Lesson Plan – Lesson 1

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Standards	
Content Standard: 7.RP.3 Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*	Standards for Mathematical Practice: Making sense of problems and persevere in solving them. Construct viable arguments Model with mathematics Use appropriate tools strategically Look for and make use of structure

Student Actions	
Learning Objective: Students will be able to find a percent part of a quantity by finding the percent of the unit 1 and using repeated addition or multiplication to apply that amount to the whole quantity.	Task: Students will draw a picture of a quantity broken into unit ones, find a percentage of each unit 1, apply the percentage to the entire quantity, and then describe the reasoning for their picture, work, and answer.

For the Teacher	
Rationale: Prior Knowledge Required: This lesson relies on student mastery of part to whole thinking, such as drawing fractions using bar models, pie charts, and number lines (e.g. Draw three-fourths using these different models). Students should also have prior knowledge of the definition of "percent" as a number that is part of 100. Also, students need to have flexibility with operations with decimals. They will have the option of adding terms of decimal numbers, or multiplying them since it is repeated addition. Goals for this lesson: Students can understand the concept of finding a percent of a quantity by breaking the quantity into units of one. For example, the number 8 is eight units of 1. We can find a percentage of a number by first finding that percentage of the unit 1. If we know that 25% of 1, for example, is .25, and we also know that 8 is equal to eight units of 1, then we could find 25% of 8 by adding up eight terms of .25. We want students to make the connection between adding up the percent of each unit and using multiplication for repeated addition. Also, we want students to describe their reasoning clearly in writing. Key questions for students to write about might include: how are you going to draw the picture? What	Student Misconceptions: We begin by finding a percent of 1. For example, why is 25% of 1 twenty-five hundredths, or .25? We make a transition on the back of the student notes to finding 25% of 2. The goal is for students to draw 2 separate ones and split them into one hundred parts. We want students to think of EACH one as twenty-five hundredths, or .25. When students add up the .25, they will visually see that the answer is .50. We think that students might be tempted to think that the 100 parts should be split into the two wholes, thus making each one only 50 parts. It is imperative for students to understand that while we have 2 separate whole dollars, each one should have 100 parts within them. Also, since we are asking students to break a quantity, such as 3, into three separate ones, and find a percent of each of those units, some students might forget the context of the original problem by thinking that the answer is the percent of only one unit. It is important that students remember that the percent of each unit one needs to be applied to the entire quantity to find the answer to the problem.

would 25% look like if we were to shade it in? How much money is 25% of $1? How many .25 do you see in the picture? Is there a different way we could add up the eight sets of .25? Differentiation: Materials: This lesson has a PowerPoint. Students will have a handout that follows the PowerPoint slides. Teachers should study the PowerPoint and student notes handout to determine the interplay between them. Clear delivery is important.	

Lesson Description and Instructional Delivery

The first slide of the PowerPoint reminds students that a "percent" means a number per, or out of, 100. This is key. A percent is simply a rate, comparing a part of whole when the whole is 100 (even if it is 100 parts of 1 whole). Students should write this in the "Big Ideas" section of their notes.

Example 1:
The second slide shows a dollar broken into 100 parts. Both PowerPoint and student notes have 25 of the parts shaded. You could call these parts or cents, since they are hundredths of a dollar.

Key questions to ask for PERCENT: How many parts has this dollar been broken into? How much money does each box/part represent? How many of them are shaded? If we know there are 100 total parts and 25 of them are shaded, what percent are shaded? The teacher and students could write: "25% of the dollar is shaded because 25 out of the hundred parts are shaded and percent means out of 100".

Key questions to ask for FRACTION: Could we represent the 25 shaded parts and the 100 total parts as a fraction? What would a fraction look like? The teacher and students could write: "$\frac{25}{100}$ of the dollar is shaded because there are 100 total parts and 25 are shaded."

- Teacher note: It is not important to reduce the fractions at this point. We are trying to focus on the relationships between percents, fractions, and decimals, as opposed to the equivalency of different fractions.

Key questions to ask for DECIMAL: When we say "twenty-five hundredths of the dollar is shaded, what do the words twenty-five hundredths look like as a decimal? If each part is 1 cent, how could we write them as money?" The teacher and students could write, ".25 of the dollar is shaded because twenty-five hundredths of the dollar is shaded, and that means twenty-five cents."

- Teacher note: The goal here is to develop the three representations and the sense of equality amongst them.

Slides 3 – 5 on the PowerPoint:
Students will not have these problems in their notes. These three slides can be used for Think Pair Share, where students analyze the given dollars, which are split into 100 parts and have some of the parts shaded. They should be discussing what the percent, fraction, and decimal/money amounts should be for the three different problems.

Example 2:
In example 2, the desired percent is given as 40% of the one dollar bill. Students will see the dollar with the grid of 100 parts, and they should, with teacher guidance, do four things. First, they should represent the fraction in the grid by shading 40 out of the 100 parts. Then they should write the three sentences for percent, fraction, and decimal representations for 40%. Desirable responses are the same as those from Example 1.

