Math in Action
Thinking like a Mathematician

>> ... another way that we can get it, instead of length times width times height. Equals –

>> So why don't we just take six times two?

>> Math in action is really important for students to really, truly understand the mathematics, and to think like mathematicians. How would you go about calculating the volume of that cereal box?

>> I would use a measuring tape. Or, if it was a small package, maybe a ruler. Then I would identify all of the measurements; length, width and height, and then slowly work towards the volume.

>> There is really strong discourse that takes place when you set up these opportunities.

>> So now, I have a challenge for you. I'd like you to build it in two different configurations altogether.

>> Put this here.

>> No, it's touching the bottom square.

>> Two...

>> What I would write is, "Our knowledge of volume is..." dot, dot, dot. "We know that for volume, you have to times the length and the width and the height." Well, sometimes when you're doing math, you're, like, I have to add this, I have to add that, I have to find the volume of this," and everything. And then if you're thinking like a mathematician, and you're, like, "Oh, yeah, I get to do this math, and I get to do my job of being a mathematician, and I get to find out all these things, so I can learn and I can teach these people about my knowledge of math."

>> You need a structure to know, and to calculate the volume of the structures.

>> So this is an opportunity to take your idea and pair it with the ideas of other students in the room.

>> You guys, I think this one's a good idea.

>> Yeah, I think that's the best.

>> Yeah, we'll take that.

>> Without this environment, I would have not learned a lot of stuff.

>> When you're doing math, you might think, oh, this is going to be really boring. But maybe when we're doing something fun, thinking like a mathematician would be, like, "Oh, if we put this here, this might happen," and you're actually thinking, other than being bored that you're doing math.

>> Yeah, like you said, if you think it as you're a mathematician, you can think and expand your ideas. And you actually like it, so you get to do more work done, and you discover more things.

>> When you're just doing math, you're, like, "Oh, I have to do math." And then when you're being a mathematician, it's kind of like your passion that you're actually doing math.

>> I have found that we can talk to kids about mind-set and having a growth mind-set. And they'll sort of get some of that. But sometimes they'll remember it and sometimes they don't. But what's really important is to give them very specific examples. So one of the things I think is very powerful that we now know from evidence, is, we now know that when you make a mistake in math, your brain grows. There's synapse, there's fire and there's brain growth that happens. But when you get work right in math, there's no brain growth. So this has huge implications. It means we want kids making mistakes in math. We want them working on hard, challenging work. So actually working with kids to reposition mistakes has a big impact on their learning. Good teachers have always said, "Oh, mistakes are helpful, they help you learn," but this is a different way of communicating to kids. Mistakes are more than helpful. We need making mistakes, that when your brain grows. When kids get that idea, that changes everything for them, because up to that point, they often think, "I make a mistake, I'm not a math person." And they just give up. So we need to teach them that having a growth mind-set comes out when you have -- when you face mistakes, and when you face hard challenges.

>> A key thing in mathematics is, you never just believe something because someone told you the result. You always understand the reason for it. So when a mathematician thinks of a theorem, in their mind, they bring up the proof, and why that theorem depends on something else and something else and something else. There's this whole chain of relationships that they see as a pattern, as a structure of which theorem or equation or whatever. It's getting people to be questioning and understanding why something is true, rather than just memorizing facts, is one of the key steps.

>> Mathematicians are willing to have, like, thought experiments, are willing to muck around with things, are willing to even try to figure out what the problem itself is, not just play with problems everybody already knows the answer to.