Conceptualizing Teacher Discourse Moves Using Different Focal Lengths

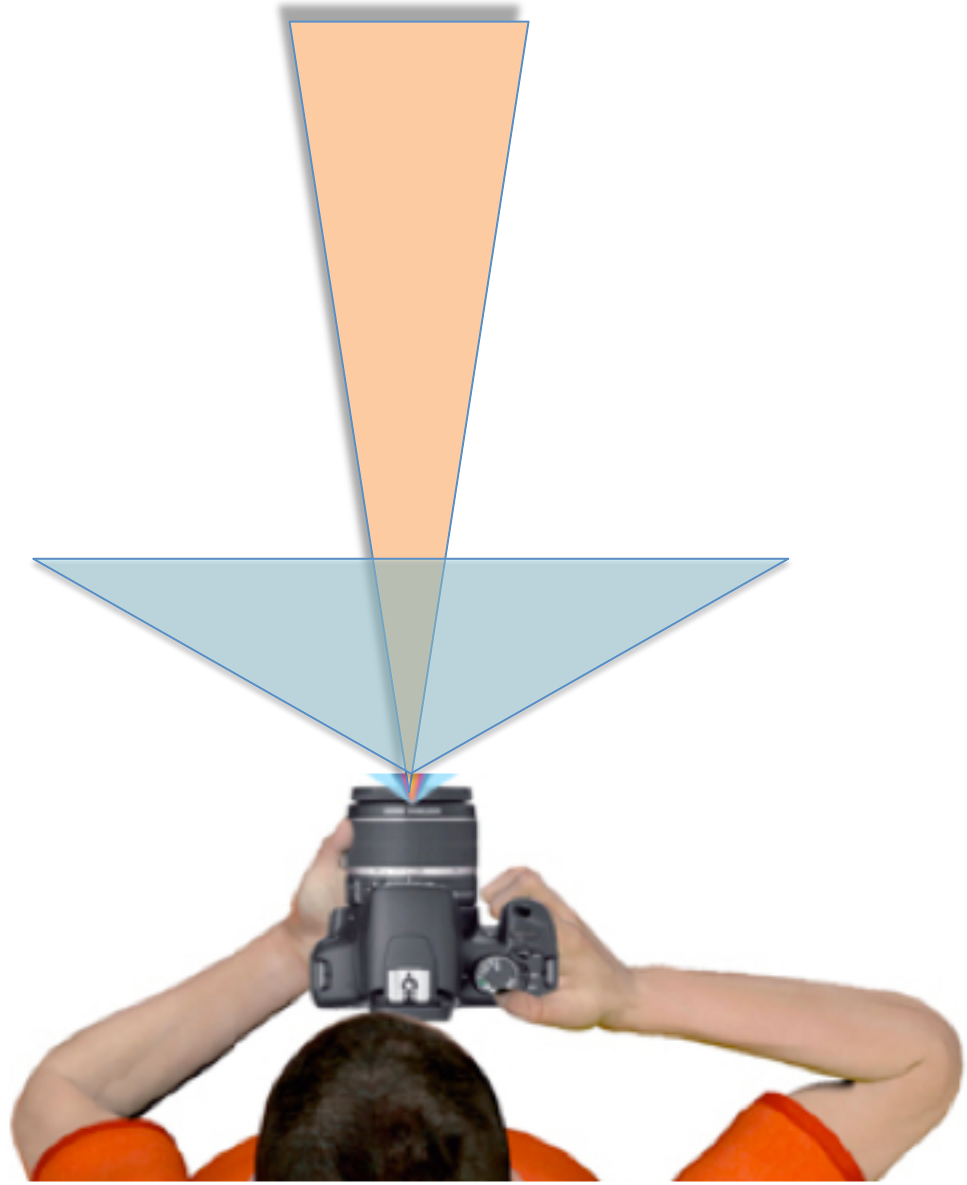
NCTM Research Conference
San Francisco April 13, 2015

Talk Moves
Suzanne Chapin & Catherine O'Connor, Boston University

Collective Argumentation
AnnaMarie Conner, University of Georgia
Laura M. Singletary, Lee University

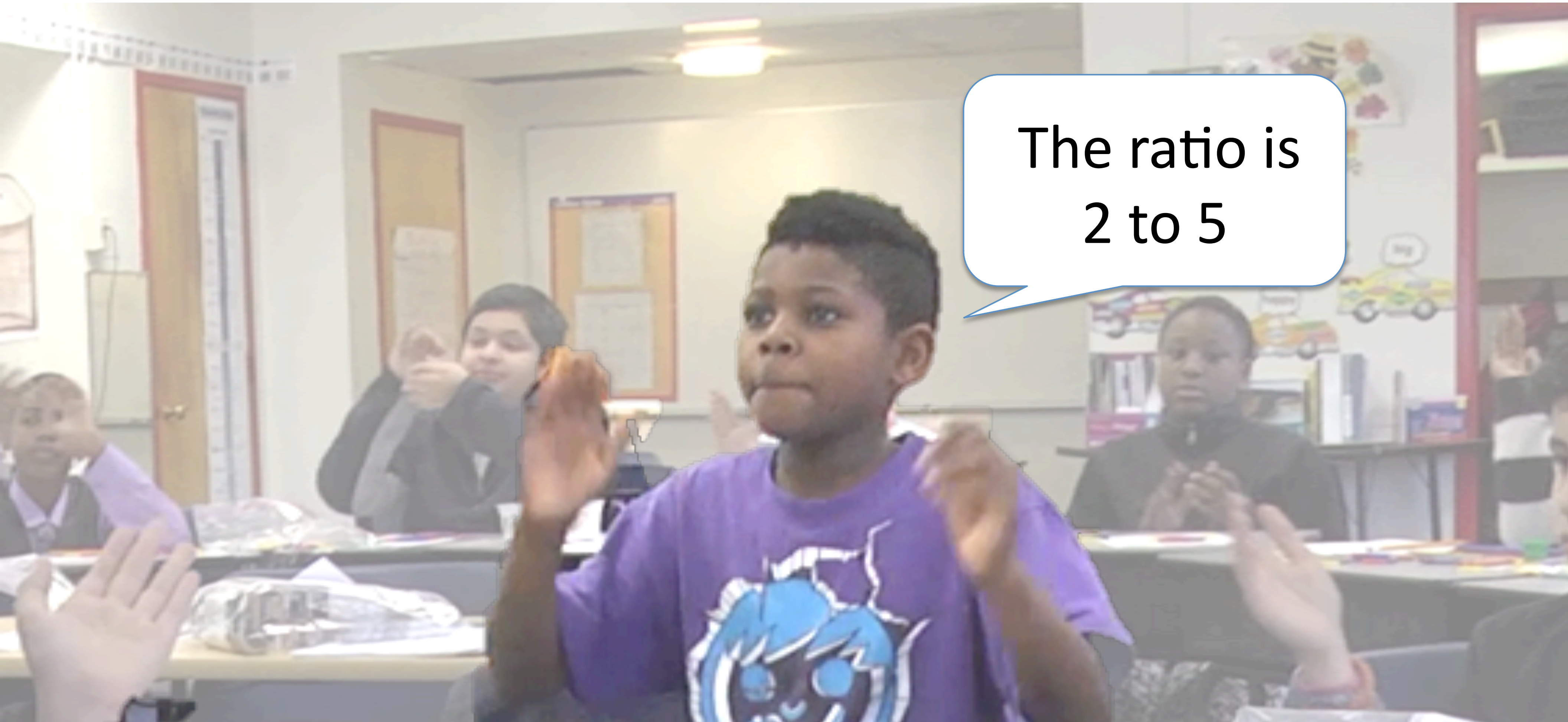
Building on MOSTs
Laura R. Van Zoest, Western Michigan University
Shari L. Stockero, Michigan Technological University
Keith R. Leatham & Blake E. Peterson, Brigham Young University

The metaphor of focal length



Wide angle lens:
you see everything, in fairly clear detail–
The detail may be overwhelming, but you can see relationships across the scene.

