Solving Word Problems with Fractions and Decimals

Students' Name: Gemma Holdman

Teaching Date and Time: 11/15/2012 Period 2 (10:25 – 11:15)

Length of Lesson: 50 minutes

Grade / Topic: 6th Grade / Math 1 Advanced

Source of the Lesson:

Carter, John A., Cuevas, Gilbert J., Day, Roger, Malloy, Carol E. *Florida Math Connects, Course 1*. Columbus, OH: The McGraw-Hill Companies, Inc., 2011. Print

Tamarkin, Kenneth, *Number Power 6: Word Problems*. Chicago, IL: Contemporary Books, Inc., 1991. Print

Appropriateness for Middle School Students:

- Students have spent the past few weeks learning about fractions, decimals, and percentages. They understand how to convert them and solve problems containing the three forms.
- Real-world word problems always appear on standardized tests such as the FCAT but it is known that students often have difficulties successfully solving them. Students will use concepts that they are familiar (fractions and decimals) and tie them in to real-world word problems.
- Students work in pairs throughout the lesson. Questioning strategies and class discussions are used to formatively assess students understanding of the material.

Concepts

Multiplying and dividing decimals and fractions is one thing, but using the same techniques to solve real-world word problems has a whole new meaning and requires the student to have a deeper conceptual understanding of the material. Word problems do not explicitly tell students what operations to perform. Rather, students must determine for themselves what is asked in the problem and what information will help them determine an answer. In some problems numbers are written as words, for example four and one eighth, further adding depth to the problem. Mathematical word problems often contain key words, also known as signal words, that tell students what operation is to be used at a given point. Examples of key words include: sum, total, parts, each, together, difference, less than, left, how much more, only, times, product, and per. This list is by no means inclusive and should not be taken as such. Once students determine what is being asked of them in the problem they must then decide how to manipulate the data to receive an appropriate solution. There are many methods and strategies to use when solving word problems. A few consist of: making a chart/table, finding a pattern, guess check and revise, choose an operation/formula, find an equation, draw a diagram/picture, work backwards, and solve a simpler form. Once manipulations have been made to the data in the problem it is vital that students check

the accuracy and appropriateness of the answer they received. Some word problems take longer than others, can be solved in multiple ways and even have multiple answers.

Carter, John A., Cuevas, Gilbert J., Day, Roger, Malloy, Carol E. *Florida Math Connects, Course 1*. Columbus, OH: The McGraw-Hill Companies, Inc., 2011. Print

Florida State Standards (NGSSS):

Grade 6, MA.6.A.1.3, Benchmark Description: Solve real-world problems involving multiplication and division of fractions and decimals. Big Idea 1: Develop an understanding of and fluency with multiplication and division of fractions and decimals. Cognitive Complexity: Level 3 – Strategic Thinking and Complex Reasoning.

Performance Objectives

Students will be able to:
1. Select the appropriate data to use in solving the presented problems.
2. Identify and implement various problem solving strategies to successfully complete word problems.
3. Multiply and divide fractions and decimals.

Materials List and Student Handouts
- Presentation for board
- Ziploc bags (one per student, 20 total)
- Student worksheets
    - Explore 1 (one per student, 20 total)
    - Explore 2 – printed on the back of Explore 1 (one per student, 20 total)
    - Explore 3 (one per student, 20 total)
    - Explore 4 – printed on the back of Explore 3 (one per student, 20 total)
- Exit tickets (one per student, 20 total)

Advance Preparations
- Slides are created to present on board
- Worksheets created and printed
- All materials placed into Ziploc bags for easy distribution
- One exit question slip per student (for evaluating student understanding)

Safety: There are no significant concerns.

ENGAGEMENT		Time: ~ 5 minutes
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses and Potential Misconceptions**
Greet students at the door.	"Good morning everyone!"	Good morning Miss Holdman.
Pass out the Ziploc bags to each student.	"Recently you have learned how to solve problems with	

	fractions, decimals, and percents. Today, we will be exploring word problems and problem solving strategies containing fractions and decimals.”	
Direct students to look at a picture on the board.	“First, I'd like you to take a look at this picture.”	
What do they see?	“What do you see?”	[An old woman.] [No, I see a young lady.]
	“Which one is correct?”	It's an old lady. A young one. [It depends on how you view it. Neither is right or wrong.]
	“Nicely said <ISNH>. In this case, the picture can be interpreted either way. Sometimes when we solve math problems there are multiple ways to develop an answer. Also, some problems can have multiple correct answers.”	
Find out what students know about problem solving.	“Can someone please tell me what you know about problem solving?”	[You have to figure out what you need to find.] [The wording can help you decide what operation to do.]
Discuss the process when solving word problems.	“Thank you! When we problem solve it is important to determine what the question is asking, what information is necessary to solve the problem, and pinpoint any key words.	[They tell us what operation we

Discuss some problem solving strategies with students.	Why are key words important?" "Exactly. Can someone please tell me some common methods to use when solving problems?"	need to complete.] [Find a pattern.] [Create a table/list.] [Draw a picture/diagram.] [Perform an operation.]
See if anyone has a question or concern.	"Those are some very nice examples. Thank you. Today, we are going to explore a few word problems related to concepts you are familiar with. What questions do you have thus far?"	

