabulary the students will understand what the story

problem is asking. When the students understand what the problem is asking they will feel confident about solving story problems. No longer will my students fear story problems. Also, having the students read the problem aloud together as a class will require all students to focus on what the problem is asking. This way the students will not leave out parts of the question. I believe that these two strategies will increase student achievement with story problems.

Literature Review

My research project is to help students translate word problems so that they understand how to solve them, and so they are successful with word problems. I have found ten new resources that allow me to see new intervention ideas that are already in place and data that has been collected to support those interventions (Mills, 2007, p. 82). I will be identifying the ten new resources that are relevant to my research topic and explaining how they are relevant to my research project.

Reed, S. (1999). *Word problems: research and curriculum reform*. Mahwah, New Jersey: Lawrence Erlbaum Associates.

I believe that this book is relevant to my Action Research Project for many different reasons. First, the book was written because of all the problems students have been having with solving word problems. This is exactly my initial thoughts about why I am doing this project. Second, "The chapters, therefore, contain examples of theories of learning, reasoning, and problem solving that have been formulated by cognitive psychologists" (Reed, 1999, p. 15). This literature is going to help me see the problem through the eyes of many different theorists. Third, the literature gives strategies to use

with the students when teaching them how to solve word problems. I find it interesting that the literature discusses that "in order to solve problems, we have to carry out a series of actions such as constructing and solving an equation. These actions can be theoretically represented as a set of rules." (Reed, 1999, p. 15). It is also interesting that this literature is directly related to the National Council of Teachers of Mathematics, so I know it is reliable.

Jacobs, V. & Ambrose, R. (2008). Making the most of story problems. *Teaching children mathematics, 15,* p. 260 – 266.

I know that this article is relevant to my research project because it starts off talking about the frustration people get from word problems. The article gives four things that the teacher can do to support the child who is trying to solve a word problem: "ensure that the child understands the problem, change the mathematics in the problem to match the child's level of understanding, explore what the child has already done, and remind the child to use other strategies" (Jacobs & Ambrose, 2008, p. 261). Then it gives the teacher four things to do after the answer is given to extend the child's thinking: "promote reflection on the strategy the child just completed, encourage the child to explore multiple strategies and their connections, connect the child's thinking to symbolic notation, and generate follow-up problems linked to the problem the child just completed" (Jacobs & Ambrose, 2008, p. 263). The article goes into great detail of what all of these suggestions look like in the classroom and they have been tested. My only question about this article is if I change the mathematics to the level my students are at can I slowly increase the difficulty to bring them up to grade level?

Cutler, C. & Monroe, E. (2006). Sixth graders' oral retellings of compare word problems. *Focus on learning problems in mathematics.*

In this article the writers share about an experiment that was done in actual classrooms that concentrate on word problems. They took two different groups of students and tried out different techniques and strategies with solving word problems. This article gives me alternative solutions and suggestions to use in my classroom while working on this Action Research Project. Cutler and Monroe stated from their research that "students who retold the problem in their own words appeared more successful" (2006, p. 9). I never even thought of the idea of having the students rewrite the story problem into their own words. This will definitely cause the story problem to make more since to the students.

Erickson, D. (1999). A problem-based approach to mathematics instruction. *The mathematics teacher*, 92, p. 516 – 521.

This article gives an interesting perceptive on how the students see the story problems. Erickson states that "in a problem-based approach, students are expected to solve problems or make sense of mathematical situations for which no-well defined routines or procedures exist" (p.516). I have not thought about how the students see story problems until reading through this article, it really opens your mind to how they think and feel. The article goes into everything about word problems including how to choose problems for your students. This article has quite a few references I just wonder if they have actually tried these strategies out in the classroom.

Pyke, C. (2003). The use of symbols, words, and diagrams as indicators of mathematical cognition: a causal model. *Journal for research in mathematics education*, 34, p. 406 – 432.

In this article provides strategies that involve the Dual Coding Theory that I learned about in my previous courses. The students use symbols, words, and diagrams to understand and solve the word problems. This is an article written based on the research used in the classroom. I find it very interesting that a lot of studies support the theory of dual coding. It seems to be very effective and useful to all students no matter what level they are. Since dual coding involves symbols does that cause difficulty for some students? I have a few students now who do not like to use dual coding with vocabulary words, is math word problems different?

Seek, P. & Mooney, E. (2009). The thinking of students. *Mathematics teaching in the middle school, 14,* p. 366 – 369.

This article is written to explain how different students solved the same word problem. The article went into great detail showing how all students are going to see the word problem in different ways, and that is why they will solve it in different ways. I know that this is relevant to my research project because my bias is that all students will learn the word problems the same way. This article breaks down the fact that there are many different ways of solving the same problem. The important thing is that the students understand what the problem is asking. This goes right back into the idea of making sure the students understand how to translate the word problem.

