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Real Life Problem Solving in Eighth Grade Mathematics

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Abstract

In this action research study of my classroom of eighth grade Pre-Algebra, I investigated how student understanding and achievement were affected when the lessons were centered around real-life problem solving when the students had input on the problems used through the use of mathematical journals. I discovered that there was an increase in achievement and understanding when the lessons were centered on real-life problem solving and that the interest level of the students increased through offering their suggestions of applications to real life. As a result of this research, I plan to implement the usage of real-life problems into my classroom every day while allowing my students to offer input on the real-life problems used.

When I started teaching, the only way that I knew how to teach mathematics was to teach a lesson in a lecture-like manner then assign several problems for practice. Then when a teacher completes all of the lessons that make up the chapter, the students take a test to show that they know how to do everything that was taught in that chapter. This was how I was taught in high school and college. There did not really seem to be any application toward the knowledge we were gaining. It felt like I was memorizing to get through the next test. When I went through my practicum and student teaching, math was taught in a very similar manner. Naturally when I began teaching four years ago, I taught in that same manner. I felt like the thinking was being taken out of mathematics. I caught myself teaching in manner of, “If you see this, do this. If you see that, do that.” I did assign story problems with each assignment, but the “common sense” kids would realize to just do what they have been doing for the problems they had been working out and they would get it right. This does not mean they really understood what they were doing or saw the real-life connections. The students who did not seem to have as much common sense always would ask for help to the point that I felt I was doing their work.

I am getting better at asking the right questions for student learning. However, I do not think that my students are getting the real grasp of turning math into a problem solving ability. In the *Math in the Middle* program, I took a course in which we were given an example of a teacher who taught solely on the basis of one giant story problem. Through this problem she was able to derive all of the mathematical concepts that she wanted the kids to learn and turn it into a real-life scenario. I want to incorporate that same style of teaching in my classroom. I do not think that I want to use one giant story problem because then I think that there would be too big of a gap between sections and students would have a tough time recalling information from the beginning. Instead I would like to have a smaller one through which I can connect two or three

lessons together. This would allow the students to make connections sooner and hopefully grasp a deeper meaning of the concepts with little to no review. I would also like to do journals so students can make their own connections to the problems. This way I can look at their journals and make sure they really understand the message I am trying to give them. When they are able to explain to me the concept in their own words, I will know that they truly understand the concepts that I am trying to convey.

This idea of teaching and learning through real-life problems follows along with the National Council of Teachers of Mathematics (NCTM) principles of learning and assessment. Students are building on the knowledge they had already gained and putting it toward new applicable life problems. Solving problems based on real life also builds upon all of the process standards. The student is building new mathematical knowledge through problem solving. The student is using reasoning to solve real-life problems. They will be making connections through what they had learned in class and the problem in front of them. Through journaling, the students also will be asked to communicate what they have learned, and then give a written representation of the ideas of the lesson to me.

It is the goal of every teacher to be able to give the kids the knowledge they need to function in the real world. More importantly, it is our ultimate goal to have our students go out into the real world and solve problems they may not have been solved before. In order to do this, they need the ability to use new and unique ways of coming up with solutions. Presenting students with new types of problems will give the students the comfort needed to be an avid problem solver.

Problem Statement

The goal of teaching should be to pass on as much usable knowledge as we can to our students. Teachers need to continuously look at their practices to see if what they are doing in the classroom is indeed doing that. This study looks at a new style of teaching in which I explicitly apply mathematics to the students' real world. I looked at some studies in which real-life problems have been used as a major part of a curriculum. I searched for other studies related to students offering suggestions for how they might use math in their own lives. This study provides new insight on to how students think about the application of mathematics. I looked at how real-life problems based on students' lives would impact their learning in comparison to previous studies in which the students have had no input on the problems given.

Math journals have been used throughout many classrooms over the years and have been very effective in showing student progress and learning. I looked at several studies that show the effectiveness of the utilization of journals in a math classroom. However, I could not find any studies that have shown students using math journals to apply daily lesson to students' lives. This study takes a look at how students correlating the daily lessons with their lives might improve the learning and comprehension of the mathematics.

It is the goal of this study to find if I gave the students ownership of their education, would their achievement improve. In the changing world, we, as teachers, cannot become complacent with our practices. We have to be able to keep up with that changing world in order to benefit our students. I looked at several changes that have been made previously in classrooms in order to make math more applicable to students. Then I investigated what happened when the students were given ownership of the path of their education.

Literature Review

Almost everyday, in the middle of a lesson, one of my students asks the question, “When am I going to use this in my life?” I usually make some comment, like “if you own your own business” or “this is just part of the big picture,” off the top of my head to sidestep the question in order to “get through” what I am teaching for the day. However, sidestepping the question is completely counter-productive to the concept of education. As a teacher, I have a role of preparing students to be successful in their lives, not necessarily only in the classroom. My classroom is the place in which the practice and preparation is done. In most occupations, the training for the job is done in a manner that is applicable to the job at hand; mathematics in the classroom should be no different.

