Wait, what are we talking about? (Re)focusing students during whole class discussion

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M O S T

Background

- Engaging students in discussion focused on making sense of other students' mathematical contributions is a hallmark of effective mathematics instruction (NCTM, 2014).
- Such discussions support student learning (e.g., Bishop, 2021; Jacobs et al., 2007; Webb et al., 2019).
- The "mere sharing of ideas does not necessarily generate learning" (Chazan & Ball, 1999, p. 7).

Important Teacher Roles during Whole-Class Discussion

- "[E]stablishing and monitoring a common ground" (Staples, 2007, p. 172)
- Re-establishing the common ground as it "accumulates and changes as a joint activity advances over time" (Staples, 2007, p. 180)
- Guiding the mathematics of the discussion (Arnesen & Rø, 2024; Conner et al., 2014; Staples, 2007)
- Making "high-potential mathematical reasoning moves" to prevent the class' joint sense making from stalling (Staples, 2007, p. 179)

Effective student-centered instruction requires substantial and intentional teacher work— mathematical work for teaching that positions the students to do mathematical work for learning.

A MOST is a **M**athematical **O**pportunity in **S**tudent **T**hinking

Establish → **Grapple Toss** → **Conduct** → **Make Explicit**

Building on a MOST

The goal of building is to engage the class in constructing a sense-making argument about the MOST.

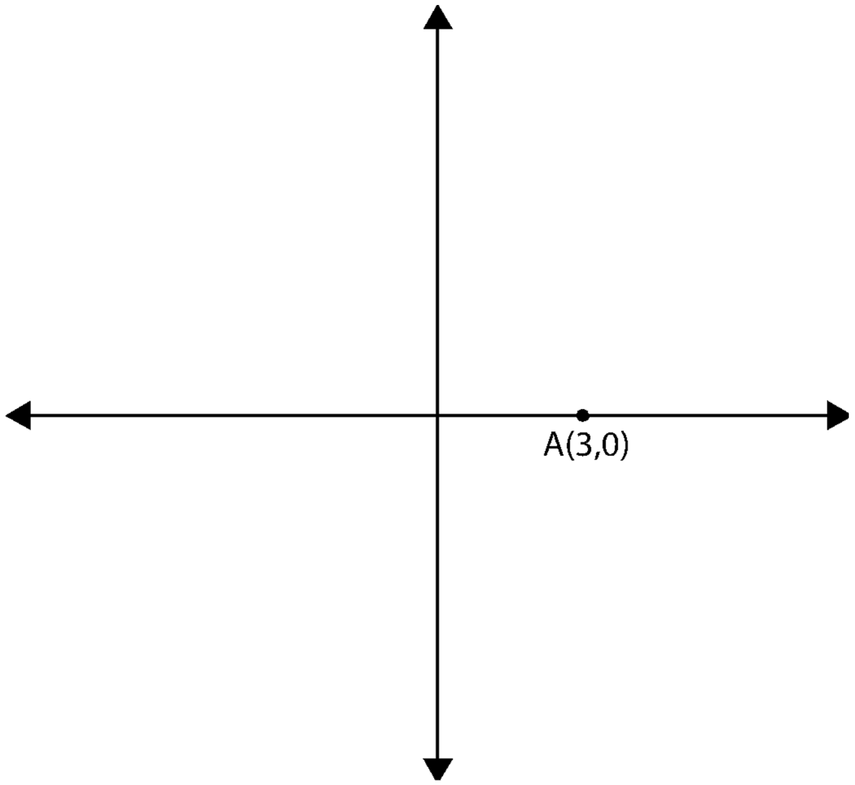
What are some of the challenges you've encountered around keeping students focused during a sense-making discussion?

