

Leaders in Mathematical Thinking

Jill Gough - Building Conceptual Understanding through Visualization

>> We're going to talk about building conceptual understanding of both fractions and ratios and proportional reasoning. Often our students struggle with both of those concepts, and in fact, some teachers don't have clarity of language about what makes a fraction versus a ratio. And we're too casual with our language, and our goal is to deepen our students' understanding so that they're competent and confident in their mathematics ability to solve problems. And we're going to do that by some visualization. Can you show what you know more than one way, to build visual language and common verbal language for our students? I have been studying the work of Sunni Brown, who wrote "The Doodle Revolution," for about two years. And in her book, she posits that you remember, understand and retain more if you can visually represent your ideas. We use technology to visualize math all of the time. But are we helping our students make a brain connection to what they see on the screen? Often, our students are passively moving things around on the screen, and not stopping to observe, to notice and note, to make hypotheses and ask themselves questions that they can then answer. So we're going to talk about using technology to do the heavy lifting, so that students can take time to think about and see and ask questions, and see if they can answer for themselves. And all along the way, we're going to draw pictures, to note and understand so that they retain it longer and understand it better. I hate when I walk around and a child hides their work, or a teacher, for that matter, because at school, lots of times, we've set a goal to learn more math together. We should be a community of learners. Mistakes are where you learn. In "The Talent Code," Daniel Coyle talks about not thrashing around blindly, which we see students do often in math. Oh look, two numbers -- do something with them. I have a 50-50 shot. Whether that's add, subtract, multiply, divide, integrate, differentiate -- yaay! Instead of thrashing around blindly, we want them to reach in a targeted manner. And if they make a mistake, we want them to go back and do it again, but take a different tact instead of just trying the same thing again and again and again. In lots of cases, we use dry erase markers so that students can draft like they do in English. Here's my first draft -- uh-oh, that one didn't work out well. Okay, I'm going to learn from that, I'm going to try again. And we do the redrafting process with peer editing, just like they do in English and social studies to write about math, to increase our precision of language and our understanding as well. And we know that if you're not making mistakes, you are not working on the edge of your ability. And that's where we want every learner in our classrooms -- I want to work on the edge, I want to make mistakes so that I can overcome the obstacle in front of me. In the presentation that I'm going to make this week, I am going to present ratios and proportional reasoning, and show how ratios and fractions are graphed. And it is a big "aha," and on the screen at the TI-Nspire, you see a table built, as well as a graph drawn at the same time, so the children can see pictures, numbers and symbols all at the same time, and begin to see those connections. Many students are drawn to the table. I am not. I am always drawn to the graph. But when they're all together at the same time, everybody makes connections, and then we turn and talk so that we share and become more flexible

in our understanding, because we have the benefit of others' ideas. Well, I think the visualization work is really strong. I had the opportunity to work in literacy as well as math. And I'm connecting the work of the literacy teachers to the work of the math teachers. When we talk with the same language, we notice, we note, we make rough drafts. We write new drafts and get peer edits in math and science, just like they do in English and social studies. Our students see that we're not doing different things to them or with them. It's all interlaced and connected. The processes are what we're looking for, and that product just happens to be whatever subject we are working on together. So how to sketch ideas, how to illustrate, here's an idea that I had. This is what the picture looks like in my head, making my thinking visible so that others can see and ask me clarifying questions. It's the most exciting thing I've done this school year, is just being able to help kids show me what they know. And if they can draw me a sketch, they can write a paragraph to go with it. It seems to unlock an idea, and particularly, a math student's struggle with writing. And once they get the table, the graph, in a doodle, they can talk about it in words, which attaches meaning in a very different way.