00:00 In one of the points that you wanted the observers to look for were those changes in language.

00:08 You talked about how you heard the changes in language, either you going around or in discussion.

00:16 Are there others who would like to speak to that? Did they go from, I think you said earlier, in the pre-lesson, going from kid language to the more academic language?

00:24 Or were they using those terms the students had developed through the work on sorting the graphs?

00:30 Some of you like to speak?

00:33 When the kids began the task, I went through the same thing you thought, that "Oh my god, they got this."

00:42 Because first thing that came out, I observed Gracie, Cameron, Niall and Isabelle, first thing that came out of Gracie's mouth was "that's a negative slope."

00:53 And then Cameron, "That's an undefined slope." And then Niall, "That's a zero slope." I'm "Oh my god, these kids got this!"

00:59 But as it went on, so the change in language, um, didn't go in the direction that you, that I expected it, from you know, unsophisticated description to use of math language,

01:23 And it didn't actually deteriorate, I was shocked by how they had it instantly.

01:29 I was at the same group too, and they had the same thing. They came up with "All these ones were linear."

01:34 I had to take a double-take when I heard that, they wrote down all the quadratics, you know.

01:38 So I was thinking, "Oh, you know, maybe they don't know!" So I was refocused, maybe, they had this language to describe things,

01:48 But they were just a little bit off. And so as you progressed through the lesson, and asked more pointed questions, you got them to redefine what "linear" and "non-linear" was.

02:00 And then it dovetailed more with the mathematical language that they already had, and their sense-making.

02:07 There was one student, Sam, I think it was Same, who you had describing, "the line doesn't go anywhere." So there's the language, "there's no rise over run,"

02:19 "There's no slope," So within a matter of three sentences that came out of his mouth, from informal to saying "no rise", and then "no slope."

02:30 I thought that was a perfect example of someone kind of, their language getting more mathematical in describing.

02:39 There's perfect examples of, at the end of the year we've taught all this stuff, we've covered common ground, "This is the y axis," we've said a thousand times.

02:51 But kids haven't had… you know, in most lessons kids don't have the opportunity to say it even three times.

03:01 And it's through that having to say it, having someone else question it, having to defend it, which when necessary a protocol is a good thing for,

03:10 How to think out loud, have somebody else raise questions when they don't agree, saying "Isn't that the x axis? I thought that was the x axis."

03:20 Having to work that out, those are the mistakes that I assume no kid in my class is mistaking the x axis and the y axis.

03:28 Because I've gone over it so many times that they must know it. It must be internalized by now. But it's not.

03:34 I'm overlooking those things on a daily basis. So, you know.

03:43 It seemed like they were mostly looking at the graphs. They'd settle on one graph, and cycle through the equations, trying to plug in numbers and see if that lined up with the graph.

03:52 So that was definitely their point of reference. I was also going to mention that I thought it was a really, really brilliant lesson, that I will be stealing.

04:04 You know, it plays into differentiation, it plays into this desire to categorize, and so they dug right in right away.

04:14 And it really opened up, they got into debates about which ones should go in which category. It didn't have to be all the academic language.

04:22 The kids were, "These ones were all lines." "Positive slopes, we can put them in there." So I just thought it was really really, a really great lesson.

04:35 You were talking about the protocol. One thing, one person just sort of established themselves as the leader,

04:41 And they were kind of…the other kids were kind of rolling with that one student.

04:47 Which group was it?

04:49 Which group? Uh…

04:50 Connor, and Tegram, Sam, and Michael.

04:55 It was Connor, Tegram, Sam, and Michael. You were standing next to me.

05:00 And there was…the one boy..

05:03 Michael.

05:04 …in the corner. Michael. Was sort of taking charge. Not that he completely ran the show, but they were definitely sort of checking with him quite a bit.

05:15 I thought one thing, and maybe you don't necessarily want to do this, because it didn't break down in all the groups,

05:21 Maybe like having a kitchen timer or something for each turn, to just make sure that everyone got a chance to talk it out.

05:30 But you know, you guys stopping by the group sort of took care of that.

05:34 I remember, Jesse, you came by the group and said "Is it your turn? Okay, so you should be talking." And then it sort of put them right back on track.

05:43 But yeah. Really really fabulous lesson, I thought.

05:50 You had come originally to the group, and you said, "Does everybody agree with Michael?" and they said, "Yes!"

05:53 And you said, "He must always be right." Or something. And they all said, "Yeah."

05:56 Well none of them were listening to him while he was talking!

05:59 So they took one of the equations where the horizontal was on the 4. And Connor had matched an equation with the graph.

06:09 And then Michael said "Oh no no, you're wrong." And I look at Margie, and I'm like, "Isn't he right?" And she looks, and Connor was correct,

06:17 But they were so convinced that Michael was right, they just took another equation and put it over there.

06:24 And then all of a sudden someone said, "Well, wait a minute," and they had it, and Margie and I were second guessing ourselves. Plugging everything in.

06:32 So it was interesting, because they were gonna let Michael, you know, say that this was right. And they did, luckily, before time ran out, figured out

06:40 Connor was correct, and then was able.

06:43 In the equation they were trying to match, they were getting down to sort of the end of the pile,

06:49 And they couldn't find what they wanted from the match with the table and the equation and so on.

06:55 And so Michael said, "Well, I'm just gonna make my own." And he sat there and he made his own.

