Video Supplement

Norms for Watching Video (if not using your own)

- Speak from the "I" perspective. For example: "If I could rewind the tape and ask students a question, I would ask…"
- Be inquisitive, not judgmental. For example: "I wonder what might happen if," instead of "the teachers should have…"
- Justify your ideas and conjectures based on the video clip, and not other parts of the lesson that you didn't see. For example: "I think that the student understands...because in the video she…"
- Focus on how what you learned from the video might help you implement this (or similar lessons) with your own students.

School Context

- School Type: Urban Public School
- School Demographic Information (approximate):
    - Students of color: 70%
    - Free and reduced lunch: 25%
    - English language learners: <5%
    - Students with special needs: 10%

Lesson Context

- Subject: Middle School Algebra
- Unit: Exponents
- Number of students in class: 24
- Lesson duration: 90 minutes
- Prior preparation: Students have been taught the exponential identities, and they completed and turned in the pre-work prior to class

Video Context

In the video, which has two segments, students from a group are working on the card sort activity that is central to the lesson. In each scenario, the students have called the teacher over in order to discuss an issue they are having matching cards, who is working to formatively assess the knowledge that the group has.

Discussion Questions

Formative Assessment: *Do classroom discussions include my thinking? Does instruction respond to my thinking and help me think more deeply?*

1. What do students appear to understand and misunderstand about specific mathematical ideas?
2. As a teacher, what questions might we ask or moves might we make that respond to students' thinking and help them to think more deeply about important mathematical ideas?

Video Transcript

Legend		
T	Teacher	Per and within dialogue
S1 – S4	Students 1 - 4	Per and within dialogue
C	Class	Per and within dialogue
[ ]	Actions/Non-verbal	Dialogue
{{x}}	Sounds like	Dialogue
{{}}	Inaudible	Dialogue

1	S1:	0:02	Is there a limit of how many like, of these can go into the blue cards?
2	T:		Why are you asking that?
3	S1:		Because we found four of the cards go with one card
4	T:		Say it one more time?
5	S1:		Four of the white index cards go with the one blue one.
6	T:		You're saying…
7	S1:		They're all equal to two to the fifth power.
8	T:		Ok, can you, so, since there is four of them, can each of you choose one and tell me why it's equivalent to 2 to the fifth?
9	S2:		Well, 2 to the second power plus 2 to the third power, that is 2 to the fifth power. You add the exponents.
10	T:	0:36	How do we know that? Sorry.
11	S2:		So, 2 to the second power…
12	T:		So, can I have just everyone listen to what S2 is saying?
13	S2:		2 to the second power
14	T:		Show them the card

15	S2:		That would equal to 4, and then 2 to the third power, that would equal 8, 4 + 8 = 12.
16	T:		Ok, and you are saying 2 to the fifth is equal to 12?
17	S1:		Because, when the bases are the same you add the exponents. So, it's 2 plus 3 is five, so it's like that. And for this one, you have like, if have a parenthesis, if you have an exponent inside the parentheses with one outside.
18	T:	1:12	S4, can you hear what they are saying over here? [Turns to S1] Can you speak a little louder so they can hear you?
19	S1:		So, I am saying, when you have a base, when you have 2 to the x power, when you have like an equation like this, when one exponent is inside the parentheses and one's outside, in the video it says you are supposed to multiply them. Wait,
20	T:		Ok, but we are looking at…Those are the ones we're looking at. This [pointing the white and blue cards on S1's notebook] is kind of what we are…Oh, but you're saying that might be something else?
21	S1:	1:40	Yeah.
22	T:		Hmm.
23	S2		2 to the fifth is 32 [showing his whiteboard to all, see Figure 1].
24	T:		So S2, you're saying…Can you tell the group what you just did?

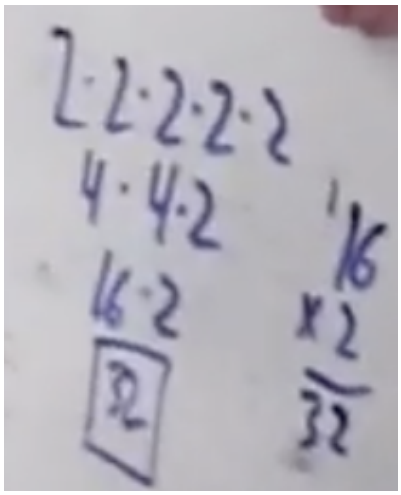

FIGURE 1

25	S2:		[Pointing to his whiteboard, see Figure 1]So, I did 2 to the fifth power and that equals 32.
26	T:		Make sure S4 can see it. So, hmm, so do we think that this expression…[all shake heads, implying no]. Ok, that's ok.
27	S2:	2:10	Using a power of 2.