Ponce, G. & Garrison, L. (2005). Overcoming the "walls" surrounding word problems. *Teaching children mathematics*, 11, p. 256 – 262.

This article goes into the issues surrounding word problems. Ponce stated that "not knowing what the problem says, not understanding what the problem means, and not recognizing how to do the problem contribute significantly to the frustration that students feel when trying to word problems and to the challenge teachers face in trying to help students overcome this frustration" (2005, p. 256). This article clearly states the problems that I have noticed in my classroom. The article also goes into addressing the real issues and creating a change with word problems. The best part was they have actually put these practices into place and have data showing how the students have improved there word problems.

Clement, L. & Bernhard, J. (2005). A problem-solving alternative to using key words. *Mathematics teaching in the middle school*, 10, p. 360 – 365.

A problem-solving alternative to using key words is an article about making sure that the students understand the word problem. Clement and Bernhard state that "the use of key words subverts mathematical understanding, can lead to incorrect solutions, focuses students' attention on values rather than quantities, and orients students toward automatically performing procedures rather than first making sense of the situation" (2005, p. 364). This is relevant to my research project because I want for my students to understand the problems, I do not want them to just see certain words and assume how to solve the problem. When I teach the students the vocabulary I need to be sure that they understand we are learning the vocabulary so that we can comprehend the problem.

Whitin, P. & Whitin, D. (2008). Learning to solve problems in primary grades. *Teaching children mathematics*, 14, p. 426 – 432.

Learning to solve problems in primary grades is an article that is geared towards elementary students. I know that I teach sixth grade but I believe that this article is relevant to my research project. One of the first things this article talks about is how the word problem needs to be grade appropriate. I have many IEP students that are a year behind and are struggling to comprehend the word problems we are currently working on. I need to make sure that I modify those word problems so that those students can become successful. This article also has implications for classroom instruction that are very basic to help my students gain back their confidence. My only question is do my students struggle with word problems because these strategies were missed in the elementary school?

Foster, S. (2007). The day math and reading got hitched. *Teaching children mathematics*, 14, p. 196 – 201.

Shannon Foster shares how she was able to get her students to apply their reading strategies into the math class. Shannon Foster stated that "to comprehend text, good readers engage in mental processes before, during, and after they read. My students were zooming through their mathematics work in search of a grade, not necessarily understanding" (2007, p. 197). I made this my research project because everyday I feel like my students are rushing through the math, just trying to get it done. I want for my students to incorporate what they have learned in Language Arts class and apply that to

their word problems. This is relevant to my project because I want to help the students understand/comprehend the word problems so that they may become successful.

Research Process

I want to help my students translate word problems so that they understand them and can solve them correctly. I will be implementing many different techniques and strategies to help increase my students' comprehension skills. I will be collecting different types of data to determine if my students are translating and comprehending word problems correctly. I will be discussing my different data collection sources that I have chosen for each research question, how they work together, and how I will analyze and interpret the data.

My first research question is how will direct instruction of word meaning help clarify the operation needed, affect the achievement when solving word problems? My first data collection piece is a pretest on the meaning of the math vocabulary. The pretest will only be given at the beginning to determine if the students understand any of the math vocabulary. I do not want to use direct instruction on vocabulary that the students already comprehend. I want to make sure that the time is spent on teaching the students what they do not know, the only way to find that out is by having a pretest. The pretest is a chart with the four operations and an equal sign at the top, and then the students are to fill in as many vocabulary words that they can think of. I will allow the students to use their math books so that they can look at word problems to remind them of words that they already know. After four weeks I am going to have the students complete the posttest. The posttest is a chart with the four operations and an equal sign at the top, and

then the students are to fill in as many vocabulary words that they can think of. For the posttest the students are not going to use their math books. The pretest and the posttest (shown in appendix A) are only going to be used once, unless after the posttest I realize that students are still struggling with the math vocabulary. Everyday during the time between the pre and posttest I will be using teacher observation and notes for a data collection piece. I will keep a clip board with all of the students' names on a sheet of paper (shown in appendix C). When I notice students struggling with certain vocabulary words I will make note of it. I will also be writing down my observations to the students as they solve word problems, do they use their knowledge of the vocabulary or do they solve them a different way? The pretest allows me to see what I need to teach my students, the teacher observation allows me to see if the direct instruction helped. Then based on the teacher observations I can make corrections to my teaching so that the students understand the vocabulary by the time the posttest. I will also have the students complete a weekly quiz with four to five word problems (shown in appendix B). This way I can determine if the students have increase in achievement. Dorothy Korzym stated that "when you analyze your data, you need to summarize it, you need to reflect upon it, you need to write out what you found" (Video: *How do I analyze and interpret my data?*). During my planning period everyday I will reflect on how the direct instruction went and on how the students interpreted the vocabulary. I will look for patterns with students in my teacher observation sheet to determine if I am missing anything. When I find patterns I will try to determine what caused those patterns. I may need the students to complete a survey to determine what happened. I will also "raise questions about the study" pointing out the way (Mills, 2007, p. 135).

My second research question is how will using word meaning to decrease frustration affect the amount of work completed? First I will have the students complete a student survey (shown in appendix D). The survey will have questions on there that ask them if they think knowing the vocabulary help with completing word problems. This way I get direct feedback from the students so I know if the vocabulary helps. I will have the students complete this survey once every two weeks. I want to make sure that the students are becoming more comfortable with the vocabulary and they are using that knowledge. I will also have the students write in their student journal each week (shown in appendix E). The journal will have a small prompt to get the students to discuss word problems. I will use the journals to determine if the students feel that work is easier than before. Finally I will have a checklist for each student tracking the amount of work completed, class work and homework (shown in appendix F). Before doing this I will track the students for two weeks so that I have a baseline data to show the growth. This will inform me which students are completing work and if the amount of work increases as the students learn the vocabulary. Together all three pieces will allow me to see if the students feel more comfortable with the word problems and if the amount of work being turned in increases. I want to make sure that the amount of work being turned in is due to the knowledge of vocabulary, but I need the student surveys and journals to figure that out. I will analyze the students' responses to the surveys and journals. Having the students complete the surveys and journals weekly or biweekly will allow for me to have ongoing analysis (Mills, 2007, p. 121). Dorothy Korzym stated that "when you're interpreting your data analysis, you need to look for patterns, you need to look for themes, you need to look for the what, or to explain what you received or what happened

because of your data analysis." (Video: *How do I analyze and interpret my data?*). To find the patterns I am going to use coding, I will put the information on index cards that way I can sort through the information (Mills, 2007, p. 124). I am going to use my checklist to determine if there is a pattern or theme with the assignments that are being turned in. I want to know if only certain assignments are not being turned in, or if there is an increase of assignments.

My third research question is how will reading word problems aloud before students start the work affect completion? Every other day for a month I will keep a checklist of the number of students completing the word problems (shown in appendix F). After having the students read the problems aloud I will mark each student that is then able to complete the word problem. This way I have a record of how many students are able to complete the word problem after reading it aloud. I will also have the students complete a survey at the end of each week for four weeks (shown in appendix G). The survey will ask them questions like, does reading the problems aloud help with translating word problems? From the surveys I will be able to determine how the students feel reading aloud affects their completion. Finally, I will collect teacher observation and notes every other day when the students are reading aloud (shown in appendix H). From my observations and notes I will notice if the students are completing the work, struggling, or need redirection. All three data collection pieces are there so that I can see if reading the problems aloud first affect their completion. I am going to analyze each student survey to see if they notice a difference with reading aloud, does it help them? I will also use the checklist to make sure that the students are actually reading the problem aloud and how much work they turn in. Then I will look at the

teacher observations/notes to see what patterns exist. I will interpret the results by reading through all those pieces and creating a concept map. A concept map is a great way to "visualize the major influences that have affected the study" (Mills, 2007, p. 130).

Data Collection Matrix

Research Questions	Source 1	Source 2	Source 3
1. How will direct instruction of word meaning help clarify the operation needed, affect the achievement when solving word problems?	Pretest on the meaning of the math vocabulary. Posttest on the meaning of the math vocabulary to measure the growth from the pretest. Shown in Appendix A	Weekly quiz with 4 or 5 word problems to see how the grades change. Shown in Appendix B	Teacher Observation and Notes Shown in Appendix C
2. How will using word meaning to decrease frustration affect the amount of work completed?	Student Survey (does knowing the vocabulary help with completing word problems?) Shown in Appendix D	Student Journal Shown in Appendix E	Checklist (the amount of work completed, class work and homework) Shown in Appendix F
3. How will reading word problems aloud before students start the work affect completion?	Checklist (number of students completing the word problems) Shown in Appendix F	Student Survey (does reading the problems aloud help with translating word problems?) Shown in Appendix G	Teacher Observation and Notes Shown in Appendix H

Data Analysis

Research Question #1: How will direct instruction of word meaning help clarify the operation needed, affect the achievement when solving word problems?