One way to demonstrate the application of mathematics in the world is to allow the students to apply the computational aspects to real-life scenarios. However, what is real life to the teacher is not necessarily what is real life to the student. Encouraging student input in mathematics is another way in which teachers can allow the students to make their learning meaningful in order in increase achievement. In addition, another way is through mathematical journals. Mathematical journals not only allow the students to gain a more meaningful understanding of concepts, but also they allow the teacher to gain better insight into what might be meaningful to the students. I have read some related educational research to find out what has already been done in terms of making math applicable to students and to student learning in the manner of using real-life problem solving and the use of student math journals in the classroom.

Real-Life Problems in Mathematics

The National Council of Teachers of Mathematics (NCTM) decided in 1989, that problem solving should become “the focus” of mathematics in school. According to NCTM,

centering mathematics instruction on problem solving can help all students learn key concepts and skills within motivating contexts. This current emphasis is on problem solving as a means to learn mathematical content and processes.

In 2004, Fuchs, Fuchs, Finelli, Courey, and Hamlett conducted a study in which their goal was to see if the types of real-life problems used in a classroom would affect the transfer of knowledge to the student**.** This study was conducted with third grade students, in which they were given four different types of real-life problems to solve. They concluded that, mathematical problem solving is a transfer challenge requiring children to develop schemas for recognizing novel problems as belonging to familiar problem types for which they know solutions (Fuchs, et al., 2004). This shows that students need some familiarity to a problem, which might mean if teachers can make the problems used more applicable to the students' lives, they may be more familiar with it.

Lubienski (2000) conducted a study to apply the Connected Mathematics Project (CMP) to a socioeconomically diverse school in a medium-sized midwestern city. The CMP is a middle school curriculum-developed project to create problem-centered materials aligned with the NCTM standards. The emphasis is placed on students' learning mathematical content and processes through solving open, contextualized problems. Lubienski found that lower SES students had improved more from problem-solving instruction and that teaching for meaning can increase students' problem-solving and computational abilities when compared to teaching through rote memorization (Lubienski, 2000).

My study investigated the effects of the different types of real-life problems; however, it was conducted on eighth grade students. This is different than the study conducted by Fuchs, et al (2004), which was conducted with elementary-aged students. Also, my students had input into

how the concepts can be applied to their lives. Lubienski (2000) studied middle level children, however it was conducted in a very culturally diverse setting. My study included only one student of a different ethnicity.

Student Achievement Through Problem Solving

Wedege viewed learning as a social process. In 1999, she conducted research on several individuals' everyday life through observations and interviews. Wedege observed subjects at school, work, with family, and during leisure time. Her focus was to follow the use of mathematics in real life. Wedege noticed that arithmetic and mathematics had been presented to her subjects as two different types of practice (Wedege, 1999). One subject had achieved a competence at arithmetic through the teaching that she had received that proved to be relevant in other forms of social practice. However, through this subject's math lessons she learned that she was not interested in it and had no relevance for her life (1999). Wedege's study shows the value of creating a social and useful importance to the subjects we teach in order to provide relevance to our classrooms.

There are several different types of real-life problems. In 2004, Fuchs, Fuchs, Finelli, Courey, and Hamlett conducted a study on third grade students from seven urban schools, which included 24 classrooms. They wanted to find out, first of all, if problem solving had in impact on student achievement, and secondly, if the types of problems presented had an impact on student achievement (Fuchs, et al., 2004).

The researchers grouped the students by dividing the students evenly among classrooms based on the performance levels of the students. All groups were tested based on the current curriculum, which was the *Math Advantage* text. One group was a control group and received no further treatment. There were four other groups that received treatment. Group one was

instructed with novel problems used for problem-solution rule instruction. Group two was instructed with novel problems used for problem-solution rule instruction with an emphasis on the vocabulary. Group three was instructed with novel problems used for problem-solution rule instruction with the inclusion of one piece of irrelevant information, combining two problem types, or mixing two transfer features of appearance and vocabulary. Group four was instructed with far transfer real-life problem solving, which included a format to the appearance of a commercial test with multi-paragraph narratives describing real-life situations - some of the information needed for a solution had been removed and the containment of multiple pieces of numeric and narrative irrelevant information (Fuchs, et al., 2004).

The researchers' discoveries showed that all of the treatment groups showed more improvement then the control group. Furthermore, they demonstrated superior mathematical problem solving abilities. Group four showed the most meaningful transfer abilities by demonstrating knowledge through a wider variety of problems used for multiple instructions (Fuchs, et al., 2004). This study shows that achievement can best be gained through multiple types of instruction through real-life problems.

The value of problem solving comes from using fundamental concepts of mathematics to find solutions to more complicated and realistic scenarios. Carlson and Bloom (2005) conducted an experiment in which they presented 12 research mathematicians, from two large public universities, five complex real-life problems (each individual only had to answer four of them) that required knowledge of foundational content and concepts such as basic algebra or geometry. Carlson and Bloom concluded that the subjects' abilities to play out possible solution paths to explore the viability of different approaches had contributed significantly to their efficient and

effective decision making process. It is important to develop this fundamental of "knowing to act in the moment" through use of mental imagery to imagine a future situation (2005, pg. 69).

