I think I heard you say something about that at the beginning of the school year, right before the school year started, your whole staff did an investigation of thinking about rates? So I'm wondering how that sort of changed, maybe how you approached it this year, compared to how you did it in a different year? How those experiences relate?

We did, we were, granted, literally, two days of time to work as a math staff, and … math staff? Yes. Why did that sound off? It's late in the day. And we focused on a particular, one of the things… content pieces we wanted to focus on was slope.

So we looked at slope across the grade levels, and we looked at functions, generally, just the content and skills and concept of those ideas as a staff. And for our own understanding. So without going too deep into that, there was certainly… that just having that community dialogue was a huge basis for conversations around rate.

You know, you were talking about slope, and so as I was looking at some of the student posters, I was noticing they were using slope, too,

Which is not how I would typically think middle school students would approach the problem. Let's go over and look at some of them.

They've worked out the rates, so can you talk me through the problem so that it makes sense to me, so that I know what's going on?

The problem asks the students about, if Tom is running, if Tom runs for 4 seconds and goes 6 yards, and Diane runs 5 yards in 3 seconds, Who's running faster? And the problem intentionally gave one of the rates with seconds in yards, in that order, and one of the rates is yards-seconds.

They've obviously put the terms … on like levels at that point. But it's so who's running the fastest in 30 yards, is generally the question. So this student has really like shown us two different ways of sort of making that same sense, so they have the 20 seconds and 30 yards, And the 1.5 yards per second, and the 1.6 yards per second. So a really nice convincing job.

So after looking at that, then it was really interesting to see that graph and how really close together those rates are.

Diane would be at 16 yards… that would've been nice.

So, well, this highlights what's so difficult about, and you need a transition from a number line when we're talking about ratios, to either a double number line, or a graph.

Because Yet, the single y doesn't do it.

Because time, is not, it's not both for every 3 seconds, or every 1 second. So they have yards, but they can't represent the second … a linear…. So did they have like little words above them? I can't read that part.

Interesting! Diane… it does. Diane at 3 seconds is at 5 yards. And Tom at 4 seconds is at 6 yards. So it says "I'm winning—a little."

Interesting that this has Tom winning, it looks like.

Yeah, because they're not relating both of the components at the same time.

And then here, Tom is behind. "I'm losing." "Who's going to win?" So let's see. We don't have a time anymore. They've dropped time off.

And I was actually surprised … I thought this 15 would be…

So that should have been…

Yeah.

So and then they have it here. But so … this whole idea of that the linear is troublesome gets us over here to …

In a fourth grade classroom in particular, we were really investigating, with a different MARS task, with Granny's Balloon Ride.

How students were using, in 4th grade they were using a bar graph to represent two pieces of information, which now we're calling a rate in 6th grade.

And they're wanting to use a bar graph when in fact the problem itself was using a Cartesian graph. So points.

So we did a bunch of work in a 4th grade classroom, different students, to grapple with this idea, and noticed that kids get sort of stuck in this idea

Of a bar graph. And what does that mean, when before they've learned that a point can hold two bits of information.

So I was looking at this Diane versus Tom, I feel like in a sense it's accurately graphed, although there are no labels here.

So this would be seconds, and this would be yards. But it doesn't tell us anything. And I don't think it told the students anything.
05:55 Their work is clearly explained, and we've blown this up, that their statement is quite clear and their conclusion is accurate,
06:03 But I would love to ask these students what this graph means to them.
06:06 So this is more like one of those things that I always talk about, when students are doing something to please the teacher,
06:12 Because they need a multiple representation, but it has no sense-making for them. All the sense-making is coming over here.
06:21 The only thing I would add to what you just said is that I think there is an accuracy here. They've made sense of it to a degree,
06:31 In order to get this far as representing it, but it doesn't help them go all the way. Doesn't help them come to that conclusion in the end.
06:40 Right, absolutely.
06:42 There's a MARS task on Lawnmowing, where people are doing things at different rates of time, and that's really hard for them to think
about.
06:53 What happens if they work together? So there's some kind of nice posters here … do you think somebody could explain one of these to me?
07:04 So the problem was one... Tammy could clean up an area in, half of any area. She could clean up half of any area in one hour.
07:20 And Melissa could clean up 1/3 of an area in one hour. If they worked together, how quickly could they clean up that area?
07:30 The interesting thing with this problem for the kids was they were given no values, they were given no area,
07:35 So they struggled, you know, with what's the area? Tell me the area! I'll find half of it, and a third of it, and so… it really got them back into
working with fractions,
07:47 And… which is always a very scary thing for a kid to put a fraction within a rate.
07:56 I was just thinking of that tortoise and hare problem that they never finish, because if they got this much done combined, and then
somebody did a half and a third,
08:06 There would always be an area left. So I was blown away that they could make more sense of it than I could.
08:12 Because they could actually figure out that it took another 12 minutes to do the rest of it. And I thought "They're going to work this all
infinitely to get this all done!"
08:23 Another thing that stood out to a few teachers when looking at level C was that only a few of the groups used these rectangular area
models,
08:35 Where more groups used circle…. Kind of pie graph models. Which becomes really difficult when you are trying to identify a sixth of a
circle without a compass or a protractor.
08:54 Yeah, where it's much clearer. Using the nice rectangular models.
09:01 I know that there was a third grade class at one of our elementary schools, that took the one sixth left after each of them had done their
one hour of cleaning,
09:13 And gave each of the kids strips that big to figure out, within an area, how many of those strips fit in. It worked out well,
09:23 And for the third graders to really see that.
09:27 Oh, nice!
09:28 I have to say that this third grade teacher has… she recently read from front to back Li Ping Ma's book, around division of fractions and
other things.
09:39 It's kind of spreading, hopefully like wildfire, that more people are asking to learn from it.
09:46 Okay, so fascinating, so! I've run out of questions, but do you guys have any final comments about the lesson, or
09:56 You know, I think from beginning to end it's been a really interesting process, because we don't ... at the 6th grade level, we don't use
textbooks. Can I say that on tape?
10:05 Yes.
10:06 It's okay? We don't. So we put together our own curriculum, and a lot of it comes from these deep discoveries, you know, of …
10:14 Our best... our best units come from when we take the time to do these deep discoveries. And ... so seeing the 3.5-4 weeks ago, the
jumping-off point,
10:25 And where they are now, and very little formal instruction as to rates, ratios. I mean, there were some, obviously. There's going to be
some teacher-led discussions.
10:38 But how far they had come has been really amazing. I've been doing this long enough to not be impressed by many things.
10:49 And it's really blown me away, this particular unit. It will be used again next year, for sure.
10:58 As Becca said, there are many jumping-off points for 7th grade, and for 8th grade. You know. Which I'll be teaching next year.
11:10 So do you sort of do one of those circle things like they do?
11:13 No.
11:14 It's just a schedule…
11:15 I just have the lucky, position.
11:21 All right, okay!
11:22 All right!
11:23 Do we feel done?