Points on a Line Task

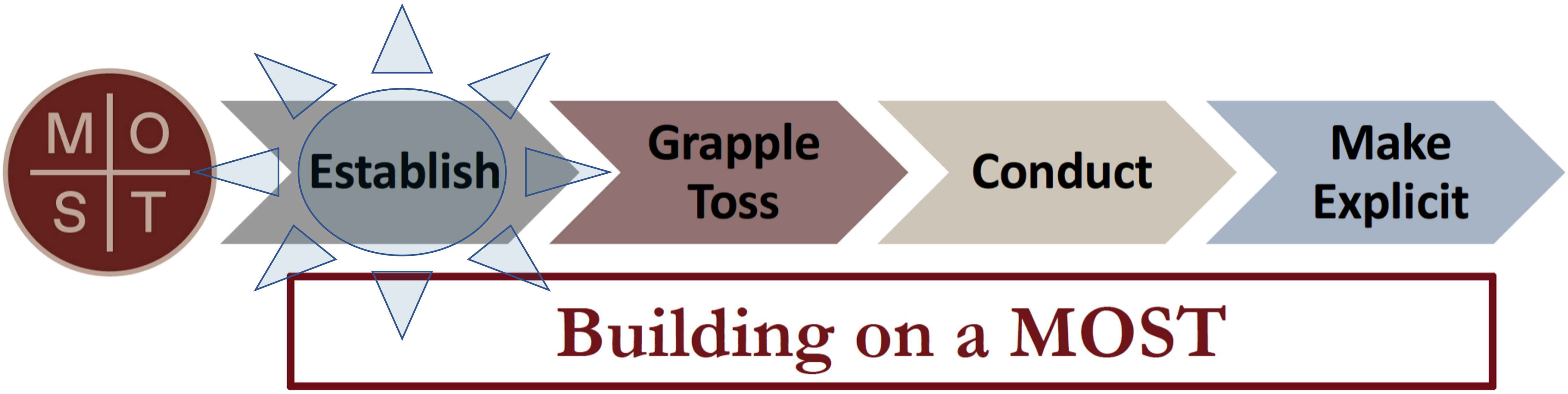
Is it possible to select a point B on the y-axis so that the line x + y = 6 goes through both points A and B? Explain why or why not.

Common Student Thinking: *"If you plug x = 3 into the equation, you get y = 3. So B is (0, 3) because 3 + 3 = 6."*

Mathematical Point: *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.*

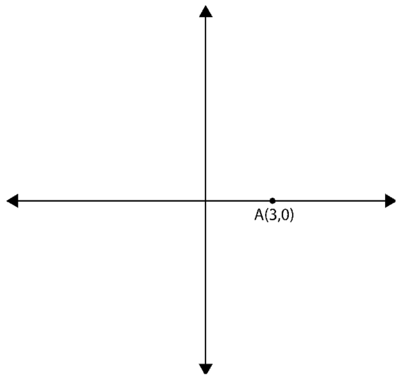


Focusing Students at the Start of a Sense-Making Discussion



Make the Contribution Precise

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



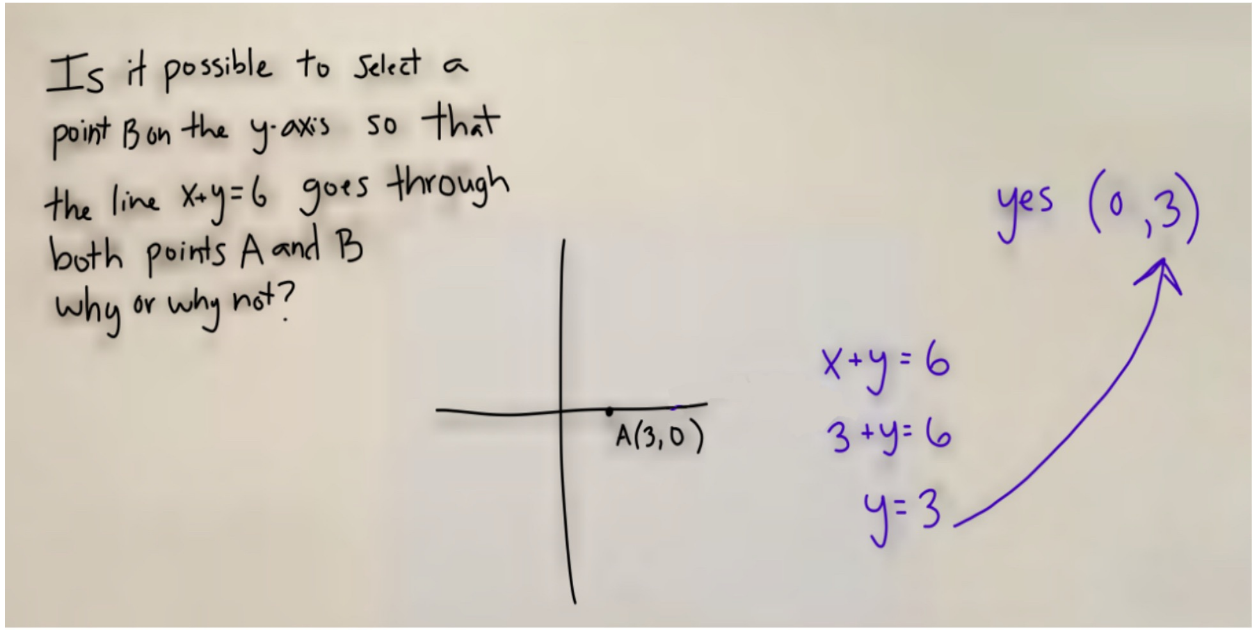
Student:

So I said, yes, if the point B was (0,3) because I plugged in x from the point into the equation. So then I just did 3 plus y equals 6 which is 3, so then, the y-intercept would be (0,3).

