

00:00 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

00:09 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?

00:22 How those experiences relate?

00:25 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.

00:41 And we focused on a particular, one of the things... content pieces we wanted to focus on was slope.

00:50 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.

01:04 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.

01:21 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,

01:30 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.

01:38 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?

01:45 Right. 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,

02:03 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.

02:15 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. 02:30 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, 02:42 And the 1.5 yards per second, and the 1.6 yards per second. So a really nice convincing job.

02:54 So after looking at that, then it was really interesting to see that graph and how really close together those rates are.

03:07 Diane would be at 16 yards... that would've been nice.

03:14 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.

03:28 Because

03:30 Yet, the single y doesn't do it.

03:31 Because time, is not, it's not both for every 3 seconds, or every 1 second.

03:38 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

03:49 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."

04:01 Interesting that this has Tom winning, it looks like.

04:07 Yeah, because they're not relating both of the components at the same time.

04:13 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. 04:25 And I was actually surprised ... I thought this 15 would be...

04:32 So that should have been...

04:34 Yeah.

04:36 So and then they have it here. But so ... this whole idea of that the linear is troublesome gets us over here to ...

04:45 In a fourth grade classroom in particular, we were really investigating, with a different MARS task, with Granny's Balloon Ride.

04:54 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.

05:05 And they're wanting to use a bar graph when in fact the problem itself was using a Cartesian graph. So points.

05:17 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

05:29 Of a bar graph. And what does that mean, when before they've learned that a point can hold two bits of information.

05:38 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.

05:47 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  $\frac{1}{3}$  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?