Source one is the pretest and posttest on the meaning of the math vocabulary. From the pretest I learned that 15 out of 23 students did not realize that “out of” means multiplication. 18 out of 23 students did not recognize that “combined” meant addition. All but one student missed the fact that “was” and “will be” means the answer or equal sign. 19 out of 23 students did not recognize that “of” means multiplication. 16 out of 23 students did not notice that “split” means division. 17 out of 23 students did not recognize that “per” means division. 21 out of 23 students did not realize that “is” means the answer or equal sign.

On the posttest I noticed that many students became confused about some of the vocabulary studied. On the pretest only 9 students out of 23 missed “twice” as multiplication. On the posttest 14 out of 23 missed “twice” as multiplication. I’m not sure if the students just skipped over that word or if they were confused. Only 5 out of 23 students missed “out of” and “combined” which compared to the pretest was a large turn around. 12 out of 23 students missed “was”, only ten more students understood that “was” meant equal. 3 out of 23 students missed “per” on the posttest, this means that 14 students learned what “per” means. 9 out of 23 students missed “is”, this showed improvement, and so 12 students learned the meaning of “is”. 6 out of 23 students missed “will be”; previously all but one missed the vocabulary. Before this research project I did not spend a lot of time teaching the vocabulary for the equal sign. It is obvious that many students have benefited from the lessons on the vocabulary. Every

single student in the class correctly identified the word meaning from the following: decreased, total, of, minus, equal, increased, and sum. This was a huge improvement from the pretest. It was obvious that on this specific vocabulary words the students understood there meaning. The overall change from the pretest to the posttest was unbelievable. From the pretest 582 out of 805 were correct, 72%. On the posttest 708 out of 805 were correct, 88%. Creating an increase of 16% from the pretest to the posttest.

Source two is a weekly quiz with four story problems. Each week the students were given a quiz of four completely different story problems. This data is scattered all over the place. On the first quiz 10 out of 23 students received a 75% or above. On the second quiz 8 out of 23 students received a 75% or above. On the third quiz one student received a 75% or above. On the fourth quiz 8 out of 23 students received a 75% or above. On the fifth quiz 12 out of 23 students received a 75% or above. On the last, sixth, quiz 11 out of 23 students received a 75% or above. Not one single student received a 75% or above on all six quizzes. Not one single student showed growth consistently over all six quizzes. I think that this data is invalid because each quiz has different topics being tested. Since the quizzes are different it is hard to say if the students applied the vocabulary to help them answer the questions.

Source three is teacher observations and notes on how students are doing with word meaning. From the teacher observations and notes I am able to see which students spent time studying the vocabulary and which students did not. The students that studied the vocabulary were able to answer questions in class at a faster rate. Many of the students would mix up the meaning to words such as “of” and “per”. As I already

discussed it is obvious that all of my students understood that “of” meant multiplication by the end of the research project. From my observations I realized how I needed to change my lessons to help meet the needs of my students. I also had many students that loss their flashcards that we created at the beginning of the research project. I kept track of those students who choose not to replace the flashcards and their scores on the posttest. 90% of those students did not pass the posttest.

Research Question #2: How will using word meaning to decrease frustration affect the amount of work completed?

Source one is the student survey asking if knowing the vocabulary helps with completing word problems. The survey consisted of six different statements and was given to the students three different times, every other week. The scale for each question was 1-5, five states that they strongly agree and one states that they strongly disagree. The first statement was I believe that I know what vocabulary words mean math operations. On May 1st the student average was 3.8 meaning that the majority of the students agreed with the statement. On May 15th the student average was 4 stating again that they agree with the statement. On May 29th the student average was 4.05. From all three weeks the student average slowly increased. The students consistently agreed that they know there math vocabulary. The second statement was I believe that understanding the math vocabulary makes solving story problems easier than before. On May 1st the student average was 3.9 stating that the majority of them agree. On May 15th the student average was 3.7 stating that they agree. On May 29th the student average was 3.6. Overall the students agreed that understanding the math vocabulary makes solving story

