Puzzle prompt #1

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1 Purpose

The goal of the puzzle is to teach a group of middle school students how to work with percentages. Some stipulations:

- The group is small.
- The lesson need only be an introduction to the idea.
- The lesson should use some element of Freirean theory.

2 Context

The group is selected from an honors mathematics class of 7th graders at Northshore Junior High School (a school in Bothell, Washington that is attended by all ranks of children; however, the honors class here mostly caters to children in the middle- to upper-middle-class). In addition to being in the honors mathematics class, these precocious students also have an unusually high level of verbal intelligence. They have, moreover, in previous years already learned fractions, decimals, percentages, and the rudiments of algebraic thinking. However, this lesson takes place in September; in other words, even these autonomous, prodigious, bright stars have become "rusty" in their ability to manipulate numeric symbols. Hence the lesson here is part of the first session of the year, in which students will review material they have already covered.

3 Materials needed

Students may take notes, but no specific materials are required.

4 Method

The lesson will be an oral discussion of sorts. In particular, the teacher will present a motivating example to get the students back in the mindset of doing mathematics, and will continue to pull the discussion toward more fruitful paths, but students will be free to add to the discussion.

Since the students are precocious, it is fitting to introduce more abstract ideas. In particular, here it is best to (without using the term) introduce the idea of an *equivalence class*; in other words, whereas for the natural numbers and integers it is uncommon to see them written in different ways, for the rationals different representations are extremely common. The idea

is to show them that $0.5 = 0.4999\ldots = 1/2 = 2/4 = 50\% = 1:2$ and so on (or, at least to show that *some* of those are the same).

Specifically, a motivating example to use would involve the two distances 1 meter and 1 kilometer (1,000 meters); say Alice has to walk 1 meter and Bob has to walk 1,000 meters. In each case, one can go half the way or a third of the way, and so on, and that the *ratios* will remain constant in each case, but the absolute amounts will vary.

Students should realize that writing $x\%$ is nothing more than writing $x/100$; i.e. that the percentage symbol can be taken as an operator that divides by 100. Students familiar with geometry may find it amusing that the degree symbol is nothing more than the multiplication by $\pi/180$; i.e. that $x^\circ = \pi x/180$.

The discussion-based lesson is Freirean, but the teacher will also ask questions like "Can you think of another example like this one?", "Where have you seen this notation before?", "Why might it be useful to not work in terms of absolute amounts?" in order to elicit responses. In this way, the teacher takes something from the students in order to re-present those ideas, creating a Freirean dialogue of sorts.

5 Results

I think the lesson went well in that I was able to follow what was outlined in the "methods" section. One feedback I received was that I didn't have very many visuals, so that my explanation was difficult to understand. I had hoped that visuals would not really be needed because setting the context as a review would mean students only needed a quick overview (though perhaps I was incorrect). Another feedback I received was that I talked too much in my lesson. I suppose this was somewhat of a side-effect of feeling rushed in teaching the lesson, though I did try to elicit responses from students. Overall the feedback was positive (except for the points mentioned above), and I was able to teach at a more sophisticated level than what some of the others' lessons had in mind.