General Information

Lesson Parts & Duration

Total Duration: 1 hour

- Introduction: Multiplicative Comparison & Word Problems with a Variable

Subject(s)

- Operations and Algebraic Thinking: Multiply and Division, Solving Word Problems, Additive Comparisons, Multiplicative Comparisons, Using Variables, Tape Diagrams **(4.OA.A.2)**.

Objective

- Students will be able to distinguish between additive comparison and multiplicative comparison.
- Students will be able to solve word problems by multiplying or dividing numbers.
- Students will be able to solve word problems using drawings and equations with a letter for the unknown variable.

Materials

- blank paper
- pencil & crayons/colored pencils
- document camera or whiteboard
- **Optional:** printable "Exit Slip" (page 7)
- **Optional:** printable "Break Up Your Day" brain/movement break ideas (page 8)

Instructional Setting

- Students should be seated with or near another student for partner work.

Throughout this lesson, you will find:

- ***Scripted Text*** indicates things that need to be said directly. Bullets starting with a **"T"** followed by *italicized type* indicate scripted text
- **Clarifiers** within scripted text are in orange
- **Teacher Directions** indicate things you should be doing
- **Side notes** provide helpful hints, ELL strategies, differentiation and information
- **Break Up Your Day** (Brain/Movement Breaks) are in green boxes (at the end)

Remember!

Quality over quantity. All components do not have to be accomplished; lessons may be ended at any time and resumed later.

Instructional Plan: 45-60 minutes

Before the introduction, provide each student with a piece of blank paper to take notes.

Introduction

- ***T*** *Today we will talk about comparing things, sets of things, time, measurements, money, all kinds of items that we can think of.*
- ***T*** *I am sure you have compared these types of things before using an additive comparison either this year or last year.*
- ***T*** *Does anyone remember what an additive comparison means?*
- ***T*** *You may not remember that it is called this, but I am sure when I tell you what it means you will know exactly what I am talking about.*
- ***T*** *Who would like to make a guess at what an additive comparison means?* **Call on a few students. Answer: We find an unknown variable by comparing how much more or less it is than another variable. We use addition or subtraction.**
- ***T*** *The definition of an additive comparison is: "finding an unknown variable by comparing how much more or less it is than another variable."*
- ***T*** *We use addition or subtraction when completing an additive comparison.*
- ***T*** *Let me give you an example.*

Scenario # 1

- ***T*** *I have two bowls of cherries – one for me and one for my brother. There are some cherries in my bowl. My brother's bowl has 14 more cherries than mine. We have 66 cherries in total. How many cherries does my brother have in his bowl? How many do I have in my bowl?*
- ***T*** *Now let's try to think of an equation that you can create based on this scenario.*
- ***T*** *With the person next to you, please discuss and come up with an addition or subtraction equation I might use to solve this problem.* **Write the problem on the board and give the class a few minutes to solve it.**

Provide a minute or so for students to come up with an equation for this problem. Monitor and provide assistance as needed.

- ***T*** *Ok, hopefully you and your partner were able to come up with a potential equation I might use to solve this problem.*
- ***T*** *Let's see if you were correct.*
- ***T*** *I will show you how I would solve this problem.*
- ***T*** *We don't know how many cherries my bowl contains.*
- ***T*** *When creating equations in math when there is an unknown value, we use what is called a variable.*
- ***T*** *A variable is a lower-case letter that stands for the unknown number.*
- ***T*** *Some common variables you may be used to seeing are: x, y, a, b, c.*
- ***T*** *You can use any lower-case letter as your variable though.*
- ***T*** *Ok, back to our problem.*
- ***T*** *Let's say my bowl contains "x" cherries.* **See example & model so students can follow.**
- ***T*** *That means that my brother's bowl would contain "x + 14."* **See example & model so students can follow.**
- ***T*** *So the equation that will represent this problem is: "x + x + 14."* **See example & model so students can follow.**
- ***T*** *Together we have 66 cherries, so the complete equation is: "x + x + 14 = 66."* **See example & model so students can follow.**
- ***T*** *From there, 2x + 14 = 66.* **Write the solution step by step on the board.**

Additive Comparison

I have two bowls of cherries – one for me and one for my brother. There are some cherries in my bowl. My brother's bowl has 14 **more** cherries than mine. We have 66 cherries **in total**. How many cherries does my brother have in his bowl? How many do I have in my bowl?

