DOINGWHATW⚡RKS

VIDEO
5:33 min

Full Details and Transcript

Multiple Interpretations of Fractions

Eliza Hart Spalding School of Math and Technology, Idaho
January 2011

Topic   **DEVELOPING EFFECTIVE FRACTIONS INSTRUCTION FOR K-8**

Highlights
» Math education professor Jonathan Brendefur describes professional development for teachers about fractions based on presenting multiple interpretations of fractions.

» He begins with fair sharing or part-whole interpretations but emphasizes how part-whole representations consist of unit fractions (e.g., three-fourths is three one-fourth pieces).

» He emphasizes the importance of multiple namings (e.g., four one-fourths or one whole) and the use of various representations.

» He continues with a measurement approach to interpreting fractions using a number line and then to fractions as ratios.

» Dr. Brendefur describes the importance of linking different representations, including iconic types of mathematical diagrams, to symbols.

About the Site   **Eliza Hart Spalding School of Math and Technology Boise, Idaho**

Demographics

» 89% White
» 6% Hispanic

- » 3% Asian
- » 1% Black
- » 15% Free or Reduced-Price Lunch
- » 3% English Language Learners

At Eliza Hart Spalding School of Math and Technology, a math and technology magnet, the focus is on developing students' mathematical thinking. Features of the program include the following:

- » A learning environment that supports using a variety of strategies in mathematical problem solving, reasoning and proof, and connections;
- » Use of models, manipulatives, and visual representations to support fractions instruction; and
- » Emphasis on mathematical discourse and communication to explain reasoning.

Full Transcript

📺 **00:05** Hi, my name is Dr. Jonathan Brendefur. I am a math education professor at Boise State University.

Fractions is a really difficult topic for a lot of elementary and middle school teachers. Students—I think we see from across United States—have a lot of difficulty achieving well with fractions. And so we use professional development, which is a really critical aspect of getting teachers to understand what are fractions and how you teach fractions, to frame fractions as a number of different types of interpretations.

📺 **00:37** When teachers are solely focused on fractions as a part-whole relationship, that does becomes a hindrance for teaching fractions. And so we would like to push them to look at a couple of things within that part-whole relationship for both the teachers and for the students. One is, the part-whole, the three-fourths, really consists of unit fractions, and so kids begin to start talking about three one-fourth pieces in there. So then when you switch and say, "Well, what

would five-fourths be?", that's when you want students to represent or talk about it as, "Hey, that's five one-fourth pieces."

📺 **01:14** So that's a very different take on looking at the relationship in the fractions, and then you can ask them to draw it. So one way would be a bar model where they say, "I filled up four one-fourth pieces; there's one. And I have an additional one-fourth piece." But then pushing them to the number line, the double line, where they are actually representing this continuous idea of multiple fourths. So you get to one-fourth, two one-fourth pieces, three one-fourth, four one-fourth, five one-fourth pieces, and then you can continue.

📺 **01:44** And you can actually represent on a number line those multiple namings because that becomes a difficult idea as well, that we have multiple names for fractions. So when we get to four-fourths, four one-fourth pieces, we can also represent that as one whole, and then we can also continue that. Teachers can press them to say, well, "What if we had twice as many parts? So now, there's eight parts." So that's also a representation of eight over eight. So it really starts changing our idea of what our focus is on the part-whole to something much greater, so focusing on the idea of equivalent pieces and then also this idea of a unit fraction.

📺 **02:26** So after the fair share and the part-whole interpretation, then we really start looking at fraction as number. What does that mean? A fraction's a point on the number line, and that's how mathematicians tend to look at it. But also, at that same time, we look at, well, where would a fraction be on a number line? How do you find it? And that starts moving toward continuing this idea of a partitive look from the fair share to also a measurement look at fractions.

📺 **02:56** So another example would be, with measurement, you have four cups of flour and each recipe takes three-fourths of a cup. And so you have this measurement idea of removing three-fourths of a cup each time for each recipe. But then that changes again when you start looking at a partitive division type of an idea within the context of fractions. And so that would be where you have four cups of flour,

but that only makes three-fourths of a recipe. So now even though the answer is going to be the same, in context those are two very different looks at a fraction.

🖥 **03:36** Now, and then the last way of looking at fractions, the last interpretation that we pose in our professional development, is as fractions move into ratios. We really work with the teachers to help build their knowledge to see, given a certain situation, how would you enact, how would you use different manipulatives, whether it's paper folding and paper cutting, to using the fraction rods, to then moving into iconic? In the iconic, we really focus not just on drawings of fractions, but really moving to different types of mathematical diagrams—usually the bar model and the number line or the double number line—to get a visual representation of the fractions. And then finally, attaching symbols and notation to all of that work in the enactive and iconic stage, then we have tied together those three modes of representing. And that tends to be really powerful.

🖥 **04:29** So I think to really deepen teachers' understanding of fractions is very critical, and we do it really in two parts. We focus on the situation, the context. So is there a contextualized problem, or is it just bare numbers? So what is the type of numbers; the situation becomes very important. And then we also focus on a second part that is sometimes missed: How do children develop these ideas? So it's two-part: What are the situations, and then what do students know or need to know to understand fractions? By opening up teachers' ideas of all these interpretations, all these different situations where you could be looking at fractions, then that becomes the first starting point where teachers say, "Ah, I understand what are fractions, how to teach fractions." And then they can now change their instructional strategies in the classroom to accommodate kids that are struggling.