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The Effect of Direct Instruction in Teaching Addition and Subtraction of Decimals and Decimal Word Problems on Students At Risk for Academic Failure

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THE EFFECTS OF DIRECT INSTRUCTION IN TEACHING ADDITION AND SUBTRACTION OF DECIMALS AND DECIMAL WORD PROBLEMS ON STUDENTS AT RISK FOR MATHEMATICS FAILURE

by

Heather Hoopes Small

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ABSTRACT

The Effect of Direct Instruction in Teaching Addition and Subtraction of Decimals and Decimal Word Problems on Students At Risk for Academic Failure

by

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Utah State University, 2011

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This study investigated the effects of a direct instruction program on the ability of elementary school students identified as at risk for math failure to add and subtract numbers with decimals, and complete addition and subtraction word problems with decimals. Direct instruction has previously been shown to increase the math skills of special education and general education students. This study examined the extent to which these students could master these skills in six hours of instruction, with carefully designed sequences of examples and strategy instruction in word problems. The study took place in two elementary schools. The participants were fifth grade students who had received low math scores on a school wide test and placed in a math group accordingly. The students were given a pretest and placed into two different groups, based on a stratified random process. The students in the treatment group received six lessons in decimals and word problems. After the six lessons, the groups were given a posttest. Student progress was assessed by comparing the groups on posttest results, comparing the students' pretest and posttest scores, and using the ANOVA to determine statistical significance. On the posttest, the students in the treatment group scored 35 percentage points higher than the students in the control group – this difference was statistically significant. The increase was largest in their ability to add and subtract decimals, however many of the students also made considerable progress in their ability to solve word problems. (131 pages)

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INTRODUCTION

Importance of Math

Students can expect to spend many hours each week studying math throughout their elementary, junior high, and high school years. They will be expected to learn everything from basic math facts to algebra, and even encouraged to learn as much as calculus. If they struggle with math early, their challenges often continue throughout their school experience. Additionally, in many states, they will not be able to get a regular diploma without at least a ninth grade math ability (California Department of Education, 2009; Minnesota Department of Education, 2007; Oregon Department of Education, 2010). Their ability in math will greatly influence whether they will be able to attend college, what kind of careers they can have, and their income in the workplace (The American Diploma Project, 2010). Also, math is needed in everyday life, from learning to handle personal finances, to making purchases, to doing home improvements. Math is a part of life and advanced math skills will increase students' life choices.

Given the importance of math, it is vital for research to find the most effective and efficient way to teach math, especially to students with disabilities and students at-risk for math failure. However, Gersten et al. (2009) stated that, "Until recently, mathematics instruction was often considered an afterthought in the field of instructional research on students with LD. A recent review of the ERIC literature base found that the ratio of studies on reading disabilities to mathematics disabilities and difficulties was 5:1 for the decade 1996-2005. This was a dramatic improvement over the ratio of 16:1 the previous decade" (Gersten et al., 2009, p. 5).

More research needs to be done on individual math skills, especially for remedial students, who will need efficient and effective strategies to solve math problems. If these students are systematically taught using effective methods, the problems many of them encounter can be minimized.

Direct Instruction

The direct instruction program of math has been shown to be effective in helping students succeed at math. In a summary report about Direct Instruction, Kinder, Kubina, and Marchand-Martella (2005) state that Direct Instruction has (a) a careful content analysis that supports generalization; (b) clear communication (the wording of instruction, as well as how the instruction is sequenced and examples are introduced); (c) clear instructional formats (specifies teacher's questions and comments and student responses); (d) strategic sequencing of skills (easier skills are taught before more difficult ones, prerequisites are taught before the strategy is taught); and (e) track organization (Kinder, Kubina, & Marchand-Martella 2005).

Use of Examples

Kameenui and Simmons (1990) state, "in teacher-directed instruction, the teacher provides the rule first and then follows up with a set of exemplars of the rule… if the rule is clear and the set of examples and non-examples are carefully chosen, direct instruction can be virtually errorless" (Kameenui & Simmons, 1990, p. 362). The importance of the examples that are used in teaching cannot be overstated. The examples that a teacher uses are vital for clearly demonstrating a new skill, as well as giving the students sufficient practice to master the new skill. Zodik and Zaslavsky (2008) echo this in saying, "the specific choice of examples may facilitate or impede students' learning, thus it presents the teacher with a challenge, entailing many considerations that should be weighed" (Zodik & Zaslavsky, 2008).

Problems with Traditional Math Curricula

Kameenui and Simmons (1990) state that there are three common deficiencies in commercial math curricula. The first is a "lack of sufficient amounts of instructional and practice examples" (Kameenui & Simmons p. 407). Students are often given only a few examples to illustrate a new skill, thus not allowing the students to fully master the new skill before moving on. Also, with too few instructional examples, the student is not provided with an appropriate range of examples so that the student can successfully apply the new knowledge to a new situation. Gersten et al. (2009) explained, "if the teacher teaches a wide range of examples, it will result in the learner being able to apply a skill to a wider range of problem types" (Gersten et al, 2009.)

The second deficiency that Kameenui and Simmmons cite in commercial math curricula is that, 'there is inadequate distribution of practice activities' (Kameenui &

Simmons, p. 407). The students must have many opportunities to practice after they are initially taught each new skill.

The third deficiency that Kameenui and Simmons cite is “poor instructional and practice examples” (Kameenui & Simmons, p. 407). Poor instructional and/or practice examples can lead to student errors. Students may learn a faulty rule in completing problems if they are able to get the correct answer by applying this faulty rule. When given a different situation, the student will answer the problem incorrectly, based upon the faulty rule they learned to apply.

Poor instructional and practice examples can also hinder the student’s progress in making important discriminations. For instance, when each example in a teaching sequence has the same solution, the student does not learn to make the necessary discriminations (Kameenui & Simmons, 1990). If students do not practice making the necessary discriminations, they are less likely to master the skill.

A teacher must attend closely to the examples given to teach a concept, thereby making sure the students must apply the correct rules to answer the problems. Rowland (2008) states that “the examples provided by a teacher ought, ideally, to be the outcome of a reflective process of choice, a deliberate and informed selection from the available options, some ‘better’ than others…” (Rowland, 2008).

Difficulties with Word Problems

Given problems with traditional math curricula, students in both general and special education are likely to fall behind, and their deficits increase systematically as the curriculum moves forward. Many skills in math build upon previously learned material. If students are not able to master each skill as it is taught, they will be left behind as the teacher moves on. This is true with learning the computations of multiplication and division as well as fractions and decimals. And when these problems are put into a real-life format, they are even harder for most students to comprehend. One of the most complex skills is applying their computational skills in verbal problem solving situations (Kameenui & Simmons, 1990). Yet, word problems are extremely important since everyday actions require the application of word problem solving skills (Wilson & Sindelar, 1991).

Stein (1998) found that there was a significant difference in students' achievement based upon the type of problem the students were given. When students were given math problems that were purely computational, the students were able to solve many more of them correctly. When the same computations were in word problems, the students had a much lower level of achievement. The author concluded that, "for some students, the additional burden of interpreting language, and choosing appropriate algorithms, may have resulted in a breakdown in their ability to calculate the problems correctly" (Stein, 1998).

Word problems involve the mastery of many different skills (Kameenui & Simmons, 1990). Many of these skills are covert, that is, we cannot observe them. When students are not able to correctly solve a problem, it is often because they have not mastered all of the component skills. One of the challenges for a teacher is to make each of these skills overt and then to teach each of the component skills explicitly (Kameenui & Simmons, 1990).

Problems with Delivery of Instruction in Word Problems

Garderen (2008) attempted to find out about special education teachers' practices and beliefs about teaching word problems. Garderen (2008) completed an exploratory study in which 89 junior high and high school teachers responded to a survey in regards to their own practices when teaching word problems to their special education students. The teachers' answers revealed that, although they believed strategy instruction to be the most important element in teaching word problems to their students, in practice the teachers rarely helped the students with strategy instruction. The author also pointed out that, "perhaps of greater concern than type of problem provided is the result that the majority of teachers (i.e., 70.7%), regardless of setting, provided only one hour of instruction or less per week for solving word problems" (Garderen, 2008). For students who are struggling in math, improvement in word problems will only be made with intensive instruction focused on how to solve word problems. This study illustrates that many teachers of students with disabilities do not use the proper research-based curriculum in teaching word problems, and do not spend the time necessary to teach problem solving strategies.

Direct Instruction in Word Problems

Wilson and Sindelar (1991) studied the effect of using the direct instruction methodology on students with disabilities in completing word problems. They concluded that students with disabilities can be taught to solve addition and subtraction word problems, if they are taught using strategy instruction. The students in their study improved dramatically with strategy instruction, and although they did not catch up to their peers, the authors point out that this could be because of the limited time allotted in the study (Wilson & Sindelar, 1991).

REVIEW OF LITERATURE

There are a small number of studies showing the benefit of Direct Instruction in mathematics for students with disabilities and students at risk for failure in mathematics. In this review, studies that show Direct Instruction being applied in mathematics with various mathematical skills are analyzed. These studies include Direct Instruction being applied as a teaching strategy for large groups of students as well as for small groups. Additionally, there are several meta-analyses which have been done (Baker, Gersten, & Lee, 2002; Kinder, Kubina, & Marchand-Martella, 2005; Przychodzin, Marchand-Martella, Martella, & Azim, 2004), some of which compare Direct Instruction with another teaching strategy, such as the constructivist approach. These also are analyzed and the results are discussed.

Research on Direct Instruction in math was identified using ERIC, Google Scholar, and Ebsco Host Databases. Also, studies were found using the JSOR collection of electronic journals, under the math and education disciplines. The keywords *Direct Instruction* and *Math* were used to find the articles that pertained to the use of Direct Instruction as a math strategy to teach a group of participants. Six meta-analysis articles were found which combined results from many primary research studies on Direct Instruction. Three of the meta-analysis studies were used in the literature review because they were the most relevant to this study (Baker, Gersten, & Lee, 2002; Kinder, Kubina, & Marchand-Martella, 2005; Przychodzin et al. 2004). Another four studies were found that directly pertained to Direct Instruction in teaching a specific math skill

(Flores & Kaylor, 2007; Jitendra, Hoff, & Beck, 1999; Troff, 2004; Wilson & Sindelar, 1996). The studies that were discarded either did not use many of the elements of Direct Instruction or combined Direct Instruction with another teaching strategy.

In researching word problems particularly, the keywords *Word Problems*, *Direct Instruction*, and *Math* were used. This search yielded 14 studies. Of the 14, only 3 were used in this literature review. The others were discarded because they did not use many of the components of Direct Instruction.

Baker, Gersten, and Lee (2002) found that, according to available research, there are many factors that play an important role in the achievement of at risk students in math. One of the factors was the use of explicit or direct instruction. Baker et al. (2002) reviewed four studies involving direct instruction. Three of the studies used Direct Instruction alone (Cardelle-Elawar, 1992, 1995; Moore & Carnine, 1989) and one of the studies compared direct instruction with a contextualized approach to math (Woodward et al., 1999). The contextualized approach included stressing the real-world application of the math, as well as focusing on the underlying concepts of the problems. The explicit instruction techniques included extensive modeling by the teacher on all the components that were being taught. Then students worked on similar problems that were modeled, with close supervision and monitoring. The student feedback followed the same pattern of question-answer that was present in the teacher modeling. The effect of using explicit or direct instruction was statistically significant. The authors concluded that, "the approaches that used explicit instruction had a positive, moderately strong effect on the mathematics achievement of at-risk students" (Baker et al., 2002).

Kinder, Kubina, and Marchand-Martella (2005) analyzed 37 studies (between the mid 1970's and 2005) which showed the effect of Direct Instruction on students with high-incidence disabilities (learning disabilities, communication disorders, behavior disorders, and mild mental retardation). The studies included research on math, reading, writing, and spelling. The studies included participants from three years old to high school; however, the majority of the studies included elementary and middle school participants. Out of the 37 studies analyzed, 34 showed a greater positive result for the students who received Direct Instruction training (Kinder, Kubina, & Marchand-Martella, 2005).

In a meta-analysis by Przychodzin, Marchand-Martella, Martella, and Azim (2004), the authors compared Direct Instruction with the constructivist approach to math. The authors found 12 studies involving the Direct Instruction math program post 1990. Seven of the 12 studies compared Direct Instruction with other math programs (Brent & DiObilda, 1993; Crawford & Snider, 2000; Snider & Crawford, 1996; Tarver & Jung, 1995; & Vreeland et al, 1994; Young, Baker, & Martin, 1990). Four of the studies showed the effectiveness of Direct Instruction alone (Glang, Singer, Cooley, & Tish, 1991; McKenzie, Marchand-Martella, Martella, & Moore, 2004; Sommers, 1991; & Wellington, 1994). They found that 11 of the 12 studies showed positive results for Direct Instruction (Przychodzin et al., 2004).

Troff (2004) applied the direct instruction teaching model to teach proportions to 22 high school students in the 10^{th} to 12^{th} grade. Each of these participants tested below grade level in their math achievement. Also, on the pretest involving proportions, 89% of the students scored less than three of eight problems correct. Troff used the direct instruction model, which included determining the big ideas of each new skill, extensive modeling by the teacher, teaching explicit strategies to solve the problems, and guided practice. After teaching the students using this model, all of the students made significant gains, including 26% of the students receiving a perfect score on the posttest. Also, during independent exercises, the group's mean performance never fell below 77%, and in 19 of 25 independent exercises, the group reached mastery level at 85% (Troff, 2004).

Flores and Kaylor (2007) conducted a study in which the math skill of fractions was taught using the direct instruction model. In this study, 30 students, between the ages of 12 and 14 were taught adding/subtracting and multiplying/dividing fractions, as well as translating fractions into whole numbers and vice versa. Each of these students was identified as at risk for failure in mathematics. The students had been taught basic fraction skills earlier in the school year, but had made little progress according to district progress assessments. The students were given a pretest to determine their skills involving fractions. The scores on the pretest ranged from 0- 57%, with the mean score being 20%. The students were then taught using the direct instruction model, which involved the teacher modeling the new skills for the students and providing guided practice. Students worked on problems independently only after achieving mastery on the guided practice. The mean score on the posttest was 77%. All but three of the students received a score of 75% or above. Flores and Kaylor point out that a limitation of this study is that the students were not taught in a whole group, as they would be in a regular classroom. The students were taught in groups of seven or eight students, thus allowing more attention to each student during the instruction (Flores & Kaylor, 2007).

Jitendra, Hoff, and Beck (1999) conducted a study to determine the effects of a direct instruction program on 3 fourth-grade students with learning disabilities. The participants had been struggling with mastery of word problems, according to their teacher, prior to the study. For the instructional program, the word problems were separated into several categories. The students were taught a strategy, with a schema diagram, to solve each of the types of problems. Instruction included extensive modeling, explicit explanation of rules, guided practice, monitoring, corrective feedback, and guided practice. The results indicated that the schema based direct instruction approach was successful in improving the student's scores on addition and subtraction word problems. The students, on average, scored 26% higher on the posttest than the pretest. Also, when tested several weeks later, the students showed that they retained the progress that they had made (Jitendra, Hoff, & Beck, 1999).

Wilson and Sindelar (1991) evaluated a Direct Instruction strategy for teaching students addition and subtraction word problems. The participants were 62 elementary aged students who were receiving special education services from nine elementary schools. The participants were taught addition and subtraction word problems, according to the Direct Instruction model for 30 min each day for 14 days. These problems were divided into four main types, as described by Silbert et al. (1981): simple action problems, classification problems, complex action problems, and comparison problems. The four problem types were equally represented in the pool of word problems. The participants were separated into three different groups: a Strategy Plus Sequence group, a Strategy Only group, and a Sequence Only group. The Strategy Plus Sequence group received instruction on the big number strategy and also learned the rule, when the big number is given, you subtract; when the big number is not given, you add. They were presented with the different problem types one after another, for example, the simple action word problems were taught first, the classification problems second, and so on. The Strategy Only group was also taught the big number strategy to solving word problems, but they were given mixed types of problems, instead of the problems being separated according to problem type. The Sequence Only group did not receive any strategy training to complete the problems. However, the problems were sequenced according to problem type, as described above. The results of the study showed that the Strategy Plus Sequence group scored the highest on the posttest; however they did not score significantly higher than the Strategy Only group, based upon statistics. Both groups scored significantly higher than the Sequence Only group. Because both groups that received the strategy instruction according to the Direct Instruction model made such significant gains between the pre and posttest, the authors affirm that students with disabilities can master word problems if given sufficient instruction. Although the participants still tested below their grade level peers, the authors conclude that this may be because of a lack of sufficient time to teach them (Wilson & Sindelar, 1991).

Based on the literature review, the direct instruction teaching strategy has been shown by several meta-analyses of studies, as well as individual studies, to be effective remedial instruction in various math skills, including proportions, fractions, and word problems. The present study seeks to extend this literature with the use of Direct Instruction in teaching addition and subtraction of decimals and word problems involving decimals with elementary aged students.

PROBLEM STATEMENT

More research needs to be done in determining the best practices in teaching math. Elementary students who are falling behind in math need to be taught basic math skills in as efficient and successful way as possible, so that they do not miss out on these essential advanced skills which will help them throughout the rest of their education. It is vitally important that these students do not continue to experience failure in math, especially when there is research to show that, with adequate instruction, students with disabilities can become proficient in solving word problems.

Direct Instruction has been shown to produce significant gains in various math skills. However, research has not been conducted on its effectiveness on teaching students to add and subtract decimals, nor on solving word problems that involve decimals. Therefore, it would be worthwhile to examine the effects of a direct instruction program on the ability of these students to solve decimal word problems.

The purpose for this research is to determine the effects of a well sequenced program of Direct Instruction on the ability of elementary school students to solve decimal computations and decimal word problems of several types.

The research question is:

What is the effect of a direct instruction program of teaching decimal addition and subtraction computation and word problems on at risk elementary schools students' accuracy on: decimal addition and subtraction computations, decimal addition and subtraction word problems, decimal complex action word problems, decimal classification word problems, and decimal comparison word problems?