Narrow angle (telephoto) lens:
allows focus on a smaller portion…
but also…



Narrow angle (telephoto) lens:
allows focus on a smaller portion...
but also... *blurs the background*.
Allows an even sharper look at the focal center.

Commonalities

- Focus on student mathematical thinking.
- Prioritize the learning of *mathematics*.
- Focus on understanding and supporting teacher orchestration of classroom discourse.
  - Consider mathematical discussion to be an instructional tool.
  - Recognize the challenging nature of facilitating productive mathematical discussions with learners.
- Aim to design frameworks that are broadly usable to support teachers.

Anchoring "talk moves" in broader goals for classroom discussion

Suzanne Chapin & Catherine O'Connor
Boston University

NCTM Research Conference
San Francisco, CA
April 13, 2016

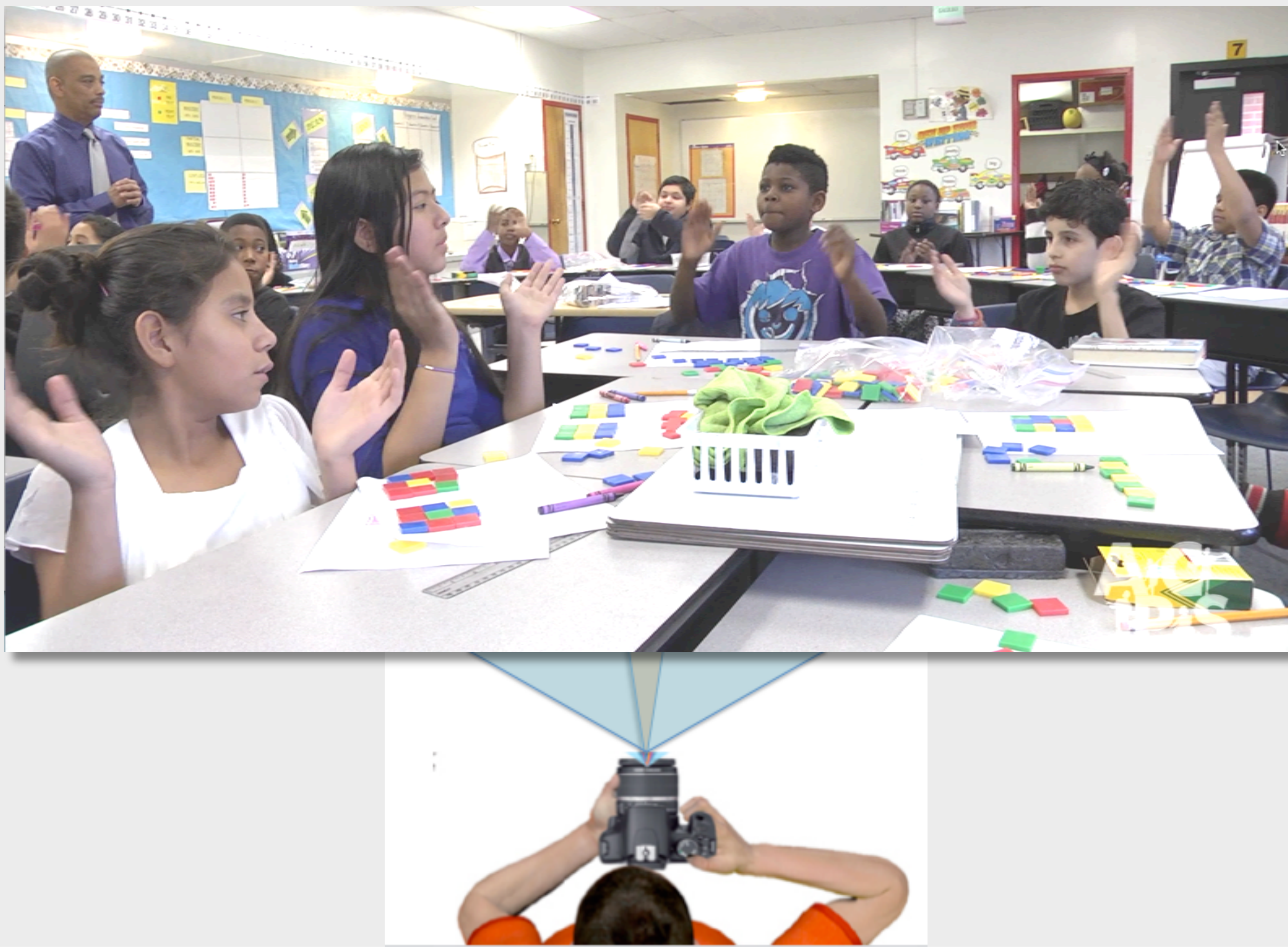
Our “framework” looks simple but,
we have learned, it isn’t.

Teacher “talk moves”

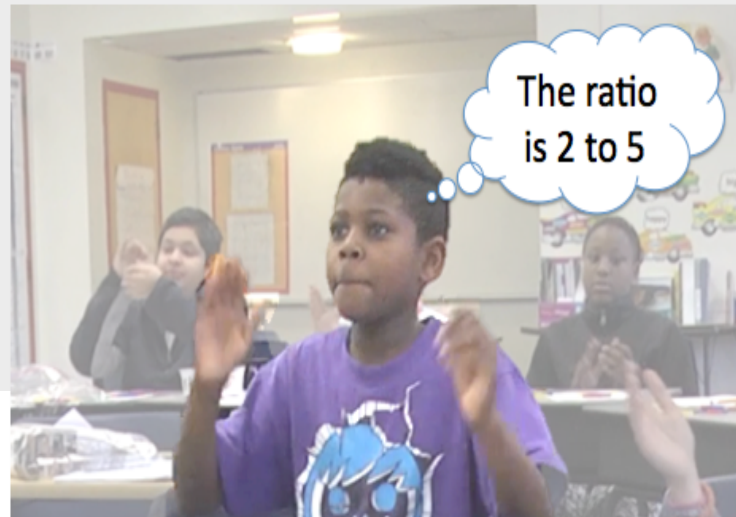
<u>and</u>

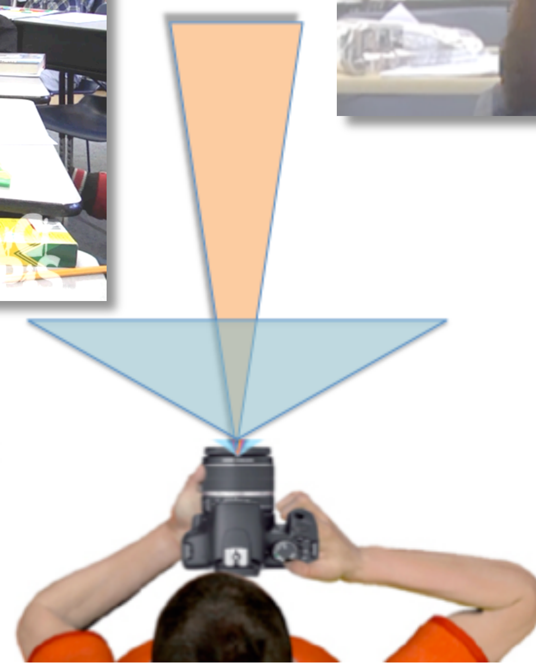
The purposes for using them and the contexts in which they are most useful

In this presentation, focal length is short and wide: we attempt to capture teacher development as well as student benefits.



But for us, as for our colleagues, research and development have required focal lengths ranging from long and narrow to short and wide!





Early Work

- O'Connor and Michaels (1993, 1994, 1996) studied teachers gifted in orchestrating classroom discussions.
- Primarily at elementary and middle school levels

Development of "Talk Moves"

Revoicing (Verify and Clarify)

Let me see if I understand what you're saying. What you said was….
Is that right?

Revoicing Example

Student: "One-sixth is the biggest. It's more than one-third."

Teacher: "So you are saying that one-sixth is greater than one-third? Did I get that right?"

Student: "Yes, I just look at the bottom number in a fraction and I can decide right away. Six is more than three."

What is happening in this example?

