Noticing With Respect To _____

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What are examples of things MTEs might want a teacher to notice in the midst of teaching?

students’ strategies	student strengths	motivational posters
evidence of student understanding	extent to which students speak with confidence/authority	wrong or right
connections between concepts	productive dispositions	
student struggle	status	
student misconceptions	level of engagement	
interactions between students	behavior	use of technologies/tools

Framing Noticing

Cognitive-psychological perspective

“human perception is limited…. teachers must learn to pay attention to certain instructional aspects while disregarding other aspects” (König et al., 2022, p. 3)

Framing Noticing

Noticing Within Contributions

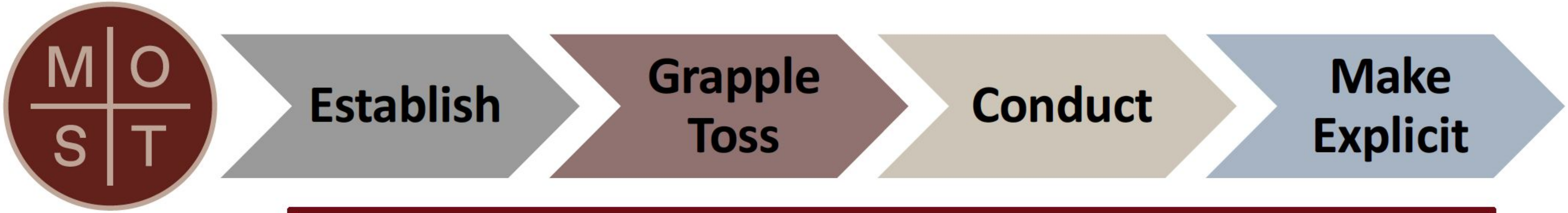
- attending, interpreting, deciding (Jacobs et al., 2010)

Noticing Among Contributions

- responsive teaching (Robertson et al., 2016)
- shaping (van Es & Sherin, 2021)

Stockero, S. L., Leatham, K. R., Van Zoest, L. R., & Peterson, B. E. (2017). Noticing distinctions among and within instances of student mathematical thinking. In E. O. Schack, M. H. Fisher, & J. A. Wilhelm (Eds.), *Teacher noticing: Bridging and broadening perspectives, contexts, and frameworks* (pp. 467-480). Springer International. https://doi.org/10.1007/978-3-319-46753-5_27

A **M**athematical **O**pportunity in **S**tudent **T**hinking (**MOST**) is a high-leverage student contribution made during whole-class interaction ("teachable moment")



Building on a MOST

Building engages the class in making sense of the MOST to better understand the mathematics of the MOST.

Context for Theorizing

Conceptualize Building

MOST-Eliciting Prompt:
Points on a Line

Is it possible to select a point B on the y-axis so that the line $x + y = 6$ goes through both points A (3, 0) and B? Explain why or why not.

Coded enactments for teacher actions that either facilitated or hindered the overall practice of building