METHODS

Procedures for Instructional Design and Sequencing

Determining the Knowledge Form

The teaching sequences are constructed using the generic instruction set, set forth by Kameenui and Simmons (1990) in 'Designing Instructional Strategies' (pp. 108-114). There are five steps, according to Kameenui and Simmons, to take when designing an instructional sequence. The first step is to determine the knowledge form, i.e., understanding exactly what is being taught. When the teacher understands clearly what is being taught, this helps the teacher in determining how it will be taught (Kameenui & Simmons, 1990).

Addition and subtraction of decimals, as well as decimal word problems are cognitive strategies. A cognitive strategy is defined by Kameenui & Simmons as, "a series of multi-step associations and procedures that involve facts, verbal chains, discriminations, concepts, or rules designed to bring about a response or set of responses to a specified problem" (Kameenui & Simmons, 1990).

The instructor must make sure that the students have all of the pre skills necessary to be able to successfully learn the new information taught. The teaching sequences that were included in this study were carefully analyzed to make sure that each skill built upon the previous skill. Also, the students were tested to make sure they had the pre skills necessary to learn the new information. The cognitive strategies that were taught were broken down into component skills, or, in other words, each skill was broken down into observable parts.

Range of Examples

The second step that Kameenui and Simmons cite in designing an instructional sequence is determining the range of examples. They state that, “an adequate range of examples must be provided to allow the learner to generalize the concept, rule, or strategy to untaught examples” (Kameenui & Simmons, p. 378). Rowland states that, “Exercise examples ‘for practice’ will also ideally expose the learner to the range of types of problem that s/he might encounter from time to time” (Rowland, 2008). The range of examples that was provided in the decimal teaching sequence considered all the types of decimal problems that a student must know to progress in the subject matter. Careful attention was paid in creating the word problem sequences, so that an adequate range of examples would allow the learner to complete addition and subtraction word problems of all types.

Sequencing the Examples

The third step cited by Kameenui and Simmons in designing an instructional sequence is sequencing the examples. Easier examples were taught early in the sequence, thus allowing the students to experience success, as well as help them become firm on the early examples before presenting them with more complex examples. Also, examples which required the same steps to complete were placed consecutively, so the students would be able to learn the generalizability of the strategy (Kameenui & Simmons, p. 379).

Selecting Test Examples

The fourth step that Kameenui and Simmons set forth in designing an instructional sequence is selecting test examples. Test examples are to assess the learner's knowledge with the academic skill immediately after the skill was taught. The test examples should not be used to extend the learner's knowledge to new problem types; they only confirm whether or not the learner had become proficient with the new academic skill (Kameenui & Simmons, p. 379).

Designing and Scheduling Practice Activities

The fifth and final step cited by Kameenui and Simmons in designing instructional sequences is designing and scheduling practice activities. They state that, "Initial practice exercises should be conducted under teacher supervised conditions and scheduled frequently throughout the day and over the course of the week. As the learner becomes more facile with the skill, independent practice exercises may increase and the schedule of practice may be distributed over longer periods of time and for shorter time increments." (Kameenui & Simmons, pp. 379-380).

Assessing the Instruction

During instruction, the teacher must also "monitor and adjust when necessary the number and quality of student responses to tasks" (Kameenui & Simmons, p. 95).

The teacher also must establish a plan for recording the errors made during instruction and individual seatwork, as well as establish a plan for responding to the errors. If the students are quickly able to grasp the new material, the number of sequences may need to be reduced. If the students are not able to obtain at least 80% accuracy on the guided practice problems, the teacher may need to decrease the difficulty of the problems at first, or add more examples to teach the new skill. Overall, the teacher must determine the reason that the students are struggling with the new information and make changes accordingly.

Questions that need to be asked when assessing instruction include: “Were students able to perform a task at the end of the session that they couldn’t perform before the session began? If not, why? Will the learning objectives and outcomes need to be revised? If yes, which? Why? Were the students held to a high criterion level of performance throughout the lesson? If no, was the problem one of management, teacher presentation, or program design? Will newly introduced skills require more instructional time than was scheduled in the lesson? If yes, how much time and how should it be scheduled? Was the criterion level of performance on independent seatwork met? If yes, should the criterion be raised to a higher level? Should the difficulty of the task be increased?” (Kameenui & Simmons, pp. 101-102).

Description of Word Problem Sequences

There are three different types of addition/subtraction word problems. They are: comparison word problems, classification word problems, and complex action word problems.

The students in the treatment group were taught the different types of word problems separately first. Then, the different problem types were presented in combination with one another so that the students had practice discriminating between the different types. Also, the students were taught the word problems initially with smaller whole numbers, so they could focus on the word problems, rather than the numbers. As the students became more proficient in the word problems, the numbers became larger, as well as began to include decimals.

The content analysis for the included instruction is available in Appendix A. Sample lesson plans for each of the teaching sequences are also included in Appendix D. The lesson plans are written using the guidelines of Direct Instruction set forth by Kammenui and Simmons (1990) and Stein et al. (2006).

Participants and Setting

Twenty-five 10 and 11-year-old students in the fifth grade from two different elementary schools participated in this study. Fifteen of the students were girls, 10 of them were boys. Five of them received special education services at the time of the study. The other 20 students were considered at risk for mathematics failure based upon a school wide test. The PLATO test (Plato Learning, 2010) was used to determine the students' being at-risk for academic failure in the first elementary school; and the Saxon pre and posttests (Saxon, 2010) was used in the second elementary school.

The students were given the pre-test as a group. The pretest was scored for all of the students and the students were assigned to two groups, based on a stratified random process. The two students with highest scores on the pretest were identified and one was randomly selected to be in the treatment group, with the other assigned to the control group. Each successive set of scores within the class were assigned in a similar manner.

There were 30 students who were given the pretest. Two of the students were not included in the study because they were not able to regroup according to the guidelines set up for the pretest. There were 28 students assigned to the treatment and control groups; 14 in the treatment group and 14 in the control group. Three of the students in the treatment group's scores were not included in the data analysis because of more than one absence or missing the pretest.

In both schools, the students were currently using the Saxon (Saxon, 2010) math program in the classroom. They had previously received decimal instruction earlier in the school year. The students were taught to line up decimals in addition and subtraction. They were also taught how to multiply decimals with a one digit number. The students had also received instruction in various methods of solving addition and subtraction word problems in the fifth grade, as well as previous years.

The study was conducted in the classroom of the first elementary school, and in the math and science labs of the second elementary school. The lessons were given with the use of an overhead projector and a white board in both classrooms. The students were seated at individual desks in the classroom and at tables in the math and science labs.

Intervention and Procedures

Intervention Treatment

The instruction was delivered for one hour each day for six days. The instruction covered (a) addition and subtraction of decimals, (b) reading and recognizing decimals up to hundredths, and (c) addition and subtraction word problems with decimals. The individual examples were previously written out and shown on the overhead projector so that there was little down time between examples. The students also had a copy of the problems that were shown on the overhead projector. The students watched, and were asked to respond to questions, as the teacher presented the material on the overhead. They also completed individual seatwork, worked problems on the whiteboard themselves, and worked in groups of two.

Control Treatment

The students in the control group were taught by their regular classroom and special education teacher in their regular classroom. The students in the control group from one elementary school received instruction in multiplication as a form of repeated addition. The students in the control group in the second elementary school received instruction in frequency tables and line plots, multiplying by two-digits, and naming numbers through billions. None of the students in the control group received instruction on decimals or word problems while the study was taking place.

The control group in the first elementary school was taught by a special education teacher with twenty years of experience in teaching special education. The control group of the second elementary school was taught by a regular education fifth grade teacher with five years of experience in teaching fifth and sixth grade.

After the instruction was completed with the treatment group, the students were given the posttest again, as a group, and their scores were compared. Their scores are reported in the data analysis section of the paper.

Additional Treatment Phase

The control group was then given the instruction that the treatment group received. They were also given a second posttest, with similar problems as the pre and posttest. Their scores were compared against their scores on posttest 1 and also reported in the data analysis section.

The instruction that was given to the control group before posttest 2 varied slightly from the instruction that was given to the treatment group. The researcher found that the students in the treatment group made the most progress when the comparison word problems were taught. Therefore, the comparison problems were taught first in the sequences, rather than the complex action word problems. Also, the students in the control group completed the lessons faster than the treatment group, so the researcher added a final component of having the students write their own word problems, an activity that the treatment group students did not complete.

MEASURES

Dependent variable

Dependent measures included the pretest and the posttest scores. The pretest consisted of 15 problems. The students were asked in writing, as well as verbally, to show all of their work on the tests. The problems on the pretest were as follows:

- The first three problems were multi digit addition and subtraction problems, written vertically, which required regrouping, but did not contain decimals. These problems were given to assess the learner's pre skills, the mastery of which qualified them to participate in the study. These problems were scored by the correct number of digits. If the students were able to get 75% of the digits correct, they were eligible to participate in the study.

  Example:
  $$\begin{array}{r} 313 \\ \underline{+\ 98} \end{array}$$

- The next three problems were computation problems with decimals that were written horizontally and required regrouping and two of which required the addition of 0's for place value. These problems assessed the learner's ability to rewrite the problems in vertical form with proper alignment of decimals, perform the operation correctly, and correctly place the decimal in the answer.

Example: 212.76 - 209.8

- The next three problems assessed the learner's ability to solve the word problems which were taught in the teaching sequences. One was a simple action word problem that contained whole numbers with subtraction; one was a comparison word problem that contained whole numbers with addition; and one was a classification word problem that contained whole numbers with addition.

Example: Jerry got on the scale with his friend Alex. They both weighed 202 pounds. When Alex got off the scale, the scale read 98 pounds. How much does Alex weigh?

Example: On the math test, Ellen got 56 of the problems correct. Her friend, Eliza, got a better score. She got 18 more problems correct than Ellen. How many problems did Eliza get correct?

Example: There were 19 boys and 22 girls who tried out for the part in the play. How many kids tried out?

- The last six problems assessed the learner's ability to solve the word problems which were included in the teaching sequences with decimals; two were complex action word problems with decimals, one was an addition problem and one was a subtraction problem; two were comparison problems with decimals, one was an addition problem and one was a subtraction problem; and the last two were classification word problems with decimals, one was an addition problem and one was a subtraction problem.

> *Example:* *Rob had $5.29 in his wallet. He found a $20 bill on the ground as he was walking to class and also put it in his wallet. How much money does he have in his wallet now?*
>
> *Example:* *Aaron climbed 72.3 feet up a rope before he could go no further. Justin climbed 3.6 feet farther than Aaron before he slipped. How many feet did Justin climb?*
>
> *Example:* *Stephanie bought 2.3 pounds of celery and 3.5 pounds of squash at the grocery store. How many pounds of vegetables did she buy?*

A 12 item posttest was given after the treatment was completed. The posttest included the same decimal computation problems as the pretest, but did not include the whole number computations or whole number word problems.

The control group was also given a second posttest. This posttest had similar problems as Posttest 1. A sample of the pre and posttests are included Appendix B.

The tests were scored with the decimal computation items worth two points and the decimal word problems worth three points: one point for correct computation, one point for correct alignment of decimals, and one point for choosing the correct operation (in the word problems). The researcher analyzed the pretests and posttests with respect to each of these components of the process of arriving at the correct solution. In addition, scores were summed up to characterize overall performance.

Reliability of Dependent Variables

The researcher was the primary scorer and scored all pretests and posttests. A second person also scored at least 50% of the tests to assess reliability. This person was trained in the scoring of the tests, previous to scoring them by the researcher. The problems were each examined based upon the three components mentioned above: correct operation, proper alignment of the decimals, and correct computation. The researcher and the independent person agreed on the scoring of all items.

Treatment Integrity

Independent observers attended 25% of the treatment sessions and completed a checklist (see Appendix C) at the end of each session that they attended. The checklist was used to determine the fidelity with which the instruction was given according to the lesson plans. The checklist included such items as: Did the teacher follow the wording of the lesson plans?, Were all of the students given an opportunity to respond?, Were all of the examples given in each instructional sequence?, Did the students complete their individual seatwork?. The observer completed the checklist and the total instructional fidelity for the sessions in which an independent observer was present was 99%.

RESULTS

The data results from this study have been analyzed in several ways. First, the treatment group and control group are compared on overall scores. Next, the scores from the tests are also broken down into several different components, with correct computation and placement of decimals being analyzed separately from choosing the correct operation in word problems. The word problems are analyzed according to the three types of word problems taught: complex action, comparison, and classification problems. Also, choosing the correct operation in the addition and subtraction word problems is analyzed. For each component of the tests, the groups are first compared on the pretest to assess whether they were substantially different prior to beginning the treatment. Second, the two groups are compared on the corresponding posttests to determine whether they were substantially different after the treatment group had been exposed to the treatment.

Finally, the control group was given the treatment after the formal experiment was finished, and given a second posttest. Their scores on the second posttest (Posttest 2) are compared to their pretest and their first posttest scores (Posttest 1).

Overall Pre and Posttest Performance

Overall pretest and posttest scores are shown in Table 1. On the pretest, the mean for the treatment group was 59%, with scores ranging from 36% to 80%. The control group's mean score was 60% on the pretest, with scores ranging from 30% to

80%. On the posttest, the mean for the treatment group was 90%, with scores ranging from 63% to 100%. The average growth for the treatment group from pretest to posttest was 31 percentage points. As shown in Figure 1, three students received 100% on the posttest, and four others scored in the 90%'s. Thus, six of the 11 students scored 90% or better; further, 10 of the 11 scored 80% or higher.

On the posttest, the mean for the control group was 55%, a decrease of five percentage points compared to the pretest. This was 35 percentage points below the posttest mean for the treatment group. Only four of the 15 control group students scored higher on the posttest than they did on the pretest.

The ANOVA confirmed that on overall test scores, the two groups were very similar on the pretest (p = .722, eta^2= .004), but on the posttest, the difference between groups was statistically significant and very large (p < .001, eta^2 = .690).

Table 1

Mean Performance on Overall Scores of Pre and Posttests

Group		Pretest	Posttest
Control	Mean	60%	55%
	N	14	14
	Std. Deviation	14	12
Treatment	Mean	59%	90%
	N	11	11
	Std. Deviation	13	12

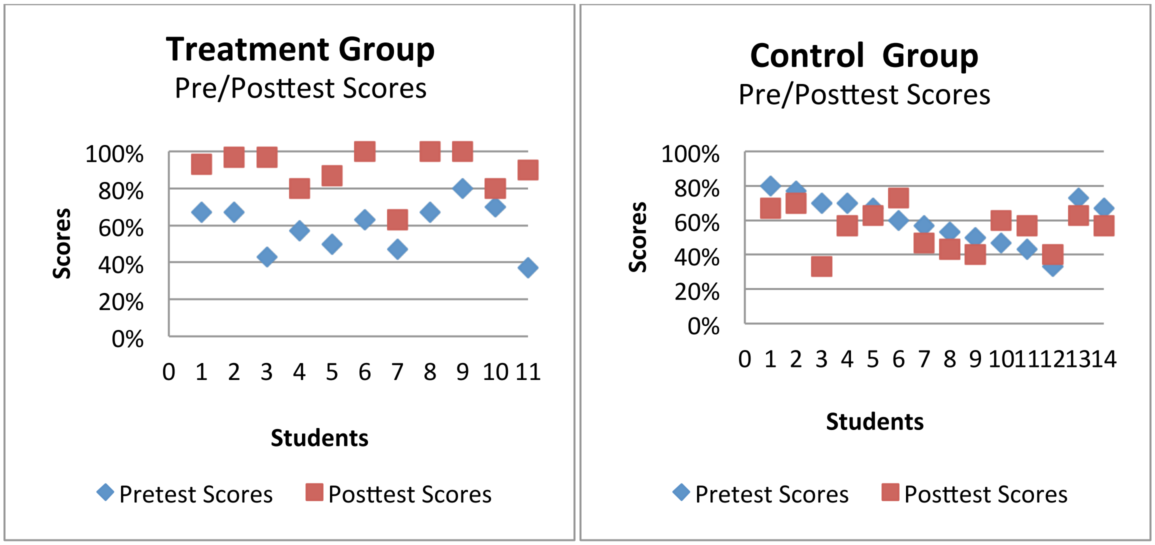


Figure 1. Pre and posttest comparison of treatment and control group students in overall scores.

Figure 2 shows the pretest score of each student in the treatment group and the amount of growth they made from pretest to posttest. The student who made the most growth received a score of 43% on the pretest and increased to a 97% on the posttest, showing a growth of 54 percentage points. Another student improved from a pretest score of 36% to a posttest score of 90%, showing a growth of 53 percentage points. Given that six of the students scored at or above 90%, a ceiling effect clearly limited the amount of growth that could be demonstrated.

The student showing the least growth increased his score 10 percentage points from pretest to posttest, and another increased 16 percentage points.

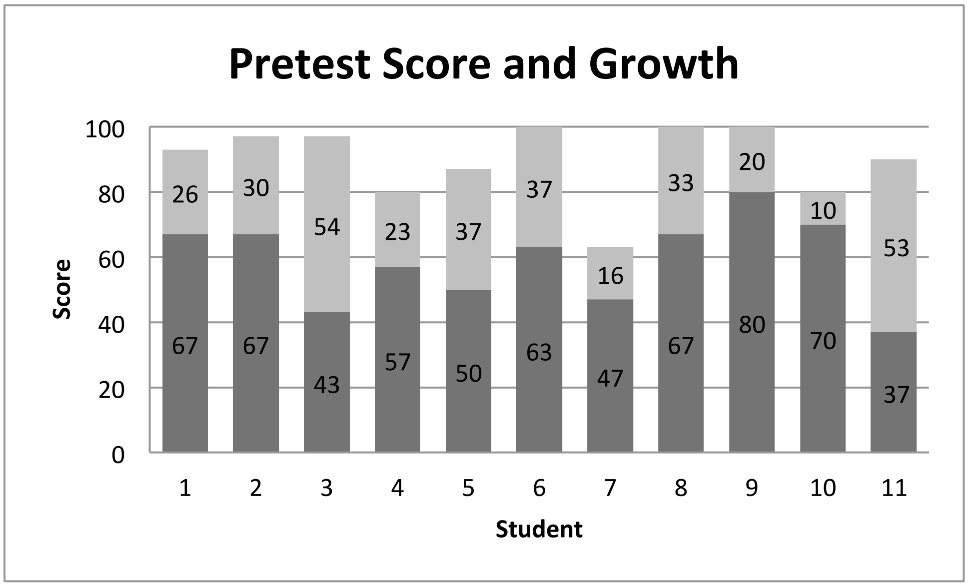


Figure 2. Pretest score of each student in treatment group and amount of growth made on posttest.