- The teacher is unsure of the student's reasoning at first, but then gets a clearer sense of what the student understands and doesn't understand.

- This is *formative assessment* at its best.

What is happening in the example?

- The student realizes that the teacher <u>wants</u> to <u>understand</u> her contribution.

- The teacher doesn't just assume that she knows why the student gave a response.

- Over time, this can have a profound effect.

What is happening in this example?

- By checking back with the student, the teacher allows the student to *accept* or *reject* the teacher's interpretation, which positions the student as a legitimate participant in the intellectual enterprise.

Other Talk Moves

- Say more…
- Who can put what she said into their own words?
- Why do you think that? Explain your reasoning for us.
- What do you think about what he said?
- Do you agree or disagree and why?
- Who can add on to that?

Early Studies

Focused on micro-level details about each of these talk moves:

(a) How they positioned the students in relation to the <u>content</u> at stake in the discussion.

(b) How they positioned the students in relation to <u>one another</u>

(c) How they created a culture in which students took on the role of **reasoners** and **collaborators.**

All of these teacher moves were examined in comparison to classrooms featuring the traditional **IRE / Recitation** moves.

Project Challenge

- In 1998, Chapin began “Project Challenge”—bringing challenging mathematics into a low-performing district in Massachusetts. Instructional emphasis was on talking about the mathematics and supporting students’ reasoning.
- O’Connor brought the teacher discourse moves to the project and a small group of teachers were intensively trained to use them in relation to math materials that were new to the district.
- Over four years, results were very positive (O’Connor et al. 2015, Chapin & O’Connor 2012, 2007)

But when we tried to disseminate this approach through traditional professional development, we found that

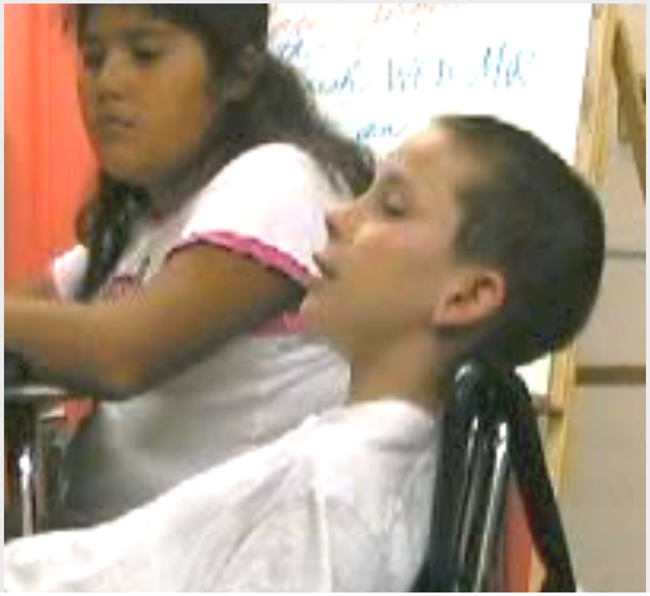
- some teachers used the moves robotically.
- some did not discriminate between contexts in which a move would be useful.
- some did not understand their “new” role as facilitator.

So how to convey the overall purposes of these talk moves and when to use them?

Why Do We Use Talk Moves?

- So that students will externalize their thinking,
- So that students will engage with the thinking of others,
- So that students will externalize their reasoning,
- So that students will engage with the reasoning of others.

When Do We Use Talk Moves?



- When students don't respond,
- When students are confused,
- When students say something brilliant but no one heard or understood,
- When students are inarticulate or unclear.

… and many more situations

Combining Goals and Obstacles

- We decided to highlight the **obstacles** to productive talk…

- These obstacles are the context within which the talk moves make sense as **tools** to help teachers accomplish their instructional goals.

- And at the same time we provide teachers with a concrete example of how to engage in a different role in the classroom.

For example …..

How could we start to figure out what three-fourths divided by 3 is?

What if the response is this:

24 blank faces. No hands up.

Goal 1. Help individual students to **clarify** and **share their thinking** so that it **can be heard** and **understood**.

If only one or two students can do this, you don't have a discussion, you have a monologue or a dialogue.

Goal 1. Help individual students to **clarify** and **share their thinking** so that it **can be heard** and **understood**.

Goal 1 Talk Tools:

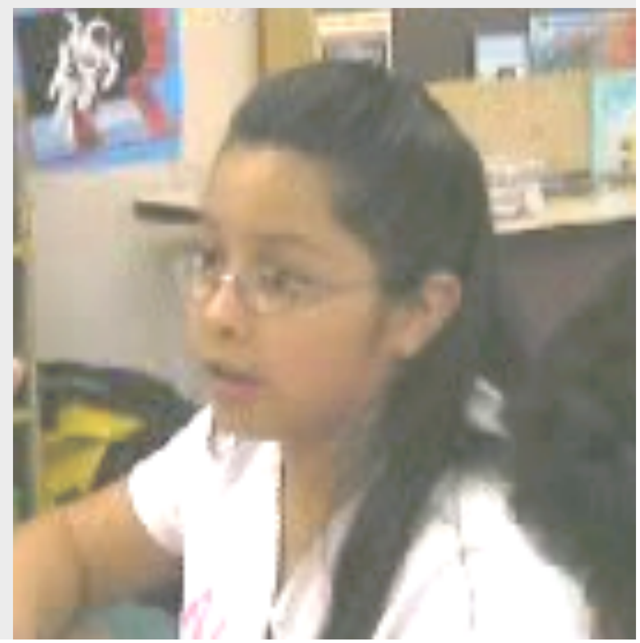
- ***Wait time***
- ***Stop and jot* (1-2 minutes)**
- ***Turn and talk* (1-2 minutes)** (also known as Think-Pair-Share, Consider & Commit, etc.)

Then…ask the question again.

How could we start to figure out what three-fourths divided by 3 is?

What if the response is this:

Rosalina: Um, if it... you could kinda... like, um... start by like dividing each fourth up... Or taking it away...



You think:

Huh?? I didn't understand that at all!

Still stuck at Goal 1!

Goal 1. Help individual students to **clarify** and **share their thinking** so that it **can be heard** and **understood**.

More Goal 1 Talk Tools:

- **"Say more"**
- **Revoicing**

Goal 2. Help students to **orient to others** and **listen** to what others say.

Your ultimate goal involves sharing ideas, agreements and disagreements, arguments and counter-arguments, not simply a series of students giving their own, unconnected opinions.

Talk Moves to Clarify and Orient

Clarify: What are you saying?

- Turn-and-Talk (also called *partner talk or think-pair-share)*
- Revoicing: "So are you saying . . . ?"; "Is that what you mean?" (also called *verify and clarify)*
- Say More: "Who can say more?"; "Can you give us an example?"

Orient: What are others saying?

- Who can restate that?
- Can someone put that in their own words?
- Turn-and-Talk: "Tell us what your partner said."

Goal 3. Help students to work on **deepening their own reasoning**.

Good discussions keep a focus on reasoning. The teacher must scaffold this consistently, getting students to dig deeper.

Goal 4. Help students to **work with the reasoning of other students**.

Real discussion involves students actually taking up the ideas of other students, responding to them and working with them.

Talk Moves That Support Reasoning

Students Deepen Their Reasoning	Students Focus on the Reasoning of Others
• Press for Reasoning: “Why do you think that?” • “That was important, but sort of complex. Who can put that into their own words?” • “Does everyone follow that? Let’s do a quick turn-and-talk about her reasoning.” • Tell us about the evidence you are using.	• “What do you think about that? Who can add on?” • “Do You Agree or Disagree . . . and Why?” • “That was a key point. Who can explain what was just said?”

Talk Moves Grounded in Goals

Their purpose is to help teachers become skillful at *automatically* dealing with the kinds of challenges that emerge in attempts at academically productive discussions, so that they can focus on the mathematics.

Their purpose for students is to support them in learning mathematics by helping them articulate their thinking and reasoning and by engaging in others thinking and reasoning.