problems easier than before. By the end of the research project the students' scores lowered but they only went down a little bit. The third statement was I believe that the math vocabulary explains how to solve the problem. On May 1st the student average was 3.3 stating that they are undecided about the statement. On May 15th the student average was 3.4 which is in the middle of undecided and agrees. On May 29th the student average was 3.7 which is a lot closer to agrees. This shows that over time the students realized that the math vocabulary explains how to solve the problem. The fourth statement was I believe that knowing the math vocabulary is necessary for solving the problem. On May 1st the student average was 3.6 stating that they agree with the statement. On May 15th the student average was 3.4 which is in the middle of undecided and agrees. On May 29th the student average was 3.8 stating that they agree. At first the students agreed that the math vocabulary is necessary for solving story problems, then the second week a few students decided that it was not needed. At the end of the research project even more students agreed that the vocabulary is necessary for solving the problems. The fifth statement was I believe that story problems are no longer confusing because the math vocabulary explains what the problem is asking for. On May 1st the student average was 3.8 stating that they agree. On May 15th the student average was 3.6 which is the middle of undecided and agrees. On May 29th the student average was 3.5 which is the middle of undecided and agrees. As the research project went on the students stated that they were undecided about the story problems are no longer confusing. From this data I can conclude that the vocabulary did not either help or hinder the students' confusion with story problems. The sixth statement was I believe that focusing on the vocabulary has made story problems more confusing. On May 1st the student average was 3.1 stating

that they were undecided about the statement. On May 15th and on May 29th the student average was 2.8 stating that they are undecided. Overall, the students do not know if the math vocabulary helps them or confuse them.

Source two is the student journals. The journals were there for me to monitor the individual student's work with word meaning. A few of the journal prompts were story problems where the students had to show and explain how they solved the problem. I noticed that more than 50% of the students would circle the math vocabulary words. From this many of the students were able to get to the correct answer. Every once in awhile the question would have vocabulary but ask for something else. In these problems I realized that students just focused on one word instead of the entire problem.

Source three is a checklist of the amount of class and homework completed. Before the research project started 50% - 82% of class and homework was turned in completed. After the research project started 50% - 86% of class and homework was turned in completed. Although the percentage increased 4% it still is basically the same before and after the project. One of the main reasons why the percentages are so spread out is because each homework assignment is on different topics. This data has too many variables to determine if the slight increased was caused because of the math vocabulary.

Research Question #3: How will reading word problems aloud before students start the work affect completion?

Source one is a checklist of the number of word problems completed. Before and after the research project I monitored the number of word problems completed. The baseline data for the number of students completing word problems was 55%. After the

research project started the average jumped around. Some days the average was 50% and other days the average was 80%. The middle of the research project data the average number of students completing word problems was 79%. At the end of the research project the number of students completing word problems was 70%. From the baseline data to the end of the project the number of students completing word problems increased. Keeping a checklist of the number of problems had a lot of different variables. Due to the variables the data is hard to interpret. The students may have not completed the word problems because of time management or the concepts.

Source two is the student survey asking if reading the problems aloud help with translating word problems. The survey consisted of six different statements and was given to the students three different times, every other week. The scale for each question was 1-5, five states that they strongly agree and one states that they strongly disagree. The first statement was I believe that reading aloud story problems helps me understand what the question is asking. On April 24th the student average was 3.8 stating that they agree with the statement. On May 8th the student average was 3.6 which is in the middle of undecided and agrees. On May 22nd the student average was 3.4 stating that they are more undecided. Over time more students became undecided about reading aloud helped them understand what the question asked. The second statement was I believe that reading aloud makes problem solving easier. On all three dates the student average was between agrees and undecided, closer towards undecided. On April 24th the student average was 3.4, on May 8th the student average was 3.2, and on May 22nd the student average was 3.5. The students are not sure if reading aloud helps with solving word problems. The third statement was I believe that reading aloud the story problem does

not change the difficulty of the problem. The student average stayed the same all three weeks on undecided. The students are not sure if reading aloud changed the difficulty of the story problem. The fourth statement was I believe that reading aloud the story problem reminds me to answer all parts of the question. The student average was 3.7 all three weeks stating that the students agree. The students agree that reading aloud the story problem reminds them to answer all parts of the question. The fifth statement was I believe that it is easier to understand the problem when the entire class reads the problem aloud. The student average was 3.0 at undecided. Again the students are not sure if reading aloud helped them understand story problems. The sixth statement was I believe that reading aloud has increased my overall scores in class. On April 24th the student average was 3.0 which is undecided. On May 8th the student average was 3.1 remaining still undecided about the statement. Then on the last week, May 22nd, the student average was 3.5 which is in the middle of undecided and agrees. More students decided that reading aloud has helped them understand the story problems.

Source three is teacher observations and notes on how students are doing reading aloud. From the teacher observations and notes I could track which students were actually reading aloud with the story problems. I wanted to see if the reading aloud helped the students understand the problem. At the beginning of the research project many students did not want to read aloud, mainly because they did not see a point to it. As the weeks passed by many students would mention how they missed parts of the question because they did not read it aloud before. In class each day I ask my students if they have any questions on their homework. During the research project I would have the students read aloud the story problem if someone had a question on it. 3 out of 4

times that this happens the student would say that they did not need help after we read the question. This showed me that reading aloud did help some of the students comprehend and complete the story problems. This shows me that reading aloud is a great strategy to continue to use in the classroom.

