GRID AND PERCENT IT

Research Theme: TBD

Broad Subject Matter Goals: TBD

Unit Learning Objectives: Students will develop and use multiple strategies to solve percent problems.
Learning Objectives:
Students will

- Shade 10 x 10 grids to represent percent, and determine the percent of a grid that is shaded;
- Determine the value represented by one square in a 10 x 10 grid, and determine the value of a grid given the value of one square;
- And Use a 10 x 10 grid as a strategy to solve percent problems

Materials:

- Grid Worksheet
- Dry-erase, water-based, or grease markers (optional)

Instructional Plan

This lesson presents a methods of solving percent problems that focuses on the basic concept of percent, that of "parts per hundred." A 10 x 10 grid, which is a common model for visualizing percents, is extended in the following examples to solve various types of percent problems. This is one strategy the students can use to solve percent problems.

PART 1			
Steps	*Main Learning Activities*	*Students' Anticipated Responses*	*Remarks on Teaching*
Introductory activities: Evoke prior knowledge	1. Give students one minute each to complete each of the following brainstorming tasks: a) write down everything you know about percent and about 100 grids; b) share with a partner what	1. Students may make connections to grades, money (pennies and dollars), sales, etc.	• Use questioning to determine that students understand that the grid is a 10 x 10 grid (100 squares).

	you wrote down. 2. Distribute the Grid worksheet to all students. Ask students to represent various percents on the grids. Include whole-number percents, decimals, and fractions (ex. 10%, 30%, 47%, 12 $\frac{1}{2}$%, 33.25%). Give students shaded grids and allow them to determine the percent for a shaded amount (ex. 1%, 9%, 78%).		• Focus discussion towards clarify the meaning of "percent". Students should see that 100% is represented by one whole grid square (a *unit square*). • Incorporate the term *unit square* in discussion and check that all student understand its meaning. • Use questions such as: What does is mean to have a percent greater than 100 (or less than 1)? What would it look like on the grid? (greater than 100 would use more than 1 unit square; less than 1 would use only a part of a small square)
Introductory activities: Understanding the grid representation	Preliminary activities: 3. Once students understand the representation of 100% and 1%, show them shaded grids representing percents less than 1 and greater than 100 and ask them to shade grids representing percents less than 1 and greater than 100.		

Introductory Activities: Determining the value of 1 small square or the unit square	4. Let the *unit square* (10 x 10 grid) represent given amounts and determine the value of one of the small squares (ex. the *unit square* represents each of the following: 400 people; 50 pounds; 150 days). Students share ideas about how to find the value. 5. Assign a value to one or more of the small squares and then determine the value of the *unit square*. For example, if one of the small squares represents 2 people, then the *unit square* has a value of 200. If one of the small squares represents 0.75 centimeters, then the *unit square* represents 75 centimeters. If 10 small squares (one column) represents $30, how much is one small square (30 ÷ 10 = 3)? How much is the unit square (3 x 100)? If 160 small squares have a value of 400, then one small square has a value of 2.5 (400 ÷160) and the *unit square* has a value of 250. Students generate ideas about how to approach the problem. Using the grid is one strategy. Students may come up with others, as well.	4. Students may have difficulty understanding when a small square does not represent a whole number value. Students may need time to share with others, in particular, if they have a weak understanding of fractions. 5. Students may share different strategies and reasoning processes such as reasoning up to 100 squares by doubling, by multiples or 5, 10, etc. or reasoning down to determine the value of one small square.	• Determining the value of one small square (1%) is one strategy for solving the percent problems. Students can also reason up and down using the value of one column or row (use chunking of the *unit square* into different amounts). • Students might have difficulty transitioning from the *unit square* as representing 100 to a different amount. • They can think of sharing the given amount equally among the 100 parts of the *unit square*. • Pose questions that involve "friendly" fractional parts of the grid. For example, if the *unit square* represents 400 people: a) How many people would be represented by half of the *unit square*? By one-fourth of the *unit square*? By three-fourths? By 20 small squares? By ten small