Talk Moves Grounded in Goals

The talk moves and the overarching goals support learning mathematics by helping teachers **assume new roles as facilitators.**

Implementing the goals often results in teachers providing students with **greater agency** and **sharing of mathematical authority.**

As our colleagues will discuss in their talks, these talk moves and the goals they support are basic underpinnings...

But in order to organize talk that will focus on complex mathematics, these simpler dimensions need to be in place.

Next we will hear more about where these kinds of teacher goals and moves can take teachers and their students in terms of mathematics learning...

Thank you!

Developing Collective Argumentation

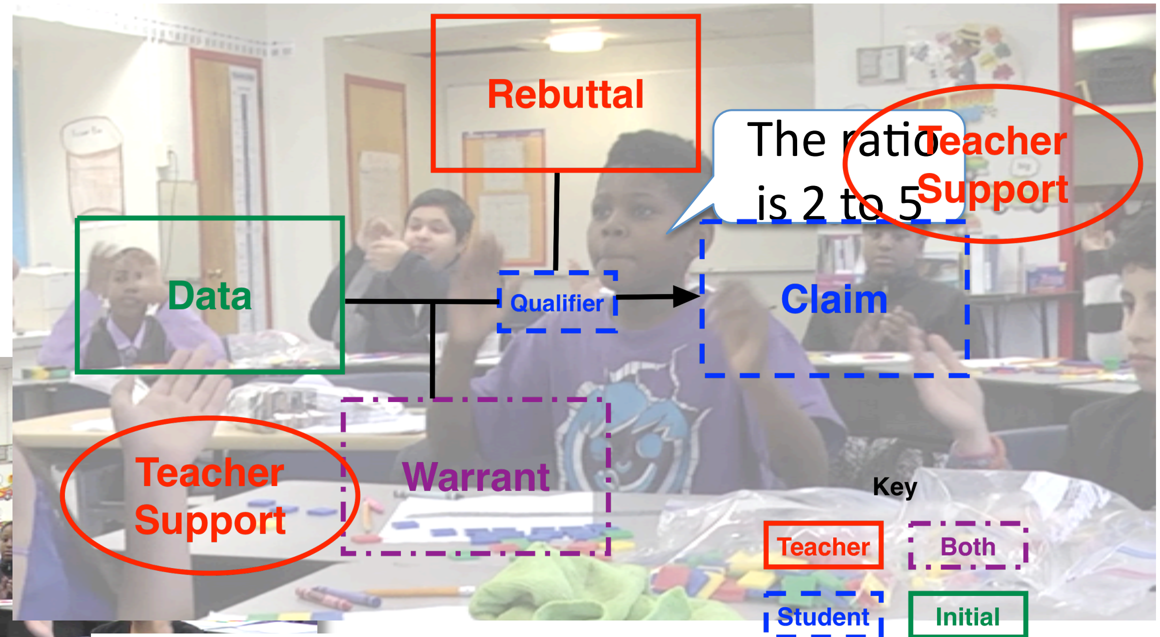
AnnaMarie Conner

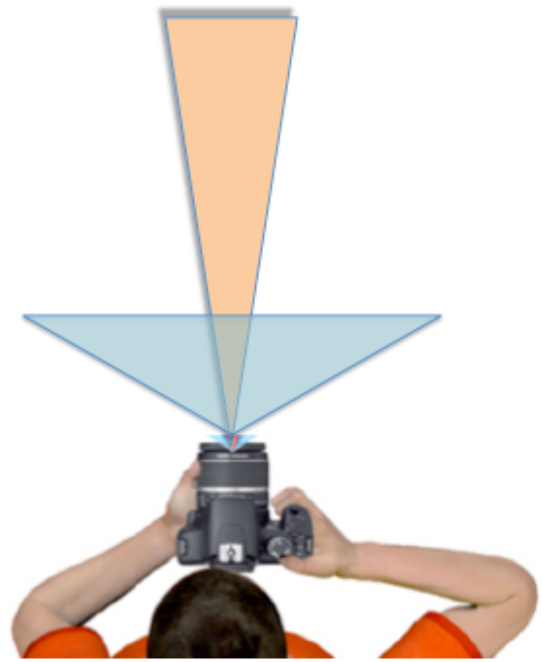
Laura Singletary

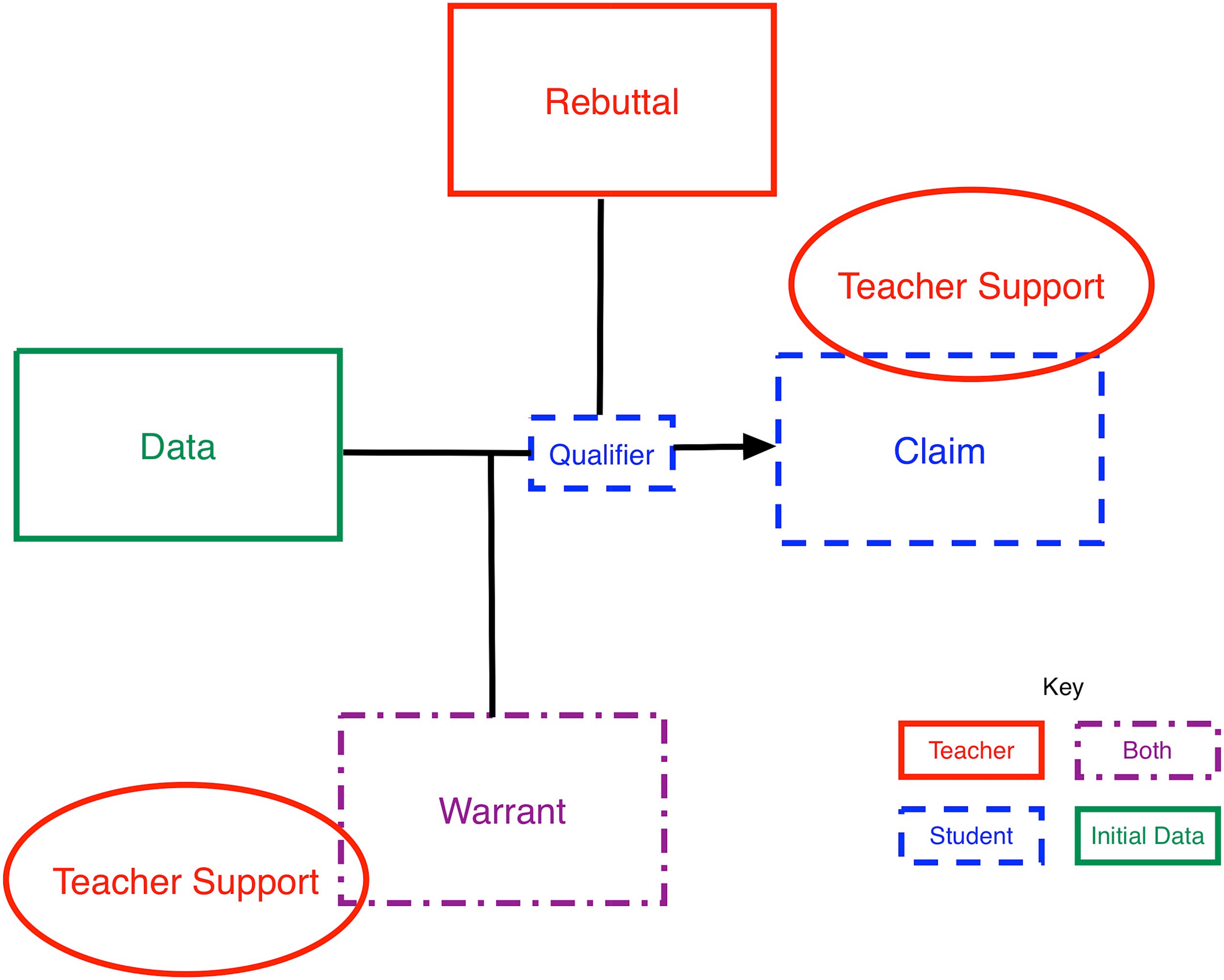
Collective Argumentation

- “Any instance where students and teachers make a mathematical claim and provide evidence to support it” (Conner, Singletary, Smith, Wagner, & Francisco, 2014, p. 404)
- Occurs across multiple instructional styles
- Facilitates a close look at mathematical discourse


Our original focal length is short and wide, to identify argumentation within a class. Then we use a long and narrow lens to zoom in on a mathematical argument.