Performance in Pre and Posttest Decimal Computation

Pretests and posttests each included three computation only items that required addition or subtraction with decimals but did not involve story problems. These problems, along with the computation of the decimal problems within the 12 story problems, were used to determine each student's abilities to correctly compute addition and subtraction of decimals.

Mean performance on decimal computation is shown in Table 2 and distribution of individual scores are shown in Figure 3. The treatment group's mean score for the decimal computation was 39% (range 11% to 56%) on the pretest. The control group's mean score on decimal computation was 30%. On the posttest, the treatment group's mean score was 93%, a growth of 54 percentage points. Six of the 11 students received a 100% score on the posttest, seven scored above 90%, and 10 scored above 80%. The lowest score in the group was 67%.

On the posttest, the control group averaged 37% (range 11% to 67%), showing a seven percentage point of increase from pretest to posttest. One student received a score of 67%, one student scored in the 50%'s, six students scored in the 40%'s, two students scored in the 30%'s, two students scored in the 20%'s, and two students scored 11%.

On the computation aspect of the pretest, the two groups were somewhat different with the treatment group scoring higher, although the differences were not

Table 2

Mean Performance on Decimal Computation of Pre and Post-tests

Group		Pretest Decimal Computation	Posttest Decimal Computation
Control	Mean	30%	37%
	N	14	14
	Std. Deviation	19	16
Treatment	Mean	39%	93%
	N	11	11
	Std. Deviation	14	10

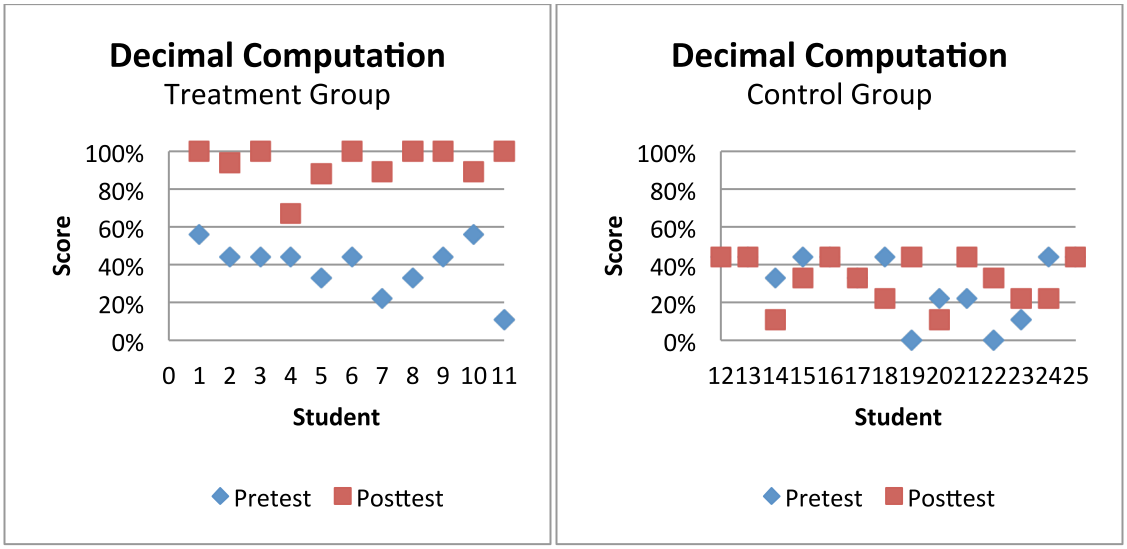


Figure 3. Pre and posttest comparison of treatment and control groups in decimal computation. When only posttest score is shown, student received same pre and posttest score.

statistically significant (p = .179, eta^2 = .077). On the posttest, the difference between groups was very large and statistically significant (p < .001, eta^2 = .816).

Performance in Determining Correct Operation in Word Problems

The word problems are analyzed in several ways. First, the word problems are analyzed as a group according to whether or not the student was able to determine the correct operation (addition or subtraction). Second, the word problems are analyzed according to type: complex action, comparison, and classification.

As a whole, the treatment group averaged 63% (range 22% to 100%) on the pretest in determining the correct operation (see Table 3). The students in the treatment group increased to a mean score of 79% on the posttest, a 16 percentage point increase. The posttest scores also ranged from 22% to 100%, but five students received 100% on determining the correct operation (see Figure 4). The other scores were much higher as well, reflecting the higher mean.

For the control group, the mean score for the class on the pretest was 72%, with scores ranging from 44% to 100%. On the posttest, there were four students that increased their score on the posttest, and five students who received a lower score on the posttest than the pretest. Two students received a 100% score on the pretest and posttest. Overall, the mean for the class was 72%, with no increase as a class from pretest to posttest.

On the word problem aspect of the test, the ANOVA revealed that the groups were somewhat different with the control group scoring somewhat higher, although the

Table 3

Mean Performance on Word Problems of Pre and Post-tests

Group		Pre-Test Word Problems	Post-Test Word Problems
Control	Mean	72%	72%
	N	14	14
	Std. Deviation	19	20
Treatment	Mean	63%	79%
	N	11	11
	Std. Deviation	23	24

difference between groups was not statistically significant (p = .253, eta^2 = .056). By the posttest, there was still no statistically significant difference (p = .469, eta^2 = .023). However, between pretest and posttest, there was virtually no change in average control group score and the treatment group mean increased by 16 percentage points. The treatment group was 10 points lower than the control group on the pretest and six points higher on the posttest.

There were five addition and four subtraction word problems on the pre and posttests. Mean results on choosing the correct operation in addition and subtraction word problems of the pretests and posttests are reported in Table 4. The distribution of individual scores is shown in Figures 5 and 6. Both groups did substantially better in determining the correct operation in addition problems than determining the correct

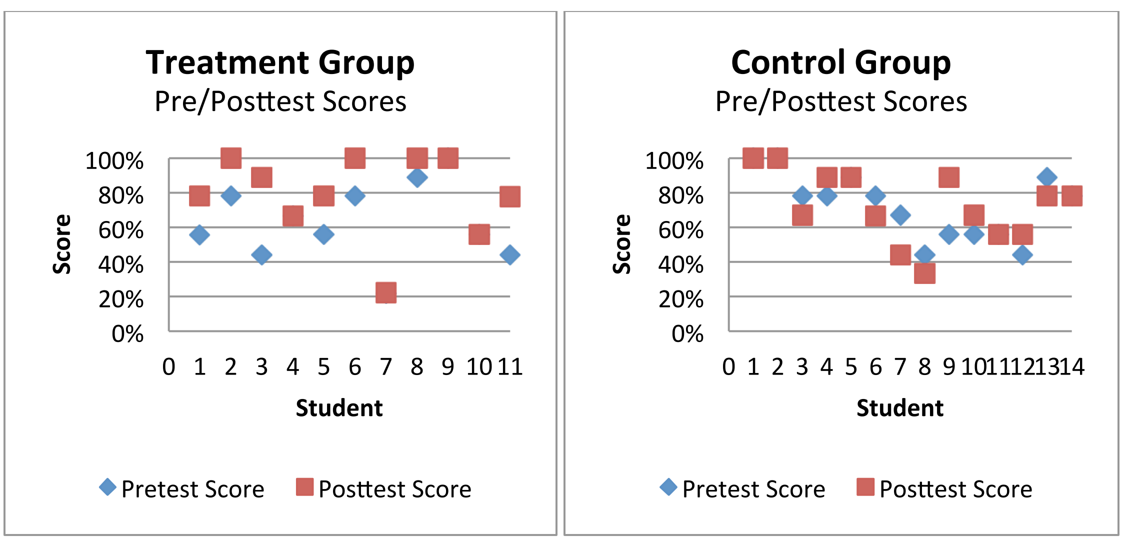


Figure 4. Pre and posttest comparison of treatment and control group students in choosing the correct operation in word problems. When only posttest score is shown, student received same pre and posttest score.

operation in subtraction problems. In fact, several students added on all of the problems on the pretest, regardless of whether it was an addition or subtraction problem. The pretest average for the treatment group in determining the correct operation in addition word problems was 76% (see Table 4). They increased to 84% on the posttest in determining the correct operation in addition word problems, an increase of eight percentage points.

The control group's mean score on the pretest for addition problems was 93%, and they decreased to an 86% on the addition problems on the posttest.

According to the ANOVA, the control group scored substantially higher on the pretests and the effect size was large, though not statistically significant (p = .061, eta^2

Table 4

Mean Performance on Addition and Subtraction Word Problems of Pre and Post-tests

		Addition		Subtraction	
Group		Pre-test	Post-test	Pre-test	Post-test
Control	Mean	93%	86%	54%	50%
	N	14	14	14	14
	Std. Deviation	13	23	31	33
Treatment	Mean	76%	84%	45%	73%
	N	11	11	11	11
	Std. Deviation	28%	25	29	34

= .144). On the posttest, treatment group students closed the gap and their average scores were very close to that of the control group (p = .830, eta^2 = .002).

In subtraction word problems, the treatment group increased from a pretest score of 45% to a posttest score of 73%, an increase of 28 percentage points (see Table 4). According to the ANOVA, the control group scored somewhat higher on pretests (p = .510, eta^2 = .019). On the posttest, the treatment group scored higher, but the difference was not statistically significant (p = .104, eta^2 = .111).

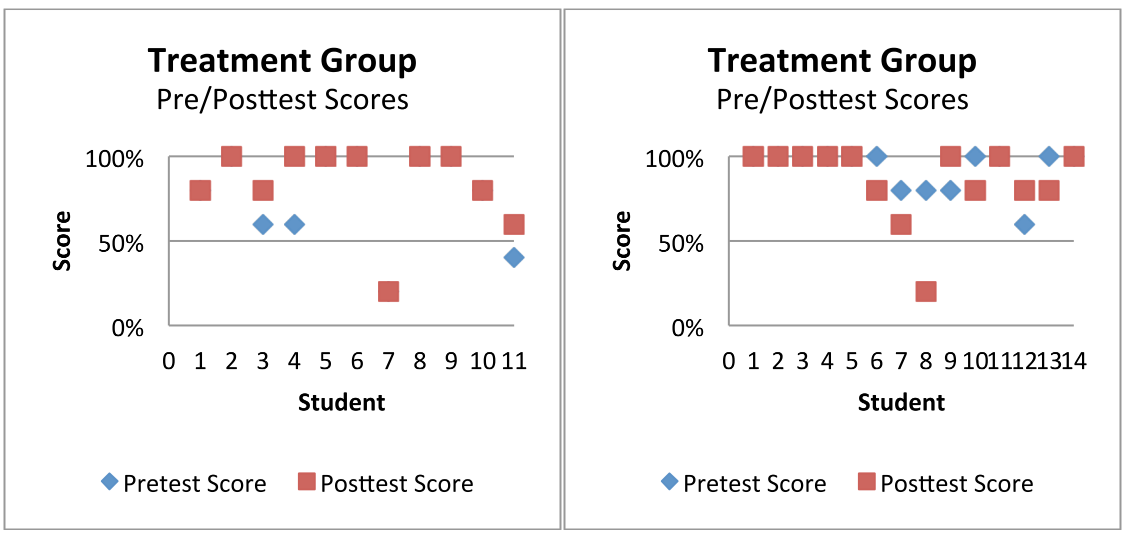


Figure 5. Pre and posttest comparison of treatment and control group students in choosing the correct operation in addition word problems. When only posttest score is shown, student received same pre and posttest score.

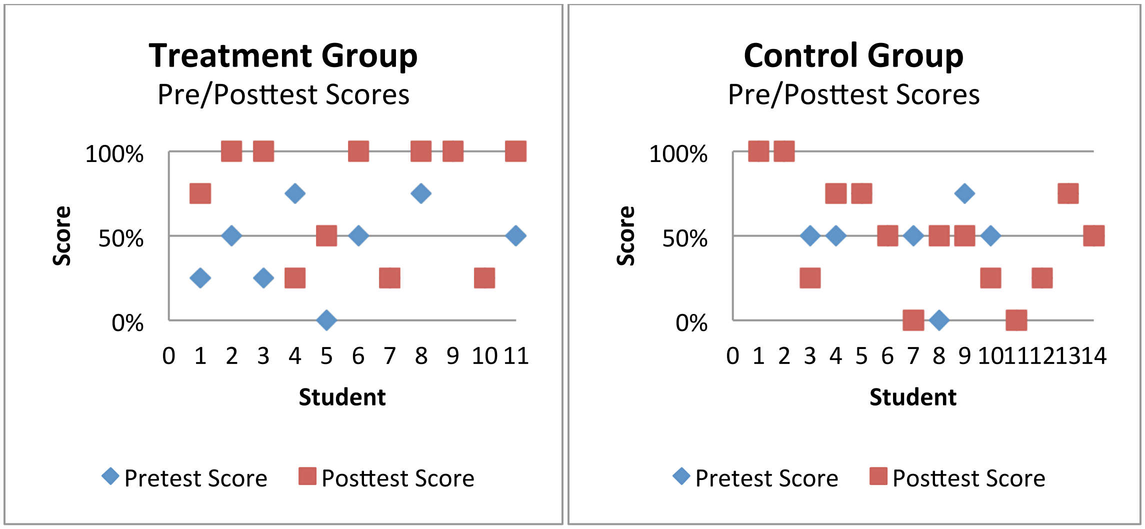


Figure 6. Pre and posttest comparison of treatment and control group students in choosing the correct operation in subtraction word problems. When only posttest score is shown, student received same pre and posttest score.

Performance in Different Types of Word Problems

Table 5 shows the means for the treatment and control groups in determining the correct operation in the three types of word problems.

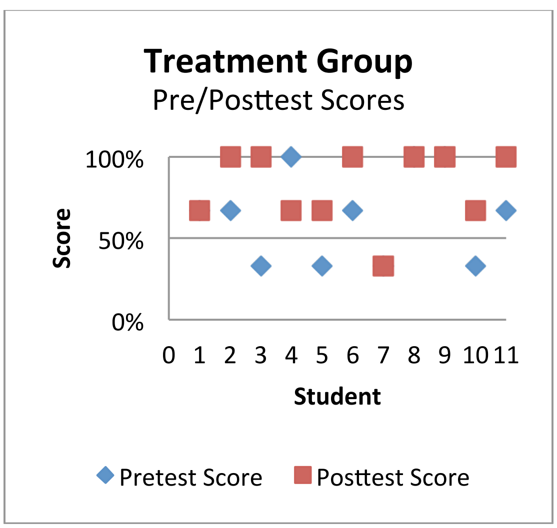
Pre and Post-test Scores in Complex Action Word Problems

Three items on the pretests and posttests addressed the student's abilities to correctly complete complex action word problems. Figure 7 shows the growth, if any, the individual students in the treatment group made in correctly determining the correct operation in these problems. As a whole, the treatment group increased from a 64% to an 82% from pretest to posttest, an increase of 18 percentage points. The control group also increased their score from pretest to posttest by 21 percentage

Table 5

Mean Performance on Complex Action, Comparison, and Classification Word Problems on Pre and Post-tests

		Complex Action		Comparison		Classification	
Group		Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Control	Mean	62%	83%	89%	74%	72%	60%
	N	14	14	14	14	14	14
	Std. Deviation	29	22	17	33	22	27
Treatment	Mean	64%	82%	67%	82%	58%	73%
	N	11	11	11	11	11	11
	Std. Deviation	28	23	30	23	26	36



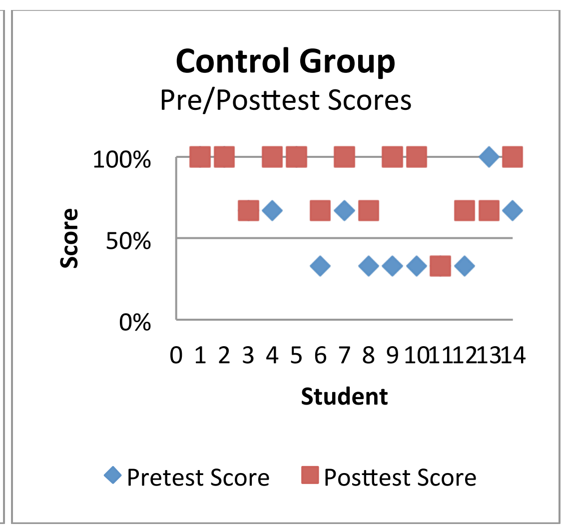


Figure 7. Pre and posttest comparison of treatment and control group students in choosing the correct operation in complex action word problems. When only posttest score is shown, student received same pre and posttest score.

points.

On these problems the differences between average scores for the groups was not large on either the pretest (p = 878, eta^2 = .001) or the posttest (p = .867, eta^2 .001).

Pre and Posttest Scores in Comparison Word Problems

Three items on the pretests and posttests addressed the student's ability to determine the correct operation in comparison word problems. Figure 8 shows the growth the treatment group made in correctly determining the correct operation in comparison word problems. The treatment group's mean score on the pretest was 67%. They increased to an 82% on the posttest, an increase of 15 percentage points. The control group scored substantially higher on the pretest than the treatment group did, with a group mean of 89%. They decreased to a 74% on the posttest, a decrease of 15 percentage points.

On comparison problems, the control group scored substantially higher on pretest (p = .054, eta^2 = .152) – the difference was on the margin of statistical significance. On the posttests, the treatment group had surpassed the control group but the difference was not large (p = .494, eta^2 = .021).

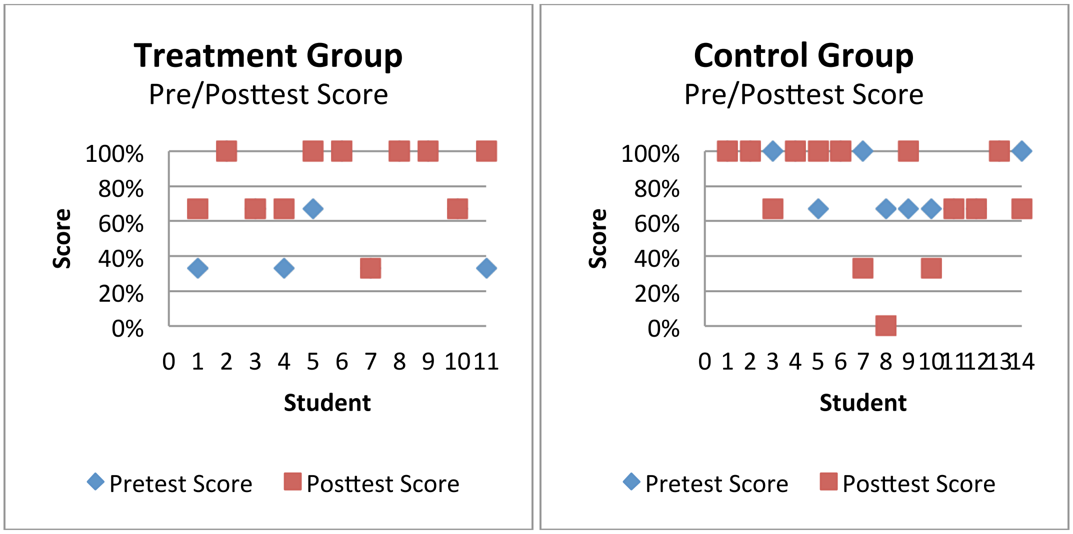


Figure 8. Pre and posttest comparison of treatment and control group students in choosing the correct operation in comparison word problems. When only posttest score is shown, student received same pre and posttest score.

Pre and Posttest Scores in Classification Word Problems

Three items from the pretests and posttests addressed classification word problems. Figure 9 shows the growth the treatment group made in correctly determining the correct operation in these problems. The treatment group's mean was 58% on the pretest and 73% on the posttest, an increase of 15 percentage points. The control group's mean on the pretest was 72% and 60% on the posttest, a decrease of 12 percentage points.

On classification problems, the control group scored substantially, but not statistically significantly, higher on pretests (p = .167, eta^2 = .081). On the posttest, the

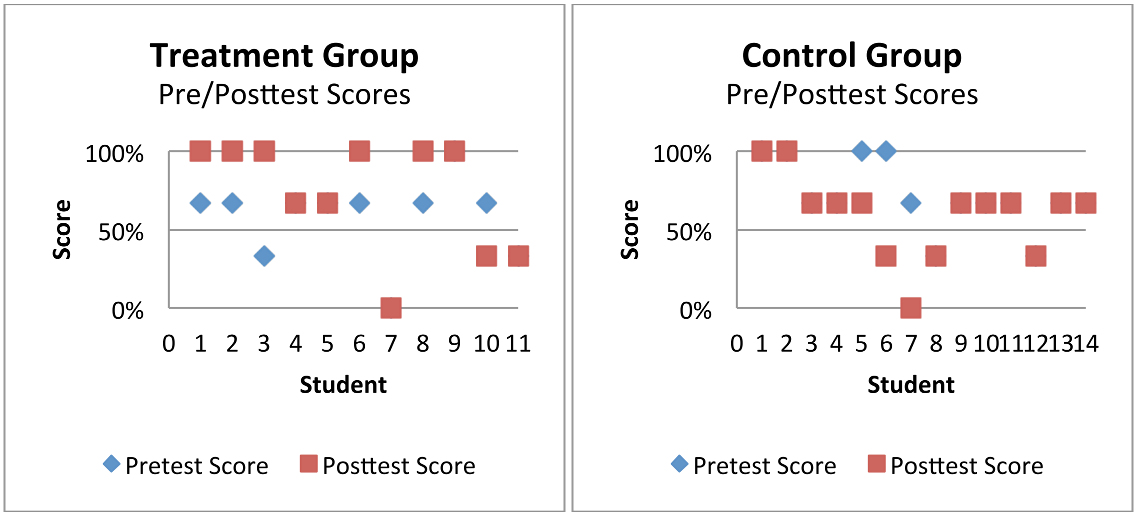


Figure 9. Pre and posttest comparison of treatment and control group students in choosing the correct operation In classification word problems. When only posttest score is shown, student received same pre and posttest score.

position of the two groups was reversed with the treatment group now higher, but the difference was still not statistically significant (p = .308, eta^2 = .045).

Control Group Instruction

After the posttest, the control group received the treatment instruction. The scores for the control group, after receiving the treatment are described below. Statistical comparisons between posttest 1 and posttest 2 were made with paired sample *t*-tests.

The mean for the control group in the overall scores was 55% on posttest 1. After receiving the treatment, the mean for the group increased to 80%, an increase of 25 percentage points (p = .003). Only one student in the control group received a score of 100% on posttest 2. Five of the students scored above 90%, seven scored above 80%, and four students were between 45% and 74%. There were two students that did not increase at all in their final score compared to their pretest score.

On word problems, the control group showed a small change (2.9 percentage points) between posttest 1 and posttest 2 which was not statistically significant (p = .560).

Three of the students in the control group, after the treatment, made a greater increase than the others. One of these students received a pretest score of 40%. She increased to a 100% at posttest, an increase of 60 percentage points. Another student increased from a pretest score of 33% to a posttest score of 74%, an increase of 41 percentage points. The third student received a pretest score of 60% and increased to a 97% on the posttest, an increase of 37 percentage points.

DISCUSSION

Analysis of Overall Scores

The scores from the pre and posttests show that the instruction was effective and statistically significant in improving the treatment group's overall scores in addition and subtraction of decimals and decimal addition and subtraction word problems. The students in the treatment group improved 31 percentage points from their own pretest scores, and exceeded the control group's posttest mean by 35 percentage points. Two of the 11 students increased by more than 50 percentage points from the pretest to the posttest and six of the 11 students improved 30 percentage points or more Similarly, after the control group was given the treatment (after posttest 1), as a group they scored 24 percentage points higher than their score before the treatment was given.

Further, a substantial number of students in the treatment group showed very high performance on the posttest. Six of the 11 students in the treatment group scored at or above 90% correct on the posttest with their overall score. Five of the 11 students in the control group scored 90% or above on posttest 2 after receiving the treatment. These students showed by their classroom work, as well as their posttest answers, that they understood the information taught. Because their posttest scores were so high, a ceiling effect is plainly shown. These students may have been able to increase even more, if they were given the opportunity, with harder or more complex word problems or more difficult decimal computation problems.

Analysis of Decimal Computation

In analyzing the separate skills in the problems, the students showed the most improvement in their abilities to solve decimal computation problems. Six of the 11 treatment group students received a score of 100% on the decimal computation portion of the posttest. Seven of the 11 treatment group students increased in their decimal computation to 90% or above on the posttest. This improvement in decimal computation was consistent even when the decimal problems were embedded in word problems, which may have increased their difficulty. These scores show that the instruction given was effective in teaching decimal computation and produced statistically significant effects. Again, the ceiling effect was shown, and these students may have made even more improvement if the opportunity was given to them.

In teaching decimal computation, the instruction first focused on teaching the students the names of the decimals (tenths, hundredths, etc.) Although the naming of the decimals was not a part of the pre or posttests, almost all of the students were able to correctly name the decimals after the first day of instruction, as shown by their individual work. As we reviewed across following days, most retained the skill of naming of the decimals.

The skill that was most difficult for the students in the decimal computation was placing a decimal in a number that previously was written without a decimal (placing the decimal to the right of the last digit; e.g., putting the decimal after the 6 in 326). Although this skill was practiced with several examples on the board, most of the students needed extra practice with this up until the fifth day of instruction. On the posttest, there was still one student who did not place the decimal correctly in this situation. On all of the problems that were written without a decimal, she put the decimal in between two of the numbers. However, in the problems that were written with decimals, she was able to solve them correctly, including adding a '0' for place value when needed. Although this was the only student who made this mistake on the posttest, placing a decimal in a number that was written without a decimal was difficult for most of the students until the end of the instruction.

Analysis of Word Problems

Many, but not all, of the students made gains in choosing the correct operation in word problems – this is clearly shown in Figure 4. The student who made the most improvement in the treatment group improved from a pretest score of 44% to a posttest score of 89%, an increase of 45 percentage points. Another student increased 34 percentage points from pretest to posttest. Four of the 11 students improved 22 percentage points from pretest to posttest. One of the students increased only 11%, but his posttest score was 100%, thus obviously limiting the amount of growth that he could make. Four of the students did not increase in their ability to choose the correct operation. One of these four students received a 100% score in determining the correct operation on the pretest, thus not allowing growth to be made. The other three students received pre and posttest scores of 22%, 56%, and 67%. The researcher observed that each of these students was never able to understand the critical concept of the ‘big number’ during the six days of instruction.

Comparison of Word Problem Types

The students in the treatment group made similar amounts of improvement in each type of word problem - as a group, they increased between 14 and 18 percentage points on the three types. This is shown in Table 5 by the similarity of mean scores across types of word problems. This was true individually, as well as with the group. Although more of the students began to understand the concept of the ‘big number’ when taught comparison word problems, they did not make larger gains on this type of problem compared to any other.

Determining the ‘Big Number’

In learning the strategy for the word problems, the students were taught to find the ‘big number’ of the problem. The big number was the phrase that told about the largest number in the problem. After determining which phrase told about the ‘big number’, the students then had to determine if the ‘big number’ was known. If the big number was known, the students were taught the rule, ‘If you know the big number, you subtract. If you do not know the big number, you add.’

Finding the ‘big number’, and especially determining whether or not the ‘big number’ was known, was the most difficult concept for all of the students to understand throughout the course of the instruction. Only one student (who received a 100% score on choosing the correct operation in word problems on the pretest) was able to understand this concept when going through this on the overhead the first time. As the instruction continued over the next six days, with much repetition on the overhead and individual seatwork practice, the students that did make improvement 'caught on' at different times throughout the instruction. Some of them did not catch on until almost the last day of instruction. One of the students who increased over 50 percentage points received a pretest score of 43%. She struggled with the concept of the 'big number' and was not able to answer group questions correctly, or complete her individual work correctly without help from the teacher. On the fifth day of instruction, however, she was finally able to grasp which of the three numbers in the problem was the 'big number' and her individual written work as well as her classroom answers improved to 100%. At that point, there was a significant increase in her ability to solve addition and subtraction word problems. On the posttest, this student scored 97% - a gain of 54 percentage points.

The biggest turning point for the students that did make improvement was the instructional day when comparison problems were taught. They were able to comprehend that the 'big number' was the bigger of two numbers being compared, and they were able to differentiate when the big number was not known.

There were several students, however, who were never able to grasp the concept of determining the 'big number'. Some of these students were not able to even distinguish which of two numbers was larger. For example, they would say, during teacher led instruction, that the smallest number in the problem was the ‘big number’. Also, the students would put a smaller number above a larger number and then try and subtract the numbers. When subtracting, they would subtract the smaller digit from the larger digit, no matter which number was on the top (‘0 - 3’ would be ‘3’). For these students, who were not able to distinguish which of two numbers was bigger, the skill of solving word problems was too difficult – they clearly lacked critical prerequisites for the instruction offered in this study.

For the other students who were not able to determine whether or not the ‘big number’ was known, but were able to distinguish the value of numbers; they may have been able to make more significant improvement with more instructional time. They may have been able to understand the concept of the ‘big number’ if the skill of finding out whether or not the ‘big number’ was known was broken into smaller steps and these steps were presented with more repetition.

Other Instructional Challenges

One of the problems that occurred when teaching the strategy of finding the big number on the board was that when the examples were first put on the overhead, most of the students tried to solve the problem before learning the strategy step by step as it was presented. Most of the students had a difficult time paying attention during the time the researcher was presenting the word problems on the overhead, even though the presentation was fast paced and allowed significant student involvement. This may have been because of the difficulty the students had with the ‘big number’. When the researcher called on the individual students for answers to questions involving the ‘big number’, most were not able to answer correctly.

Another problem that occurred in the instruction was that a few of the students demonstrated a lack of effort or attention. One of the students in the treatment group walked around the classroom most of the class, distracting others and not fully participating himself. Although he did make improvement, 23 percentage points on his overall score, the improvement he made may have been greater if he had given his full attention to the tasks that were at hand. Also, the other students may have made more progress as well. Another student, although his scores were not included because of two absences on the second and third days of instruction, was distracting to others throughout the time he was there. His behavior was significantly more distracting on the fourth through sixth days of instruction. With missing two instructional days, and with so much taught each day that he missed, he may have felt that he could not catch up.

Other Considerations

With the control group, there were four students who consistently received 100% on their classroom work with regard to decimals, computation, and determining the correct operation in word problems but did not receive 100% scores on the posttest. Each of them made errors on the posttest that were surprising to the researcher because of the performance, as well as their ability to describe what they knew during the instruction time. Their errors on the posttest may be attributed to test anxiety or other extraneous factors. All four of them showed a significant increase from pretest to posttest; however, it was a smaller increase than what the researcher anticipated from the daily instruction. The overall mean of the control group after the treatment may have been much higher if these four students would have performed on the posttest as they had on their daily classroom work.

Further Research

Further research could be conducted to determine if the skill of identifying the 'big number' could be taught more effectively, if it would make a difference if it was broken down into smaller steps and taught over a longer period of time. These steps could include smaller changes from one example to another until the students were able to understand the 'big number' of a problem.

Another consideration for further research would be the students that scored very high on the posttest, some of whom understood the material fairly quickly in the daily lessons as well. There were four students who received scores of 100% on the posttest, and another eight students who received scores in the 90%'s from the treatment group and the control group after instruction. Many of these students flew through the independent work activities and seemed to grasp the concepts being taught quickly. Further research would be able to report how much more these students would have been able to learn in the six hours of instruction if they were taught more advanced skills, such as determining the correct operation in multiplication and division of decimals, and multistep problems.

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APPENDICES

Appendix A

Solving Word Problems with Decimals a Content Analysis

Given multi-digit whole number addition/subtraction problem presented horizontally, student rewrites vertically and solves.

Example: 524 -16

Component Skills:

1. Determine proper column alignment.
2. Determine if regrouping is required.
3. Regrouping.
4. Basic addition and subtraction facts.

Given decimal addition/subtraction problem presented vertically and properly aligned, student solves (including bringing decimal down).

Example:

$$\begin{array}{r} 324.3 \\ \underline{+\ \ 22.1} \end{array}$$

Component Skills:

1. Determine if regrouping is required.
2. Regrouping.
3. Addition and subtraction facts.
4. Rule Relationship: Bring the decimal point straight down.

Given decimal addition/subtraction problem presented horizontally, student re-writes problem vertically, properly aligning decimals, then solves.

Example: 452.36 + .21

Component Skills:

1. Determine proper column alignment
2. Addition and subtraction facts.
3. Rule Relationship: "Bring the decimal point straight down."

Given decimal addition/subtraction problem with unequal number of place values after the decimal point, presented horizontally, student re-writes problem vertically, properly aligning decimals, adding 0's as needed, then solves.

Example: 81.6 - .445

Component Skills:

1. Determine proper column alignment.
2. Add 0's for place value.
3. Determine if regrouping is required.
4. Regrouping.
5. Addition and subtraction facts.
6. Rule Relationship: "Bring the decimal point straight down."

Given an addition or subtraction complex action word problem with decimal numbers, the student determines if the total is given, then adds or subtracts the numbers to determine the answer.

Example: Sara needs $7.50 for a football game ticket. She also wants to buy food for $6.50. How much money does she need to take with her?

Example: Sara had $20. If she spent $4.50 on food, how much does she have left?

Component Skills:

1. Vocabulary knowledge.
2. Determine if the total is given.
3. Rule Relationship, "When the total number is not given, you add."
4. Rule Relationship, "When the total number is given, you subtract."
5. Addition and subtraction facts with decimals.

Given an addition or subtraction comparison word problem with decimals, the student determines if the total is given, which number goes in the total, then adds or subtracts the numbers to determine the answer.

Example: Sara's backpack weighs 15.6 pounds. Jack's backpack weighs 16 pounds. How much more does Jack's backpack weigh?

Example: Sara's backpack weighs 15.6 pounds. Jack's backpack weighs 3.1 pounds more than Sara's. How much does Jack's backpack weigh?

Component Skills:

1. Vocabulary knowledge.

2. Determine if the bigger number (or total) is given.
3. Rule Relationship, “When the total number is given, you subtract.”
4. Rule Relationship, “When the total number is not given, you add.”
5. Addition and subtraction problems with decimals.

Given an addition or subtraction classification word problem with decimals, the student determines if the total is given, which number goes in the total, then adds or subtracts the numbers to determine the answer.

Example: A chef bought .2 kilograms of almonds. He also bought .35 kilograms of walnuts. How many kilograms of nuts did he buy?

Example: Sam went to the store and bought 16.3 pounds of nuts. 12.1 pounds were almonds. How many pounds of other types of nuts did he buy?

Component Skills:

1. Vocabulary knowledge.
2. Determine which is the larger class.
3. Determine if the total of the larger class is given.
4. Rule Relationship, “When the total number is not given, you add.”
5. Rule Relationship, “When the total number is given, you subtract.”
6. Addition and Subtraction problems with decimals.

Appendix B

Pretest, Posttest 1, and Posttest 2

Pretest

Complete the problems below. Please show all of your work.