Again, unlike the Fuchs, et al. (2004) study, which was conducted with third grade students, my study dealt with eighth grade students. Also, that study was conducted with problems developed by adults for children while my study included questions that my students had input in the creation on. Although Wedege's (1999) study was interesting in that it applied the social aspects of math in real life, it was conducted on adult subjects. My study still connects the social aspects of mathematics to the classroom. Also, Wedege drew her conclusions through observations, while I collected some numerical data through test scores to show more concrete evidence of some of my discoveries. The Carlson and Bloom (2005) study was conducted on college level students research mathematicians. Again, I could not find much research in terms of real-life problem solving conducted in a middle level classroom, which makes my study somewhat unusual.

Student Application of Real-Life Problems Through Journals

Administrators often encouraged teachers to instruct students in a variety of ways in order to meet the many learning needs of the different students. Thinking is established as a behavior; it becomes tenacious and extremely difficult to relinquish (Harel, 1998). This means that teachers must lay the groundwork for different ways of thinking early. It is difficult to understand a mathematical idea until it is used and difficult to use a mathematical idea until it is understood. The understanding of mathematics is the ability to express mathematical ideas, appreciate why they work, and how they work (Nicol, 2002). One way to show this understanding and meet the needs of different learners is through mathematical journals.

Borasi, Siegel, Fonzi, and Smith (1998) conducted a study in which they wanted to try different reading strategies to see the affects it may have in an eighth grade mathematics classroom. The researchers had the students use three strategies. The first was “the say something strategy” in which a student will talk their way through a text with another student and discuss different things about the text at their own free will. The second strategy was “the cloning and author strategy” in which the students had discussions similar to the first strategy; however, they did this as if they were the authors of the text. The final strategy implemented was “the sketch-to-stretch strategy” in which the students would draw their interpretations of the text (Borasi, et al., 1998)

The researchers found that new ways in which to summarize mathematics can do more than help students better understand the texts read in a mathematics classroom, because by their very nature this strategy also encourages further investigation and understanding of the mathematical ideas or issues about the nature of mathematics. In other words, thinking of different ways to explain new knowledge students are forced to think more deeply about what they have learned. These ways of summarizing the lessons provide different symbolic meanings – oral language, written language, visual images, and actions (Borasi, et al., 1998).

Pugalee (2004) conducted a study to determine the effects of written and oral descriptions of the problem-solving process. He had a class of 20 students in which, for a 10-week session, had each student, once a week, either through oral or written description, provide the entire thought process they went through to solve a novel math problem. He found that both methods provide a useful lens for studying the problem. Students who wrote about their problem solving processes produced correct solutions at a statistically higher rate than when using a think-aloud process. Finally, Pugalee’s findings provide support for the premise that the interaction of

students with metacognitive processes along with an understanding of mathematical concepts distinguishes them as successful problem solvers and that writing can be a tool for supporting a metacognative framework.

While the Borasi, et al. (1998) study dealt with having students put what they read into their own words, it was done orally and through pictures. In my study, my students interpreted math lessons in their own words; however, it was in the form of a written journal. While Puglee's (2004) study is similar to what I wanted to look at in my study, as far as putting their thought processes in words, his study was conducted with high school students. My focus is on studying thought process of middle level students through the problem solving process.

Changes in Teacher Practices

Nicol (2002) researched 22 prospective teachers as they received on the job training. She was able to draw several conclusions from her observations. Nicol said that prospective teachers were not able to unpack the mathematics and the mathematical demands of work in various contexts and when prospective teachers did focus on the mathematics used in a context, they recontexualized it or decontextualized it in ways that lost the authenticity or the context and the richness of the mathematics (Nicol, 2002). This means that the current on-the-job training is not really training prospective teachers to teach mathematics in a way that is beneficial to students. The relationship between knowing and teaching, for teachers, and between knowing and doing, for students, is complex and interactive (Nichol, 2002). Changes in teacher practices should be made to accommodate this complexity and interaction.

The initiative of changing teaching practices in order to make learning more applicable to math in the real world is that of the teachers. Teachers need to ask questions at the intersection of

theory and practice (Lubienski, 2000). This suggests that teachers need to build upon the complexity of a lesson during the practice of that lesson.

For students, well-connected conceptual knowledge appears to have influence on all phases of the problem-solving process. The ability to access useful mathematical knowledge at the right moment during each of the problem-solving phases is highly dependent on the richness and connectedness of the individual's conceptual knowledge. The development and coordination of a vast reservoir of reasoning patterns, knowledge, and behaviors, and the effective management of both resources and emotional responses that surface during the problem-solving process, as well as a great deal of practice and experience (Carlson & Bloom, 2005). Our goal as teachers is to equip our students with the ability to access knowledge at the right moment. Changing in teaching practices should focus on building that richness and connectedness.

There must be balance among the modes of teaching, a balance that each teacher has to develop individually. This should include a combination of modes of teaching rather than dogmatic devotion to one single mode (Harel, 1998). The more tools that teachers have at their disposal, the more meaningful they can make each lesson.

Nicol (2002) did her study on prospective teachers and how they are really not prepared to teach when they begin their first job. My study focused on specific changes that can be made to improve education. So while Nicol discovered that changes needed to be made, I show a change that can be made. Also, I am at the completion of my fourth year of teaching while Nicol studied prospective teachers. Carlson and Bloom (2005) studied college math students, so my study provides a perspective from a teacher who has been on the job for four years.