Adaptation of Toulmin's (1958/2003) diagram for an argument

Teacher Support Framework

Direct Contributions:	*Questions*:	*Other Supportive Actions*:
Claims	Requesting…	Directing
Data	A factual answer	Promoting
Warrants	An idea	Evaluating
Qualifiers	A method	Informing
Rebuttals	Elaboration	Repeating
Backings	Explanation	

From Conner, Singletary, Smith, Wagner, & Francisco (2014)

Questions

Requesting a factual answer: Asks students to provide a mathematical fact; includes calculations, identifying relevant information, recalling known facts or previous results, providing appropriate mathematical terms

Requesting an idea: Asks students to compare, coordinate, or generate mathematical ideas; includes making conjectures

Requesting a method: Asks students to demonstrate or describe how they did something

Requesting elaboration: Asks students to elaborate on, interpret, explain, or justify an idea, statement, or diagram

Requesting evaluation: Asks students to evaluate a mathematical idea; includes eliciting agreement or disagreement

From Conner, Singletary, Smith, Wagner, & Francisco (2014)

Other Supportive Actions

Directing: Actions that serve to focus the students' attention and/or the argument

Promoting: Actions that serve to support mathematical exploration; includes encouragement to continue or suggestions for changing focus

Evaluating: Actions that center on the correctness of the mathematics

Informing: Actions that provide information for the argument; includes expanding, summarizing, or clarifying students' statements with descriptions or gestures

Repeating: Actions that repeat what has been or is being stated either verbally or visually

From Conner, Singletary, Smith, Wagner, & Francisco (2014)

Ms. Bell: [Writes on board, under the heading Regular Polygon: All sides congruent, all angles congruent (Data labeled 1)] If I made another square, [draws a larger square on the board under the first (Data labeled 2)] what is different between these two squares?

Angela: The side lengths. (Warrant labeled 3, with Micah's contribution below)

Ms. Bell: So…

Micah: No, just the side lengths.

Ms. Bell: So just the sides? All right, but according to our definition, all sides are congruent, all angles congruent. (Warrant labeled 4)

Martin: It's regular because. (Data/Claim labeled 5, with Ms. Bell's and Martin's contribution below)

Ms. Bell: Is it a regular polygon?

Martin: Yeah.

Ms. Bell: I guess what I'm trying to say--do you want to say it for me, Martin? You might say it better.

Martin: That you don't have to have like a certain size square for it to be a regular polygon. It can be large; it just has to be the same side lengths and the same angles. (Data/Claim labeled 6)

Ms. Bell: Do you guys agree?

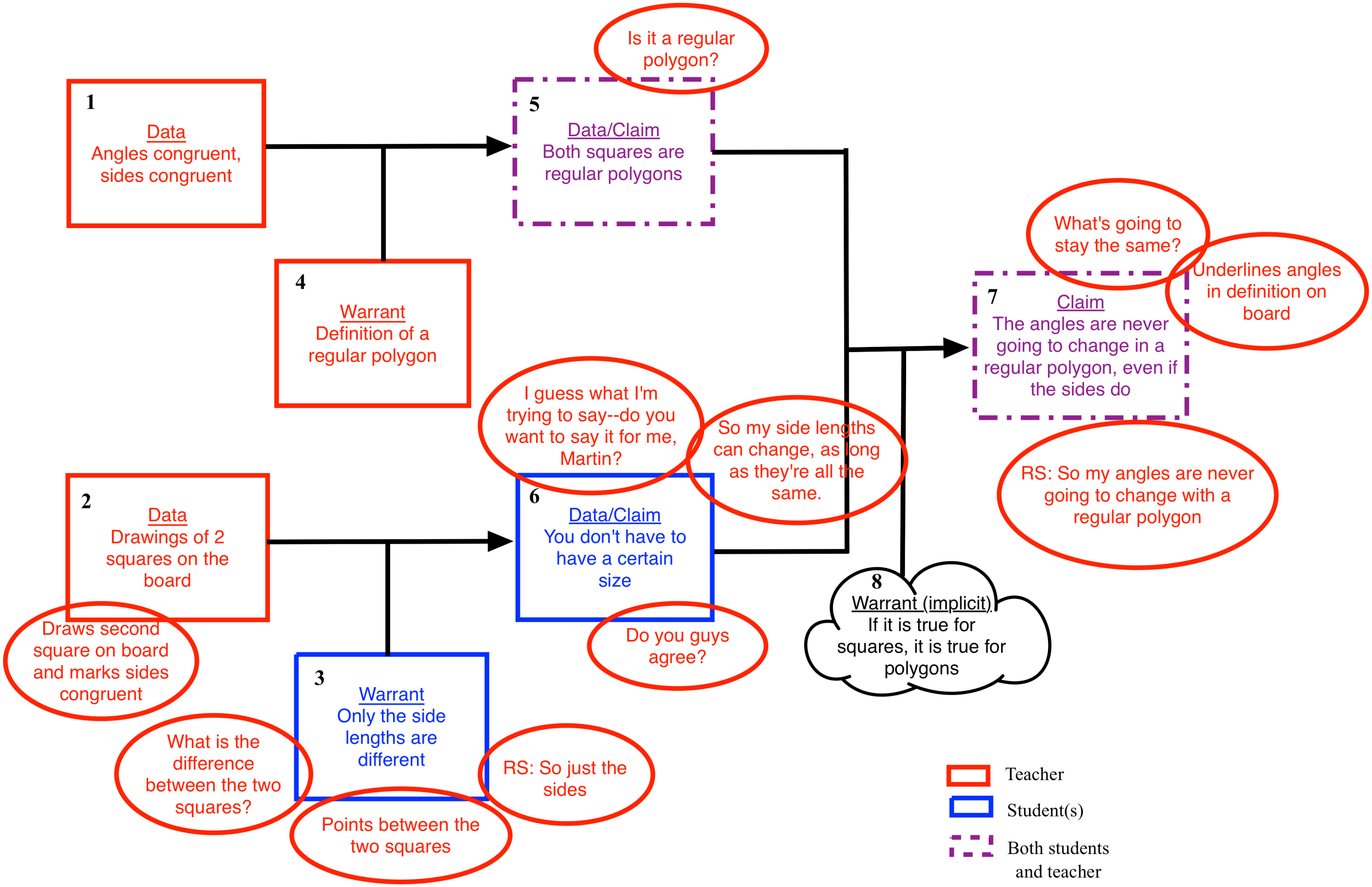
Students: Yeah.

Ms. Bell: So my side lengths can change, as long as they're all the same, right? But what's going to stay the same? (Claim labeled 7, with Adam's and Ms. Bell's contributions below)

Adam: The angles.

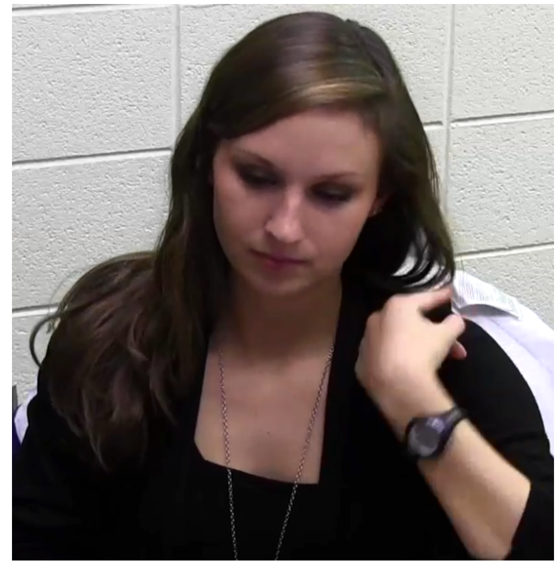
Ms. Bell: The angles. So my angles are never going to change with a regular polygon.