1- $\begin{array}{r} 313 \\ \underline{+\ 98} \end{array}$

2- $\begin{array}{r} 29 \\ \underline{+\ \ 13} \end{array}$

3- $\begin{array}{r} 6922 \\ \underline{-\ \ \ 73} \end{array}$

4- 212.76 - 209.8

5- 36.055 + 2.3

6- 4.5 - .003

Complete the word problems below. Please show all of your work.

7- Jerry got on the scale with his friend Alex. They both weighed 202 pounds. When Alex got off the scale, the scale read 98 pounds. How many pounds does Alex weigh?

8- On the math test, Ellen got 56 of the problems correct. Her friend, Eliza, got a better score. She got 18 more problems correct than Ellen. How many problems did Eliza get correct?

9- There were 19 boys and 22 girls who tried out for the part in the play. How many kids tried out?

10- Rob had $5.29 in his wallet. He found a $20 bill on the ground as he was walking to class and also put it in his wallet. How much does he have in his wallet now?

11- Aaron climbed 72.3 feet up a rope before he could go no further. Justin climbed 3.6 feet farther than Aaron before he slipped. How many feet did Justin climb?

12- Stephanie bought 2.3 pounds of celery and 3.5 pounds of squash at the grocery store. How many pounds of vegetables did she buy?

13- The tallest player on the basketball team was 76.25 inches tall. If the second tallest person was 3.5 inches shorter, how many inches tall was the second tallest person?

14- Trinity needed to buy 4 lbs of fruit. She bought 2.5 lbs of strawberries and she also wanted to buy raspberries. How many lbs. of raspberries did she need to buy?

15- John weighed 136.2 lbs before Thanksgiving. On Christmas Day, he weighed 145.75. How many pounds did he gain between Thanksgiving and Christmas?

Posttest 1

Complete the problems below. Please show all of your work.

1- 212.76 - 209.8

2- 36.055 + 2.3

3- 4.5 - .003

4- Brooklyn and Sierra got on the scale together and it read 204 pounds. When Sierra got off, it read 101. How much does Sierra weigh?

5- On the Science test, Jasmine got 82 problems correct. Ella got 13 more problems correct than Jasmine. How many problems did Ella get correct?

6- There were 26 girls and 13 boys who volunteered at the food pantry. How many kids volunteered?

7- Stephanie bought 4 pounds of fruit at the grocery store. If she bought 2.5 pounds of strawberries, how many pounds of another fruit did she buy?

8- Rob had $6.15 in his wallet. If his friend gave him $3 more, how much does he have?

9- Chandra hiked 4.25 miles. Jason hiked 3 miles more than Chandra before he could go no further. How far did Jason hike?

10- Jared was the tallest person in his family. He was 78.5 inches tall. If the second tallest person in his family was 2.25 inches shorter, how tall was the second tallest person?

11- Isabel put 2.25 cups of water and 1.5 cups of milk in a recipe. How many cups of liquid did she put in the recipe?

12- The hike to table rock is 3.8 miles. If Sera hiked 2.1 miles by noon, how much farther does she need to go to get to table rock?

Posttest 2

Complete the problems below. Please show all of your work.

1- 269.76 - 109.9

2- 49.054 + 8.4

3- 8.6 - .004

1- Isabel put 3.5 cups of water and 1.75 cups of milk in a recipe. How many cups of liquid did she put in the recipe?

2- The hike to the top of the mountain was 4.65 miles. Rob made it 3.8 miles before lunch. How much farther did he need go to get to the top?

3- There were 13 girls and 18 boys whose birthdays were in January. How many kids had birthdays in January?

4- Eli bought 4.25 pounds of dried cranberries and raisins at the grocery store. If he bought 2 pounds of dried cranberries, how many pounds of raisins did he buy?

5- Kaitlyn and Justice got on the scale together and it read 200.9 pounds. When Kaitlyn got off, it read 89.75. How much does Kaitlyn weigh?

6- Ralph had $25.36 in his wallet. If his mom gave him $6 more for his birthday, how much does he have?

7- Charity biked 40.25 miles to win her race. Jason biked 3.2 miles more than Chandra for his race. How far did Jason bike?

8- Jared was the shortest person in his family. He was 65.75 inches tall. If the tallest person in his family was 78.5 inches tall, how much taller was he than Jared?

9- On the Social Studies test, Jacob got 80 problems correct. Eva got 16 more problems correct than Jacob. How many problems did Eva get correct?

Appendix C

Checklist for Independent Observer

Checklist for Independent Observer

Date of Observation______________ Time of Observation____ to ______

+	-	
		The students were seated so they could see and hear what the teacher presented.
		The teacher had all the required lesson scripts, student's individual seatwork, copies of overhead projector material, etc.
		Each student had writing utensils and other things they would need to take part in the lesson.
		The teaching sequences (specified in the lesson scripts) were taught in their entirety.
		The teacher asked all of the questions that were specified on the lesson script and waited for student response(s).
		The teacher maintained quick pacing through-out the lesson.
		Teacher followed the script without reading directly from the script.
		There was no more than 30 seconds downtime during transitions (problems on the board, teaching sequences, independent work).
		Students responded during the teacher-led instruction at least 80% of the time.
		Students responded with at least 90% accuracy before teacher moved to the next part of the lesson.
		When an individual error or group response error was made, teacher corrected the error before moving on.
		Students were on-task at least 80% of the time when completing their individual seatwork.
		Classroom management was evident (the rules/expectations for the group are clear; misbehavior is either ignored or redirected; praise is given for positive behavior and correct answers).
		Behavior issues did not prevent the students from participating fully in the lesson.

Total Number of +/# of questions = ______% Total Effective Instruction Fidelity

Appendix D

Lesson Plans

Reading Decimals: Tenths and Hundredths

"We are going to learn a rule about decimals. The rule is, 'If there is one digit after the decimal point, the decimal tells us how many tenths.' Let's practice.

.3	Teacher: How many digits are after the decimal? Say it as a group… Students: One Teacher: Remember the rule, 'If there is one digit after the decimal point, the decimal tells us how many tenths.' So we read this number as three-tenths. (Teacher shows three-tenths written out.)
.6	Teacher: How many digits are after the decimal? Say it as a group… Students: One Teacher: Remember the rule, 'If there is one digit after the decimal point, the decimal tells us how many tenths.' So we read this number as six-tenths. (Teacher shows six-tenths written out.)
.9	Teacher: How many digits are after the decimal? Students: One Teacher: How do we read this number? Student: nine-tenths (Teacher shows nine-tenths written out.)
.7	Teacher: How many digits are after the decimal? Students: One Teacher: How do we read this number? Student: seven-tenths (Teacher shows seven-tenths written out.)

"Okay, now we are going to learn another rule about decimals. The rule is, 'When there are two-digits after the decimal place, the decimal tells us about hundredths.' Let's practice.

.03	Teacher: How many digits are after the decimal? Say it as a group… Students: Two Teacher: Remember the rule, 'If there are two digits after the decimal point, the decimal tells us how many hundredths.' So we read this number as three-hundredths. (Teacher shows six-hundredths written out.)

.36	Teacher: How many digits are after the decimal? Students: Two Teacher: Remember the rule, 'If there are two digits after the decimal points, the decimal tells us how many hundredths.' So we read this number as thirty-four hundredths. (Teacher shows thirty-four hundredths written out.)
.7	Teacher: Does this tell us tenths or hundredths? Now I will call on you individually. Student: Seven-tenths. (Teacher shows seven-tenths written out.)
.15	Teacher: Does this tell us tenths or hundredths? Student: Fifteen-hundredths. (Teacher shows fifteen-hundredths written out.)
.8	Teacher: Read this number. Student: Eight-tenths. (Teacher shows eight-tenths written out.)
.02	Teacher: Read this number. Student: Two-hundredths. (Teacher shows two-hundredths written out.)
.74	Teacher: Read this number. Student: Seventy-four-hundredths. (Teacher shows seventy-four-hundredths written out.)
.9	Teacher: Read this number. Student: Nine-tenths. (Teacher shows nine-tenths written out.)
.23	Teacher: Read this number. Student: Twenty-three-hundredths. (Teacher shows twenty-three-hundredths written out.)
.91	Teacher: Read this number. Student: Ninety-one hundredths. (Teacher shows ninety-one-hundredths written out.)

Individual Practice Problems

Circle the correct decimal

1.	five-tenths	.05	.5	5
2.	three-hundredths	.3	.03	3
3.	six-hundredths	6	.06	.6
4.	two-tenths	2	.02	.2
5.	nine-hundredths	.09	.9	9
6.	four-tenths	.04	.4	4
7.	one-tenths	.01	1	.1
8.	five-hundredths	.5	5	.05

"Okay, now we are going to practice writing the decimals. I am going to say the number, and you will write them on your paper." (Teacher will say the decimals, and walk around the room, checking the students' papers.)

Six-tenths	Students write .6 on their papers.
Two-tenths	Students write .2 on their papers.
Two-hundredths	Students write .02 on their papers.
Eighty-five hundredths	Students write .85 on their papers.
Twenty-five hundredths	Students write .25 on their papers.
Eighteen-hundredths	Students write .18 on their papers.
Nine-tenths	Students write .9 on their papers.
Six-hundredths	Students write .06 on their papers.
Sixty-two hundredths	Students write .62 on their papers.

Adding and Subtracting Decimals: Same Number of Decimal Places

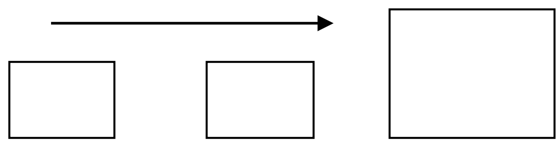
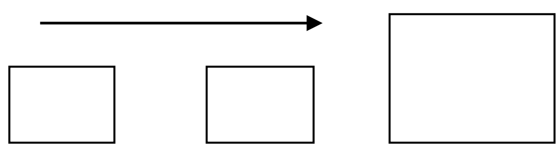
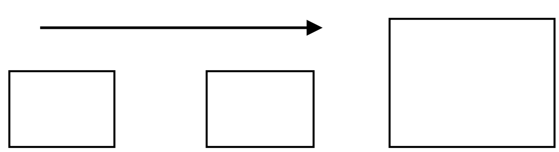
"Today we are going to learn to add and subtract numbers with decimals."

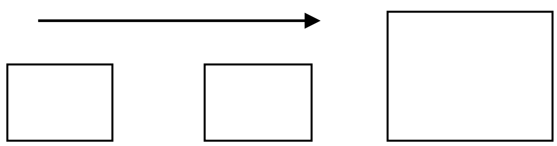
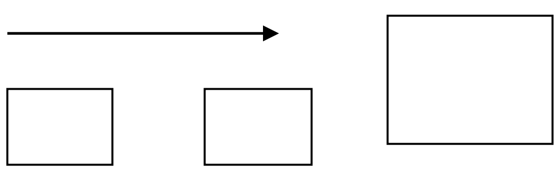
(Teacher writes on board.) 32.43 + .21	"First, add the numbers." (Teacher models adding the numbers.) "Bring the decimal point straight down." (Teacher models where the decimal point goes.)
324.3 + 2.1	"First, add the numbers." (Teacher models adding the numbers.) "Bring the decimal point straight down." "Do I put the decimal point here?" (Teacher points to the left of the last digit). Students: No "Do I put it here?" (Teacher points to the correct location). Students: Yes
3.243 + .021	"First, add the numbers." (Teacher models adding the numbers.) "Bring the decimal point straight down." "Do I put the decimal point here?" (Teacher points to the right of the last digit). Students: No "Do I put it here?" (Teacher points to the correct location). Students: Yes
2.78 -1.87	"First, subtract the numbers." (Teacher models subtracting the numbers.) "Bring the decimal point straight down." "Do I put the decimal point here?" (Teacher points to the right of the '9'.) Students: No "Do I put it here?" (Teacher points to the right of the '1'.) Student: No. "Do I put it here? (Teacher points to the correct location). Students: Yes
7.811 +8.322	"First, add the numbers." (Teacher models adding the numbers.) "Bring the decimal point straight down." "Do I put the decimal point here?" (Teacher points to the correct location). Students: Yes
(Students write these problems on their paper. When they are finished writing them, the students solve the problems while the teacher walks around the room and checks the problems.)	

32.9 +32.5	
18.236 - 7.117	
6000.2 - 1.1	
17.39 -6.08	
99.9 +80.2	

Complex Action Word Problems: Determine if Total is Given

"We are going to learn how to solve some word problems."

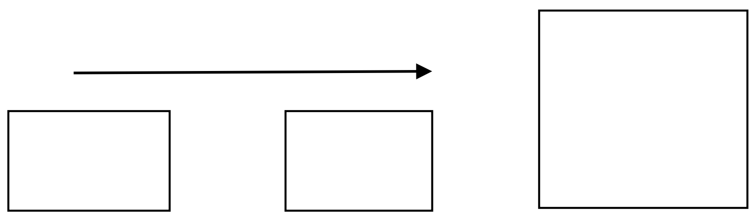
John wants to buy a baseball bat. The bat costs $40. He has saved $10 so far. How much more does he need to save? 	"We have three numbers in this problem: the cost of the baseball bat, the amount he has saved, and the amount he still has to save. Two of these are small numbers, and one is a big number. The total cost of the bat is the big number. (Teacher writes $40 in the big box.) The amount he has saved so far is a small number. (Teacher writes $10 in the first small box.) The other small number is the amount he still needs to save. We don't know this number, so we will write 's' in the small box. (Teacher writes an 's' in the small box.)
Alfredo wants to buy a bike. He has saved $100 and the total cost of the bike is $400. How much money does Alfredo still need? 	"We have three numbers in this problem: the cost of the bike, the amount Alfredo has saved, and the amount he still has to save. Two of these are small numbers, and one is a big number. The total cost of the bike is the big number. So, what do I write in the big box? (Ask an individual student.) Student: $400 (Teacher writes $400 in the big box.) The amount he has saved so far is the small number. How much has he saved so far? Student: $100 (IS) (Teacher writes $100 in the first small box.) The other small number is the amount he still needs to save. We don't know this number, so we will write 's' in the small box. (Teacher writes an 's' in the small box.)
Sara has saved $50 for the decorations for her room. She still needs to save $30 to pay for all of them. How much do all the decorations cost? 	"We have three numbers in this problem: the cost of the decorations, the amount Sara has already saved, and the amount he still has to save. Two of these are small numbers, and one is a big number. Which is the big number? (IS) Student: The total cost of the decorations. We don't know the total cost of the decorations. (Teacher writes a 'd' in the big box.)

	However, we know the other two small numbers. How much has she saved so far? (IS) Student: $50 (Teacher writes $50 in the small box.) How much does she still need to save? (IS) Student: $30 (Teacher writes $30 in the other small box.)
The students travelled 60 miles the first day of their trip. The second day, they travelled another 45 miles. How long was their trip? 	What are the three numbers in the problem? (IS) Student: The length of the trip, how far they travelled the first day, and how far they travelled the second day. Teacher: Which is the big number? (IS) Student: The length of the whole trip. Teacher: Do we know the big number? Student: No. (Teacher writes a 't' in the big box.) Teacher: How far did they travel the first day? (IS) Student: 60 miles. (Teacher writes 60 in the first box.) Teacher: How far did they travel the second day? (IS) Student: 45 miles. (Teacher writes 45 in the second box.)
Jen wanted to ride her bike 65 miles in one day. By noon, she had already ridden 32 miles. How much more does she need to ride to reach her goal? 	Teacher: What are the three numbers in the problem? (IS) Student: How far Jen wanted to ride her bike, how far she rode in the morning, and how far she still needs to ride. Teacher: Which is the big number? (IS) Student: How far she wanted to ride her bike. Teacher: Do we know the big number? (IS) Student: Yes. 65. (Teacher writes '65' in the big box.) Teacher: How far did she ride in the morning? (IS) Student: 32 miles. (Teacher writes 32 in the first box.) Teacher: How far did she still need to go? (IS) Student: We don't know. (Teacher writes an 'r' in the second small box.)

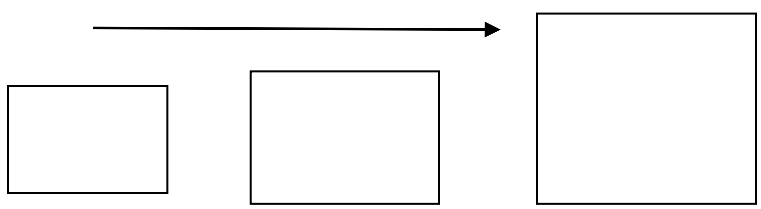
Group Practice Problems

Fill the correct numbers in the boxes.

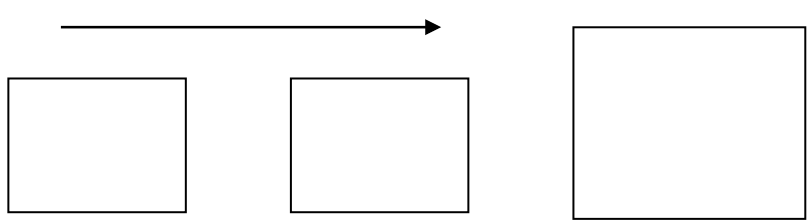
1. To practice for the swim meet, Jaxon needed to swim 7 miles in one week. If he swam 3 miles by Wednesday, how many more did he need to swim?



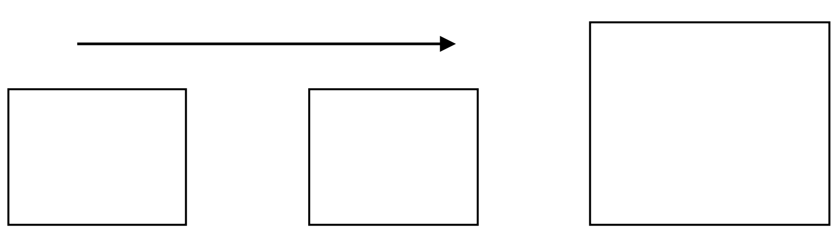
2. If you spent $30 on Christmas presents for your friends on Saturday, and bought another present for $15 on Wednesday, how much money did you spend on your friends for Christmas?