Conclusion

Making mathematics practical and useful to the students in the real world should be the main focus of all mathematics teachers. However, there is no one and easy way to do this. Much of this depends on the many different learning styles of the students and the many different personalities of the teachers. One way to force the students to think about real-life applications is through real-life problems. However, it important to make the problems applicable to the student's lives in order to for them to make the connections needed to be meaningful. One way to discover how students apply mathematics in their lives is through mathematical journals.

Through the many journals that I have reviewed, I have noticed that there is no miracle solution to the problem of connecting students to mathematics. The researchers had focused on each of the aspects that I have focused on in my study; however, no one study had all of the components put together. My study puts together the components of real-life problem solving, student communication, and changes in teaching practices rather then focusing on them as separate parts. Also, not much research in this area has been conducted at the eighth grade level, which was my focal point.

Purpose Statement

The purpose of this study is to determine the effectiveness of using a problem-solving-oriented curriculum to improve a student's academic achievement in mathematics. The goal of teachers should be to prepare a student for success in life after school, not necessarily for success in their next math course. A student's math knowledge needs to be functional and applicable to that student's life. I wanted to find out if teachers were to sum up lessons using "real-life" problems, how that would affect the student's understanding of mathematics. My goal was also to discover how a student's level of understanding might be affected if the student were to sum

up lessons in his or her own words. I wanted to see if students could connect classroom math lessons to their own lives. This would also increase their ownership to their learning. I also wanted to see how my teaching would be affected by creating a more problem-solving centered curriculum. Ultimately, this study was conducted to find a new method of teaching math students in a manner that might allow a student to solve new problems in the real world rather than to solve practice problems out of a textbook.

To conduct this study, I collected data to investigate the research questions:

- What will happen with a student's level of understanding if sections of lessons are summed up with a "real-life" problem?
- What will happen with a student's understanding of mathematics when they are asked to write in math journals at the conclusion of a concept?
- What will happen to my teaching when I focus my lessons more around real-life examples and incorporate more of my students' thoughts into my lessons?

Method

I conducted this study over a seven-week period with two eighth grade Pre-Algebra classes during the spring semester, 2009. There were 36 students who participated, 19 females and 17 males. There were 20 students in the first period, 10 female and 10 male, and 16 students in the second period, 9 female and 7 male. Four of the males in the first period receive special education services. There was one African-American male in the first period and the rest of the students were Caucasian. The school is not a very culturally diverse school. However, more then 50% of the students qualify for free or reduced lunch.

The data was collected during the curriculum period of the instruction of chapter six. The chapter had nine sections in it, which I divided into three groups. Group one included sections one through three, group two included sections four through six, and group three included sections seven through nine. For each group of sections the students took a pre-test before any

instruction and a post-test after instruction of the group of three sections. I graded each of the tests and compared each student's pre- and post-tests.

Each lesson included new ways in which the mathematics could be used in real-life. These "real-life" comparisons and scenarios presented were given in a manner applicable to my life and to something I viewed as applicable to a student's life. At the completion of each new section the students were asked to write in a journal. In their journals the students were to first answer the question, "How would you explain today's lesson in your own words?" Second, "How can you apply today's lesson to some aspect of your life?" I reviewed the journals in order to see if the students were able to accurately portray the lesson in their own words and to see how each student would apply the lesson to their life in order to find similarities and differences. Each time that the students made a journal entry, I wrote a journal entry. My journals consisted mainly of comments discussing things I noticed about the class and the presentation of the lesson. I considered how I might change my presentation and what I liked about it. I also offered my observations of whether the students "got it." I then compared my journal with the students' journals.

During this process, interviews were conducted with the students (see Appendix A for the interview questions). I interviewed every student once over the course of the study. They were interviewed in groups of three during either their lunch period or study hall. The questions consisted mainly with what they thought of the changes made in the classroom and how my teaching was impacting their learning. I reviewed the interview answers and made comparisons between each of the journals and my own teaching journals.

My last piece of data was a problem-solving quiz at the end of each group of sections (see Appendix B for the quiz questions). Each of the quizzes consisted of two questions. One

question was a real-life problem taken directly from the textbook. The second problem was a real-life problem that I created based on student journals. The goal was to create a problem applicable to the students. Each question was graded on a three-point scale. The students received three points if they had a correct answer, which included a correct explanation as to how they came about that solution. The students received two points if either the answer was correct and their explanation was not completely correct or if the students' explanation was completely correct but included a computational error that caused an incorrect solution. The students received one point if they only gave a solution or an explanation. One point was also received if both the answer was incorrect and the explanation was incorrect. I graded all of the quizzes and recorded them on a spreadsheet with my data from the pre-test. I compared the scores with the improvements made from the pre-test to the post-test. I also compared and contrasted the scores on the separate questions. I wanted to find if there were any similarities or differences in the scores between the textbook question and the question I made up based on the student journals.

This study began on February 23, 2009, and concluded on April 10, 2009. That was a good stopping point for the study because that was the end of the chapter and I needed to focus my attention at that point to the state assessments. Also, of the 36 students who took part in this study, 11 of the students missed at least one part of the data collection due to not being in school that day. This means that they missed either a journal entry, a pre-test, post-test, or end of group quiz. However, every student was interviewed.