Make the Contribution Precise

Teacher:

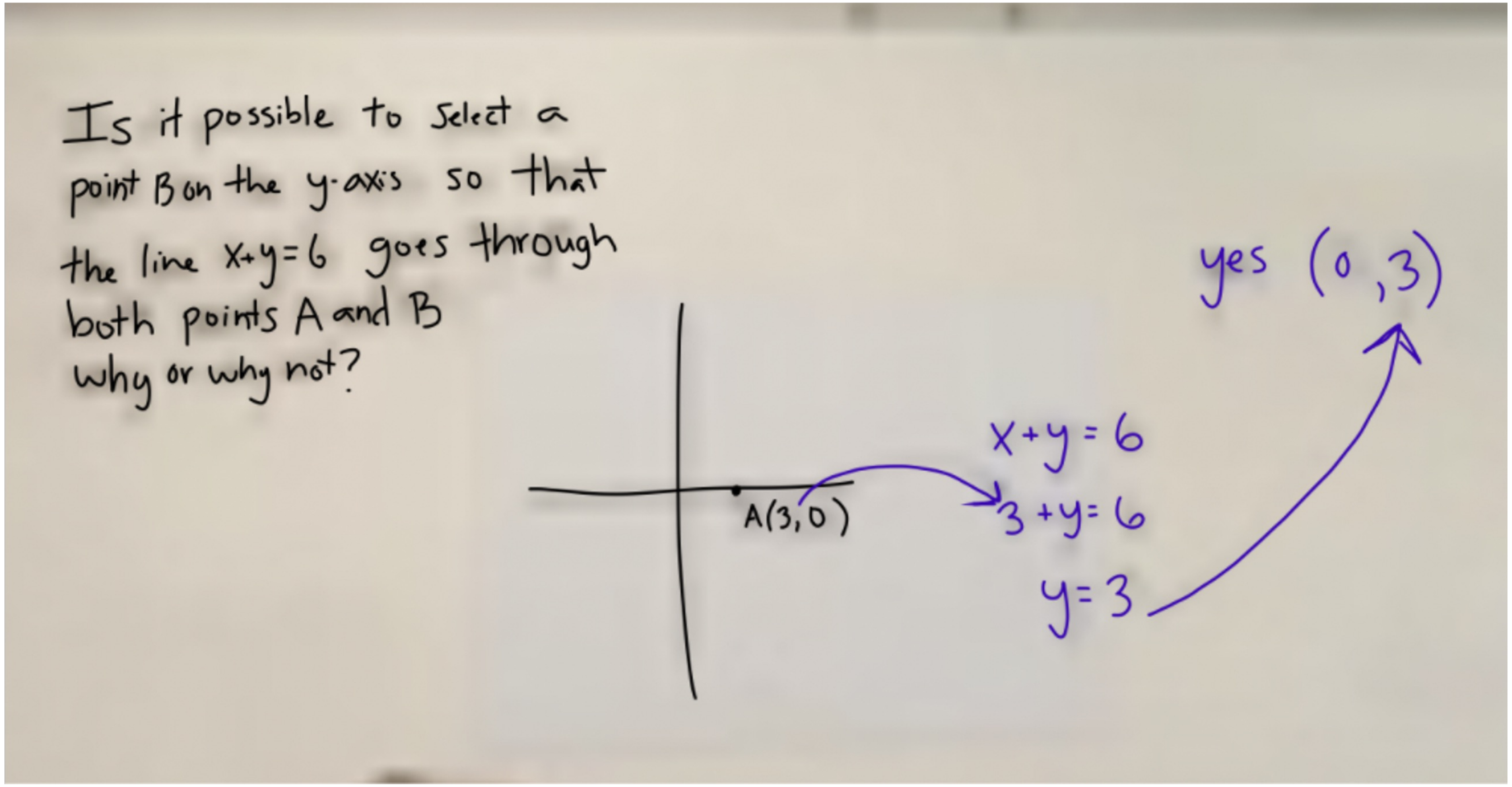
Where did you get this 3 that you plugged in? [pointing to the 3 in the equation 3 + y = 6]