Analyze Instantiations

- Four prompts to elicit predictable MOSTs
- 27 videorecorded enactments

Create Instantiations of Building

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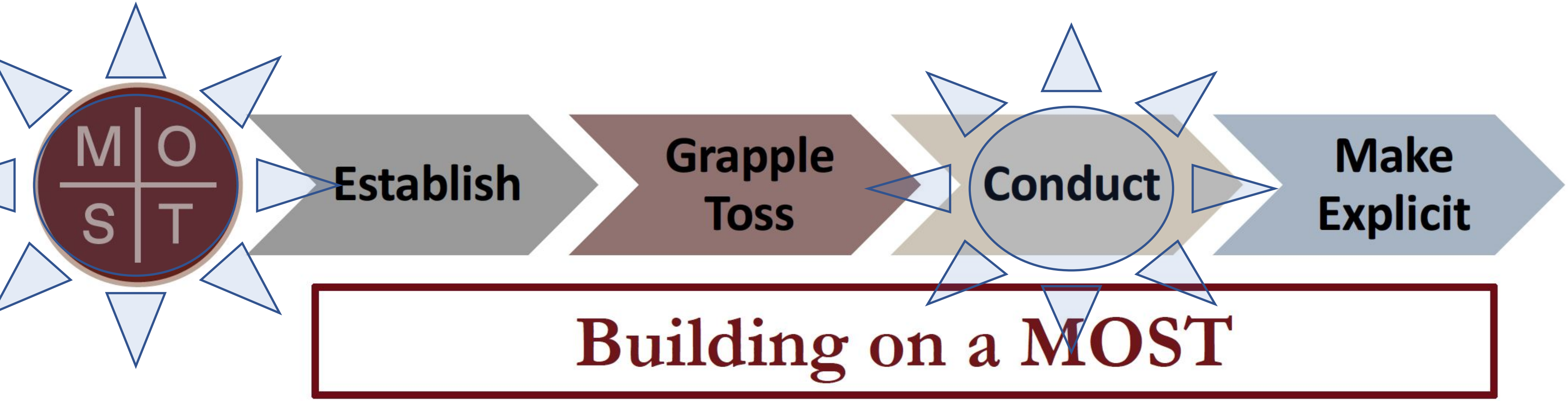
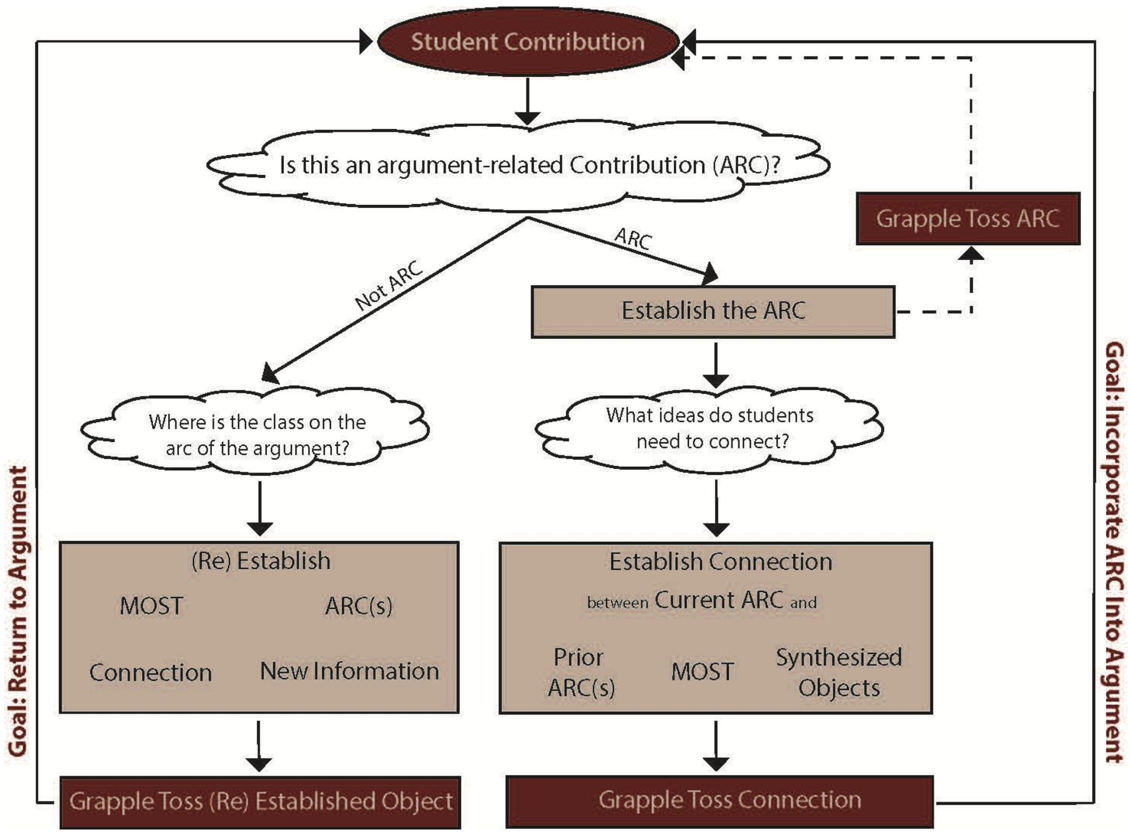