Findings

On the typical day of data collection, I started with teaching the computational portion of the concept. After students gained understanding of the concept we discussed where they could

find it in a real-world situation. Students brainstormed ideas and we talked about how we would solve the problem using the knowledge gained from the computational portion of the lesson. When this was complete, I asked the students to write journals. They were supposed to describe the lesson in their own words then relate the concept to their own life. Once this was complete, they were allowed to work on their homework until the class was over.

This differed from non-intervention days as students did not write journals, and the time allotted for discussing real-life situations was limited. We spent quite a bit of time going over student misconceptions and correcting errors from their homework.

The main goal of this study was to find out what would happen with a student's level of understanding if sections of lessons are summed up with real-life problems. It is difficult to gauge the students' level of understanding on a day-to-day basis. Furthermore it is difficult to gauge how a student's level of understanding might have been impacted based on the change in lessons. During classroom instruction for each lesson, I tied the lessons in with real-life examples to draw connections. In order to have some data on the improvements made from the beginning of each section to the end, I gave the students a test prior to instructions of the groups of lessons and the same test after the instruction of the groups of lessons.

For the pre-tests and post-tests for group one (sections one through three of chapter six), there was one student for which no data was collected. Of the remaining 35 students, 33 students showed an improvement from the pre-test to the post-test, one student's score did not change, and one student's score decreased from the pre-test to the post-test. There was an average increase of 7.18 points out of 16 total points on the test with a standard deviation of 3.64. Period one had 17 of the 19 students tested show an increase while all 16 students test in period two showed improvements in scores. Period one's average improvement was 7.29 points with a

standard deviation of 3.92 while period two's average improvement was 7.06 points with a standard deviation of 3.4. There was an average score on the pre-test of 2.58 with a standard deviation of 1.69 and an average score of 9.76 on the post-test with a standard deviation of 1.88. Period one had an average score of 2.63 on the pre-test and 9.92 on the post-test with standard deviations of 0.387 and 3.86 respectively, while period two had an average score of 2.53 on the pre-test and 9.59 on the post-test with standard deviations of 0.4 and 3.32 respectively.

For the pre-tests and post-tests for group two (sections four through six of chapter six), there were four students for which no data was collected. Of the remaining 32 students, 23 students showed an improvement from the pre-test to the post-test, eight students' scores did not change, and one student's score decreased from the pre-test to the post-test. There was an average increase of 4.92 points out of 16 total points on the test with a standard deviation 4.33. Period one had 13 of the 16 students tested show an increase while 10 out of 16 students tested in period two showed improvements in scores. Period one's average improvement was 6.16 points with a standard deviation of 4.37 while period two's average improvement was 3.69 points with a standard deviation of 4.04. There was an average score on the pre-test of 4.53 with a standard deviation of 3.9 and an average score of 9.45 on the post-test with a standard deviation of 3.68. Period one had an average score of 3.59 on the pre-test and 9.75 on the post-test with standard deviations of 2.87 and 4.00 respectively, while period two had an average score of 5.47 on the pre-test and 9.16 on the post-test with standard deviations of 4.66 and 3.42 respectively.

For the pre-tests and post-tests for group three (sections seven through nine of chapter six), there were three students for which no data was collected. Of the remaining 33 students, 23 students showed an improvement from the pre-test to the post-test, six students' scores did not change, and four students' scores decreased from the pre-test to the post-test. There was an

average increase of 3.32 points out of 16 total points on the test with a standard deviation of 3.42. Period one had 12 of the 18 students tested show an increase while 11 out of 15 students tested in period two showed improvements in scores. Period one's average improvement was 3.61 points with a standard deviation of 3.46, while period two's average improvement was 3.32 points with a standard deviation of 3.46. There was an average score on the pre-test of 4.01 with a standard deviation of 2.63 and an average score of 7.34 on the post-test with a standard deviation of 3.4. Period one had an average score of 4.69 on the pre-test and 8.31 on the post-test with standard deviations of 3.1 and 3.0 respectively, while period two had an average score of 3.33 on the pre-test and 6.37 on the post-test with standard deviations of 1.76 and 3.65 respectively.

Taking a look at the big picture, when I combine all of the pre-test/post-tests, 79 out 100 pre-test/post-tests taken showed improvements. Also, 15 out of 100 showed no change in score, and 6 out of 100 pretest/post-tests showed a decrease in scores. This shows that the majority of the students had an increase of knowledge during the time in which this study occurred.

My next form of data collection was the math journals the students had to write in after each new lesson. In these journals, the students had to sum up the lesson in their own words and come up with some way in which that lesson could be applied to their own life.

Group one of chapter six gave the kids an introduction to working with percentages. The section also dealt with solving equations using decimals and percentages. The majority of the journals were very excellent in describing the processes in a "non-textbook" way; however, most of the kids described the processes in the "non-textbook" words that I used. For example, when solving equations I say to find the more interesting side of the equation first and then do the opposite of what sign is used. One student wrote, "The first step to solving an equation is find the

more interesting side. Then use the opposite operation to solve the problem" (Student Journal, February 27, 2009). That was the exact journal entries for most of the students on that day. This trend continued with the entries as the students applied the math to their lives. The majority of examples included things that we talked about in class, such as giving tips at a restaurant and dividing up the percentage of value owned in something. One student wrote, "If I needed to win 3/5 of my wrestling matches to go to state and I know I will have 20 wrestling matches I could use the equation x/20 = 3/5" (Student Journal, February 27, 2009).