From Singletary & Conner (2015)



Adapted from Singletary & Conner (2015)

These diagrams are representations of teaching that allow teachers to reflect upon specific aspects of their practice



J: All right so, let's go back to just the 24 then. Go back to the 24. So I'm going to erase this. One of the groups had this - uhh - we're going to do this without the wall [writes 1 x 11 =]. Hang on, let me see your paper [erases what she wrote; writes list of equations 1 x 11 = 11, etc.].

J: All right. This is the full expansion of what we did yesterday for part one. This is for part two for where we do not have the wall. So this 11 here [points to 1 x 11 = 11], where did they come up with that? If I'm calling this length [labels first number in equation column L] think back to here [points to previous work] - this is the same thing as this [points to list of equations] just I wrote all of them - all of them out instead of just half of them. So if I'm calling this 'l' how would I get this number [points to second number of equation]? How do we get this number [points to first groups list of products]? Remember if we had this number [first six of 12 = 6 + 6], we did this - to get this number we did what [points to second six of 12 = 6 + 6]?

S1: Subtracted it from 12.

J: We subtracted it from 12, right. So that would be twelve minus this number equals our area [writes l x (12 - l) = A], right. Yes?

Multiple: Yes

J: All right so for any length and any - this would be for a 24 feet of fencing. For any length and any width we get our area. So what is - what about this right here [points to l x (12 - l)] can I simplify that?

S2: Yes

S3: If you want to.

J: Well I have 'l' times twelve minus 'l' that would be what?

Multiple: Twelve 'l' minus

S4: Two 'l'

S5: 'l' squared

Multiple: Squared

S4: 'l' squared

J: Okay. Equals some area, right. Well what does this look like [circles 12 - l^2]. Have we seen this before?

S6: Oh gosh. Is that like the quadratic things, whatever they're called.

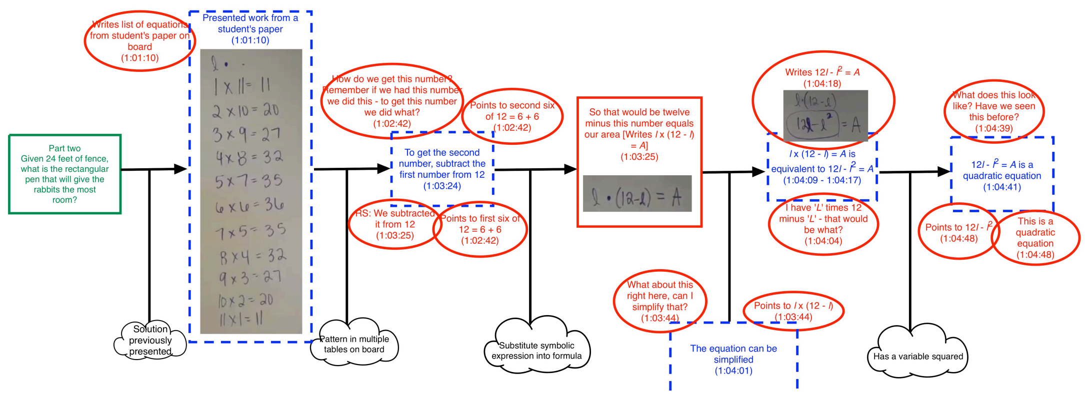
J: This is a quadratic equation.

S6: Oh gosh. I was wondering how you were going to try to make us do that again.

J: This is a quadratic equation [points to 12 - l^2]. So...

S6: Let me guess, we have to graph it.

J: Yes. You read my mind. All right let's graph this. You can plug in points if you want. That's fine. So graph this [points to 12 - l^2] right here. You can do it.



Jill: “I like this, because I can actually see, I mean, I know that I ask all of these questions, but I like seeing how me **asking these questions** (points at questions by data/claim) **leads to this** (points at data/claim), and then me asking these questions (points at questions by warrant) leads to this (points at warrant). I like that.”

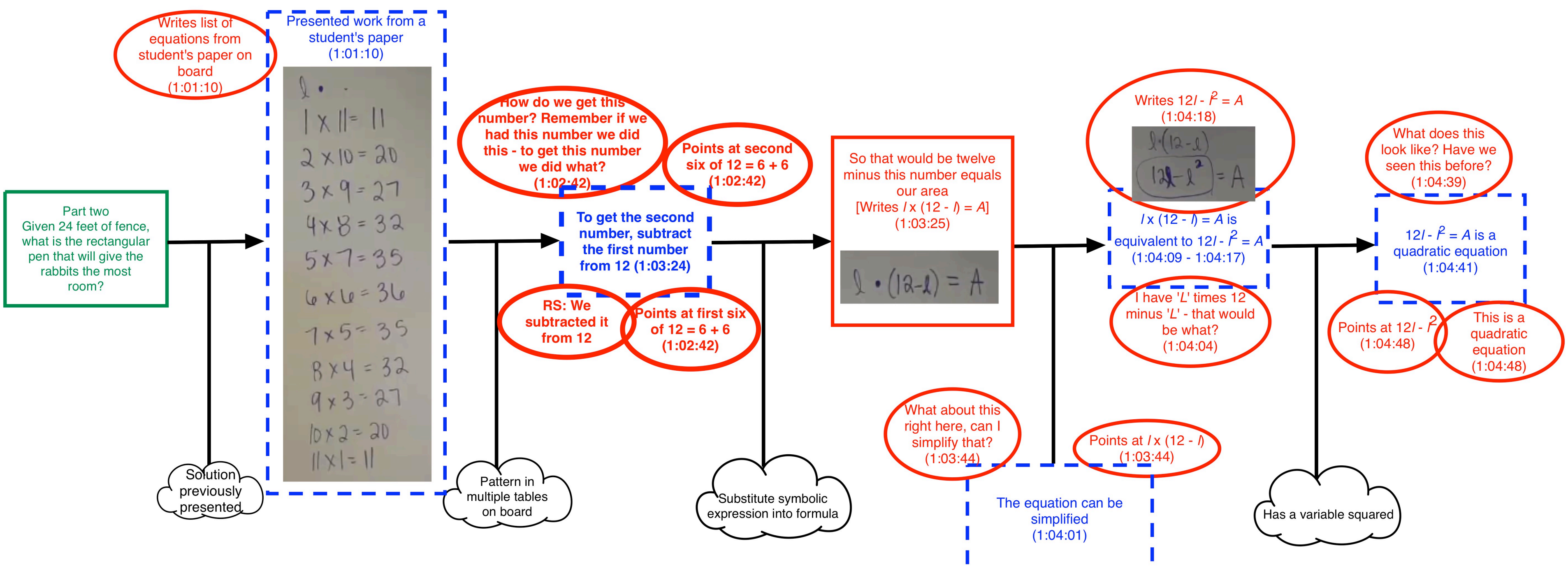


Diagram of argument from Jill’s class

Jill: “I like this, because I can actually see, I mean, I know that I ask all of these questions, but I like seeing how me asking these questions (points at questions by data/claim) leads to this (points at data/claim), and then me **asking these questions** (points at questions by warrant) **leads to this** (points at warrant). I like that.”

