DOINGWHATWORKS

VIDEO
8:00 min

Full Details and Transcript

Understanding Ratios

Tollgate Elementary School, Colorado
February 2011

Topic DEVELOPING EFFECTIVE FRACTIONS INSTRUCTION FOR K-8

Practice RATIO, RATE, PROPORTION

Highlights

- Staff developer Arlene Mitchell describes the meaning of ratios and how they are linked to fractions.
- She encourages teachers to present students with lots of experience in different contexts to build up to working with proportions.
- She provides definitions of different types of ratios with examples, including part-to-whole, part-to-part, and ratios as rates.
- She gives workshop participants a problem that requires them to compare unit rates to determine which of two options is a better price deal.
- Math teacher participants explain their reasoning while solving the problem and Mitchell scaffolds their thinking, offering alternative ways to think about the problem.
- The group tackles a problem that involves using multiplicative thinking with a ratio table. They develop alternatives that involve adding, subtracting, and dividing while preserving the relationship within a ratio.

About the Site

Tollgate Elementary School
Aurora, Colorado

Demographics

- 45% Hispanic
- 31% Black
- 18% White
- 5% Asian/Pacific Islander
- 2% American Indian/Alaska Native
- 65% Free or Reduced-Price Lunch

Tollgate Elementary School focuses on developing mathematically powerful students using the districtwide curriculum developed by Aurora Public Schools. Features of the program include the following:

- A district mathematics coach and a school teacher leader who support classroom instruction, including collaborative lesson planning and demonstration lessons;
- Use of models, manipulatives, and visual representations to support fractions instruction;
- Ninety-minute blocks of math instruction, which allow for a number talk, whole-group lesson, small-group work, independent work time, and assessment; and
- Emphasis on mathematical discourse and communication to explain reasoning.

Full Transcript

00:05 Arlene Mitchell: A ratio is a cognitive process. It's not a writing process. Just because you give them a problem and you ask them to write the ratio does not mean that they understand a ratio. When you are asking them to work with a ratio, you are asking for them to pull apart attributes that are being described and how those characteristics of that attribute relate to one another.

00:30 When we look at this idea of ratios, a lot of times it connects to the idea of fractions, and it links to it through a lot of different ways. They share the same notation; fractions are ratios, but not all ratios are fractions. As you look at this, it's the building block because we are trying to get kids to think proportionally. You have to start with ratios to be able to build up to proportions. You need to give kids a lot of experiences with ratios in a lot of different contexts, which is saying, make yourself a little bit more familiar with the different types of ratios.

01:07 One of them is that part-to-whole. The part-to-whole makes it look like it is fraction; it *is* a fraction. And as you are doing the fraction piece here, you are comparing two measures of the same type. So some of the examples there, the nonfiction books to all of the books in the library. When you set that up as a fraction, as a ratio, you have the part that is nonfiction, but the nonfiction is also included in all of the books in the library.

01:40 Another one would be part-to-part, and this truly, then, is a ratio when you look at it as part-to-part. You are expressing one part to another part, but they are of the same measure. So to follow along with the same type of examples, it would be nonfiction books to fiction books. They are still books, but you are classifying it as either nonfiction or fiction to do the comparison.

02:11 Another one that comes into play is ratios as rates. When you have a ratio that is a rate, you now are putting together two measurements, and those measurements can be different. So it can be two balloons for three dollars. The balloons and the dollars are the two different units. Miles per gallon, inches per feet—all of those become a rate, and the rate is a comparison of two different types of measurements.

02:45 So here is the one I would like for you guys to work on, and I do have this one written up for you. So the idea for this one is, come up with a unit rate for the two camps that are dividing up the pizzas. This comes back then to that sharing, and you are looking at it from

the idea of which one of them is going to give you the better deal. If you start off in looking at the Bear Camp, what's one of the unit rates that we might end up with? And unit rate means that we have a one, and then it means that label becomes critical.

Teacher 1 03:21 One camper gets two-thirds of a pizza.

Mitchell And how did you do that?

Teacher 1 Because three two-thirds equals two pizzas. So one is equal to two-thirds of a pizza.

Mitchell All right, so what's it going to be over here? One camper to how many pizzas?

Teacher 1 Three-fifths of a pizza.

Mitchell 03:51 All right, if you were to judge right now, who's got the better deal when it comes to the pizza? Is it the Bear Camp or is it the Raccoon Camp?

Teacher 1 The Bears.

Mitchell Why the Bears?

Teacher 1 Because they get 66% of the pizza, and the Raccoons only get 60% of a pizza.

Mitchell 04:09 Now, that's not the only way to think about it because as soon as—this is the way you're thinking about it—you know you've got that kid in the back of the room who goes, "But I want to think about it as one pizza." If it's one pizza, how many campers will that feed for the Bear Camp?

Teacher 1 One and a half.

Mitchell And I'll write it as three-halves campers. On this one over here, one pizza will feed how many?

Teacher 2 Three-fifths?

Other teachers in background Five-thirds.

Mitchell Which one is it?

Other teachers Five-thirds.

Mitchell 04:45 Okay, this is the one that's going to become one, so I have to divide both sides by the three. So five-thirds of the campers. Which one is the better deal?

Teachers The Raccoons.

Mitchell 04:58 Raccoons? This one is for one and a half campers. One pizza will go for every one and a half campers. Over here, one pizza will go for every one and two-thirds campers. This is where you really have to stop and think about what's the relationship and where do I answer the question from. It's not just going for the bigger number, but it's the relationship that's existing within the problem.

05:30 This is the first problem on the sheet. It sets it up as saying, "A person who weighs 160 pounds on Earth will weigh 416 pounds on the planet Jupiter. How much will a person weigh on Jupiter who weighs 120 pounds on earth?" In setting it up, all I need to know is the relationship that exists from the problem. In this case, the Earth weight of 160 and it's given that Jupiter, then, I would weigh 416.

06:00 Now, all I am going to do is use that table, and I am just going to start to think of it multiplicatively. I am also going to keep in mind where I need to end up, 120 for what? For Earth. One way I could think about this is this: What if I just went and took 160 and the 416 and divided it by two? Is my relationship the same?

06:30 What you do to one, do it to both. You've still got that same relationship. All right, I'm at 80. If I go down to 40, which is, again, dividing by two. The 80 divided by two. The 208 divided by two. Where do I want to be?

Teacher 3 120.

Mitchell 06:57 120. Anything jumping out at you?

Teachers [Indiscernible.]

Mitchell Add the what?

Teacher 1 80 and 40 is 120. Add the 208 and the 104, then you have 312…

Mitchell I elected to multiply, but…there's yours.

Teacher 4 Or the 160 minus 40.

Mitchell Oh, nice. 160 get to here to the one 40. Subtract these two, and that would also give you your 120.

Teacher 4 16 minus 104, 312.

Mitchell 07:29 Nice.

The idea of this is that there isn't just one way to complete the chart. But the multiplicative comparison is based off of that unit rate, and it allows you to use that unit rate to do that comparison, but the questions are going to look different than what you have had from before. All right, so that's one that we will build on for tomorrow as we start to look at this thing called *proportion*.