My bowl: *x cherries*
My brother's bowl: *x + 14 cherries*
Equation: *x + x + 14 = 66 cherries*

- **T** *2x = 52 and x = 26.* Write the solution step by step on the board.
- **T** *Looking back at the original problem, my bowl contains 26 cherries and my brother's bowl has 26 + 14 = 40 cherries.* Write the solution step by step on the board.
- **T** *Think about the calculations we made in this problem.*
- **T** *What were the keywords for comparing the two bowls?* Call on a student. Answer: 14 more. 66 total.
- **T** *We used addition for this comparison, since one bowl had 14 more than the other.*
- **T** *This is the additive comparison; raise your hand if you remember solving an equation like this before.* Most students should be raising their hands.

Multiplicative Comparison

I have two bowls of cherries – one for me and one for my brother. There are some cherries in my bowl. My brother's bowl has **twice as many** cherries than mine. We have 66 cherries **in total**. How many cherries does my brother have in his bowl? How many do I have in my bowl?

My bowl: *x cherries*
My brother's bowl: *2x cherries*
Equation: *x + 2x = 66 cherries*

Solution:
x + 2x = 66
3x = 66
66 ÷ 3 = 22
x = 22

Scenario # 2

- **T** *Now let's think of a different scenario.*
- **T** *I have some cherries in my bowl and my brother has twice as many cherries in his bowl. We have a total of 66 cherries. How many cherries do we each have?*
- **T** *Now let's try to think of an equation that you can create based on this scenario.*
- **T** *With the person next to you, please discuss the similarities and differences between these two scenarios and then we will discuss them together.* Write the problem on the board and give the class a few minutes to solve it.

Provide a minute or so for students to come up with an equation for this problem. Monitor and provide assistance as needed.

- **T** *Ok, what similarities and what differences did you notice?* Call on students to share.
- **T** *Let's see if you were correct.*
- **T** *I will show you how I would solve this problem.*
- **T** *This time if my bowl has x cherries, what would the amount of cherries in my brother's bowl be? He has twice as many as me, so 2x. In total, we have 66 cherries.*
- **T** *The equation will be "x + 2x = 66."* Write the solution step by step on the board.
- **T** *"3x = 66," that means I need to divide 66 by 3 to find out how much x equals.* Write the solution step by step on the board.
- **T** *"x = 22."*
- **T** *That means there are 22 cherries in my bowl.* Write the solution step by step on the board.
- **T** *My brother has 2 times 22 which gives us 44 cherries.* Write the solution step by step on the board.
- **T** *To make sure I calculated right, I will check by plugging the numbers into my equation.*
- **T** *22 + 2 x 22 = 22 + 44 = 66 cherries. So, we are correct!*
- **T** *Think about the calculations we made in this problem.*
- **T** *What were the keywords for comparing the two bowls?* Call on a student. Answer: twice as many. 66 total.

Multiplicative Comparison

I have two bowls of cherries – one for me and one for my brother. There are some cherries in my bowl. My brother's bowl has **twice as many** cherries than mine. We have 66 cherries **in total**. How many cherries does my brother have in his bowl? How many do I have in my bowl?

My bowl: *x cherries*
My brother's bowl: *2x cherries*
Equation: *x + 2x = 66 cherries*

Solution:
x + 2x = 66
3x = 66
66 ÷ 3 = 22
x = 22

My bowl: *22 cherries*
My brother's bowl: *2 x 22 = 44 cherries*
Equation: *22 + 2 x 22 = 66 cherries*

Key words: twice as many; 66 **total**

- ***T*** *We used multiplication for this comparison; since one bowl had twice what the other bowl had.*
- ***T*** *This is the multiplicative comparison, raise your hand if you remember solving an equation like this before.* Most students should be raising their hands.
- ***T*** *Now let's take some notes that can help us later!*

Setting up the Paper

- ***T*** *Write your name and date in the top right-hand corner of your paper.* See example & model so students can follow.
- ***T*** *The title of this lesson is: "Comparisons and Word Problems with Variables"*

Name & Date

Comparisons and Word Problems with Variables

Additive comparison: Comparing two quantities with "more" or "less." Calculated through addition or subtraction.