3. The bus tour wanted to reach the Grand Canyon, which was 130 miles away. If the bus travelled 55 miles the first day, how many more miles did the bus need to travel?

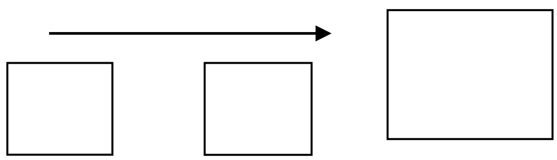
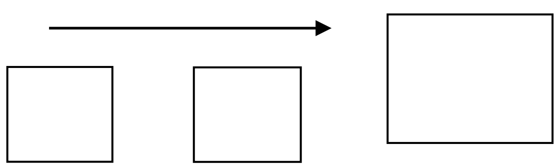
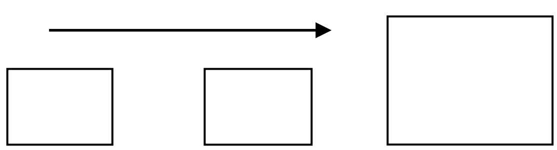


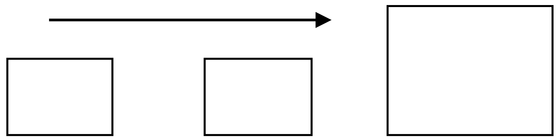
4. Jen owed her mother $35. If she has paid $17 so far, how much does she still owe?



Complex Action Word Problems: Determine if Total is Given and if Addition or Subtraction is Required

"I'm going to teach you a rule about these word problems. The rule is, 'If you are trying to find the big number, you add. If you are trying to find a small number, you subtract.' Now, listen again, 'If you are trying to find the big number, you add. If you are trying to find a small number, you subtract.'"

Sydney jogged 3 miles in the morning. She also jogged 5 miles in the afternoon. How many miles did she jog all day? 	Teacher: Do we know the total or big number? (IS) Student: No. Teacher: Remember the rule, 'If we know the big number, we subtract. If we do not know the big number, we add.' Teacher: Do we add or subtract? (IS) Student: Add. (Teacher writes the equation '3 + 5' under the boxes.) Teacher: How many miles did she jog? (IS) Student: '8 miles'.
Jade had 50 baseball cards. Kyle has 75. If they combine their cards, how many cards do they have? 	Teacher: Do we know the total or big number? (IS) Student: "No." Teacher: Remember the rule, 'If we know the big number, we subtract. If we do not know the big number, we add.' Teacher: Do we add or subtract? (IS) Student: Add. (Teacher writes the equation '50 + 75' under the boxes.) Teacher: How many cards do they have? (IS) Student: '125 cards'.
John wants to buy a new phone. The phone costs $150. He has $35 in his bank account. How much more does he need to save? 	Teacher: Do we know the total or big number? (IS) Student: Yes. Teacher: Remember the rule, 'If we know the big number, we subtract. If we do not know the big number, we add.' Teacher: Do we add or subtract? (IS) Student: Subtract. (Teacher writes the equation '150 - 35' under the boxes.) Teacher: How much does he need to save? (IS) Student: $115.
Sandy's parents' house was 150 miles away. If she drove 101 miles the first day, how much farther did she still need to go?	Teacher: Do we know the total or big number? (IS) Student: No. Teacher: What is the rule? (GR)

	Students: ‘If we know the big number, we subtract. If we do not know the big number, we add.’ Teacher: Do we add or subtract? (IS) Student: Subtract. (Teacher writes the equation ‘150 – 101’ under the boxes.) Teacher: How much farther does she need to go? (IS) Student: ’49 miles’.

"Let's practice the rule about naming decimals. The rule is, 'If there is one digit after the decimal point, the decimal tells us how many tenths.' 'If there are two digits after the decimal, the decimal tells us how many hundredths."

Have the students practice saying rule. Teacher: If there is one digit after the decimal… say it as a group. If there are two digits after the decimal… say it as a group.

1- .3

2- .03

3- .23

4. .09

5. .9

Have the students write on their papers:

1- .7

2- .07

3. .17

4. .27

5. .05

6. .5

7. .4

8. .04

Determining the Big Number- Group Practice Problems (Work together as a class)

Circle the big number

1. If Sarah weighed 93 pounds and Sierra weighed 92 pounds, how much would the scale read if they got on together?
Which is the big number?

a. how much Sarah weighs
b. how much Sierra weighs
c. how much they both weigh together

2. Both Thomas and Jesse got on the scale at the same time. They both weighed 198 pounds. When Jesse got off the scale, the scale read 78 pounds. How many pounds does Thomas weigh?
Which is the big number?

a. The number on the scale when both Jesse and Thomas were on it.
b. The number on the scale when Jesse got off.
c. How many pounds Thomas weighs.

3. The kitten ate 3 pounds of cat food the first week and another 2 pounds the second week. How many pounds of cat food did the kitten eat in the two weeks?
Which is the big number?

a. the amount the kitten ate the first week
b. the amount the kitten ate the second week
c. the amount the kitten ate the first two weeks

4. Jaycee has a kitten that ate 9 pounds of food in a week. If she ate 3 pounds by Wednesday, how many pounds did she eat the rest of the week?
Which is the big number?

a. the amount of food the kitten ate in one week
b. how much food the kitten ate by Wednesday
c. how much food she ate the rest of the week

5. If you saved $320 for a new computer, and you need to save another $150 to have enough, how much does the computer cost?
Which is the big number?

a. how much you have saved
b. how much you still need to save
c. how much the computer costs

6. If you wanted to buy a cell phone that cost $340, and you have $200 already saved up, how much more do you need to save to buy the cell phone?
Which is the big number?

a. the cost of the cell phone
b. how much you have saved
c. how much more you need to save

7. If you saved $20 for a video game, and the video games costs $35, how much more do you need to save?
Which is the big number?

a. the amount you saved
b. the cost of the video game
c. how much more you need to save

8. If Tallie saved $40 for a pair of new clothes, and she bought the clothes for $32, how much money did she get back?
Which is the big number?

a. the amount Tallie saved
b. the amount of the clothes
c. the amount she got back

Reading Decimals with Mixed Numbers: Tenths and Hundredths

"We are going to learn to read more numbers with decimals. We know the rules for how to read decimals. Now we are going to read whole numbers with decimals.

10.3	Teacher: We read the numbers on the left of the decimal point (teacher points to the '10') how we would normally read them. (Teacher covers the '.3') What is this? (GR) Students: '10'. (Teacher covers the '10') Teacher: How many digits are after the decimal? (GR) Students: One Teacher: Remember the rule, 'If there is one digit after the decimal point, the decimal tells us how many tenths.' So, what is this part? (GR) Students: Three tenths. Teacher: So the whole number is ten and three-tenths. Teacher shows the word 'ten and three-tenths' on the overhead projector.
8.6	Teacher: We read the numbers on the left of the decimal point (teacher points to the '8') how we would normally read them. (Teacher covers the '.6') What is this part? (GR) Students: '8'. (Teacher covers the '8') Teacher: How many digits are after the decimal? (GR) Students: One Teacher: What is this part? (GR) Students: Six-tenths. (Teacher uncovers whole number). How do we read this number? (GR) Students: Eight and six-tenths. Teacher shows the word 'eight and six-tenths' on the overhead projector.
1.09	(Teacher covers the .09.) What is this part? (GR) Students: '1' (Teacher covers the '1') How many digits are after the decimal? (GR) Students: Two Teacher: What is this part? (GR) Students: nine-hundredths.

	(Teacher uncovers the whole number.) What is this number? (GR) Students: One and nine-hundredths. Teacher shows the word 'one and nine-hundredths' on the overhead projector.
16.73	(Teacher covers the '.73') What is this part? (GR) Students: '16'. (Teacher covers the '16') Teacher: How many digits are after the decimal? (GR) Students: Two Teacher: What is this part? (GR) Students: Seventy-three hundredths. (Teacher uncovers whole number). How do we read this number? (GR) Students: Sixteen and seventy-three hundredths. Teacher shows the word 'sixteen and seventy-three-hundredths' on the overhead projector.
3.03	(Teacher points to the '.03'.) Think about what this is. (Teacher points to the '3'. Think about what this is. Teacher: What is the whole number? (GR) Students: Three and three hundredths. Teacher shows the word 'three and three hundredths' on the overhead projector.
212.16	(Teacher points to the '.16'.) Think about what this is. (Teacher points to the '212'. Think about what this is. Teacher: What is the whole number? (GR) Students: Two hundred twelve and sixteen hundredths. Teacher shows the word 'two hundred twelve and sixteen hundredths' on the overhead projector.
7.7	(Teacher points to the '.7'.) Think about what this is. (Teacher points to the '7'. Think about what this is. Teacher: What is the whole number? (GR) Students: Seven and seven-tenths. Teacher shows the word 'seven and seven-tenths' on the overhead projector.

Individual Practice Problems

Circle the correct decimal

1.	three and four-tenths	3.04	3.4	.34
2.	four and six-hundredths	4.06	.46	4.6
3.	three-tenths	.03	3	.3
4.	nine and three-hundredths	9.3	9.03	.93
5.	six-tenths	.06	.6	6
6.	eight and eight-tenths	8.8	.88	8.08
7.	seven and eight-hundredths	7.8	7.08	.78
8.	six and six-tenths	6.06	.66	6.6

"Okay, now we are going to practice writing the decimals. I am going to say the number, and you will write them on your paper." (Teacher will say the decimals, and walk around the room, checking the students' papers.)

Five and Two-hundredths	Students write 5.02 on their papers.
Eighteen and Eighty-five hundredths	Students write 18.85 on their papers.
Five-tenths	Students write .5 on their papers.
Twenty-five hundredths	Students write .25 on their papers.
Ninety-one and Eighteen-hundredths	Students write 91.18 on their papers.
Three hundred and Nine-tenths	Students write 300.9 on their papers.
Six-hundredths	Students write .06 on their papers.
Six hundred and Sixty-two hundredths	Students write .62 on their papers.
Twenty-seven and Six-tenths	Students write .6 on their papers.

Adding and Subtracting Decimals: Different Number of Place Values

"If we have a whole number that is not written as a decimal, I will show you where the decimal place will go."

13	Teacher: The decimal will go to the right of the numeral. (Teacher shows 13.0).
261	Teacher: Where does the decimal place go? Teacher: Do I put the decimal point here? (Teacher points to the left of the '6'). Students: No Teacher: Do I put it here? (Teacher points to the correct location). Students: Yes Teacher: After the '1'. (Teacher shows 261.0).
1	Teacher: Where does the decimal place go? Teacher: Do I put the decimal point here? (Teacher points to the left of the '1'). Students: No Teacher: Do I put it here? (Teacher points to the correct location). Students: Yes Teacher: After the '1'. (Teacher shows 1.0).
3152	Teacher: Where does the decimal place go? Student: After the '2'. (Teacher shows 3152.0).

"Now, we are going to learn how to add and subtract some more numbers with decimals. These problems are written horizontally. We will need to re-write them vertically. We will line them up just like we did with the problems we did before."

452.3 + .21	Teacher: First, we re-write the problem with the decimals lined up. Teacher: Write the top number. (Teacher writes the top number). Teacher: Put the decimal right under the decimal in the top number. Teacher: Then write the digits for the bottom number. (Teacher writes the bottom number). Teacher: Now, we put in zeros wherever there is an empty place to the right of the decimal.

	(Teacher adds the zeros needed.) Teacher: Add the numbers. Teacher: Bring the decimal point straight down.
3926.2 - .63	Teacher: First, we re-write the problem with the decimals lined up. Teacher: Write the top number. (Teacher writes the top number). Teacher: Put the decimal right under the decimal in the top number. Teacher: Then write the digits for the bottom number. (Teacher writes the bottom number). Teacher: Now, we put in zeros wherever there is an empty place. (Teacher adds the zeros needed.) Teacher: Add the numbers. Teacher: Bring the decimal point straight down.
323 + 16.15	(Teacher writes the top number). Teacher: There is no decimal in the first number. I need to put it in. Should I put it here? (Teacher points to the left of the ‘2’.) (GR) Students: No. Teacher: Should I put it here? (Teacher points to the correct location.) (GR) Students: Yes. Teacher: Now I will write the digits for the second number. I will need to put the decimal of the second number right underneath the decimal of the top number. (Teacher writes ’16.15.’ with decimals lined up.) Teacher: Do we need any zeros? (GR) Student: Yes. Teacher: Where? (GR) Students: Above the ‘1 and ‘5’. (Teacher fills in the zero’s needed). Teacher: Add the numbers. Teacher: Bring the decimal point straight down.
3000.2 - .63	(Teacher writes the top number). Teacher: Where do I put the decimal of the second number? (GR) Student: Under the decimal of the top number.

	(Teacher writes '.63' With decimals lined up.) Teacher: Do we need any zeros? (GR) Student: Yes. Teacher: Where? (GR) Students: Above the '3'. (Teacher fills in the zero's needed). Teacher: Add the numbers. Teacher: Bring the decimal point straight down.
10 - .21	(Teacher writes the top number). Teacher: There is no decimal in this number. I need to put it in. Where does it go? (GR) Student: After the '0'. (Teacher adds the decimal.) Teacher: Where do I put the decimal of the second number? (GR) Student: Under the decimal of the top number. (Teacher writes '.21' With decimals lined up.) Teacher: Do we need any zeros? (GR) Student: Yes. (Teacher fills in the zero's needed). Teacher: Add the numbers. Teacher: Bring the decimal point straight down.
9 - 1.15	(Teacher writes the top number). Teacher: There is no decimal in this number. I need to put it in. Where does it go? (GR) Student: After the '9'. (Teacher adds the decimal.) Teacher: Where do I put the decimal of the second number?" (GR) Student: Under the decimal of the top number. (Teacher writes '1.15' With decimals lined up.) Teacher: Do we need any zeros? (GR) Student: Yes. (Teacher fills in the zero's needed). Teacher: Add the numbers. Teacher: Bring the decimal point straight down.
16.1 + 43	(Teacher writes the top number). Teacher: There is no decimal in the second number. I need to put it in. Where should I put it? Student: After the '3'. Teacher: Where do I put the second number?"

	Student: Under the decimal of the top number. (Teacher writes ’43.’ with decimals lined up.) Teacher: Do we need any zeros? Student: Yes. (Teacher fills in the zero’s needed). Teacher: Add the numbers. Teacher: Bring the decimal point straight down.

Individual Seatwork Problems:

1- 612 + 2.4

2- 10.9 + .67

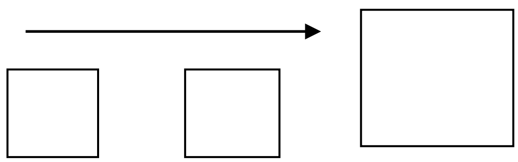
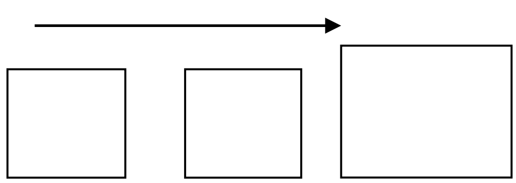
3- 800.9 + 1.03

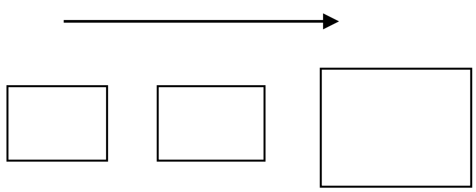
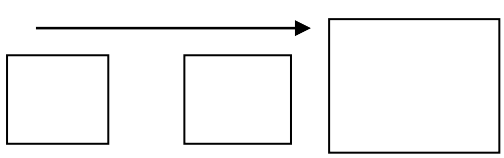
4- 14.33 + 208

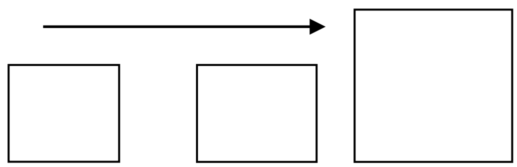
5- 6 - 2.367

Complex Action Word Problems: Solve Whole Problem

"Today we will be learning how to solve the entire word problem."