28	S1:		I know, I know. We do 2, we do 3 to the second power, that's 9 right, plus, and then we can do 3 to the first power, that's 3 right? 9 plus 3, that's 12.
29	S2:		9 plus 3 equals 12.
30	S1:		Then, don't you add these[pointing to 3^2+3^1 on S2's whiteboard]?
31	S2:		I mean, are there any other like equations {{that one}}?
32	S1:		Don't you like add these [pointing to 3^2+3^1 on S2's whiteboard again]? And then that's 3 to the third power, that's twenty…
33	S3:	2:42	What's 2 to the power of -2? Doesn't that equal to -4?
34	S2:		No, 'cause we're dividing.
35	S1:		No, no, no, that's 1 over 4. 'Cause when the exponent is negative that's when, um, you put a 1, um, when the exponent is negative you turn it into a fraction, where it's 1 over and then 2 to the, your base times the exponent, base to the exponent.
36	S2:		So y equals 2 to the 1
37	S1:		For example, say it was 2 to the -3^{rd} power, that'd be 1 over 2 to the 3^{rd} power.
38	S3:	3:16	What's 2 to the 5^{th}? Isn't that 32?
39	S2:		That's 32.
40	S1:		Since we're dividing, you subtract right? So if you're subtracting, then you get
41	S2:		32.
42	S1:		But that's…subtraction, but then this is a negative, so that's where you put the parentheses
43	S2:		Yeah, and then 'cause it's dividing, and you have to subtract it anyway, but since this is already a negative, negative plus negative equals positive.
44	T:	3:47	Two and a half minutes to get your thinking on chart paper please [Giving directions to all groups, then approaching the small group of S1-S4].So these are the ones that we are sure about?
45	S3:		We still have some but,
46	T:		Ok, that's fine.
47	S1:		We're sure about this one. So the thing is, that, I thought that it was 3 to the uh, 3 to the 2^{nd} power times, 3 to the 2^{nd} power plus 3 to the first power, but then, if you see these are the same and don't I have to add the exponents?
48	T:		Can you write that down? You didn't say either of these, can you write that down.
49	S1:		No, I'm saying it for this.

50	T:	04:28	Can you write it down?
51	S1:		[Goes over what he wrote on the whiteboard, he has the expression "3^2+3^1" on his whiteboard, inaudible dialogue]
52	T:		Ok.
53 54	S1:		Um, 9 plus 3 is 12. But, then since the bases are the same, don't you have to add the exponents?
55	T:		I don't know, maybe you should put that question to the group. So that sounds like, you had a similar, what was the card, that you had before. So, something like this [pointing at a white card] So, here, you have bases are the same, and what operation are we talking about?
56	S1:		Addition
57	T:		So, we have the same thing here [pointing at S1's whiteboard], so you're saying this might be when you say equivalent to 3 to the what?
58	S1:	5:18	3 to the 3rd power?
59	T:		Can you write that down? So, let's evaluate that, what is 3 to the 2nd power?
60	S1:		9.
61	T:		And what is 3 to the first power?
62	S1:		3.
63	T:		Is 9 plus 3 equal to 27?
64	S1:		No [shaking his head].
65	T:		So you, did you just disprove your conjecture?
66	S1:		Sorta. So you only add when you multiply?
67	T:		Does that work all the time with multiplication? If I had, so let's change that addition to multiplication.
68	S2:	5:57	Oh wait, but isn't that the same thing as 3 to the 3rd power because, 3 times 3 and then there's another multiplication by another 3
69	T:		So it works for this example, why don't you try another example, why don't we use this one [pointing at a white card], so, change this plus to a multiplication and see if it's going to work and then test it out. It's a great idea to test out.
70	S2:	6:26	So, 2 times two 2 times, because of this multiplication, yeah, this works. That's how this works because of this multiplication sign [pointing at his whiteboard, see Figure 2].

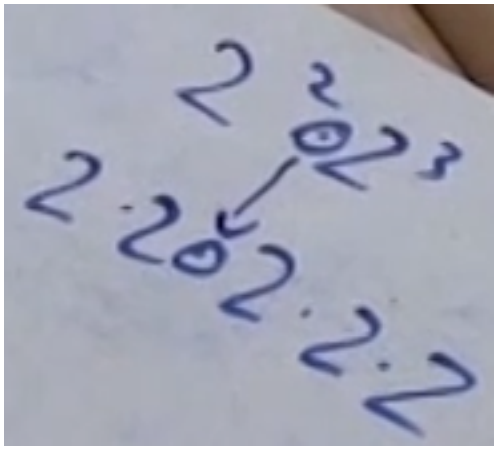

FIGURE 2

71 S1: Yeah, it works. So 2 times 2 times, because of this multiplication