Multiplicative comparison: Comparing two quantities with "x times more" or "x times less." Calculated through multiplication or division.

- ***T*** *First, we are going to write "additive comparison" and what it means. It means "comparing two quantities with "more" or "less." Calculated through addition or subtraction."* See example & model so students can follow.
- ***T*** *Then, we will write the definition for "multiplicative comparison." It is "comparing two quantities with 'x times more' or 'x times less.' Calculated through multiplication or division."* See example & model so students can follow.
- ***T*** *Now let's solve another problem that we can calculate using the multiplicative comparison.*
- ***T*** *This time not only will I include an equation, I will also make a drawing to help me solve this problem.*
- ***T*** *Our word problem is: "In my bowl, I counted 108 cherries. In my brother's bowl, there was 6 times less."*
- ***T*** *Here is my drawing to represent this problem."* See example & model so students can follow.
- ***T*** *Please copy this example into your notes as I do each step; then you will be able to refer back to it later.*

In my bowl, I counted 108 cherries. In my brother's bowl, there were 6 times less.

My cherries = 108

My brother's cherries = 6 times less

- ***T*** *What do you notice about the way I represented the cherries.* Call on a few students.
- ***T*** *Does anybody know what this way of representing word problems with multiplication and division is called?* Call on a few students.
- ***T*** *This drawing is called a tape diagram.*
- ***T*** *You can write it on top of this example, so you can refer to it later.*
- ***T*** *A tape diagram helps us visualize items when they are a certain "times more" or "times less" than another number.*
- ***T*** *The squares on top represent all the cherries that I have which is 108.*
- ***T*** *The square on the bottom represents the cherries that my brother has.*
- ***T*** *Each square is equivalent to a certain number; this is our unknown.*
- ***T*** *Just like before we will use the variable "x" for our unknown.*
- ***T*** *Now we can figure out this number together.*
- ***T*** *If I have 108 cherries that are equal to six squares, then how can I find the amount of cherries for each square?* Call on a few students.

In my bowl, I counted 108 cherries. In my brother's bowl, there were 6 times less.

Tape Diagram

My cherries = 108

My brother's cherries = 6 times less

x= 1 box of cherries

$108 = 6x$

$108 \div 6 = 18$

$x = 18$

- ***T*** *I will write down the equation on the board. 108 = 6x, where x is the amount of cherries in one square which is also the same amount that my brother has.* See example & model so students can follow.
- ***T*** *In order to solve this equation what do we need to do?* Call on a student. Answer: Divide 108 by 6.
- ***T*** *That is right, we need to divide 108 by 6.* See example & model so students can follow.
- ***T*** *We get 18 is equal to x.* See example & model so students can follow.
- ***T*** *What does that 18 represent then, what is our unit or the object we are talking about?* Call on a student. Answer: The number of cherries in one square. The number of cherries the brother has.
- ***T*** *Now that we have practiced using a tape diagram, it's time for you to come up with a problem.*
- ***T*** *I will give you a few minutes to come up with a scenario and then you will trade it with a partner.*

Pass out a sheet of paper to each student.

- ***T*** *On half of your paper you will write your word problem and on the other half piece of paper you need to solve the problem and create an answer key.*
- ***T*** *Use your creativity and make sure it's a problem that you can solve yourself!*
- ***T*** *Remember this is a multiplicative comparison so you should be using the phrases "times more" or "times less" in your word problem.*
- ***T*** *To find the total you may want to solve the equation first, for example if I was writing our last problem, to create it I may have decided what one box or my variable x represented first.*
- ***T*** *Say I choose "18," then I know that I want my amount of cherries to be 6 times more.*
- ***T*** *So, I would solve "6 x 18 = 108."*
- ***T*** *Now I would be ready to write my word problem because I know the total.*
- ***T*** *So, I can say that I had 108 cherries and in my brother's bowl there were 6 times less.*

Provide time for students to create their own problem and answer key. Monitor and provide assistance as needed. If students struggle suggest that they modify one of the two problems you solved as a whole class.

- ***T*** *Ok, let's trade your paper with a partner!*
- ***T*** *See what he or she has written, try to solve it and give it back to him or her for correction.*

Provide time for students to solve each other's word problems and correct their partner's work once the problem is solved. Monitor and provide assistance as needed.

Assessment Component "Exit Slip"

Pass out a printed "Exit Slip" (page 7) to each student or project the problem for students to copy on a separate piece of paper.

- ***T*** *Now it is time for you to show your teacher what you have learned.*
- ***T*** *Take your time and try to apply everything we learned in this lesson.*
- ***T*** *You will need to use a variable for the unknown, a tape diagram as a visual representation, and equations to solve for your variable.*
- ***T*** *Once you have found an answer please record that answer in a complete sentence including the unit the problem is referring to.*
- ***T*** *When you are finished, please double check if you have written your name in the upper right corner, hand in your paper and we will take a stretch break once everyone is finished.*

Name: ANSWER KEY Date: _____

Exit Slip:
Multiplicative Comparisons

Directions: Use a multiplicative comparison to solve this word problem. Show your work using a variable for the unknown, a tape diagram, and equations. Record your answer as a complete sentence.

Jane raised $48 after selling cookies on the first day. Her friend Becky raised three times more money. How much money did Becky raise?

Becky's money = x

Jane's money $48

$x = 48 \times 3$

$48 \times 3 = 144$

$x = \$144$

Becky raised $144 on the first day.

Make sure to "Break Up Your Day!"

Now is a great time to take a break and get students re-energized.
See our list of engaging movement and brain break ideas to get your students moving and ready to refocus! (see page 8)

Name: _____Date: _____

Exit Slip:
Multiplicative Comparisons

Directions: Use a multiplicative comparison to solve this word problem. Show your work using a variable for the unknown, a tape diagram, and equations. Record your answer as a complete sentence.

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Name: _____Date: _____

Exit Slip:
Multiplicative Comparisons

Directions: Use a multiplicative comparison to solve this word problem. Show your work using a variable for the unknown, a tape diagram, and equations. Record your answer as a complete sentence.

Jane raised $48 after selling cookies on the first day. Her friend Becky raised three times more money. How much money did Becky raise?

Make sure to "Break Up Your Day!"

These can be used in the middle of a lesson or at the end of your lesson.

Here are a few engaging movement and brain break ideas to get your students moving and ready to refocus!

Break Up Your Day: Guess My Number!

- Teacher thinks of a multiple digit number.
- The students will take turns asking yes or no questions to try and figure out the number, can use equity cards to call on students to ask questions.
- (Example: does the number have six digits, is the number in the tens place greater than 2).
- Providing paper and pencils for students to write down guesses can be helpful.)

Break Up Your Day: Body Stretches!

10 minutes
FORMATION: Standing at desks

- Have students begin the day with a series of simple activities lasting 30 seconds or more: jumping jacks, knee lifts, flap arms like a bird, hopping, scissors (feet apart then cross in front, feet apart then cross in back)…
- Follow each activity with a basic stretching movement:
- Reach for the sky runner's stretch
- Butterfly stretch (sit with bottom of feet together)
- Knee to chest, rotate ankles, scratch your back

Hold stretches for 10 - 30 seconds. Repeat a different simple activity followed by a new basic stretch as many times as desired.

Break Up Your Day: Thumbs Up!

- Student is called on (use name cards or equity cards if available) to state a rounding observation from within the classroom using numbers from 1 to 500.
- Other students signify whether they understand and agree with the observation. (Example: "There are approximately 100 pencils in the classroom because each student has 3 pencils and there are 32 students. 3 times 32 is 96 and 96 rounds to 100.)
- Tally how many students agree with the rounding statements.
- The statement with the most votes or Thumbs Up is the "Round Up Captain"!