

Grade Level/Course: Grades 6-7
Lesson/Unit Plan Name: Part 1 - Multiple Representations of Ratios: from concrete to operational. Lesson 3 of 4 Representing Percentage Ratios Visually
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 $1/2 / 1/4$ miles per hour, equivalently 2 miles per hour.

Part 1, Lesson 3 - Representing Percentage Ratios Visually

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

- one paint swatch cut into 5 segments with each segment labeled to show ratio of color drops to white drops.
- glue
- student worksheets
- labels for the back of the paint segment to write the amount of each color.

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.

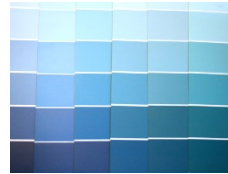
Part 2, Lesson 1

- 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 3 - Representing Percentage Ratios Visually

Student Materials

- one paint swatch cut into 5 segments with each segment labeled to show ratio of color drops to white drops.
- glue
- student worksheets



Lesson 3 – Representing Percentage Ratios Visually

This station should have one paint swatch cut into segments. Each segment should be labeled with the number of color drops and the number of white drops used to make that color (make it up). Try to use numbers that when added together are a factor of 100 for easy conversion to a percent (see example). Students should order swatches from the least amount of color to the most color. Then, students should write the ratio of colored drops to white drops as a fraction and in words. Next, students will find the percent of color drops to total drops by solving each proportion for the percent (see example). Repeat this station two or three times using different amounts of drops to create different ratios and percentages or another activity using numbers and percentages. Vary how you have them list the ratios from least to greatest and from greatest to least, until students are confident in creating and presenting their ratio as a fraction, converting it to a decimal or decimal fraction, and then to a percent. After your last time give them the exit ticket on page 5 for this activity.

$$\text{Ex) } \frac{4 \text{ color drops}}{16 \text{ white drops}} \text{ or } \frac{4}{16} \text{ or } \frac{1}{4} \quad 4 + 16 = 20 \quad 20 \text{ is a factor of } 100.$$

$$\frac{4 \text{ color drops}}{20 \text{ total drops}} = \frac{x}{100}$$

$$20x = 4 \cdot 100$$

$$20x = 400$$

$$\frac{20x}{20} = \frac{400}{20}$$

$$x = 20\%$$

The percentage of color in the paint is 20%

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 3 - Representing Percentage Ratios Visually

STUDENT WORKSHEET

Each group should receive:

- 5 colored segments (1 paint swatch cut apart from your local hardware or paint store)
- student worksheet.

Take the 5 segments and put them in order from least amount of color to the most amount of color.

1. Write the ratio of colored drops to total drops as a fraction and in words.

Segment 1 _____

Segment 2 _____

Segment 3 _____

Segment 4 _____

Segment 5 _____

2. Given the ratio, find the percentage of colored drops to total drops for each segment. Show your work.

Segment	% of colored paint
1	
2	
3	
4	
5	

Exit Ticket

Lesson 3 ANSWER

In each can there is a different amount of milk chocolate (m) to dark chocolate (d). Write the ratio of dark chocolates to total chocolates for each can, and then put them in order from greatest amount of dark chocolates to least amount of dark chocolates. Given the ratio, then find the percent of dark chocolates to total chocolates in each can.

$\frac{13}{20}$ or 65%

$\frac{6}{20}$ or 30%

$\frac{17}{20}$ or 85%

$\frac{13}{20}$ or 65%

Exit Ticket

Lesson 3

In each can there is a different amount of milk chocolate (m) to dark chocolate (d). Write the ratio of dark chocolates to total chocolates for each can, and then put them in order from greatest amount of dark chocolates to least amount of dark chocolates. Given the ratio, then find the percent of dark chocolates to total chocolates in each can.