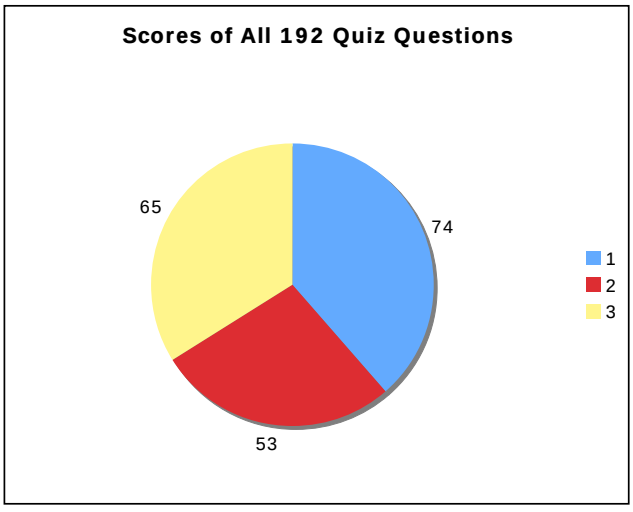
Group two was a section that offered more work with solving equations with many different types of numbers. We also worked on the conversion of numbers into different types of numbers. For this group of journals I found the same thing that went on with group one as far as using my words to describe the lessons in their own words. The students were again applying the lessons to their lives in manners that we covered in class discussions. However, 11% of the journals in this group did not include entries applying the daily lesson to the students' lives. One student wrote, "You change hours to minutes so you could divide them to get the answer. You could change miles to inches. You could use that for calculating stuff" (Student Journal, March 10, 2009). I had started to see some disinterest in the journal writing at this point.

Group three was a section in which probability and percent of change were introduced. This has been difficult section on my students every year I have taught these concepts. In this section, the percentage of journals that did not include an entry applying the material to their own lives dropped to about 5%. The applications to their lives in the journals were excellent for the group three sections. They included examples of shopping, tips, surveys, grades, card games, etc. However, the students showed the same ability to explain the lessons in their own words as they did for groups one and two. They seemed to prefer to use the words that I used rather than

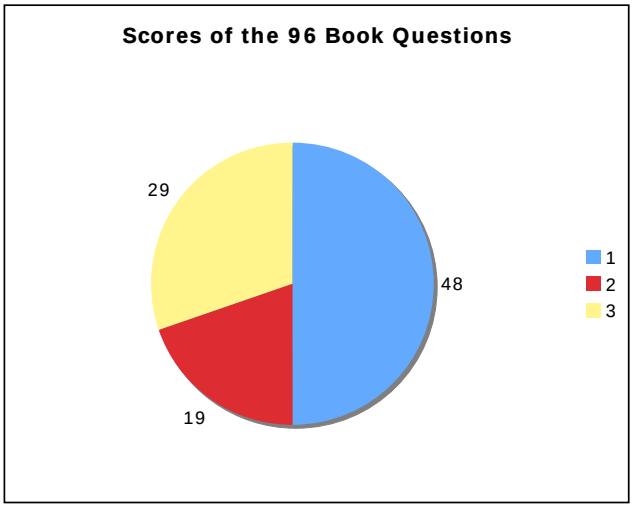
coming up with their own. One journal said, “Well making a [number] into a [percent] is simple, you move the decimal forward two times. When you make a [percent] into a [number] you move the decimal backward two times.” The example provided was, “You could use this in real life figuring out what the tip is for a $100 meal by multiplying 100 by 20% by changing 20% into .2” (Student Journal, March 27, 2009). Overall from the journals, I learned that my students had a difficult time comparing the concepts to their daily lives. Students also continued to repeat my words in their journals instead of finding their own voice.

My third form of data collection was through the quizzes given at the end of each group of section. The quiz consisted of two questions. One question was taken directly from the book and one I created based on the journal entries of the students. The scoring was based on a three-point scale in which I described in the *Methods* section of this paper.

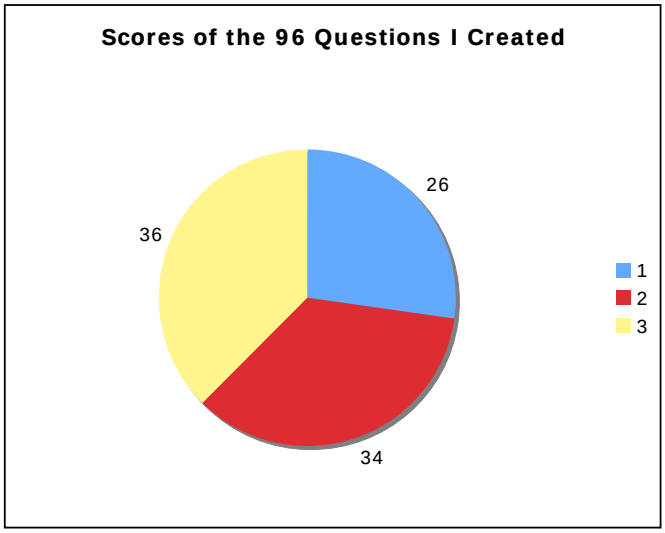
Overall there were 192 questions completed, 96 from the book and 96 that I created. Of the 192 questions, 74 were scored a one, 53 were scored a two, and 65 were scored a three (as represented on the graph).