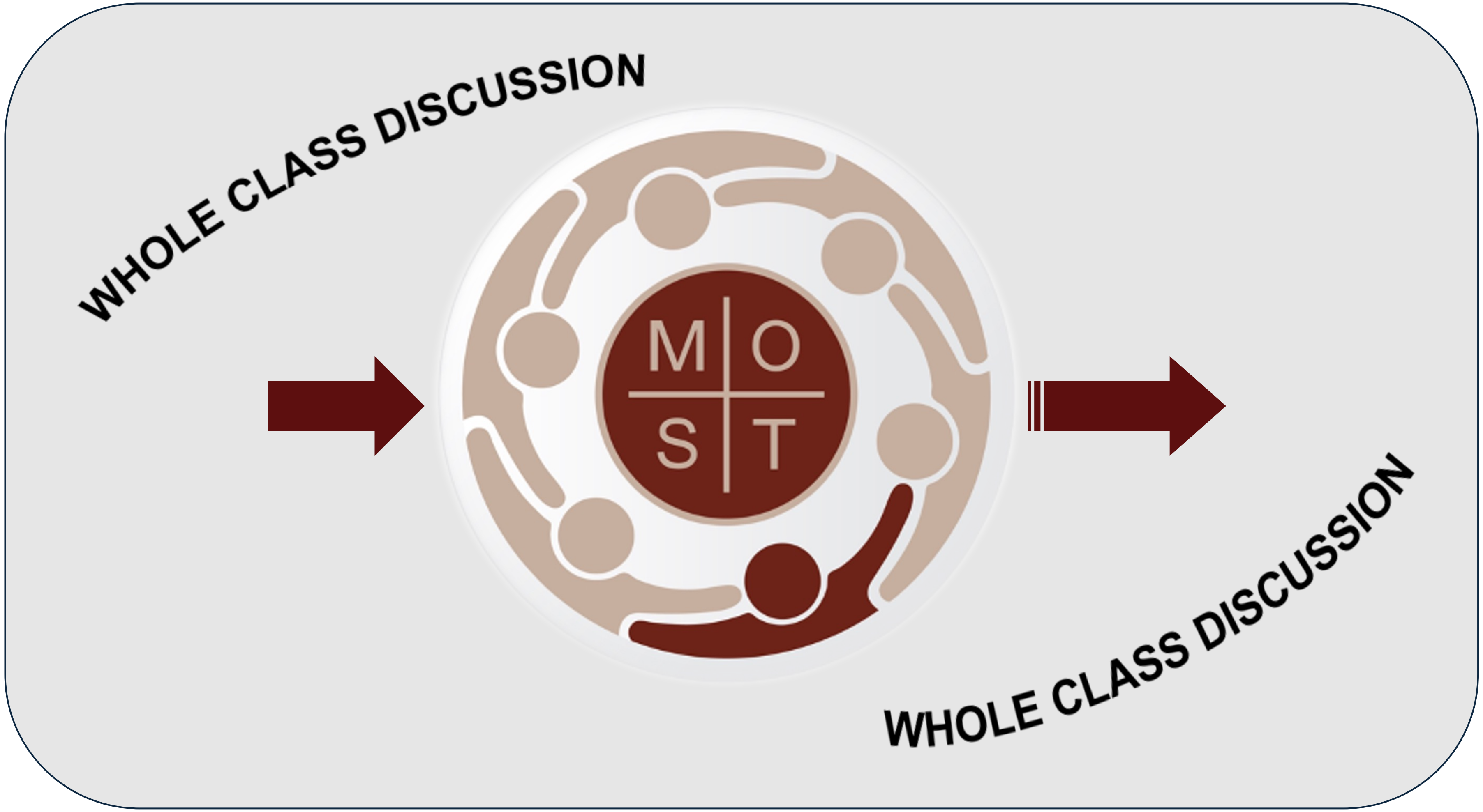
Student:

From the point A.

Make the Contribution an Object



Create a ‘Conversational Bubble’



Create a 'Conversational Bubble'

Teacher:

Awesome. Okay so **let's pause for a minute and just think about Kara's solution, this solution on the board.** What I want us to think about is how does this reasoning hold up mathematically?