Action Plan

From this research project I have learned many different things. First, having the students focus on math vocabulary can give them a better understanding of story problems. Second, many students benefited from reading the story problems aloud. Third, the overall number of students completing story problems increased as the research project continued. This research project has taught me that I need to spend more time focusing on math vocabulary and story problems. From the pretest I realized that many of my students did not understand basic math vocabulary. This research project has completely impacted the way I am going to teach story problems to my students. As soon as school starts I am going to have the students focus on the math vocabulary and reading story problems aloud. This way the students become more comfortable with the story problems by the time the Ohio Achievement Test rolls around.

From doing this research project I have learned that there are many different variables when dealing with story problems. Having story problems over many different mathematical concepts may have caused the overall results to be inaccurate. I noticed that many students would excel with certain mathematical concepts and then struggle with other concepts. This revelation has made me realize that there are a few things I need to do differently as a result. I need to make sure that all of the story problems are

focused on the same mathematical concepts. This way when I am finished I can compare the beginning results with the end results.

Appendix A

Word Meaning Pretest/Posttest

Directions: In math there are many words that tell you what operation you need in order to solve the problem. Below is a list of random words, circle all of the words that represent a math operation. Then write the operation next to that word.

That	Difference	Of	What	Sum
A	Who	Spilt	Equal	Is
Twice	Total	Distance	Increased	Per
Decreased	Estimate	About	When	Reduced
Ratio	Are	Will be	The	Percent
Out of	Was	Were	Gives	Fewer than
Combined	Product	Minus	Quotient	Less

Directions: Read the word problem below. Circle the word(s) that represents the math operation and solve.

Jim needs to buy a winter jacket. The jacket he wants is on sale for 20% off of $120 in Store A. The same jacket is on sale for 25% off of $140 in Store B. Determine at which store Jim can buy the jacket for less money. Show work or explain your answer.

Appendix B

Name: _____

Date: _____ Period:___

Word Problem Quiz # 1

1. Margot paid for tickets to the county fair. She bought 3 season passes for $13.00 each and paid with a $50 bill. How much change did she receive?

2. Cassandra's family drove 275 miles at 55 miles per hour. How many hours was their trip?

3. A rectangle is 24 feet long and has an area of 192 square feet. What is the length of the rectangle?

4. The total snowfall for two snowstorms in Bounder County was 37 inches. The first snowstorm was 19 inches. How much snow fell in the second snowstorm? Write an equation for the second snowstorm. Solve the equation.

Name: _____

Date: _____ Period:___

Word Problem Quiz # 2

1. Write the product of 10 and 7 as a numerical or algebraic expression.

2. The area of Rebecca's garden is one-third the area of her yard. The area of the garden is 15 square feet. Find the area of the yard

3. Samantha bought 4 colored ribbons for $12.00. What did each ribbon cost?

4. A shoe store wants to sell 500 pairs of shoes during their week-long sale. They sold 58 pairs on Monday, 42 pairs on Tuesday, 75 pairs on Wednesday, and 59 pairs on Thursday. How many more pairs must they sell this week to meet their goal?

Name: _____

Date: _____ Period:___

Word Problem Quiz # 3

1. There are 3 grams of fiber in $\frac{1}{2}$ cup of oatmeal. There are $1\frac{1}{8}$ cups of oatmeal left in a box. Estimate the amount of fiber in the oatmeal left in the box.

2. At a sale, the price of all items is 40% off the original price. How much will Joe save on a shirt with an original price of $31.99?

3. A 15-foot tall lamppost casts a 32-foot shadow. How long of a shadow would a 30-foot flagpole cast?

4. An 8.5 in by 11 in sheet of paper is enlarged to make a poster by doubling its length and width. What is the new perimeter?

Name: _____

Date: _____ Period:___

Word Problem Quiz # 4

1. Estimate the cost of going camping by rounding to the nearest dollar.

Site rental	$12.95
Parking	$4.30
Equipment	$9.76
Food	$8.23

2. Tony opened a savings account with $18 and saved $2 each week for 8 weeks. Maria opened a savings account with $25 and saved $1 each week for the same 8 weeks. Determine which week Tony and Maria will have the same amount of money in their savings accounts. Show or explain your work.

3. What is the volume of a rectangular prism with side lengths 9 cm, 8.5 cm, and 7 cm?

4. Bob has $125 in his checking account. He wrote a check for $130 to pay his electric bill. How much money does he need to deposit in his checking account to cover his check?