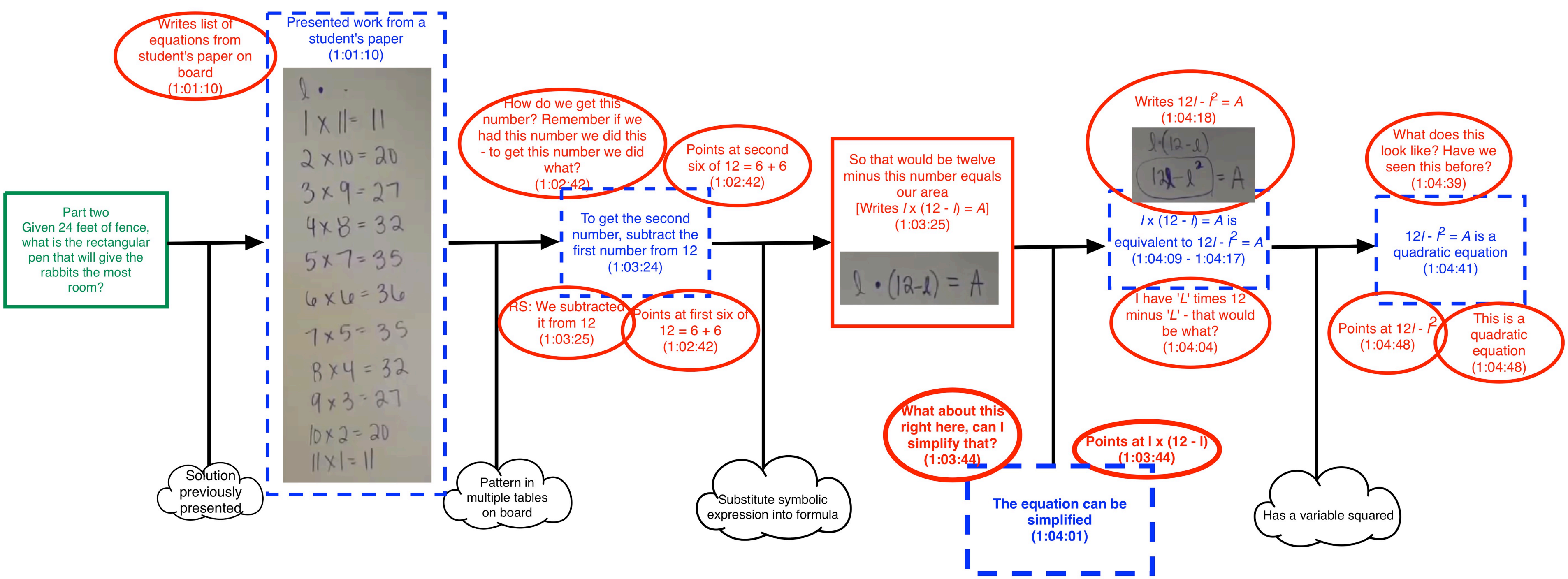
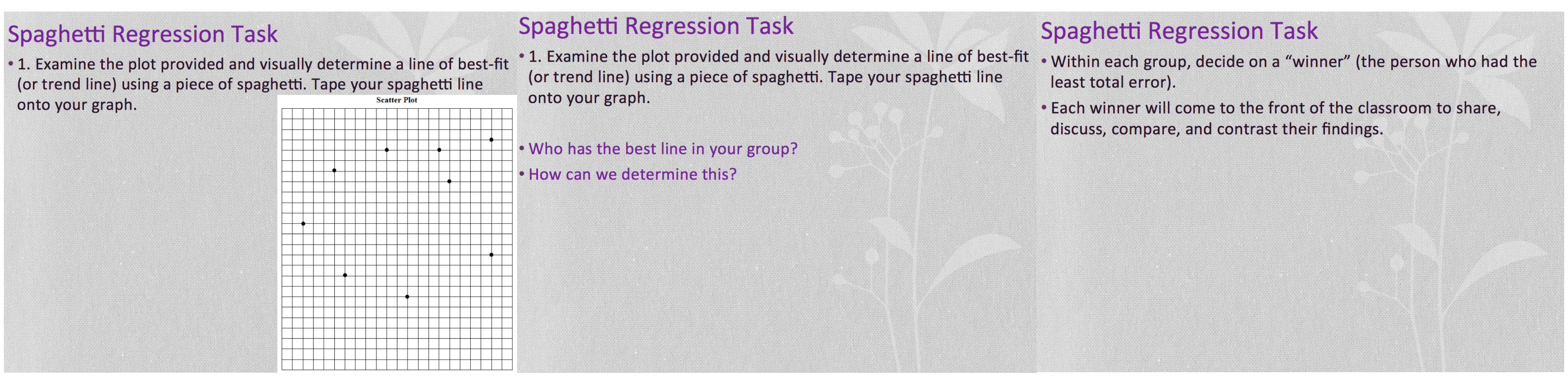


Diagram of argument from Jill’s class

Planning for future classes

- Choosing tasks that are conducive to argumentation
- Anticipating students' arguments
- Planning questions to prompt warrants
- Planning for displays of particular representations



Clarifying Questions?

References

Conner, A., Singletary, L. M., Smith, R. C., Wagner, P. A., & Francisco, R. T. (2014). Teacher support for collective argumentation: A framework for examining how teachers support students' engagement in mathematical activities. *Educational Studies in Mathematics, 86*(3), 401-429. doi: 10.1007/s10649-014-9532-8

Singletary, L. & Conner, A. (2015). Connecting research to teaching: Focusing on mathematical arguments. *Mathematics Teacher,* 109(2), 143-147.

Toulmin, S.E. (1958/2003). *The uses of argument* (updated ed.). New York: Cambridge University Press. First published in 1958.

LeveragingMOSTs.org

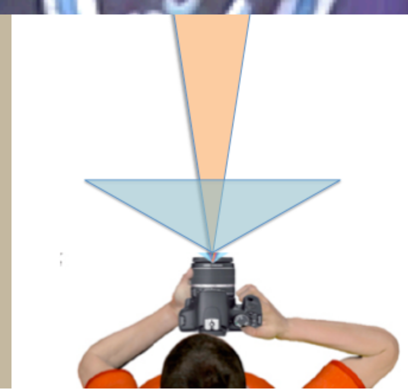
Productively Using High Potential Thinking

Shari L. Stockero – Michigan Technological University
Laura R. Van Zoest – Western Michigan University
Blake E. Peterson – Brigham Young University
Keith R. Leatham – Brigham Young University

Supported by
Leveraging MOSTs: Developing a Theory of Productive Use of Student Mathematical Thinking
a 4-year collaborative research project funded by the National Science Foundation
(DRL-1220141, DRL-1220357, DRL-1220148)

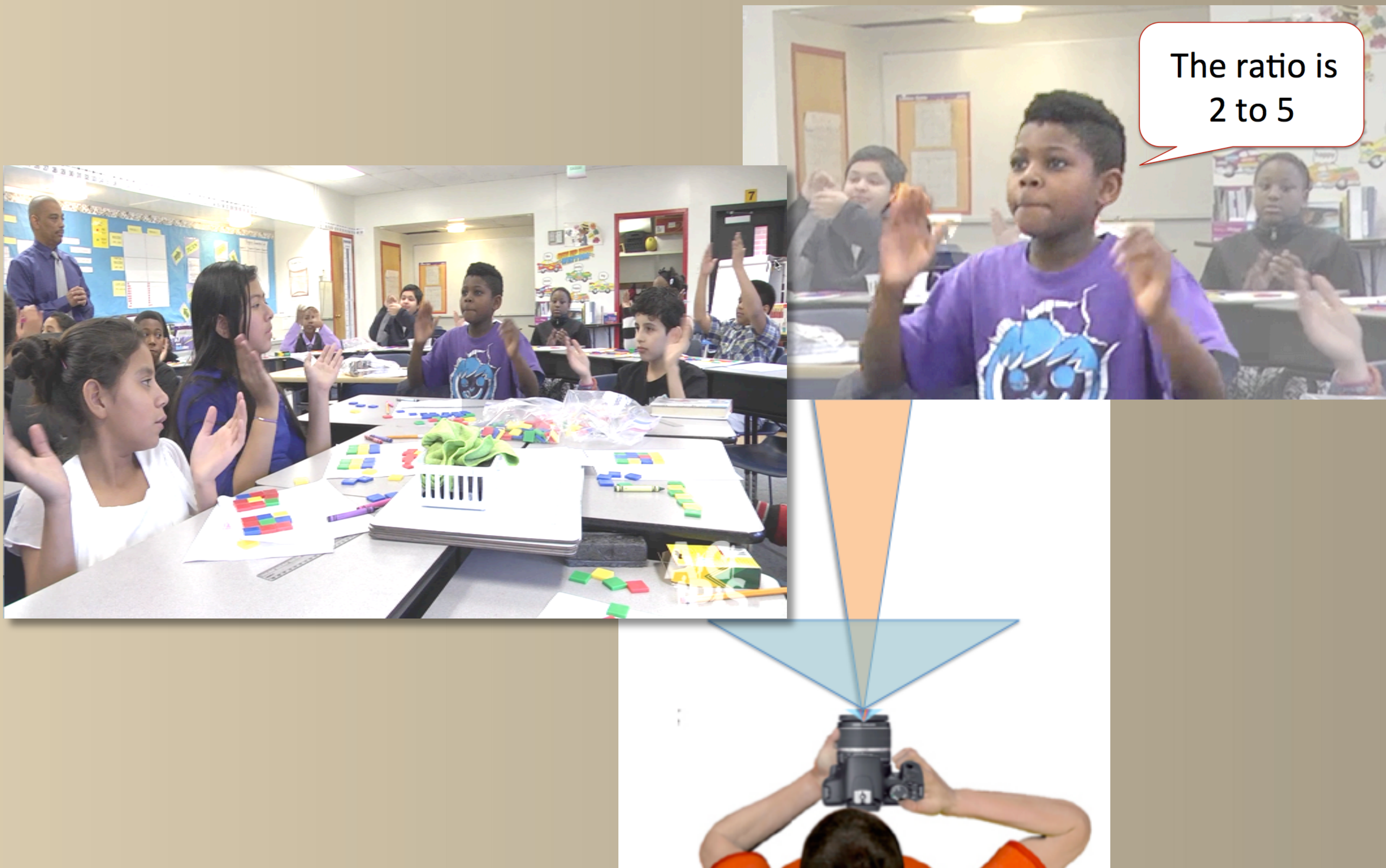
Our initial focal length is long and narrow as we focus in on an instance of student thinking.