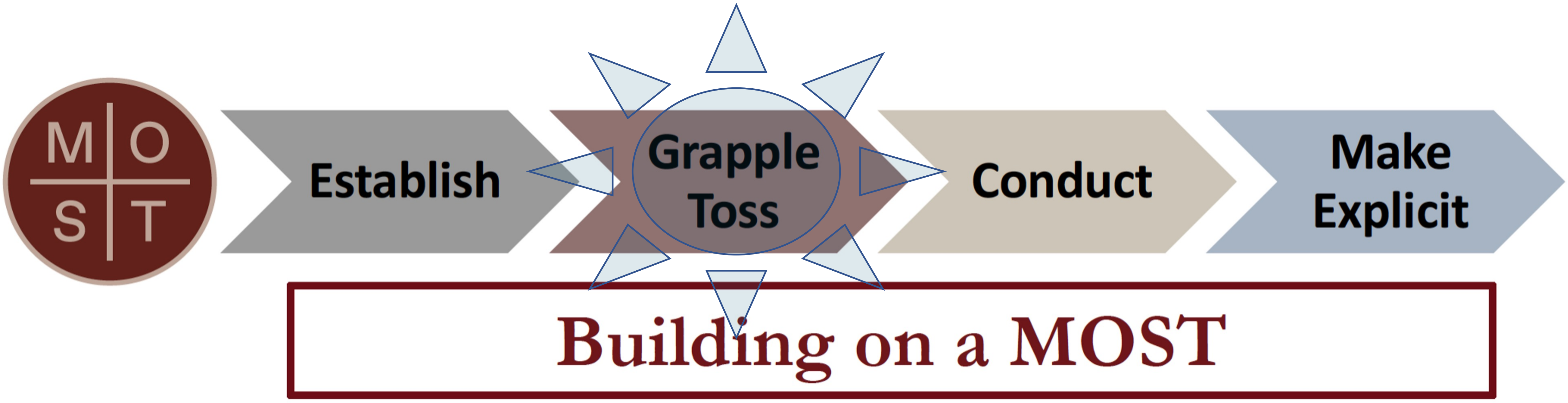
So even if this solution might be different than yours, we're just gonna take a minute and evaluate this idea. How does it hold up mathematically?

Starting a discussion:

What are other classroom situations when you would want students to focus on a specific idea? How might the focusing actions we identified apply to these situations?

- Make the contribution precise
- Make the contribution an object
- Create a conversational bubble

Focusing when Turning a Contribution Over to the Class



Provide a Clear Object

Teacher:

Awesome. Okay so let's pause for a minute and just **think about Kara's solution, this solution on the board.** What I want us to think about is how does this reasoning hold up mathematically?

So even if this solution might be different than yours, we're just gonna take a minute and **think about this idea**. How does it hold up mathematically?

Provide a Clear Action

Teacher:

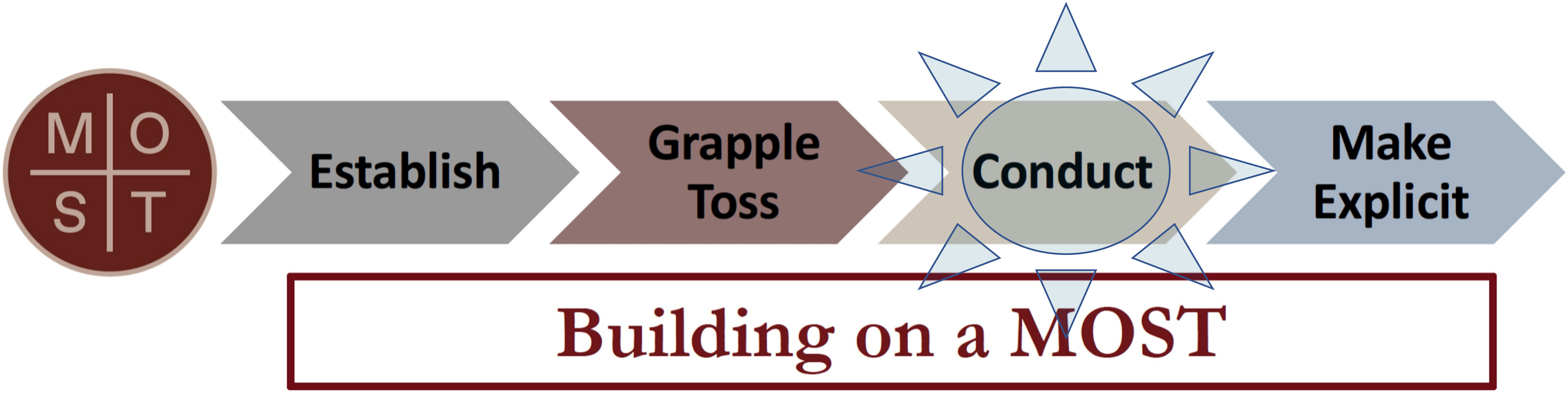
Awesome. Okay so let's pause for a minute and just think about Kara's solution, this solution on the board. **What I want us to think about is how does this reasoning hold up mathematically?**

So even if this solution might be different than yours, we're just gonna take a minute and think about this idea. **How does it hold up mathematically?**

Turning an idea over to the class:
Think back to the situations we identified previously (or new ones). How might the focusing actions we identified apply to these situations?