EXPLORATION Part 1		Time: ~5 minutes
What the Teacher Will Do	**Teacher Directions and Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Instruct students to take out the worksheet that says: Roommates.	"Please find the worksheet in your Ziploc bag with the title: Roommates."	
Read the problem aloud to the class.	"This problem states: Four roommates split their monthly food bill evenly and last month they spent a total of $572.36. If their rent and utility costs added up to be $428.14 each, how much did each roommate have to pay for food, rent and utilities combined?"	
Iterate to students that this problem has a couple steps. Read carefully.	"This problem has a few steps. So please read and re-read the problem carefully. Spend the next 5 minutes solving this problem with your partner. Please show all of your work on the worksheet."	
Verify students understand the instructions.	"<ISNH>, please repeat the instructions." "Thank you. You may begin."	[Read the problem carefully. Spend 5 minutes to solve the problem. Write all work on the worksheet.]

| Circulate the room helping students when necessary. Ask probing questions to supplement their work. | Possible questions include:
• What is/are the key words in this question?
• What is the problem asking you to find?
• What information is necessary to solve the problem?
• How many steps are needed to solve?
• What are you having difficulties with?
• What method(s) do you think are appropriate for this problem?
• Can you think of another way to solve it? | [Split means divide. Each means per person.]
[Total each roommate must pay for his/her monthly bills.]
[$428.14 and the amount each person spent on food.]

[2 steps. Divide first then add.]

Do I divide both $572.36 and $428.14 by 4?
[Using operations of decimals – division and addition.]

[This way is the quickest.] |

EXPLANATION Part 1		Time: ~5 minutes
What the Teacher Will Do	**Teacher Directions and Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Lead a discussion with the class about their methods and solutions to the problem.	"<ISNH>, could you please share with the class how you solved this problem?"	[I determined how much each roommate spent on food by dividing $572.36 by 4. Then I added it to $428.14.]
	"What indicated to you to divide $572.36 by 4?"	[The word split often means divide.]
	"Very good observation. Did anyone else solve the problem a different way?"	
	"What difficulties did you experience?"	[Word problems are always a bit tricky because we have to figure out what operations to complete.]
Ask students if they have any questions.	"What questions do you have?"	

EXPLORATION Part 2		Time: ~5 minutes
What the Teacher Will Do	**Teacher Directions and Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Instruct students to flip the worksheet to the back. It should state: Transportation Costs.	"Please flip to the back of this worksheet. The title should say: Transportation Costs."	
Read the question aloud to students.	"This problem states: Lisa spent a total of $3.85 for transportation to and from work each day. She worked an average of four and one-half days out of each week last year and there are fifty-two weeks in a year. How much did Lisa spend on transportation last year?"

"Please spend 5 minutes working on this problem. Show all of your work on the worksheet. Please begin." | |
| Move about the room helping students when needed. Ask questions to deepen their understanding. | Possible questions include:
• What is/are the key words in this question?
• What is the problem asking you to find?
• What information is necessary to solve the problem?
• How many steps are needed to solve?
• What are you having difficulties with?

• What method(s) do you think are appropriate for this problem?
• Can you think of another way to solve it? | [Each day.]

[Amount Lisa spent on transportation last year.]
[How much she spent each day, how many days she worked in the year.]
[2 steps.]

[4.5 days isn't a whole number. Even on the half day she needed to spend the whole amount.]

[Use operations of decimals – multiplication.]