Name: _____

Date: 5/22/09 Period:___

Word Problem Quiz # 5

1. A sweater is on sale for 30% off the discounted price of $42. How much will the sweater cost after the discount?

2. The sides of one triangle measure 4 ft, 6 ft, and 9 ft. The shortest side of a similar triangle measures 22 ft. What is the length of the longest side?

3. Gwen hikes up a trail, gaining 100 ft elevation. After a rest, she climbs another 80 ft. What is her total elevation gain?

4. Bob had $125 in his checking account. He wrote a check for $130 to pay his electric bill. How much money does he need to deposit in his checking account to cover his check?

Name: _____

Date: 5/29/09 Period:___

Word Problem Quiz # 6

1. There are 12 reams of paper in a case. What is the best approximation of the number of reams of paper in 32 cases?

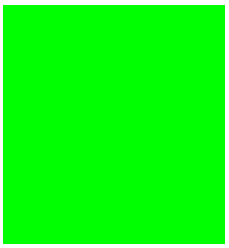
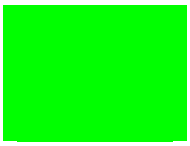
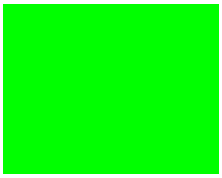
2. If Nicholas saves 15% on a $435.75 camcorder and 10% on a $94.95 microwave, how much were his total savings to the nearest penny?

3. A box of granola bars contains 6 bars. Each bar weighs $\frac{1}{8}$ lb. How much does the whole box weight?

4. Bridgette's car will hold 25 cartons of books. What is the least number of trips that she must make in order to deliver 250 cartons?

Appendix C

Teacher notes on word meaning	21-Apr	23-Apr	24-Apr	28-Apr
ALLEN, CHANCE MCKENZIE	Did not know the words for equal			
BOLYARD, EMILEE JEAN	Did not know the words for equal	not using word meaning to help solve story problems	Still struggles with words for equals	
BRECKENRIDGE, TAEYA MONAE				
CALVIN, JUWANNA MONAE			lost flashcards	
CAULFIELD, SHANE MICHAEL	Did not know the words for equal			
CORT, KYLIN KAINE-JERAN				lost flashcards
DIXON, RONNIQUE DISHAY	Did not know the words for equal			Struggles with determining words for multiplication
DRAUGHN, ODELIA	Knew most of the operation words			
GARCIA, WILLIAM	Did not know the words for equal			
GONZALEZ, URIEL ULISSES	Knew most of the operation words			
HODGE, DWAYNE ANTHONY				

JOHNSON, RAEVEN NYCCOLE	Thought she knew most of the word meaning but realized that she missed a lot.			
KAUFF, STEPAHNIE NICHOLE	Understood must of the operation words		Did not know the words for equal	
MEININGER, MATTHEW JAMES		confusing division and multiplication words	Did not understand what words meant.	lost flashcards
MYERS, KEAGAN *				
PASS, SYNEDRE JEWELL				
RION, JOSHUA DAVID				
ROJAS, KARLA Mariela	Did not know the words for equal			
ROSALES, NICOLAS				did not follow the math meaning to help him solve the problems.
SAILOR, MATTHEW		confusing division and multiplication words		lost flashcards
SMALL, FELICIA AMBER	Did not know the words for equal			
THOMAS, TYLER COLE		no effort on using word meaning		
VALDEZ, CONCEPCION				

Appendix D

Name: _____

Survey #1 on Word Meaning

Date: 5/1/09

Directions: Please respond to the following items by drawing a circle around the response that most closely reflects your opinion: strongly agree (SA), agree (A), undecided (U), disagree (D), or strongly disagree (SD).

1. I believe that I know what vocabulary words mean math operations.
   SA A U D SD

2. I believe that understanding the math vocabulary makes solving story problems easier than before.
   SA A U D SD

3. I believe that the math vocabulary explains how to solve the problem.
   SA A U D SD

4. I believe that knowing the math vocabulary is necessary for solving the problem.
   SA A U D SD

5. I believe that story problems are no longer confusing because the math vocabulary explains what the problem is asking for.
   SA A U D SD

6. I believe that focusing on the vocabulary has made story problems more confusing.
   SA A U D SD

Appendix E

Name: _____

Journal Writing Prompts

Friday April 24th: What is the difference between estimating and about?

_____

_____

_____

_____

_____

_____

Friday May 1st: Hypothesize why I am having you read aloud the story problems.

_____

_____

_____

_____

_____

Friday May 8th: Write a paragraph on how to solve a story problem.

_____

_____

_____

_____

_____

Friday May 15th: Write your own story problem, then present and defend your answer.