- Provide a clear object
- Provide a clear action

Focusing Students while Constructing a Sense-Making Argument



Conducting a Sense-Making Discussion

- Argument-related contributions
- Non-argument-related contributions

Conducting a Sense-Making Discussion

- **Argument-related contributions**
- Non-argument-related contributions

Establish Contributions that are Related to the Developing Argument

Student: The thing is with the point (0,3), if you plug it into that equation it comes out with 3 equals 6 which is false. So the point (0,3) wouldn't work.

Establish Contributions that are Related to the Developing Argument—Make Precise

Student: The thing is with the point (0,3), if you plug it into that equation it comes out with 3 equals 6 which is false. So the point (0,3) wouldn't work.

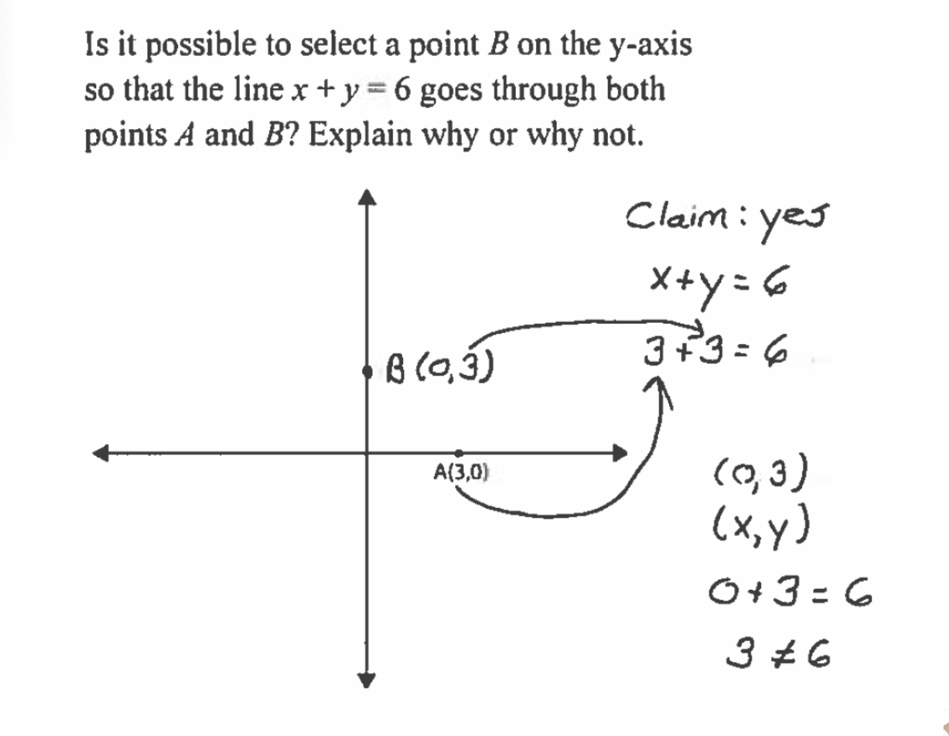
Teacher: You're saying the point (0,3) wouldn't work? Can you tell us more about why that wouldn't work?

Establish Contributions that are Related to the Developing Argument—Make Precise

Student: Alright so you got the point (0,3), which is x and y. If you plug it into the equation x+y=6 you get 0 plus 3 equals 6 which doesn’t exactly work because those are not equal.