[I could estimate using whole numbers to verify my answer.] |

EXPLANATION Part 2		Time: ~5 minutes
What the Teacher Will Do	**Teacher Directions and Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Lead a discussion with the class about their methods and solutions to the problem.	"Could I have a volunteer share their methods and solution to the class please?"	[I multiplied $3.85 by 4.5. That gave me the amount she spent on transportation each week. Then, since there are 52 weeks in a year, I multiplied my result by 52. I got $900.90.]
	"Lovely job! Why did you multiply?"	[Each day is singular and there were 4.5 days she traveled, so I knew that I needed to multiply.]
	"Good observation. Did someone get a different result?"	[Yes. I multiplied $3.85 by 5 since she still need to pay to get to and from work on the half day. I got $1,001.]
	"Great catch. Did anyone else receive the same result?"	
	"Some problems you really have to be careful when determining what they are asking of you. For this problem, even though Lisa only worked an average of 4.5 days a week, she still had to travel to and from work 5 times."	That's tricky!!
Have students place the worksheet back into their Ziploc bags. Ask students if they have any questions.	"Please put the worksheet back in your Ziplocs. Does anyone have any questions?"	
	"Word problems are difficult which is why it is important to double check your work. Also, with more experience you will become more familiar with how the problems work."	[How do we know not to multiply that problem by 4.5?]

EXPLORATION Part 3		Time: ~5 minutes
What the Teacher Will Do	**Teacher Directions and Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Instruct students to take out the worksheet that says: Guitar Lessons. Read the question to the class.	"Please find the worksheet in your Ziploc bag with the title: Guitar Lessons." "The problem states: Ben is taking guitar lessons three times a week for eight weeks. Each lesson will last one hour and 45 minutes. How many hours will Ben have spent in guitar lessons in eight weeks?"	
Students will be following the same procedures as the previous two questions. Ask a student to repeat the instructions.	"You will be following the same directions as the first two problems. <ISNH>, could you please repeat them?" "Thank you <ISNH>."	[Read the problem carefully and show all work on our paper. We can work with our partner to solve this problem. Use 5 minutes.]
Circulate the room helping students when necessary. Ask probing questions to supplement their work.	Possible questions include: • What is/are the key words in this question? • What is the problem asking you to find? • What information is necessary to solve the problem? • How many steps are needed to solve? • What are you having difficulties with? • What method(s) do you think are appropriate for this problem? • Can you think of another way to solve it?	[Each means a part and we need to find the total.] [How many hours spent in lesson over 8 weeks.] [Time spent in each lesson, number of lessons a week, and number of weeks.] [3 steps.] [It's tricky because we are given mixed numbers.] [Convert to improper fractions and use multiplication techniques.] [Draw a diagram and add.]

EXPLANATION Part 3		Time: ~5 minutes
What the Teacher Will Do	**Teacher Directions and Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Lead a discussion with the class about their methods and solutions to the problem.	"<ISNH>, could you please share with the class how you solved this problem?"	[I determined how many hours a week Ben had lessons for and then multiplied that by 8. I got 42 hours of lessons.]
	"Very good. Did anyone solve it a different way?"	[He played 3 times a week for 8 weeks, so he played 24 times total. Each time he had lessons for 1.75 hours, so I multiplied 24 by 1.75 and got 42 hours total.]
	"Wonderful. Both are ways you can solve this problem. Sometimes order is important, so you must be careful when you read these problems. Since you were working with the same units (individual lessons), you were able to do it either way."	
Ask students if they have any questions.	"What questions do you have?"	

EXPLORATION Part 4		Time: ~5 minutes
What the Teacher Will Do	**Teacher Directions and Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Instruct students to flip the worksheet over to the back. It should state: Chromosomes.	"Please flip to the back of this worksheet. The title should say: Chromosomes."	
Read the problem aloud to the class.	"The problem states: A human has 46 chromosomes. This is five and three-fourths times the number of chromosomes of a fruit fly. Find the number of chromosomes a fruit fly has."	
Give students instructions.	"Please spend the next 5 minutes completing the problem.	

| Move about the room helping students when needed. Ask questions to deepen their understanding. | Possible questions include:

• What is/are the key words in this question?

• What is the problem asking you to find?
• What information is necessary to solve the problem?
• How many steps are needed to solve?

• What are you having difficulties with? | [Times. Since humans have more we've got to divide to find fruit flies number.]
[Number of chromosomes a fruit fly has.]
[Number of chromosomes a human has. Comparison of fruit flies amount to humans.]
[3 steps – converting to improper fraction, finding reciprocal and multiplying.]
[Am I supposed to multiply or divide to find the amount?] |

EXPLANATION Part 4		Time: ~5 minutes
What the Teacher Will Do	**Teacher Directions and Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Lead a discussion with the class about their methods and solutions to the problem.	"Could I have a volunteer share their methods and solution to the class please?"	[I converted 5 ¾ to an improper fraction, made the reciprocal of it and then multiplied by 46. I got 8 chromosomes.]
Since this is the last problem, students should be more comfortable solving word problems and should display confidence sharing their responses.	"Well done! Did someone complete this problem a different way?" "That is another way to solve the problem. Good job. When working with mixed fractions it is important to convert them to improper fractions before performing any operations on them."	[I converted 5 ¾ to an improper fraction and got 23/4. Then I times 46 by 23 and divided by 4. I also got 8 chromosomes.]
Ask students if they have any questions. Have students place the worksheet back into their Ziploc bags.	"What questions do you have? Please put the worksheet back in your Ziploc bags."	