Building engages the class in making sense of the MOST to better understand the mathematics of the MOST.

Conduct

Goal: support the whole class to co-construct an argument that makes sense of the mathematics of the MOST



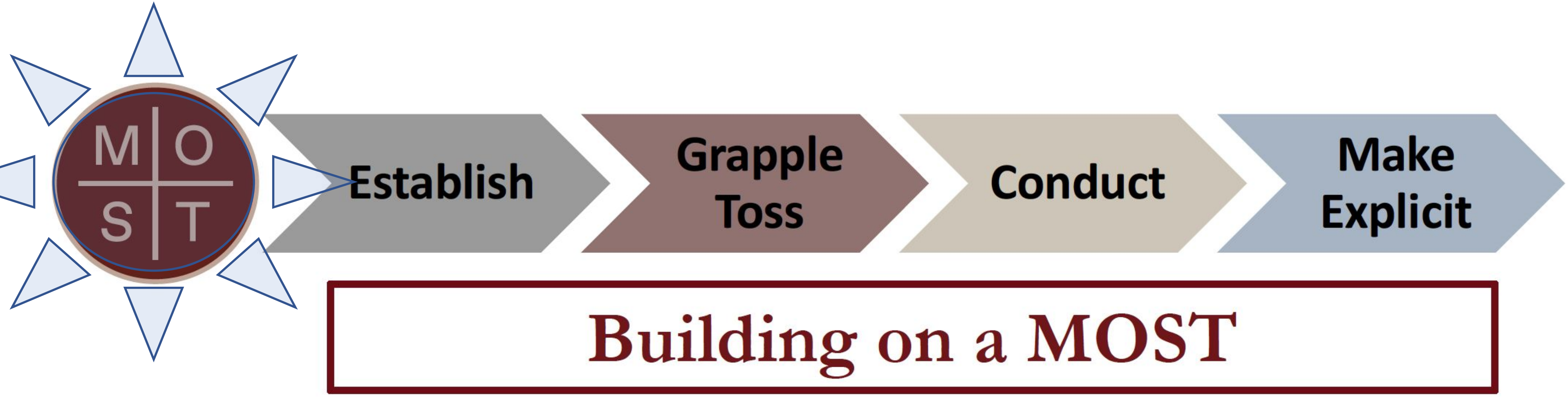
Theoretical Question

Given that capitalizing on a MOST requires the teacher to engage in an iterative noticing process as other students contribute their ideas to make sense of that MOST…

How do teachers need to engage in noticing activities to keep the class focused on making sense of a MOST?

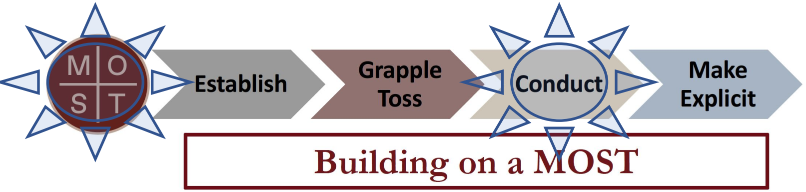
Noticing *With Respect To* (WRT)