Of the 96 book questions, 48 were scored a one, 19 were scored a two, and 29 were scored a three (as shown).



Of the 96 questions that I created, 26 were scored a one, 34 were scored a two, and 36 were scored a three (as shown).



The average score for all of the questions was 1.95 with a standard deviation of 0.73. The average score for all of the book questions was 1.80 with a standard deviation of 0.77. The average score for all the questions that I created was 2.10 with a standard deviation of 0.64. This data shows that the students were better able to give complete and correct solutions when they were given questions that they provided input on since 37.5% of the questions I developed were scored a three and 30.2% of the questions given from the book were scored a three. Also, it was

more difficult for the students to put together either a correct solution or thought process on the questions from the book compared to the questions I created from the journals as 50% of the book questions were scored a one and 27% of the questions I developed were scored a one.

My fourth form of data collection was through my teacher journals. I wrote in my journal every time that my students did. Some of the observations that I had noticed were, first of all, that when the lessons were presented applying the concepts of real-life problems, the students asked fewer questions about computational procedures, "when it was time to go over questions, students were able to easily answer my questions when I asked them higher level questions, and their computation was right on" (Teacher Journal, February). There were more questions that arose about the scenarios presented. Another observation was that the students hated to write in their journals but loved to discuss the quizzes after they took them. I also noticed that the time in took to present the lessons in the manner that I did took more time then I would have liked. I noted in my teaching journal "I'm a little frustrated with the time that it is taking to get the real-life application in the lessons" (Teacher Journal, March). I ended up spending a few extra days teaching computational things. For this reason, I decided to cut my study short and end it after chapter six. Finally, I observed that the participation of the students who normally did not participate rose dramatically while the students who generally participated a lot did not participate as much as normal.

My final form of data collection was that in the form of student interviews. I interviewed every student either during his or her lunch period or study hall. However, looking back at the questions I asked, the data collected was not really relevant to the study that I have conducted. There was a question that asked about their attitude towards doing word problems and if that attitude has changed. The majority of the students did not change their attitude as a result of this

study. One student said, “No, I don’t like word problems. I never liked word problems” (Student Interview, April 7, 2009). Another student said, “I have liked doing word problems. I’ve always like doing word problems. These problems got harder, but I still love doing word problems” (Student Journal, April 7, 2009). Basically it was a trend that if the student liked doing story problems before the study he/she liked doing them after the study. If the student did not like doing story problems before the study then he/she did not like doing them after the study.

What will happen with a student’s level of understanding if sections of lessons are summed up with a “real-life” problem? The data collected from the pre-test/post-tests, the end of section quizzes, and my teacher journal help to answer this question. The data from the pre-test/post-tests showed that nearly 80% of the students did show an improvement in knowledge and that their knowledge had increased a little more then seven points out of 16. As shown from the data from the quizzes, the students also scored higher on questions in which they were designed to fit the students’ lives, which showed a greater understanding of the knowledge. Also, I had noted in my journal on March 12, 2009, “The students seemed to be asking more intellectual types of questions. They seem to be directing their questions towards ‘the why’ rather then ‘the how’.” This shows that teaching in this manner may have helped a student understand better how to do a certain computation and allowed them to set there focus to why they need to compute in a certain manner. This is exciting to see.

This data shows that a student’s level of understanding is increasing, however, the increase in knowledge from the pre-test to the post-test may have been a natural increase of knowledge that would have also come from any form of instruction. Also, there were no tests of reliability on the questions that I used for the quizzes, so the fact that the students had higher

scores on the questions relating to their lives could be due to the fact that they might have been easier questions.

What will happen with a student's understanding of mathematics when they are asked to write in math journals on a daily basis? I have found data in the pre-test/post-tests, my teacher journals, and the student journals to show that the students are gaining an understanding. Again, from the data presented from the question presented previously, there does appear to be an increase in understanding; however, it is tough to pinpoint a single cause. Since the math journals were a part of this study, then one could say that the journals played a role in the increase in understanding as shown from the pre-test/post-test scores. In my journal I wrote, "the kids made great connections back to the proportions lesson" (February 27, 2009). This shows that they are making the connections to prior lessons through verbalization. The students did show connections in their journals also. One student wrote, "I now have figured out how I can find a 20% tip for any bill I get" (Student Journal, February 27, 2009). The math journals that I have read prior to this study did show improvements, so it would be viable that the journals were a factor here. However, it would be tough for me to be completely confident that the increase in scores was due the journaling.