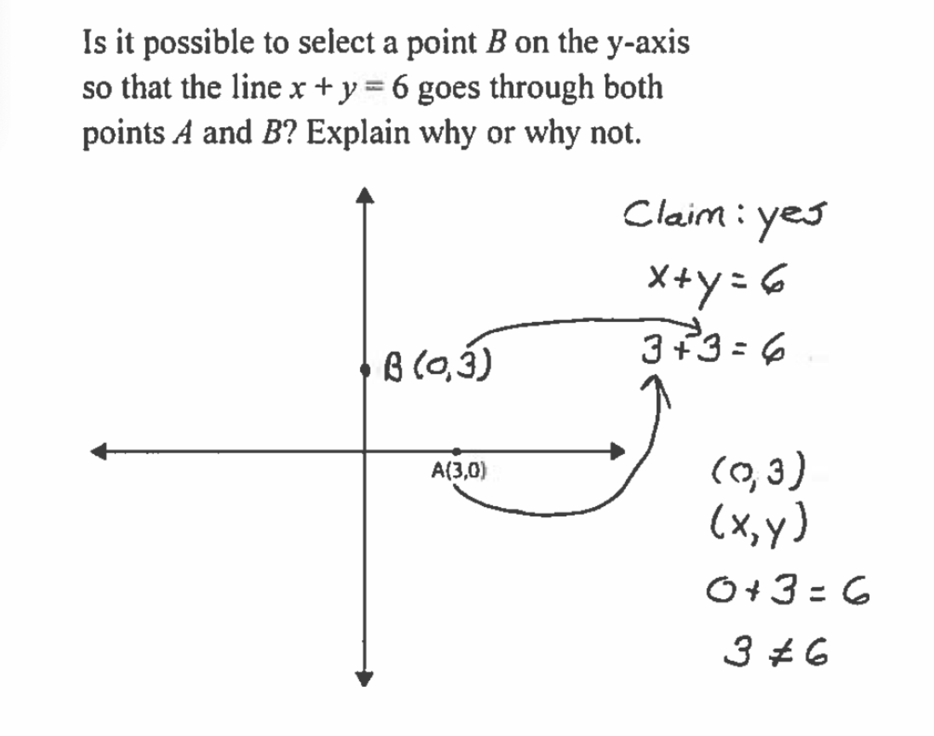
Establish Contributions that are Related to the Developing Argument—Make an Object

Student: Alright so you got the point (0,3), which is x and y. If you plug it into the equation x+y=6 you get 0 plus 3 equals 6 which doesn't exactly work because those are not equal.



Establish Contributions that are Related to the Developing Argument—Make Precise

Teacher: So Jason's saying that the claim that B is (0,3) does not hold up mathematically because of this reasoning here.
[Points to "0+3=6, 3≠6"]



Clearly Define Objects to be Connected

Teacher: So Jason's saying that the claim that B is (0,3) does not hold up mathematically because of this reasoning here. [Points to "0+3=6, 3≠6"]

So **first we had 3 plus 3 equals 6** and **now we have 0 plus 3 does not equal 6**. So how do we reconcile these two different approaches?

Turning over an Object: Provide a Clear Sense-making Action

Teacher: So Jason’s saying that the claim that B is (0,3) does not hold up mathematically because of this reasoning here. [Points to "0+3=6, 3≠6"]

So first we had 3 plus 3 equals 6 and now we have 0 plus 3 does not equal 6. **So how do we reconcile these two different approaches?**

Focusing students on argument related contributions: *Think back to the situations we identified previously (or new ones). How might the focusing actions we identified apply to these situations?*

- Establish the object to be considered
  - Make precise
  - Make an object
  - Define objects to be connected
- Provide a clear sense-making action

Conducting a Sense-Making Discussion

- Argument-related contributions
- **Non-argument-related contributions**

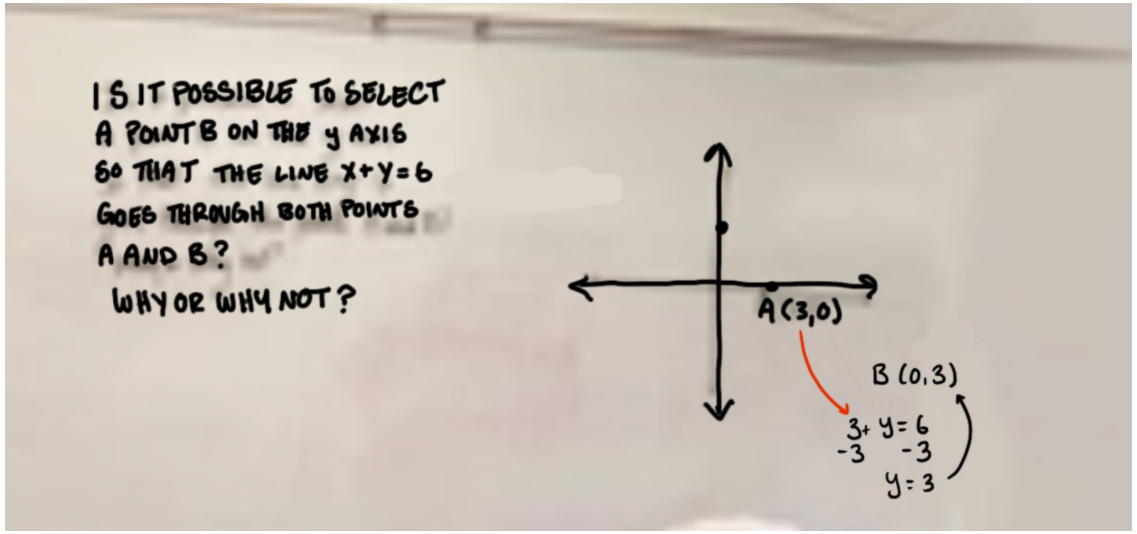
Put Aside Non-argument-related Contributions

Student: So, I don't really like standard form so I chose to change it into slope intercept by just subtracting x and then putting it on the other side and I got y equals negative x plus 6.