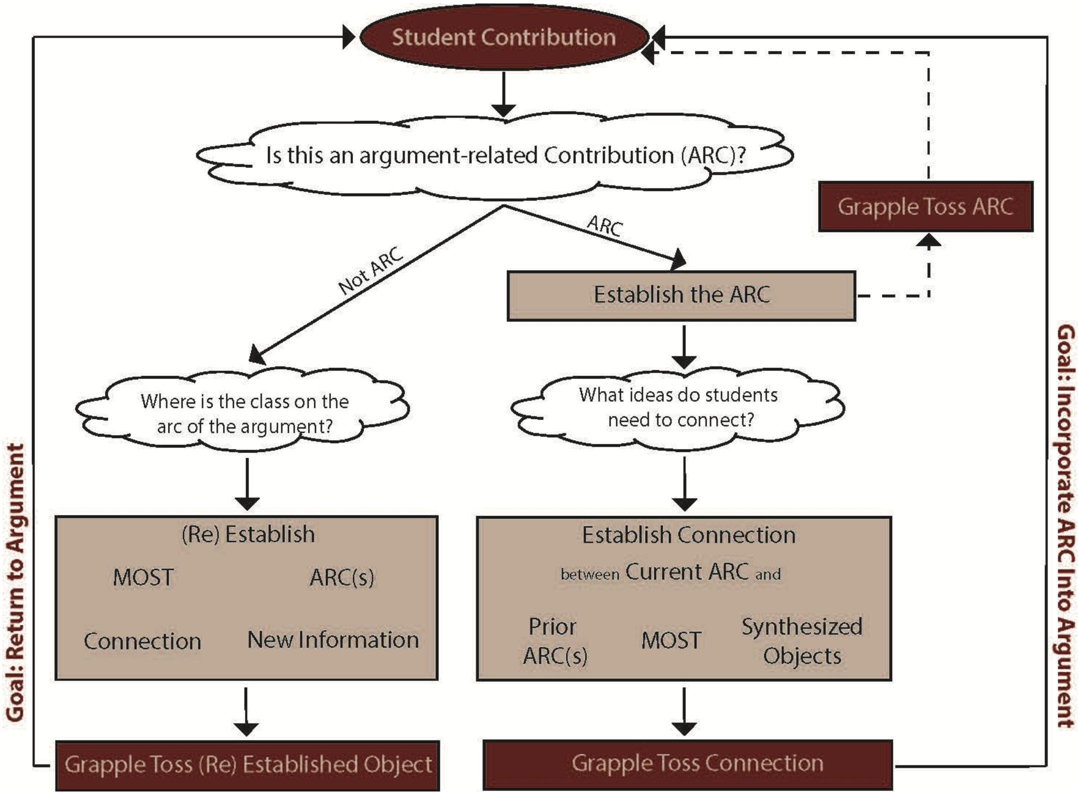
- Initial Critical Event: A MOST
    - student contributions need to be noticed with respect to (WRT) whether they embody the characteristics of a MOST (Leatham et al., 2015)
- Once a MOST is recognized and the teacher decides to build on it, teachers' noticing needs to change



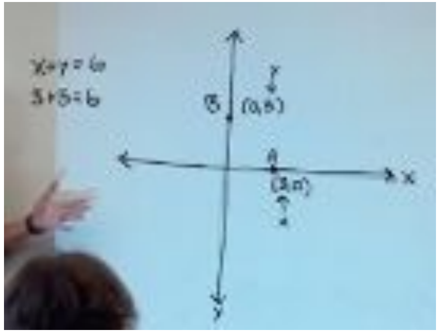
Noticing *With Respect To* (WRT)

- While conducting, student contributions need to be noticed WRT:
  - the MOST that is being built upon
  - the argument that is being co-constructed as the class makes sense of the MOST