Sara needed $7 for a football game ticket. She also wanted to buy food for $6. How much money did she need to take with her? 	Teacher: What are the three numbers in the problem? (IS) Student: The amount for the football ticket, the amount for food, and how much money she needs. Teacher: Which is the big number? (IS) Student: How much money she needs. Teacher: Do we know how much money she needs? (IS) Student: No. Teacher: So, what do I do? (IS) Student: Write an 'm' in the big box. Teacher: Do we know both of the small numbers? (IS) Student: "Yes. '7' and '6'." Teacher: What do I do? (IS) Student: Write '7' and '6' in the smaller boxes. Teacher: What is the rule about whether we add or subtract? (GR) Students: 'If we know the big number, we subtract. If we do not know the big number, we add.' Teacher: Do we add or subtract? (GR) Students: Add. (Teacher writes '7 + 6' under the boxes.) Teacher: How much does she need? (IS) Student: '$13'.
Sara took $20 to the football game. She spent $6 on food. How much money did she have left? 	Teacher: What are the three numbers in the problem? (IS) Students: How much money she took to the game, how much she spent on food, and what she has left. Teacher: Which is the big number? (IS) Student: How much money she took to the game. Teacher: Do we know how much money she took to the game? (IS) Student: Yes. $20. Teacher: So what do I do? (IS) Student: Write '20' in the big box. Teacher: Do we know both of the smaller

	numbers? (IS) Student: "No." Teacher: What do I do? (IS) Student: Write '6' in the first box and an 'm' in the second box. Teacher: Do we add or subtract? (GR) Student: Subtract. (Teacher writes '20 - 6' under the boxes.) Teacher: How much does she have left? (IS) Student: '$14'.
Bob dug a hole that was 37 inches deep. If it needed to be 45 inches, how much more does he need to dig? 	Teacher: What are the three numbers in the problem? (IS) Students: How deep the hole is, how deep the hole needs to be, and how much more he needs to dig. Teacher: Which is the big number? Student: How deep it needs to be. (IS) Teacher: Do we know how deep it needs to be? Student: Yes. 45. (Teacher writes '45' in the big box.) Teacher: Do we know both of the other numbers? (IS) Student: No. Teacher: What do I do? (IS) Student: Write '37' in one box and a 'd' in the other. Teacher: Do we add or subtract? (GR) Student: Subtract. (Teacher writes '45 - 37' under the boxes.) Teacher: How much does he have left to dig? (IS) Student: '8 inches'.
Before lunch, Jim dug a hole that was 22 inches deep. After lunch, he continued digging and dug 11 more inches. How deep is the hole? 	Teacher: What are the three numbers in the problem? (IS) Students: How deep Jim dug the hole before lunch, how much more he dug after lunch, and how deep the hole is now. Teacher: Which is the big number? (IS) Student: How deep the hole is now. Teacher: Do we know how deep it is now? (IS) Student: No. Teacher: What do I do? (IS) Student: Write an 'h' in the big box. Teacher: Do we know the other two numbers? (IS)

	Student: "Yes. '22' and '11'. (Teacher writes '22' and '11' in the smaller boxes.) Teacher: Do we add or subtract? (GR) Student: Add. (Teacher writes '22 + 11' under the boxes.) Teacher: How deep is the hole now? (IS) Student: '33 inches'.
If 14 feet were cut from a rope, and it is now 30 feet long, how long was it before it was cut? 	Teacher: What are the three numbers in the problem? (IS) Student: How long the rope was before it was cut, how long it is now, and how much was cut from the rope. Teacher: Which is the big number? (IS) Student: How long it was before it was cut. Teacher: Do we know how long it was before it was cut? (IS) Student: No. Teacher: What do I do? (IS) Student: Write an 'r' in the big box. (Teacher writes an 'r' in the big box.) Teacher: Do we know the other two numbers? (IS) Student: Yes. '14' and '30'. (Teacher writes '14' and '30' in the smaller boxes.) Teacher: Do we add or subtract? (GR) Student: Add. (Teacher writes '14 + 30' under the boxes.) Teacher: How long was the rope? (IS) Student: '44 feet'.

Individual Practice Problems

Fill in the boxes with the correct numbers or letters. Write the number sentence below the boxes. Add or subtract, as needed. Circle your answer.

1- If you wanted to buy a motorcycle that was $350, and you have $150 saved up, how much more do you need to save?

2- Jared needed to cut the log so that it was 17 inches long. If it now 39 inches, how many inches does he need to cut off?

3- Jane has a dog that eats 11 pounds of dog food each week. If Jane buys a 50 pound bag of dog food, how many pounds are left in the bag after the first week?

4- Jill has $950 in her savings account. If her grandmother gives her $55 for her birthday, and she puts it into the savings account, how much money does she have?

Review of Reading Decimals: Tenths and Hundredths

Circle the correct decimal

1.	five-tenths	.05	.5	5
2.	three and three-hundredths	.3	3.03	3.3
3.	six-hundredths	6	.06	.6
4.	two-tenths	2	.02	.2
5.	seven and nine-hundredths	7.09	7.9	79
6.	one and four-tenths	.14	1.4	1.04
7.	one-tenths	.01	1	.1
8.	five-hundredths	.5	5	.05

Review of Addition and Subtraction of Decimals: Different Number of Place Values

371.2 - 66.34	(Teacher writes the top number). Teacher: Where do I put the decimal of the second number? Student: Right under the decimal of the top number. Teacher: Do we need any zeros? Student: Yes. Teacher: Where? Student: After the '2'. (Teacher fills in the zero's needed). Teacher: Subtract the numbers. Teacher: Bring the decimal point straight down.
21.2 + 13.3	(Teacher writes the top number). Teacher: Where do I put the decimal of the second number? Student: Right under the decimal of the top number. Teacher: Do we need any zeros? Student: No. Teacher: Add the numbers. Teacher: Bring the decimal point straight down.
300.21 - .4	(Teacher writes the top number). Teacher: Where do I put the decimal of the second number? Student: Right under the decimal of the top number. Teacher: Do we need any zeros? Student: Yes. Teacher: Where? Student: After the '4'. (Teacher fills in the zero's needed). Teacher: Subtract the numbers. Teacher: Bring the decimal point straight down.
20 - .23	(Teacher writes the top number). Teacher: Where do I put the decimal of the top number? Student: After the '0'. (Teacher writes in the decimal. Teacher: Where do I put the decimal of the

	second number? Student: Right under the decimal of the top number. Teacher: Do we need any zeros? Student: Yes. Teacher: Where? Student: After the ‘0’. (Teacher fills in the zero’s needed). Teacher: Subtract the numbers. Teacher: Bring the decimal point straight down.
900.2 - 9.6	(Teacher writes the top number). Teacher: Where do I put the decimal of the second number? Student: Right under the decimal of the top number. Teacher: Do we need any zeros? Student: No. Teacher: Subtract the numbers. Teacher: Bring the decimal point straight down.

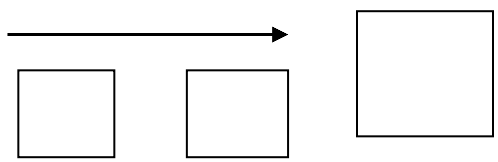
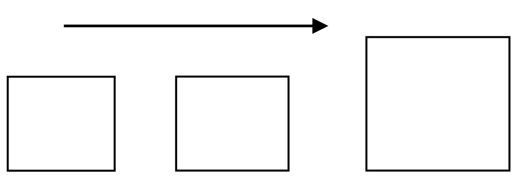
Review of Reading Mixed Decimals: Tenths and Hundredths

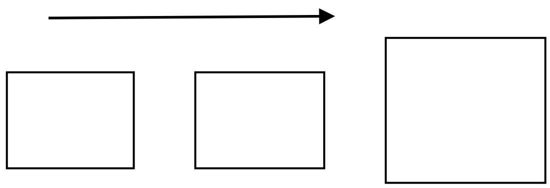
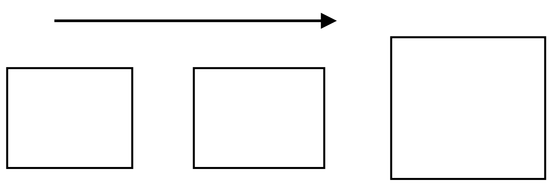
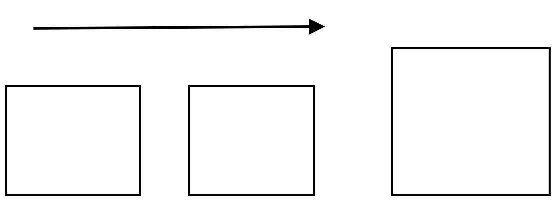
Write out the correct decimal

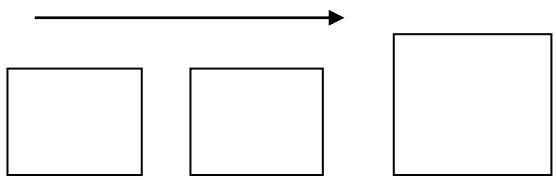
1. four and three-hundredths ____________________
2. two-tenths ____________________
3. eighteen and six-tenths ____________________
4. two hundred and nine-hundredths ____________________
5. nine-tenths ____________________
6. eight-tenths ____________________
7. three and four-hundredths ____________________
8. seven-hundredths ____________________

Comparison Word Problems: Solve Whole Problem

'Today we are going to be talking about another type of word problem, comparison word problems. Comparison word problems will tell about 2 or more people or things. They will compare the two things, using words like, 'smaller, bigger, lighter, heavier, etc.)

Sara's backpack weighs 15.6 pounds. Jack's backpack weighs 16 pounds. How much more does Jack's backpack weigh? 	Teacher: Whose backpack is heavier? Jack's. Teacher: So the weight of Jack's backpack will go in the big box or total, because it is the heavier amount. Teacher: Do we know the weight of Jack's backpack? Yes. 16. (Teacher writes 16 in the total). Teacher: The weight of the other backpack will go in the smaller box. 15.6 (Teacher writes 15.6 in the smaller box.) We don't know how much heavier, so we will write a 'b' in the other small box. Teacher: Is the total given? Yes, so we subtract. Teacher: Remember, 'If the total is given, you subtract. (Teacher writes a '16 – 15.6' under the boxes.) Teacher: Solve the problem. (Teacher models subtracting the numbers.)
Sara's backpack weighs 12.2 pounds. Jack's backpack weighs 2.4 pounds more than Sara's backpack. How much does Jack's backpack weigh? 	Teacher: Whose backpack is heavier? Jack's. Teacher: The weight of Jack's backpack will go in the big box or total, because it is the heavier amount. Teacher: Do we know the weight of Jack's backpack? No. So we will write a 't' in the big box. (Teacher writes a 't' in the bigger box.) Teacher: We will write the other numbers in the other smaller boxes. (Teacher writes '12.2 and 2.4 in the smaller boxes.) Teacher: Do we add or subtract? Student: Add. Teacher: Why? Student: 'If the total is not given, we add.' (Teacher writes a '12.2 + 2.4' under the first two boxes). Teacher: Solve the problem. (Teacher solves the problem).
	Teacher: Who weighs more?

A dog weighs 7.9 lbs. A cat weighs 3.1 lbs more than the dog. How much does the cat weigh? 	Student: The cat. Teacher: What number will go in the big box or total? Student: The weight of the cat. Teacher: Do we know the weight of the cat? Student: No. Teacher: So we will write a 'c' in the big box. Teacher: We will write the other numbers in the smaller boxes. (Teacher writes '7.9 and 3.1 in the smaller boxes.) Teacher: Do we add or subtract? Student: Add. (Teacher writes '7.9 + 3.1' underneath the first two boxes). Teacher: Solve the problem. (Teacher solves the problem).
Ellen hiked 2.3 miles. Ben hiked 6.2 miles. How much farther did Ben hike than Ellen? 	Teacher: Who hiked farther? Student: Ben. Teacher: What number will go in the big box or total? Student: How far Ben hiked. Teacher: Do we know how far Ben hiked? Student: Yes. 6.2 miles. (Teacher writes 6.2 miles in the big box.) Teacher: We will write the other numbers in the smaller boxes. (Teacher writes '2.3 and 'h' in the smaller boxes.) Teacher: Do we add or subtract? Student: Subtract. (Teacher writes '6.2 – 2.3' under the first two boxes.) Teacher: Solve the problem. (Teacher solves the problem).
Ellen hiked 2.3 miles. Ben hiked 6.2 miles farther than Ellen. How far did Ben hike? 	Teacher: Who hiked farther? Student: Ben. Teacher: What number will go in the big box or total? Student: How far Ben hiked. Teacher: Do we know how far Ben hiked? Student: No. (Teacher writes an 'h' in the last box.) Teacher: We will write the other numbers in the other smaller boxes. (Teacher writes '2.3 and 6.2' in the smaller boxes.) Teacher: Do we add or subtract? Student: Add.

	(Teacher writes a ‘2.3 + 6.2’ under the first two boxes). Teacher: Solve the problem. (Teacher solves the problem).
Jill is 10.2 years old. Jake is 8.1 years younger. How old is Jake? 	Teacher: Who is older? Student: Jill. Teacher: What number will go in the big box or total? Student: Jill’s age. Teacher: Do we know Jill’s age? Student: Yes. 10.2 (Teacher writes 10.2 in the last box.) Teacher: We will write the other numbers in the other smaller boxes. (Teacher writes ’8.1’ and ‘j’ in the smaller boxes.) Teacher: Do we add or subtract? Student: Subtract. (Teacher writes ’10.2 – 8.1’ under the first two boxes). Teacher: Solve the problem. (Teacher solves the problem).

Individual Seatwork Problems:

1. The length of a ribbon is 1.28 m. The length of a rope is 2.74 m longer than the ribbon. What is the length of the rope?

2. A pail holds 5.2 liters of water. A bottle holds 3.9 liters less than the pail. What is the volume of water in the bottle?

3. In the race, Fred finished in 36.4 seconds and Derek finished in 33.9 seconds. How much longer did it take Fred to finish the race?

4. John is 58.2 inches tall. Jarek is 3.8 inches taller than John. How tall is Jarek?

5. January got a 9.9 score in the gymnastics event. Cedric got .3 less than January. What was Cedric's score?

6. The best score for the long jump in the class was 3.8 feet. The second best score was .12 feet less. What was the second best score?

Review of Placing the Decimal: On the Board

“We are going to practice placing the decimal in problems that do not have a decimal.

1- 62

2- 13

3- 4

4- 3000

“Write these on your papers and place the decimal correctly.”

5- 612

6- 1

7- 44456

8- 17

Solve the problems below. Please show your work.

1 6 - .32

2- 500 – 1.3

3- 512 – 13.14

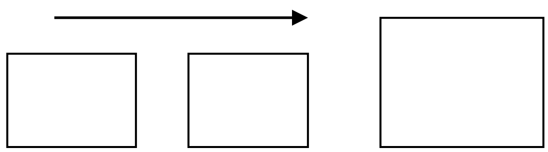
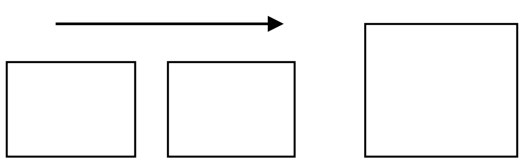
4- 3.2 - .44

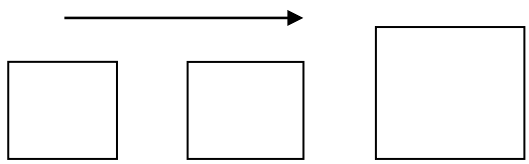
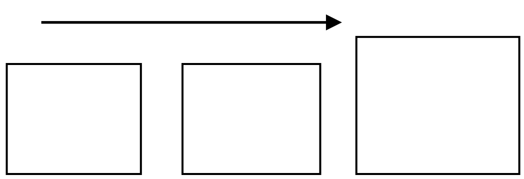
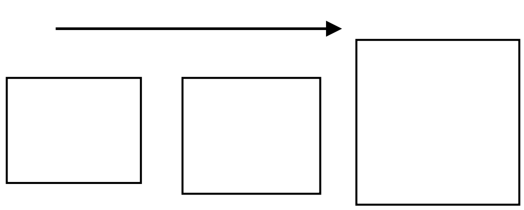
5- 1 - .11

6- 3000 + .445

Review of Comparison and Complex Action Word Problems

"Today we are going to review the word problems that we have learned to do."

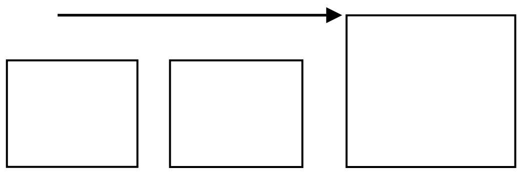
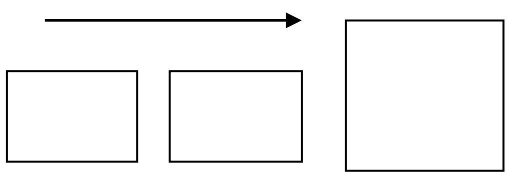
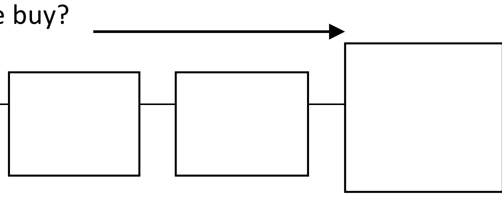
A yellow pencil is 5.3 inches long. A blue pencil is 3.66 inches longer. How long is the blue pencil? 	Teacher: Which is longer? Student: The blue pencil. Teacher: What number will go in the big box or total? Student: The length of the blue pencil . Teacher: Do we know the length of the blue pencil? Student: No. (Teacher writes a 'p' in the big box.) Teacher: We will write the other numbers in the other smaller boxes. (Teacher writes '5.3 and 3.66' in the smaller boxes.) Teacher: Do we add or subtract? Student: Add. (Teacher writes '3.66 + 5.3' under the first two boxes.) Teacher: Solve the problem. (Teacher waits while the students solve the problem and checks their answers.)
A chef bought 9.3 pounds of white rice and 7.6 pounds of brown rice. How much rice did he buy? 	Teacher: What are the three numbers in the problem? Students: How many pounds or white rice, how many pounds of brown rice, and the total amount of rice. Teacher: Which is the big number? Student: The total amount of rice. Teacher: Do we know the total amount of rice? Student: No. (Teacher writes an 'r' in the big box.) Teacher: What are the other two numbers? Student: '9.3' and '7.6'. (Teacher writes '9.3' and '7.6' in the smaller boxes.) Teacher: Do we add or subtract? Student: "Add." (Teacher writes '9.3 + 7.6' under the boxes.) Teacher: How much rice did he buy? Student: '16.9'.
A yellow pencil is 5.3 inches long. A blue pencil is 6.73 inches. How much longer is the blue pencil?	Teacher: Which is longer? Student: The blue pencil. Teacher: What number will go in the big box or

	total? Student: The length of the blue pencil . Teacher: Do we know the length of the blue pencil? Student: Yes. 6.73 inches. (Teacher writes '6.73' in the big box.) Teacher: We will write the other numbers in the other smaller boxes. (Teacher writes '5.3' and 'p' in the smaller boxes.) Teacher: Do we add or subtract? Student: Subtract. (Teacher writes '6.73 – 5.3' under the first two boxes.) Teacher: Solve the problem. (Teacher waits while the students solve the problem and checks their answers.)
Jerry weighed two metal balls during math class. The total weight of the two balls was 3.7 pounds. When he took one of the balls off the scale, the other weighed 2.1 pounds. How much did the ball that Jerry took off the scale weigh? 	Teacher: What are the three numbers in the problem? Student: The total weight of the two balls, the weight of the one ball, and the weight of the other. Teacher: Which is the big number? Student: The total weight of the balls. Teacher: Do we know the total weight of the balls? Student: Yes. 3.7 pounds. (Teacher writes '3.7' in the big box.) Teacher: What are the other two numbers? Student: '2.1' and we don't know. (Teacher writes '2.1' and 'b' in the smaller boxes.) Teacher: Do we add or subtract? Student: "Subtract." (Teacher writes '3.7 – 2.1' under the boxes.) "How much does the other ball weigh?" Student: '1.6'.
Sally scored 9.007 in gymnastics. Cindy scored .008 higher than Sally. What was Cindy's score? 	Teacher: Who scored higher? Student: Cindy. Teacher: What number will go in the big box or total? Student: Cindy's score. Teacher: Do we know Cindy's score? Student: No. (Teacher writes a 'g' in the big box.) Teacher: We will write the other numbers in the smaller boxes. (Teacher writes '9.007 and .008' in the smaller boxes.)

