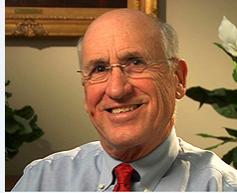


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 VIDEO
6:32 min

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What Teachers Need to Know About Teaching Fractions

Francis (Skip) Fennell, Ph.D.
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Topic DEVELOPING EFFECTIVE FRACTIONS INSTRUCTION FOR K-8

Highlights

- » Dr. Fennell discusses why there is so much interest currently in rational numbers, including the emphasis with the Common Core State Standards.
- » He looks at what it means for staff members to understand rational numbers at a deep level.
- » Teachers need to have more than one way to provide explanations related to rational numbers.
- » Teachers need to be able to represent fractions in a variety of ways, such as through pictures, number lines, and manipulatives including, virtual manipulatives.
- » Dr. Fennell uses pattern blocks to demonstrate fraction addition via creating equivalent fractions.
- » Teachers need to understand how to help students with number sense as it applies to fractions, including ordering and comparing fractions.
- » Problems occur when algorithms are simply taught without students developing conceptual knowledge.
- » Teachers need to know mathematics beyond their current grade-level assignments, including the mathematics specific to teaching.

About the Interviewee

Dr. Fennell is a mathematics educator and has experience as a classroom teacher, a principal, and a supervisor of instruction. He is currently the L. Stanley Bowlsbey Professor of Education and Graduate and Professional Studies (an endowed chair) at McDaniel College and a past president of the National Council of Teachers of Mathematics (NCTM).

He was a member of the writing teams for the *Principles and Standards for School Mathematics* (NCTM, 2000), *Curriculum Focal Points* (NCTM, 2006), and the *Common Core State Standards* (Council of Chief State School Officers, 2010). Dr. Fennell also served as a member of the National Mathematics Advisory Panel from May 2006 to April 2008. He currently directs the Brookhill Foundation-supported Elementary Mathematics Specialists and Teacher Leaders Project.

Full Transcript



 **00:00** I am Francis (Skip) Fennell. I am professor of education at McDaniel College in Westminster, Maryland. I direct the Elementary Mathematics Specialists and Teacher Leaders Project. I am also a past president of the National Council of Teachers of Mathematics.

 **00:17** If there is one thing about the Common Core State Standards, now adopted by over 40 states, that's really critical for the teachers at particularly grades 3 through middle school is the tremendous impact and influence of rational numbers. At a time when the Common Core State Standards are really showing a concerted effort and emphasis to work with fractions, all kinds of fractions, we must have teachers who understand fractions at a very deep level.

 **00:47** The obvious is, you sure need to know more than one way to do something. And as trivial as that sounds, I am in far too many classrooms where I see teachers get stuck because they only know one way to show it. A critical word is *representation*. I want you to be able to represent fractions, circular region, rectangular region, fractions as part of a group, fractions on the number line—be very conversant about, across all of those representations, and more importantly, tell me how this works in a context. It's one thing to say $1/3 \times 1/2$.

Another way to think about that is that's really saying one-third of a half. So that's really like dividing one-half and looking at a third of that amount. And is that that easier to see with a circular region, or is it easier to see a number line? Can you think of a situation where you might actually have a third of a half? I would want teachers to be comfortable with, and children to have access to, a number of manipulative materials that would help them see fraction as a part of region, fraction as a part of a set, fraction as a part of collection of objects, and so forth.

 **01:59** Here, let me demonstrate. These pattern blocks, for instance, here is a hexagon shape, and this red one can sit on the yellow one, and you can establish one-half. You can compare that to a situation where I am going to use a blue shape that is essentially one-third of this amount. Compare the two together and think about, well, what's $1/2 + 1/3$? We can see that it doesn't fill the entire amount. We are not really sure what that is, except this shape allows us to think about that because this green shape, which kind of fills it in to make a whole, is essentially a sixth. And I can confirm that by putting that across the blue to ensure that there are two greens, if you will, and a blue, and in the red shape three of those. So if I put $1/2$ and $1/3$ together, it's $5/6$.

 **03:00** Whether it's concrete materials or paper folding or drawings—and drawings are great—whether that's number lines or drawings of area regions or circular regions or what have you, all of those are ways to sort of conceptualize, if you will, this mathematics.

 **03:16** But let's also at least consider technology. Virtual manipulatives are out there. There are a number of them. I want students to be very comfortable in comparing and ordering fractions. That means that their teachers need to be comfortable in setting that up, setting those representations up, asking the right questions about what happens when I compare fractions and all the denominators are the same? What happens when I compare fractions and all the numerators are the same? When we compare a group of fractions, when all the numerators are the same but denominators are different?

For instance, $5/3$ and $5/8$ and $5/6$ and $5/7$ or whatever—when we compare those, the smaller the denominator, the larger the fraction. And that’s always a kind of a wow moment for lots of kids and frankly lots of teachers, because it goes against what they are learning with wholes.

 **04:14** I want to make a particular point about multiplication division, because when we think about those two operations, first of all, when we teach those two operations, the actual algorithms are very simply taught, and unfortunately this is part of our problem. If I want to think about $1/3 \times 1/2$, $1/3$ of $1/2$, I am dividing. This is where we have that sort of convergence of curriculum. When I multiply fractions, most of the time things get smaller. $1/3$ of $1/2$ is $1/6$. So all of a sudden, these kids who are, again, spending a lot of time with whole numbers and generally things get bigger—when they multiply fractions, generally things get smaller.

 **04:56** We owe it to children to have them really understand well why they do things. That, frankly, is one of the major obstacles, if you will, of sense of number. If kids were understanding about what happens when we multiply and what happens when we divide, then they would be able to look at their quotient and their product and know that it makes sense.

 **05:18** It’s really important that teachers understand mathematics way beyond their particular assignment. The goal for me is for you to understand the mathematics that’s coming to you and goes way beyond your particular assignment or level for this academic year. What we are actually in a perfect position to do right now is to really focus on the content background, the mathematical background of the teacher, and that’s at the pre-service level and it’s also in professional development. But it’s really investing in the mathematics that’s unique to teaching the subject, and that’s different than if you have a higher-level mathematics that one might study at the collegiate level. It’s saying, let’s unpack, in this case, fractions and see how that plays out.

 **06:03** Perfect opportunities to get at lots of what we are talking about here—a variety of representations, different ways to think about fractions and how they are contextualized in our society, thinking about ways to use materials to help convey those representations. All of those, in my opinion, are prime territory for content explorations for teachers inservice, and I think we are going to see more of that.