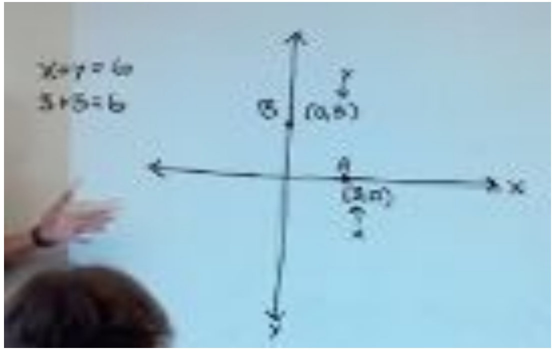




Example: Noticing a MOST

MOST-Eliciting Prompt: ***Points on a Line***	**MOST:** ***Valerie's (Incorrect) Contribution***	**Mathematical Point**
Is it possible to select a point *B* on the y-axis so that the line $x + y = 6$ goes through both points *A* (3, 0) and *B*? Explain why or why not.	"Yes. Point B is (0, 3) because you get 3 + 3 = 6" [x-value from A and y-value from B]. 	An ordered pair, (x, y), is a solution of an equation (and is therefore on the graph of that equation) if, when both x and y are substituted into the equation, the equation is true.

Example: Noticing WRT the MOST



Teacher: …[W]hat do you find mathematically compelling or mathematically conflicting about this idea? [*Pointing to public record.*] Aaron, I saw a hand.

Aaron: Um, I was thinking, I mean it makes sense like 3 plus 3 equals 6 but the x plus y equals 6 is the equation for the line so I did x plus y equals 6. [*Teacher adds* x + y = 6 *to board.*]

Aaron: And **I did slope intercept form so I subtracted the x from the side of the y and I got y equals 6 minus x, the line for that was through (0, 6) on the y-axis and uh, and (6,0) on the x-axis.** [*Teacher adds* y = 6 - x *to board.*]

Teacher: Okay, I'm gonna pause you because what **you're starting to do right now is talk about what you did and I want to talk about this idea.** [*Gestures to public record.*]

Example: Noticing WRT the MOST

Yuri: I was, kinda like what [Aaron] said, **it's not possible with that line on the graph through A so that you can have both A and B on the line**.

Teacher: Okay, again, so, so what's conflicting, are you conflicted by this then? *[Gestures towards board.]*

Yuri: Well, yeah cause **it's not a linear equation. It's not how you graph a line.**

Teacher: But I'm seeing x plus y equals 6 [*Points to the "x+y=6" for Valerie's claim.*] <Yuri: Right but that's-> and then I'm seeing this point (0,3) [*Points at point B.*], and (3,0). [*Points at point A.*] **I'm asking you to talk about this idea. Try to redirect you to this. Aaron?**

Example: Noticing WRT the MOST

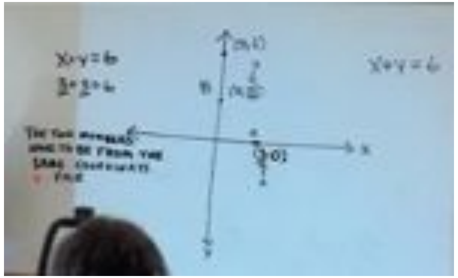
Aaron: If, if you're looking at that, **the coordinates on the graph aren't values of x and y** [*Teacher erases slope intercept form.*] **and so replacing x and y with those 3's would be saying that the x and y are like values in an equation. But, what you want to do is take the x and y and use it as a line.**

Yuri: **Like you can't just pick different coordinates from whatever different points all around the graph. They have to be in the same…**

Teacher: Ahh, that's important. Say that again. **That's a really important idea. Say that again?**

Yuri: Like, they have to be, **the two numbers have to be from the same coordinate pair. You can't just pick from whatever point around the graph that you want.**

Example: Noticing WRT the Co-Constructed Argument



Teacher: **I'm gonna try to write that.** Say that again, the two numbers…

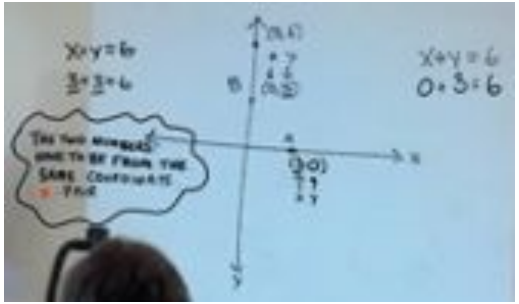
Yuri: Have to be like, from the same coordinate pair, you can't pick from anywhere. Just to make it work.