ELABORATION

What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
If time permits, have students create their own real-world word problem. They may use the previously solved problems as guides but must invent their own topic and questions. Students are encouraged to create problems relating to their personal interests. Each student must make their own problem but can use their partners for assistance. The teacher will walk around the room assisting whenever necessary. In order to create good problems, students need to use their prior knowledge on the concepts, as well as creativity and English skills. This is a good way to assess students' conceptual understanding of the material. Good problems are hard to create; a lot of time and effort is needed. Good problems can be used later on in tests and quizzes. Saves the teacher time and students would feel pleased if their problem is chosen.		Students may have difficulties performing this task. They are used to solving problems but not making up their own. Adequate English skills (grammar and word placement) is important to ensure proper flow in the problem. Students also need to be comfortable with the mathematical concepts to successfully complete this task. This is a good challenge for students but due to their lack of experience, assistance may be necessary.

EVALUATION   Time: ~5 minutes

What the Teacher Will Do	Assessment	Student Responses
Students have explored four different word problems during this lesson. They were given the freedom to solve the problems however they would like. The explanation portion	"Thank you very much for your participation today. You all did a wonderful job. To finish off today's lesson I would like you to answer the question on the exit ticket in your Ziploc bags.	

| discussed student's responses and methods. For the summative assessment, have students complete the question on their exit tickets in their Ziploc bags. | Please complete this individually. When you are finished, please place all worksheets in the bag and bring it to me. You may begin."

The exit ticket states: Please name 3 different ways you can solve a word problem.

Answers will vary. Some expected responses include:
• Look for a pattern
• Find key words
• Perform an operation
• Use a formula
• Make a table or list
• Draw a diagram/picture
Please use best judgment when grading the exit tickets. | |

Roommates

Problem: Four roommates split their monthly food bill evenly and last month they spent $572.36. If their rent and utility costs added up to be $428.14 each, how much did each roommate have to pay for food, rent and utilities combined?

Transportation Costs

Problem: Lisa spent $3.85 for transportation to and from work each day. She worked an average of four and a half days out of each week last year and there are fifty-two weeks in a year. How much did Lisa spend on transportation last year?

Guitar Lessons

Problem: Ben is taking guitar lessons three times a week for eight weeks. Each lesson will last one hour and 45 minutes. How many hours will Ben have spent in guitar lessons in eight weeks?

Chromosomes

Problem: A human has 46 chromosomes. This is five and three-fourths times the number of chromosomes of a fruit fly. Find the number of chromosomes a fruit fly has.

Exit Ticket

Name: _____

Please list 3 different ways you can solve a word problem.

1.

2.

3.

Exit Ticket

Name: _____

Please list 3 different ways you can solve a word problem.

1.

2.

3.

Exit Ticket

Name: _____

Please list 3 different ways you can solve a word problem.

1.

2.

3.

Exit Ticket

Name: _____

Please list 3 different ways you can solve a word problem.

1.

2.

3.

Problem Solving

November 15th, 2012
Period 2

Engage: What do you see?

Solving Word Problems

Must determine:

- What the question is asking

- What information is necessary to solve the problem

- Any key words

Problem Solving Methods

- Look for a pattern
- Choose an operation
- Make a chart/table
- Draw a picture/diagram
- Solve a simpler problem
- Estimate
- Guess, check, and revise

Roommates

Four roommates split their monthly food bill evenly and last month they spent $572.36. If their rent and utility costs added up to be $428.14 each, how much did each roommate have to pay for food, rent and utilities combined?

Transportation

Lisa spent $3.85 for transportation to and from work each day. She worked an average of four and a half days out of each week last year and there are fifty-two weeks in a year. How much did Lisa spend on transportation last year?

Guitar Lessons

Ben is taking guitar lessons three times a week for eight weeks. Each lesson will last one hour and 45 minutes. How many hours will Ben have spent in guitar lessons in eight weeks?

Chromosomes

A human has 46 chromosomes. This is five and three-fourths times the number of chromosomes of a fruit fly. Find the number of chromosomes a fruit fly has.

Exit Ticket

Please…

- Take out exit ticket from Ziploc

- Write name on the top

- Answer the question on your exit ticket

- Return all worksheets in Ziploc and bring to me

THANK YOU! ☺