_____

_____

_____

_____

Friday May 22nd: Solve the following problem and explain your thinking.

A photograph is 10 inches wide and 15 inches long. When the picture is enlarged, it is 20 inches wide. How long is the enlarged photo?

_____

_____

_____

_____

Friday May 29th: Solve the following problem and explain your thinking.

Bars of soap come in packages of 6 and packages of 20. The 6-bar pack cost $7.86, and the 20-bar pack costs $25.00. What is the price per bar of the better deal?

_____

_____

_____

_____

_____

Appendix F

Student Name: Turned in homework/class work before project	10-7 Practice C 3/30	10-8 Practice A 4/1	Blue Book p102 4/3
ALLEN, CHANCE MCKENZIE	2	4	2
BOLYARD, EMILEE JEAN	3		3
BRECKENRIDGE, TAEYA MONAE			
CALVIN, JUWANNA MONAE			
CAULFIELD, SHANE MICHAEL		6	4
CORT, KYLIN KAINE-JERAN			
DIXON, RONNIQUE DISHAY	4	5	4
DRAUGHN, ODELIA		6	5
GARCIA, WILLIAM	1	5	4
GONZALEZ, URIEL ULISSES		6	5
HODGE, DWAYNE ANTHONY	3	6	4
JOHNSON, RAEVEN NYCCOLE	5	5	5
KAUFF, STEPAHNIE NICHOLE	4	6	5
MEININGER, MATTHEW JAMES		3	
MYERS, KEAGAN *			
PASS, SYNEDRE JEWELL		6	3
RION, JOSHUA DAVID	4	5	5
ROJAS, KARLA Mariela			5
ROSALES, NICOLAS			3
SAILOR, MATTHEW	2	5	3
SMALL, FELICIA AMBER	2	6	5
THOMAS, TYLER COLE			5
VALDEZ, CONCEPCION	4	6	4
Number of Word Problems	6	6	5
Average Completed	3.090909091	5.333333333	4.111111111
Number of Students who did turn in the work out of 23	12	16	19
Average of Students turning in work	52%	69%	82%

= did not turn in the homework

Appendix G

Name: _____

Survey #1 on Read Aloud

Date: 4/24/09

Directions: Please respond to the following items by drawing a circle around the response that most closely reflects your opinion: strongly agree (SA), agree (A), undecided (U), disagree (D), or strongly disagree (SD).

1. I believe that reading aloud story problems helps me understand what the question is asking.
   SA A U D SD

2. I believe that reading aloud makes problem solving easier.
   SA A U D SD

3. I believe that reading aloud the story problem does not change the difficulty of the problem.
   SA A U D SD

4. I believe that reading aloud the story problem reminds me to answer all parts of the question.
   SA A U D SD

5. I believe that it is easier to understand the problem when the entire class reads the problem aloud.
   SA A U D SD

6. I believe that reading aloud has increased my overall scores in class.
   SA A U D SD

Appendix H

Teacher notes on reading aloud	21-Apr	23-Apr
ALLEN, CHANCE MCKENZIE	Struggles with reading aloud	Reading aloud but does not apply what the problem asks. Two problems asked to write equations and she did not.
BOLYARD, EMILEE JEAN	Does not like reading a all	
BRECKENRIDGE, TAEYA MONAE	Did not read aloud	Did not read aloud
CALVIN, JUWANNA MONAE		
CAULFIELD, SHANE MICHAEL		
CORT, KYLIN KAINE-JERAN		
DIXON, RONNIQUE DISHAY	not sure if she is reading aloud, very soft spoken	
DRAUGHN, ODELIA		
GARCIA, WILLIAM	Likes reading aloud	
GONZALEZ, URIEL ULISSES		reads through the problem quicker than the rest of the class.
HODGE, DWAYNE ANTHONY		
JOHNSON, RAEVEN NYCCOLE		
KAUFF, STEPAHNIE NICHOLE		reads through the problem quicker than the rest of the class.
MEININGER, MATTHEW JAMES		
MYERS, KEAGAN *		
PASS, SYNEDRE JEWELL	enjoys reading aloud hates reading as a group, says that it is confusing	
RION, JOSHUA DAVID		
ROJAS, KARLA Mariela		

ROSALES, NICOLAS	Struggles with reading aloud	
SAILOR, MATTHEW	did not want to participate at all in Math class.	
SMALL, FELICIA AMBER	Did not know some of the vocabulary presented	Reads aloud but does not really listen to what she is reading. After reading she can not explain what she read and what the problem is asking.
THOMAS, TYLER COLE		no effort on reading aloud
VALDEZ, CONCEPCION	Read nice and loud	Continues to read aloud
		Means Absent

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