	Teacher: Do we add or subtract? Student: Add. (Teacher writes '9.007 + .008' under the first two boxes.) Teacher: Solve the problem. (Teacher waits while the students solve the problem and checks their answers.)

Classification Word Problems: Solve Whole Problem

"Today we are going to learn another type of word problem."

It rained 5.2 inches on Saturday. On Sunday, it snowed 6.3 inches. How much precipitation fell over the weekend? 	Teacher: This problem tells us about two different types of a larger class. The larger class is 'precipitation'." Teacher: Snow and rain are two types of precipitation. The larger class is the big number, or the total. Teacher: Do we know the amount of the larger class or the big number? No, so we will write a 'p' in the big box. Teacher: Now we know the numbers that will go in the smaller boxes. (Teacher writes '5.2 and 6.3' in the smaller boxes.) Teacher: Now, the total or big number is not given, so we will add. Remember, when the total is not given, you add. Teacher: Solve the problem. Teacher waits while students solve the problem.
A seafood restaurant sold 8.75 cups of clam chowder for lunch and 10.2 cups of Irish stew for dinner. How many cups of soup did they sell all day? 	Teacher: This problem tells us about two different types of a larger class. The larger class is 'soup'." Teacher: Clam chowder and Irish Stew are two types of soup. The larger class is the big number, or the total. Teacher: Do we know the amount of the larger class or the big number? Student: No. (Teacher writes an 's' in the big box). Teacher: Now we know the numbers that will go in the smaller boxes. (Teacher writes '8.75 and 10.2' in the smaller boxes.) Teacher: Do we add or subtract? Student: Add. (Teacher writes '8.75 + 10.2' under the two smaller boxes.) Teacher: Solve the problem. Teacher waits while students solve the problem.
Sam went to the store and bought 16.3 pounds of nuts. 12.1 pounds were almonds. How many pounds of other types of nuts did he buy? 	Teacher: What is the larger class? Student: Nuts. Teacher: Do we know the how many pounds of nuts he bought? Student: Yes. 16.3 pounds. (Teacher writes '16.3' in the big box).

	Teacher: What numbers do we put in the smaller boxes? Student: 12.1 and we don't know. (Teacher writes 12.1 and 'o' in the smaller boxes.) Teacher: Do we add or subtract? Student: Subtract. (Teacher writes '16.3 – 12.1' under the two smaller boxes.) Teacher: Solve the problem. Teacher waits while students solve the problem.
Ed had 3.8 ounces of spices. He used .9 ounces pepper for dinner. How many ounces of spices did he have left?	Teacher: What is the larger class? Student: Spices. Teacher: Do we know the how many ounces of spices he had? Student: Yes. 3.8 ounces. (Teacher writes '3.8' in the big box). Teacher: What numbers do we put in the smaller boxes? Student: '.9' and we don't know. (Teacher writes '.9' and 's' in the smaller boxes.) Teacher: Do we add or subtract? Student: Subtract. (Teacher writes '3.8 - .9' under the two smaller boxes.) Teacher: Solve the problem. Teacher waits while students solve the problem.

Individual Seatwork Problems

1. Sherry needed 20 pounds of sweetener for her restaurant. If she had 12.5 pounds of maple syrup, how much more did she need?

2. Sophia bought 13.12 pounds of cranberries and 34.9 pounds of raisins. How many pounds of dried fruit did she buy?

3. Matthew spent the weekend picking berries at the berry farm. On Saturday morning, he picked 3.6 gallons of strawberries. On Sunday, he picked 1.75 gallon of cherries. How many pounds of berries did he pick?

Review of Decimal Computation- Individual Seatwork

1- 231.97 + 88.921

2- 26 - .3361

3- 16.321 – 15

4- 13 - .22

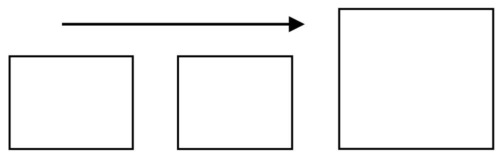
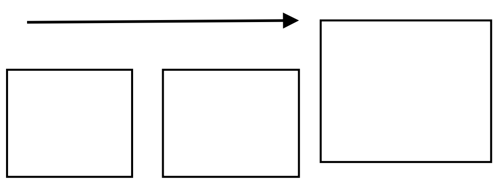
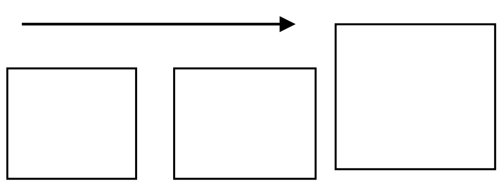
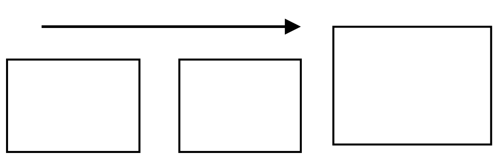
5- 1.1 + 3

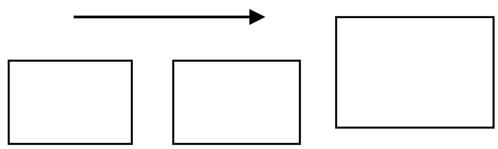
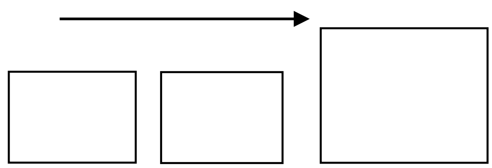
6- 12.23 - 9

7- 3 - 1.65

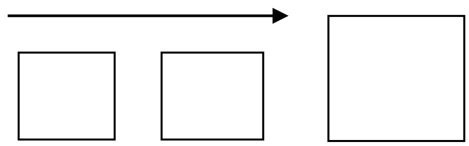
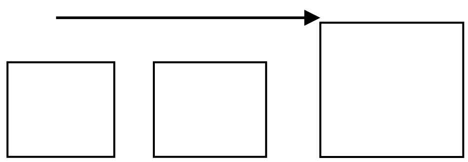
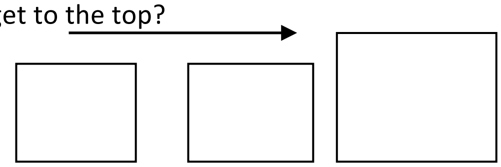
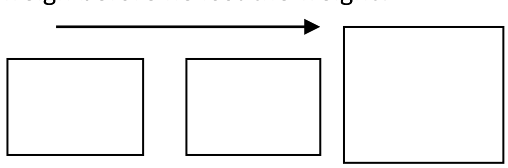
8- 2.1 + 4.5

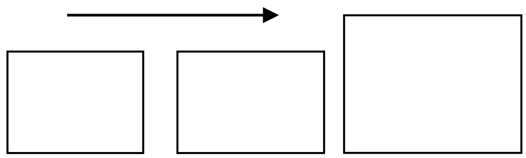
Review of All Word Problems

Evan was the tallest person in his family at 75.75 inches. Celeste was the shortest at 64.25 inches. How much taller was Evan than Celeste? 	What is the big number? The height of Evan The height of Celeste Do we know the big number?____________
Sheila was 6.5 inches shorter than Mike. If Mike was 70.25 inches tall, how tall was Sheila? 	What is the big number? a. The height of Sheila b. The height of Mike Do we know the big number?____________
The whole trip was 132.75 miles. The bus travelled 55 miles, and then stopped for lunch. How many more miles does the bus need to travel for the whole trip? 	What is the big number? a. The whole trip b. How far they travelled before they stopped for lunch c. How far the bus still needs to travel Do we know the big number?_____________
At the track meet, Braden drank 16.5 ounces of water in the morning. In the afternoon, he drank 13 ounces of milk. How many ounces of liquid did he drink all day? 	What is the big number? a. the water Braden drank b. the milk Braden drank c. the amount of liquid he drank all day. Do we know the big number?____________
A bag of apples from Sam's club weighs 10.5	

pounds. A bag of apples from Smith's weighs 3.3 pounds more. How much does a bag from Smith's weigh? 	What is the big number? a. the bag from Sam's club b. the bag from Smith's Do we know the big number?______________
A chef bought 6.9 pounds of rice, but 2.8 pounds of it spilled out of the bag in the parking lot because of a small hole in the bottom. How much rice is left? 	What is the big number? a. the amount of rice the chef bought b. the amount of rice that spilled out of the bag c. the amount of rice that is left Do we know the big number?________________

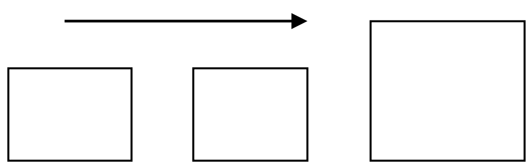
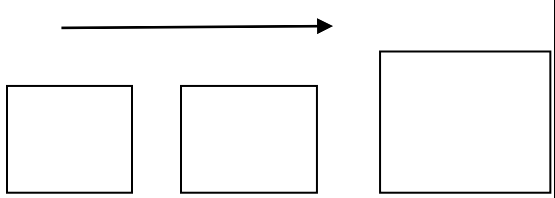
Review of All Word Problems

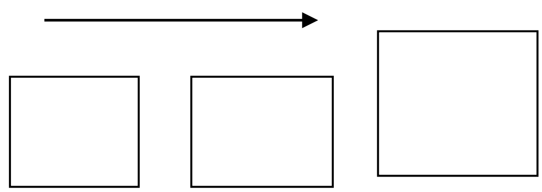
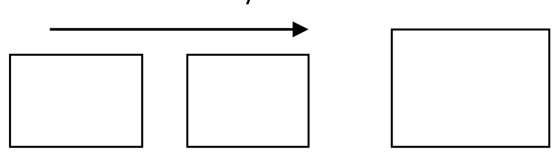
Kaitlyn's cat weighs 4.5 pounds. J.R.'s cat weighs 5 pounds. How much more does J.R.'s cat weigh? 	What is the big number? How much Kaitlyn's cat weighs How much JR's cat weighs Do we know the big number?_____________
Sara's backpack weighs 12.2 pounds. Jack's backpack weighs 2.4 pounds more than Sara's backpack. How much does Jack's backpack weigh? 	What is the big number? How much Sara's backpack weighs How much Jack's backpack weighs Do we know the big number?____________
The hike to the top of the mountain was 7.9 miles. If Jarrod hiked 3.3 miles in the morning, how much further did he need to go to get to the top? 	What is the big number? How far it was to the top of the mountain How far Jarrod hiked in the morning How much farther he needed to hike Do we know the big number?____________
John weighed 96.77 pounds before the wrestling match. He had lost 10.2 pounds to make weight the week before. How much did he weigh before he lost the weight? 	What is the big number? How much John weighed before the wrestling match How much weight he lost How much he weighed before he lost the weight Do we know the big number?_____________

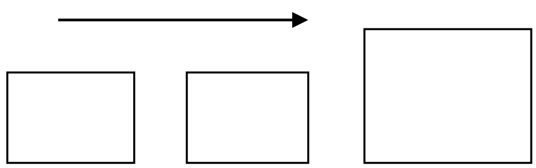
Celeste had 92.8 on her science test. Jamie got 10.3 points less than Celeste on her test. What was Celeste's score? 	What is the big number? What score Celeste got on her science test What score Jamie got on her science test Do we know the big number?

Review of All Word Problems

"Today we are going to review all types of word problems."

Evan was the tallest person in his family at 75.75 inches. Celeste was the shortest at 64.25 inches. How much taller was Evan than Celeste? 	Teacher: Who is taller? Student: Evan. Teacher: What number will go in the big box or total? Student: Evan's height. Teacher: Do we know Evan's height? Student: Yes. 75.75 (Teacher writes a '75.75' in the big box.) Teacher: We will write the other numbers in the smaller boxes. (Teacher writes '64.25' and 'c' in the smaller boxes.) Teacher: Do we add or subtract? Student: Subtract. (Teacher writes '75.75 – 64.25' under the first two boxes.) Teacher: Solve the problem. (Teacher waits while the students solve the problem and checks their answers.)
Sheila was 6.5 inches shorter than Mike. If Mike was 70.25 inches tall, how tall was Sheila? 	Teacher: Who is taller? Student: Mike. Teacher: What number will go in the big box or total? Student: Mike's height. Teacher: Do we know Mike's height? Student: Yes. 70.25. (Teacher writes '70.25' in the big box.) Teacher: We will write the other numbers in the smaller boxes. (Teacher writes '6.5' and 's' in the smaller boxes.) Teacher: Do we add or subtract? Student: Subtract.

	(Teacher writes '70.25 – 6.5' under the first two boxes.) Teacher: Solve the problem. (Teacher waits while the students solve the problem and checks their answers.)
The whole trip was 132.75 miles. The bus travelled 55 miles, and then stopped for lunch. How many more miles does the bus need to travel for the whole trip? 	Teacher: What are the three numbers in the problem? Students: The length of the whole trip, how far they travelled before lunch, and how many more miles they need to go. Teacher: Which is the big number? Student: The length of the whole trip. Teacher: Do we know the length of the whole trip? Student: Yes. 132.75. (Teacher writes '132.75' in the big box.) Teacher: What are the other two numbers? Student: '55' and we don't know. (Teacher writes '55' and 't' in the smaller boxes.) Teacher: Do we add or subtract? Student: "Subtract." (Teacher writes '132.75 - 55' under the boxes.) Teacher: How many more miles do they need to go? Student: '77.75 miles'.
At the track meet, Braden drank 16.5 ounces of water in the morning. In the afternoon, he drank 13 ounces of milk. How many ounces of liquid did he drink all day? 	Teacher: What is the larger class? Student: Liquid. Teacher: Do we know how many pounds of liquid he drank all day? Student: No. (Teacher writes an 'l' in the big box). Teacher: What numbers do we put in the smaller boxes? Student: '16.5 and 13'. (Teacher writes 16.5 and '13' in the smaller boxes.) Teacher: Do we add or subtract? Student: Add. (Teacher writes '16.5 + 13' under the two smaller boxes.) Teacher: Solve the problem. (Teacher waits while students solve the problem.)
A bag of apples from Sam's club weighs 10.5 pounds. A bag of apples from Smith's weighs 3.3 pounds more. How much does a bag from Smith's weigh?	Teacher: Which bag weighs more? Student: The bag from Smith's. Teacher: What number will go in the big box or total?

	Student: The weight of the bag from Smith's. Teacher: Do we know the weight of the bag from Smith's? Student: No. (Teacher writes a 'b' in the big box.) Teacher: We will write the other numbers in the smaller boxes. (Teacher writes '10.5' and '3.3' in the smaller boxes.) Teacher: Do we add or subtract? Student: Add. (Teacher writes '10.5 + 3.3' under the first two boxes.) Teacher: Solve the problem. (Teacher waits while the students solve the problem and checks their answers.)
A chef bought 6.9 pounds of rice, but 2.8 pounds of it spilled out of the bag in the parking lot because of a small hole in the bottom. How much rice is left? 	Teacher: What are the three numbers in the problem? Students: How many pounds of rice, how many pounds of rice spilled, and how much is left. Teacher: Which is the big number? Student: The total amount of rice. Teacher: Do we know the total amount of rice? Student: Yes. 6.9 pounds. (Teacher writes '6.9' in the big box.) Teacher: What are the other two numbers? Student: '2.8' and we don't know. (Teacher writes '2.8' and 'r' in the smaller boxes.) Teacher: Do we add or subtract? Student: Subtract. (Teacher writes '6.9 – 2.8' under the boxes.) Teacher: How much rice did he have left? Student: '4.1 pounds'.

Individual Seatwork Problems

1. The bakery ordered 5.27 pounds of molasses. That week, they used 4.03 pounds of it in their pancakes. How much molasses does the bakery have left?

2. If 26 students tried out for the school play, and 13 of them were girls, how many were boys?

3. Jesse made $113.15 at the fundraiser. He earned the most money. Cynthia made $87.20 and made the next highest amount. How much more did Jesse make than the person with the second highest amount?

4. If 18 students made it onto the soccer team, and another 14 tried out but didn't make it, how many students tried out?

5. John weighed 106.6 pounds before the wrestling match. He had lost 10.2 pounds to make weight the week before. How much did he weigh before he lost the weight?

6. Linda hiked 8.3 miles in the afternoon. She also biked 52.7 miles in the morning. How many miles did she travel that day?

7. Jayden weighed 142 pounds but he needed to lose 5 pounds to make weight in wrestling. How much did he need to weight to make weight?

8. Bob dug a hole that was 37 inches deep. If it needed to be 45 inches, how much more does he need to dig?

9. James lost 17.4 pounds. Now he weighs 145.6 pounds. How much did he weigh before he lost the weight?

10. Nathan needs to rent a tuxedo for the dance and buy a flower for his date. The tuxedo rental is $75 per night, and the flower for his date costs $27.50. How much money will Nathan need to earn to pay for the tuxedo and the flower?