Teacher: Okay so let's hold, this is kinda how you solved the problem which we'll come back to in just a second, but right now I just want to focus [points to original claim on board] on the math that she did when she solved the problem.

Re-establish a Productive Idea

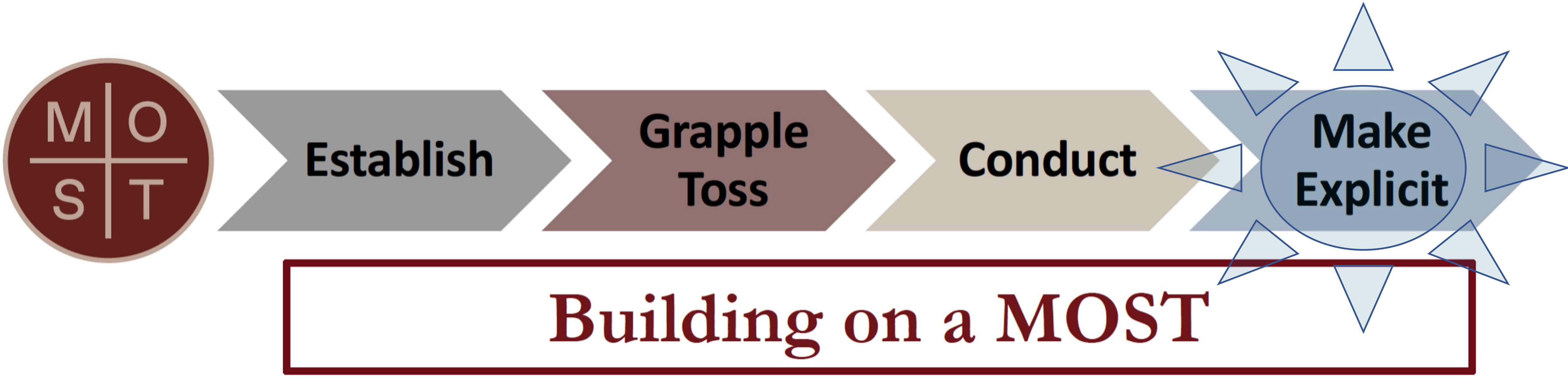
Teacher: So she took this x value from A, [points to 3 in A(3,0)] this 3, then she plugged into the equation [points to "3+y=6"] to find the y value that she used for her point B [point to "B(0,3)"]. So what do we think about this idea right here? Does the math behind this idea work? Why or why not?



Managing non-argument-related contributions: *Think back to the situations we identified previously (or new ones). How might the focusing actions we identified apply to these situations?*

- Put aside non-argument-related ideas
- Re-establish a productive idea

Providing Focus at the End of a Discussion



Ensuring students know the “take-away”

Teacher: Can anyone summarize the mathematics that we just discussed?

Student: Well you can’t like pick and choose which x and y values you take to put into your equation. You can’t just add 3 plus 3 cause they’re not on the same point of the graph, they’re two separate points. You can only take like the one point.

Teacher: Are we in consensus with that summary, that you can’t pick and choose the x’s and y’s when substituting them into an equation, they both need to come from the same point?

Focusing at the end of a discussion:
Think back to the situations we identified previously (or new ones). How might the focusing actions we identified apply to these situations?

- Ensuring students know the take-away

Moves that cause students to lose focus

- Vague questions: What do you think about this?
- Collect moves: What do others think?

Key Take-Aways

- The object that students are to make sense of changes throughout a sense-making discussion
  - Initial contribution
  - Argument-related contributions
  - Connections between two contributions
- The teacher needs to help students track the discussion by always making sure that the current object and sense-making action are explicit

An Important Note

The teacher plays an important role in focusing students during a sense-making discussion, but needs to be careful not to DO the sense-making

- Make contributions precise-enough, but don't go too far
- Provide a clear sense-making action, but don't overexplain

Questions or Comments

Thank you!

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