			squares? • For activity #5, using context (i.e., each square represents 2 people, $5, etc.) rather than just a number may help students reason through their work and understand what the numbers represent.
Posing a problem: Typical percent problems	6. Pose the following problem: Twenty percent of the 240 students in the 7th-grade have blue eyes. How many students have blue eyes? Students share solutions and reasoning strategies.	6. Students may recognize that 20% is represented by two rows but have difficulty determining the number of students. Some students may notice that one column is 1/10 of the *unit square*. They can use this to determine the number of students. Other students may determine the value of one small square and use that to determine the number of students. .	• Ask students to share strategies that use the value of one column (1/10 of 240 or 24; therefore, two columns represent 48) and strategies that determine the value of one small square. • Discuss the advantages of both strategies. Discuss elements of the problem that may make the column strategy useful (ex. the percent value is a multiple of 10, i.e., an entire column is shaded).
Students' individual problem solving	7. Pose the following two problems: A. Twenty-five acres of land are donated to a community, but the donor stipulates that six acres of this land should be developed as a playground. What percent of the land is to be used for playground? B. In our school, 57 students have dogs for pets. This represents 38% of the students in the	7. For problem A, some students may consider the *unit square* as representing 100 (acres in this case) and shade in 6 small squares of a section of 25, noticing that it takes 4 of those groups to complete the entire grid. Ask students to	7. Students might have difficulty determining what to represent on the grid (percent or the number). Remind them that the grid can be used to represent a part-whole relationship. Ask them what quantity is complete. For

	school. How many students are in our school? Students will work individually for a time and then discuss strategies with peers.	share their thinking behind this strategy and talk about why this strategy works well for this problem (because the total land, 25 acres, is a multiple of 100).	example, if they know the percent, they know that the *unit square* is 100. If they know the total number and the part in question (i.e. total amount of land and part to be developed) this relationship can represented on the grid. To provide scaffolding for students having difficulty, teachers may want to adjust the numbers in the problem to be "friendlier" initially and then modify them to be more complex.
Posing a problem: Percents greater than 100	8. Pose the following problem: This year the number of girls who attend our school has increased. It is now 120% of the number of girls who attended our school last year. This year, there are 360 girls who attend our school. How many girls attended our school last year? Students will work individually for a time and then discuss strategies with peers.	8. Students might initially need to discuss what it means (in grid terms) to be 120% of the number of girls who attended school last year.	8. Use questioning and discussion to ensure that students understand that 120% means that there is more than before (all of the previous year's population and then 20% more).
Summary	9. Summarize the main points discussed today: using a grid as one strategy to represent and solve percent problems. Students complete a summarizing activity: exit cards, discussion, etc.		9. Emphasize the meaning of "percent", "*unit square*" – *unit square* means the 100 grid, percents less than 1 or greater than 100, etc.

PART 2			
Steps	*Main Learning Activities*	*Students' Anticipated Responses*	*Remarks on Teaching*
Introductory Activities: Evoke prior knowledge	1. Ask students to summarize the main points of the previous lessons. 2. Give problems similar to those explored in Part 1. Students solve problems and discuss strategies and reasoning processes.		1. Some students will need probing questions or time to work with peers.
Pose a problem: Percent increase	2. Pose the following problem: The profit from last year's school fund raiser was $1,240. This year, the profit increased by 75% What was the profit from this year's fund raiser?		2. Assist students who are using the grid to properly model the situation. Discuss what each representation means.
Students' individual problem solving	3. Pose the following problems (or similar): A. John took a digital picture of his family of vacation. He wanted to blow it up, so he used his computer to increase the size of the picture to 250% larger than the original. The new length of the picture is 21 inches. How long was the original picture? B. A DVD is on sale at 20% off the listed price of $19.95. What is the sale price of the DVD? 4. Students work individually on the problem	3. Students may confuse 250% larger than the original price and 250% of the original.	3. Discuss with students the difference between 250% larger than the original and 250% of the original. They need to understand that 250% larger means in addition to what they started with.

	and then share strategies and reasoning processes in small groups. 5. Choose several students to share their solution paths. Ask students to repeat restate the reasoning process behind each explained solution.		
Summary	9. Summarize the main points discussed today: using a grid as one strategy to represent and solve percent increase and discount problems. Students complete a summarizing activity: exit cards, discussion, etc.		9. Emphasize the meaning of “percent increase” and “percent discount”, particularly in terms of percents greater or less than 100.