06:59 And that finally convinced him. Nothing that was there was gonna help him, but by actually making his own and doing the values and so on,

07:08 He found the match.

07:10 That was a question we had on the way over here to lunch. There isn't a one, to one, to one correspondence. There were some wild cards.

07:18 Sometimes they'll get an equation and it won't have a table for it and vice versa.

07:23 And we weren't sure if that adds a level of frustration, or if it provides more open-endedness and requires them to dig deeper.

07:30 So it's a balance. Like if it's too frustrating, then that's not good. We weren't sure how to go on that.

07:38 Those higher kids who were, like Michael, they were gonna do their own chart, because they didn't see it there. I didn't see the frustration. 07:46 I saw a positive side for that.

07:50 I had the same group. I think our girls just went like (shrug) and went with something else.

07:57 In that particular group we had, I think, Ann, who really was just an observer.

08:04 But when they came to that one, I wondered what they would do. And they kind of just skipped over it, I think.

08:10 They found something that was agreeable to them, and they put that down. And then went on to the next one.

08:16 That's what actually made me think about the language, whether the language actually helped them,

08:22 Or if that was a separate thing that they could say, "Yes, I know one there, I know slope. I know y-intercept.

08:27 So when I'm doing the matching, I'm going to go to the least, or the simplest thing I know, which is matching up points with numbers.

08:33 So they got out a piece of paper, and made x, y tables, and then found something that matched.
08:39 They didn't even really seem to look at the graphs. They pretty much did table and equation.
08:46 And if they found that match, they would look to see if there was maybe a graph that kind of worked.
08:54 The group I was watching, they had the graph and were trying to get the table, and they found one that matched, but they couldn't find the actual equation.
08:59 And they were looking, and going through, but they realized it wasn't there. And then just listening to their conversation, of what the equation would have been,
09:04 Well it was y = 4, but they had said y = x +4 –x.
09:11 Oh!
09:12 They're like, "Well, you add this, you add…" I thought it was really interesting how they derived it.
09:17 Interesting!
09:19 The group that I was watching… and I thought that you did a fantastic job of pulling the language out of them, the constant, and the y-intercept
09:30 Because they weren't really even looking at the equations until you were saying "What's similar."
09:36 I took away the… and said, "What if we didn't have this."
09:37 You took the tables away. Then it forced them to look at the different graphs that all went through 4. That the y-intercept was 4 or -4 or whatever it was.
09:47 On a couple of these graphs. At that point they started using that.
09:51 Landon wrote about that on his reflection.
09:53 Oh, did he? I didn't see his reflection.
09:55 On another point, in that same group, you also stopped in, Jake, and said "Now, whose turn is it?" You got them back on track.
10:01 And even though only one of them was speaking, Landon was doing this (pointing).
10:09 I don't know if I'd catch that, as a teacher, if I was in there by myself. But how do you stop that?
10:14 I mean, you've set up the protocols, you say "Only one person's speaking at a time," but then you're always going to have that bossy, in-charge one.
10:22 Also in regards to language I thought you did an awesome job coming and speaking their language, you're like "How many days left of school? When do you get out?"
10:32 This guy's gonna do a lesson about 5/20, 6/12, 15 days of school, it's gonna be brilliant.
10:36 And then also, by, it's hilarious to hear you think about, "Oh my god, they know the language, what am I gonna do?"
10:40 And then he tells you the linear parabola group.
10:45 And what you were thinking during that time, because you were like so smooth and calm,
10:48 I was like, this is so cool. No judgment, validating it, showing him that we just want to work through the language, and then just the structure of the lesson,
10:55 I think it worked so much opportunity for group interaction, my group did follow the protocol, from person to person to person,
11:04 And the opportunity for language that you guys were looking for was built in really well, facilitated for the students. Nice to watch.
11:12 Also, I was gonna bring up the y = x + 4 – x, because it was cool hearing them reason that out from the table.
11:20 What group was that?
11:21 Uh, that was Dylan. That was the linear parabola group.
11:25 What we've heard so often is "the argument rests in the mathematics, not in the person offering the solution or the suggestion."
11:34 So that whole thing about linear, where is the linear in the graphs that you've shown.
11:39 Just making, making the working of it rest on the mathematics, I thought was very strong.
11:47 So that the person that offered that, it wasn't about that person, who offered the, the term. But it was about the mathematics of it. Very strong.
11:56 So it looks like we're breaking up. I would like to thank you again for a wonderful lesson. Are there any last thoughts?
12:04 (applause)

12:07 I thank you both. It was, and sharing it was once again a treat, to be able to look at that. I just, I mean, as much as we can talk about that lesson in all sorts of ways

12:18 And I just want to get back to this idea of, you know, when I talk all the time about the depth of knowledge and the higher cognitive demand,

12:27 When you get down to level 4, one of the words is "connections."

12:31 And the thing is that those students had a lot of knowledge. They had it. They used vocabulary. They can talk about the graph, individually about the graph.

12:42 They can talk about the equations. They can talk about the t-chart.

12:49 But when you had all three of them, it was almost overwhelming for them to be able to navigate and connect those things.

12:57 And that is a really sophisticated idea that we almost never do in math class.

13:03 So I think this was a wonderful lesson to let us know that there is so much work that still needs to be done. 13:09 We can feel real smug and confident that the kids know what the slope is, rise over run, and all these things. 13:17 But to be able to connect these three is a really powerful idea. Thank you so much for sharing that with us. 13:24 The more we can do math meaning-making. (applause)