What will happen to my teaching when I focus my lessons more around real-life examples and incorporate more of my students' thoughts into my lessons? As I noted in my journal, I found that my teaching required more time with this new way of presenting lessons. In my notes on lesson 6-4 I wrote, "I wish I was able to make more real-life connections, but ran out of time" (Teacher Journal, March 10, 2009). Also, the better scores on the problems that I develop show that I might be making class a little more interesting by applying it to the student's lives. In my journal I wrote, "It appears that when I enjoy the lesson more that the kids enjoy

learning more" (Teacher Journal, April 10, 2009). Also, the students offering input gave me new things to talk about during class. When discussing lesson 6-2, I wrote, "The students showed a good understanding of the cross product rule." I then said, "I think the students are trying to gain a deeper understanding" (February 27, 2009). Finally, I found that through teaching, I can give the students a piece of me. I wrote, "I love the idea that from now on these students will remember that I suggested a 20% tip on everything. They now know what they are typing into their cell phones to find a tip" (February 27, 2009). Obviously, the scenarios presented in class of the real-life applications is something that they will take with them and hopefully when presented with similar situations, they will know what to do.

Conclusions

Real-life applications of mathematics in the classroom did make teaching and learning a little more enjoyable for my students and me. However, making class enjoyable is only a minor part of education. This study shows that learning can still occur while putting an emphasis on real-life problem solving. There were several differences between my study and the studies previously conducted regarding these issues. In the study conducted by Pugalee (2004), he found that students who wrote about their problem solving processes produced correct solutions at a statistically higher rate than when using a think-aloud process. The results of my study tend to lead to the conclusion that my students also made improvements based on their writing practices through journals.

Implications

As a result of this study, I will be looking to do more classroom research on the use of real-life problems in my classroom. The data I collected for this study was not ample enough to determine anything about the effectiveness of it. I will spend some time this summer planning

out some lessons a little better so that I can hopefully solve the time issues that I ran into when teaching the computational portion of my lessons. I intend to share with my peers in my city and in my area what I have learned and encourage them to use real world examples in their classrooms, while asking students to journal to gain understanding and mastery of concepts.

I intend on working with the Social Studies and Science teachers to work real-world problem solving strategies into their classrooms. I believe that students need to be saturated with math problems that they may be faced with in the world.

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Appendix A

Student Interview Questions

1. How much time on average do you spend on homework assignments?
2. What do you think is the purpose of math homework?
3. What does it look like when you justify your answers on a homework assignment?
4. What are the benefits of justifying your answers on your homework assignments, if any?
5. How successful do you feel about using Math skills in and out of class? Give an example of how you use Math outside of class.
6. What do you think about when your teacher asks questions during Math class?
7. How confident do you feel in using Math skills in and out of class? Explain.
8. What do you like best about Math? What do you like least about Math?
9. What makes math easy or difficult for you?
Have you ever had a really bad experience with math? If so, what happened?
What could teachers do to help students with in math?
10. When working a word problem, do you think you know the meaning of most of the vocabulary words in each problem? Please give some examples.
11. Why is it important to know the meanings of vocabulary words you see in math?
12. Did you enjoy working word problems before this school year? Why do you think this was the case?
13. Has your attitude about working word problems changed during your 7th/8th grade year?
14. This semester I have changed some of my teaching practices. What advice would you give me about continuing these changes next year?
15. What would you tell someone who is new to our class what it takes to be successful in this math class?
16. I would like you to work on this problem, saying aloud whatever it is you are thinking as you work through the problem. I especially want to hear you talk about how you decide what to do to solve the problem.
Emma is saving money to buy a bike that costs $72. She wants to buy the bike after saving the same amount of money each week for 6 weeks. How much money does she need to save each week?
17. I would like you to write out a solution to this problem, trying to write down all your steps and explain what you are thinking. Afterwards, I'll ask you how you decided what to do to solve this problem.
The ratio of boys to girls in a school is 5:4. If there are 180 students, how many girls are there?
18. Is there anything you want to know from me?
19. Is there anything else I should know about you to better understand your problem solving in math or your general math experience?

Appendix B

Sections 1 through 3 Quiz Questions

1. Last year I went on a trip to Chicago to watch my favorite baseball team, the Cubs. I had a picture taken of me next to a statue of my favorite all time Cubs broadcaster Harry Carey. In the picture I am 1 inch tall and the statue is 2.5 inches tall. In real life I am 5 ft 10 in tall. How tall is the statue in real life?

2. Percy O'Doyle is about to run the 100 meter dash. However, Percy hates the metric system and refuses to call it the "100 meter" dash. If 3.28 ft = 1 meter, how long of a dash would this be for Percy O'Doyle in feet?

Sections 4 through 6 Quiz Questions

1. A number n is 25% of some number a and 35% of a number b. Tell the relationship between a and b. Is $a < b$, $a > b$, or is it impossible to determine the relationship? Explain.

2. You are taking the ACT. You had heard that 30% of the answers are choice A, 15% are choice B, 35% are choice C, and 20% are choice D. You are completely stuck on a problem and are leaning towards picking choice C, however you did pick choice C for the problem before it and after it. Is this a good choice? Explain.

Sections 7 through 9 Quiz Questions

1. In 1990, the population of Nebraska was 4,040,587. In 2000, the population was 4,447,100. What was the percent increase in population for Nebraska from 1990 to 2000?

2. You went out to eat with 2 of your friends. The total bill for all 3 meals was $35.25. If you decided to divide the bill evenly between all of you, how much did each of you owe? If you wanted to leave a 20% tip, how much would you pay total?