Teacher: [*Writes Yuri's idea on the board.*] **Okay this is an important idea. The two numbers you put into the equation is it- How did you say it? Have to be from the same point? Is that what you said?**

Yuri: Uh, yeah.

[*Teacher finishes adding to the board and confirms that she correctly recorded Yuri's idea.*]

Example: Noticing WRT the Co-Constructed Argument

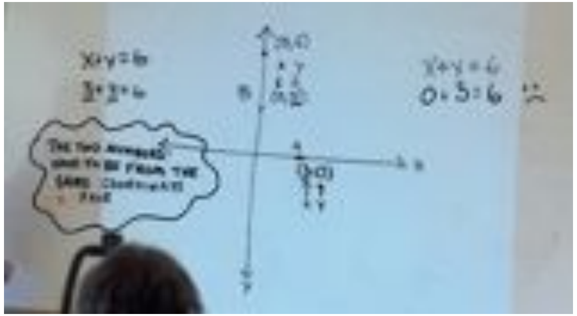


Larry: **But that would still be 3 plus 3. You're adding x's and y's together, it's just 3 plus 0 and 3 plus 0**.

Teacher: Uh… did you hear what he said? *<Many students argue at once.>*

Teacher: [*Circles Yuri's contribution on the board.*] So, I'm trying to revoice Yuri here. **Yuri said you can't take the 3 from [point B] and the 3 from [point A] to use in this equation** [*Points to x + y = 6.*] **and that if we're going to use [point B], then we use [the 0] as the x** [*draws an arrow pointing to it labeling it x.*] **in the equation and [the 3] is the y** [*draws an arrow pointing to it labeling it y.*] **in the equation, so this would have to be 0 plus 3 equals 6**. [*Writes 0+3=6 on the board under the equation.*]

Example: Noticing WRT the Co-Constructed Argument



Teacher: Valerie, I want to check back in with you real quick. What are you hearing?

Valerie: I’m just like so confused on like, okay so he said like the x and y both stand for different things right? Well what do they stand for cause **I’m really confused on the 3 plus 0 equals 6**.

Teacher: Yeah so **I wrote that because if [point B**] **was on the line, then 0 plus 3 would have to equal 6, which obviously it doesn’t right?** [*Adds frown to board.*]

Dakota: It would have to be (0,6) if it were on that line.

Take Aways

- Our work extends prior work on the initial noticing of critical events to the noticing that occurs in the follow-up to a teacher's initial noticing.
- The work highlights the importance of noticing with respect to something—what we call *noticing WRT*.
- Teachers are always noticing with respect to something; to move the field forward it seems important (for teachers and teacher educators) to be explicit about what that something is and when and how it might change during the course of instruction.

Discussion

- Choose one of the things that was identified as important to notice. What are other noticing WRTs that would support/relate to that initial noticing?
- How might the construct of noticing WRT influence our work as MTEs?

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Thank you!

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Additional Noticing WRT in Building

- We prioritized mathematics as we focused on noticing WRT student mathematical thinking
- We might also have considered how noticing WRT issues of equity and social justice might influence the teaching practice of building
  - How issues of equity can be infused into existing teaching and research frames that did not take them into account during their development (e.g., Goffney et al., 2023; Goffney et al., 2024).
  - Noticing WRT *whose* MOSTs are taken up and *who* is contributing to constructing the argument.
  - Noticing WRT equity could help teachers disrupt rather than maintain the patterns of inequity in mathematics classrooms that have been well-established (see, for example, Louie et al., 2021).