Example 3:
Similar to example 2, students will be given a percent, which in this case is 52%, and again, they should shade the unit of 1 dollar, then write three sentences representing percent, fraction, and decimal. The difference here is that students will not have a grid of 100 parts. This requires that they think about where 52% is.

Key questions to ask if students seem to need the grid: "If I could pretend for a second, what would the grid look like if I drew it? How many of the little hundredths parts do I need to shade in? Do I have to shade them in, one by one, or are there any shortcuts to do this quickly?"

- Students should be able to say that they can shade 10 at a time, since each column has 10 parts in it. Or they might say that they can shade in five columns since that would get to 50, then add two more in the sixth column.

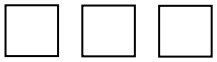
Key questions to ask if students seem to have good number sense: "Is there a way to find 52% without drawing the grid at all? Could I split the dollar in half, and if I did, what percent would that be? Should I shade more than half or less than half?"

Practice with your partner – 3 problems:
The teacher should give students 4-5 minutes to work with a partner on three problems.
Problem 1: The 100 grid is given with 50% of the unit shaded. Students should write a sentence describing what PERCENT they see and why.
Problem 2: The 100 grid is given, but with no shading. The percent desired is given as 49%, and students have to shade the 49% on their own and then write a sentence describing what FRACTION they see and why.
Problem 3: The rectangular unit is given without the grid of 100. The percent desired is given as 97% and students have to shade the 97% on their own, without the grid, and then write a sentence describing what DECIMAL they see and why.

Slide 11 on the PowerPoint:
This slide is not in the student notes. It can be used as a Think Pair Share. This slide asks students to analyze three grids and determine which of them shows 40%. They all actually do show 40%, but in three different ways. Students should be discussing with a partner which of the three shows 40% and why.

Slide 12 on the PowerPoint:
This slide is not in the student notes. It can be used as a Think Pair Share. This slide asks students to analyze three rectangular figures that are shaded, but without the 100 part grids. Students are to determine which of the three figures shows a good estimate of 90% shading. The third figure, in particular, is a tricky figure because it is smaller than the other two, and the 90 shaded parts are not oriented according to the pattern we have used within this lesson. The key for teachers, after the grid slides over the figure to reveal that it IS 90%, will be that 90% can look different as long as there are 90 out of 100 parts shaded.

PAGE 2 ON STUDENT NOTES……
Teacher Notes: We are now making the transition to finding a percent of a number more than 1. Instead of finding that 25% of a dollar is $\frac{25}{100}$ and .25, we will be looking at cases when we have TWO UNITS, instead of one.
The key thought here is that we can break the number 2 into two units of 1. Likewise, we can break any integer into units of 1. By then finding the percent of each unit 1, we can then add the amounts of each unit 1 to find the overall percent of the original quantity. For example, a problem such as 25% of $3 might look like this…



25% of the first unit 1 = .25
25% of the second unit 1 = .25
25% of the third unit 1 = .25

How many .25 do we have? .25 + .25 + .25 = .75
This means that 25% of 3 is equal to .75

Key: the math strategy here is not that we are finding 25% of the quantity 3. We are finding 25% of each of the unit ones. Then we can add up the answers from each unit one. Also, it is important that students begin to realize that they can use multiplication for repeated addition in the context of these problems.

Example 4:
In this example, students will see the question, "What is 25% of $2?" The student notes have two units, both with the grids on them. There are some guided questions for the teacher and students to ask and answer.

Describe why you shaded the way you did. I shaded 25 parts in the first one and 25 parts in the second one because there are 2 dollars and we want to find 25% of them, which means 25 out of 100 parts.
How much money does the shaded part in each dollar represent? There are $.25 (twenty five cents) in each of the ones.
Since 25% of each one is .25
And there are two dollars that have .25 shaded
then I can add .25 and .25 and .50 represents 25% of $2.

Example 5:
This example has students putting these concepts together to do three things: draw a picture to model the problem, describe their reasoning as they understand the problem to mean, and do the calculations to find the answer to the problem.

Key questions to ask: How much total money do we have in this problem? How should we draw the $3? How much of the first unit one should be shaded? Second? Third? How can we find the total amount of money we see shaded in this picture? How can we write our answer in the form of a sentence?

- Key teaching point: Students should be answering all these questions and describing their thinking process in the reasoning column. The writing is NOT ONLY their answer. It might include several sentences prior to their answer, describing their thought process.

Try it!!
This is an independent practice problem that students can do on their own. If the teacher feels that students need to be guided, it could be used as a guided practice problem. Or, if the students do well working with a partner, they can use partner practice as well. It is flexible how the teacher uses the problem.

Ticket out the Door: The task for the students is listed below.
A student was asked to find what 8% of $2 equals. He thinks that 8% of $2 is $0.16. He doesn't understand why he is wrong. Draw a picture, find the answer to the question on your own, and describe your reasoning to show him how to do the question correctly.

Draw a picture	Describe your reasoning.	Calculations: