Grade Level/Course: Grades 6-7

Lesson/Unit Plan Name: Part 1 - Multiple Representations of Ratios: from concrete to operational. Lessons 1 of 4 Modeling Ratios with Activity.

Rationale/Lesson Abstract: How comparing and contrasting multiple representations shift student's thinking from concrete to operational. Using hands on activities to create and understand the relationship of ratios to be multiplicative rather than additive. Written as four individual lessons or as stations for review.

Timeframe: multiple days.

Common Core Standard(s):

6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak."
"For every vote candidate A received, candidate C received nearly three votes."
6.RP.2 Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."
6.RP.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

6.RP.3a Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios

6.RP.3b Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

6.RP.3c Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

6.RP.3d Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

7.RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction ½/¼ miles per hour, equivalently 2 miles per hour

Part 1, Lesson 1 - Modeling Ratios with Activity

Note to teacher: *Students should already have had short lessons on ratio language, how to write ratios, and how to convert ratios to unit ratios and percent so they can apply that knowledge to these lessons.*

Teacher Materials

- your favorite way to impart group lessons (white board, document camera)
- chart paper
- markers

Student Materials

- objects that go with the activity (balls, jump ropes per group of 4)
- stop watches or timer on cell phones (one per group of 4)
- pencil and paper for recording (one per group of 4)
- student worksheets (one per student)
- small post-it note (one per student)

Part 1, Lessons 1-4

- Use and manipulate concrete objects and visual tools that are instructional in formulating and testing their thinking and understanding of ratio and proportion as multiplicative rather than additive.
- Increase their ability to think logically about the abstract concepts of ratio, rate and proportion.

Part 2, Lesson 1

- Recognize that using a proportion in isolation to solve a rate problem limits their knowledge to the answer of that specific problem. (This experience can be expanded by solving the proportion in 2 or 3 different ways.)
- Use a table to reveal the answers of the unit rate, and realize that those rates that are usually whole number multiple terms in between the proportion given and the proportion sought. (Ex. The ratio 3 to 5. Thinking: The second term is 2 times 3 which equals 6 and the second term for 5 is 10 therefore the next equivalent ratio is 6 to 10.)
- Use a graph to visually understand ratio as a linear model with answers as numerous as the points on a line.
- Use an algebraic equation to express the generalization of the pattern and to solve for any value.

Part 1, Lesson 1 - Modeling Ratios with Activity

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Lesson 1 – Modeling Ratios with Activity

Have students form groups of four and each take a job. Switch after each turn so that everyone in the group has experienced each position.

- 1. person doing the activity
- 2. counter
- 3. timer
- 4. recorder

Have them do an activity (snapping fingers, hopping, saying multiples of a number) for 10, 15, 20, or 30 seconds. They will use this data to find their unit rate for 1 minute and to answer questions on their student worksheet. When they have completed the worksheet, have each student write their unit rate and name on their post-it and place it in order on an open number line drawn on the board. When everyone's data is posted have them take a few minutes to look at the data and share what they notice. Guide the discussion by asking comparing and contrasting questions about the data. Repeat this station two or three times using different activities and different amounts of time, until students are confident in creating and presenting their own graph of the data for the whole class. After completing this activity for the last time give them the exit ticket to answer on page 6.

While they are doing these activities circulate and decide who you will have share their answers. Don't forget there is learning in misconceptions as well as correct answers.

Part 1, Lesson 1 - Modeling Ratios with Activity

STUDENT WORKSHEET
1 of 2 pages

Each group should receive:

- Any object that goes with the activity (Jump ropes, balls, etc.)
- Stop watches or cell phones (one per group of 4)
- Pencil and paper (one per group of 4)
- Small post-it note (one per student)
- Student worksheet (one per student)

When it is your turn to do the activity please list the names of your group members responsible for each task.

Activity: _____

Timer: _____Counter: _____

Recorder: _____Activity Person: _____

Do the activity for ____ seconds while each of your group members complete their task. Then switch tasks so that when everyone has completed their turn doing the activity, they have also done each task.

After completing the group activity please answer the following questions.

1. If you continued at this rate how many times would you have done the activity in 1 minute? ____ minutes? ____ minutes? Show your work.

Part 1, Lesson 1 - Modeling Ratios with Activity

STUDENT WORKSHEET

2. Explain how you arrived at your answer for 1 minute.

3. Compare your unit rate (1 min.) with each of your group members and write a comparison unit rate for each group member like the sample below.

Sample Response:

I hopped 30 times in 1 minute. Jim hopped 42 times in 1 minute. Our ratio of hops is $\frac{30}{42}$.

$$\frac{30}{42} \div \frac{6}{6} = \frac{5}{7} \quad \textit{or} \quad \frac{30}{42} = \frac{2\times3\times5}{2\times3\times7}$$

Therefore, I hopped 5 hops to every 7 hops of Jim's or $\frac{5}{7}\ of\ a\ hop\ to\ every\ 1\ hop\ of\ Jim's.$

Exit Ticket

Lesson 1 ANSWER

James made 12 baskets in 30 seconds. Shawn made 14 baskets in 30 seconds. If both boys continued making baskets at the same rate how many baskets would they make in 1 minute? 2 minutes? 10 minutes? Make a ratio table and justify your answer for James' ratio for 10 minutes using your unit ratio. Show your work.

Time Mins.	$\frac{1}{2}$	1	2	10
James' baskets	12	24	48	240

If James makes 24 baskets in 1 minute then he will make ten times that many in ten minutes.

Time Mins.	$\frac{1}{2}$	1	2	10
Shawn's baskets	14	28	56	280

Exit Ticket

Lesson 1

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