Mathematical Opportunities in Student Thinking



Then we use a short and wide focal length to take that thinking to the class.

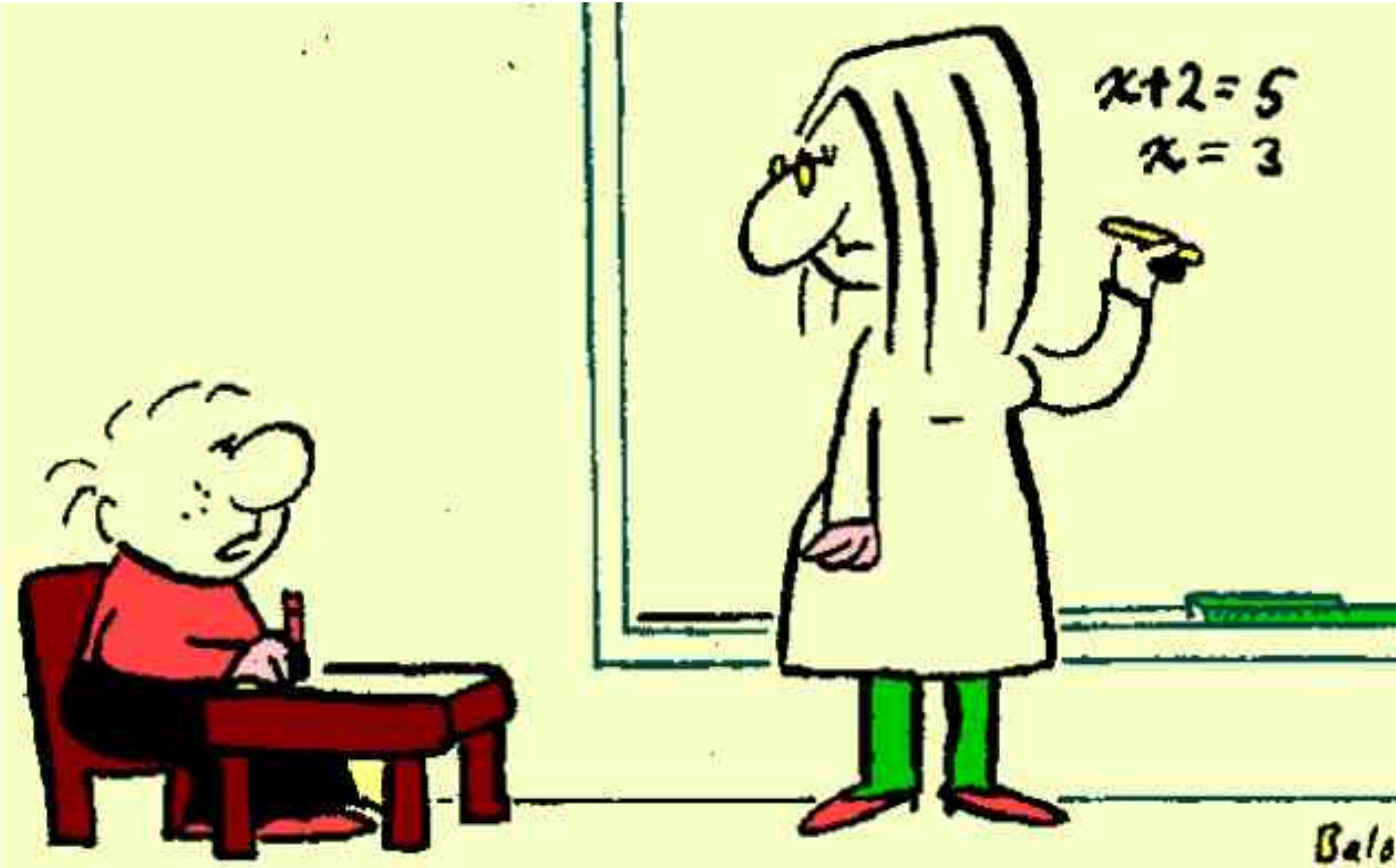
Mathematical Opportunities in Student Thinking



Focal length

First we zoom in to identify high-leverage instances of student mathematical thinking and then we zoom out to make those instances the object of whole class discussion.

- MOSTs – what student thinking is worth pursuing
- Building – how to productively use that thinking



"Just a darn minute! Yesterday you said X equals <u>two!</u>"

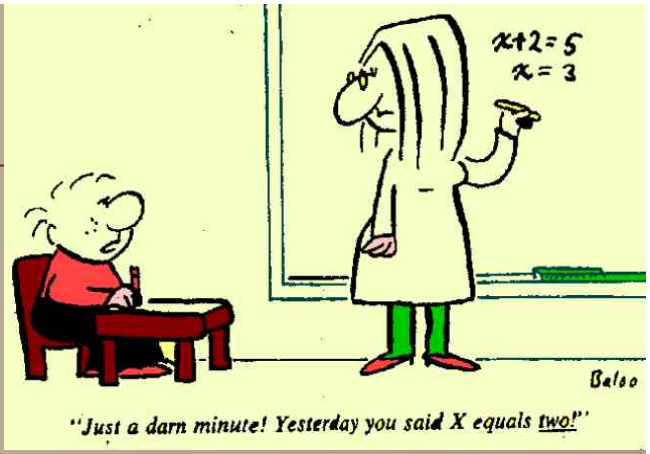
Mathematically significant

pedagogical **Opportunities**

to build on **in Student**

Thinking

MOST Characteristics



SM: Yesterday x equaled 2 and today x equals 3.

Student Mathematical Thinking

Student Mathematics

Can the student mathematics be inferred?

Mathematical Point

Is there a mathematical point closely related to the student mathematics?

MP: A letter can be used to represent an unknown quantity in an equation and can represent different values for different equations.

Mathematically Significant

Appropriate Mathematics

Is the mathematical point accessible to students with this level of mathematical experience, but not like to be already understood?

Central Mathematics

Is understanding the mathematical point a central goal for student learning in this classroom?

Pedagogical Opportunity

Opening

Does the expression of the student mathematics seem to create an intellectual need that, if met, will contribute to understanding the mathematical point of the instance?

Timing

Is now the right time to take advantage of the opening?

Leatham, K. R., Peterson, B. E., Stockero, S. L., & Van Zoest, L. R. (2015). Conceptualizing mathematically significant pedagogical opportunities to build on student thinking. *Journal for Research in Mathematics Education, 46*, 88-124.

MOSTs are opportunities…

…for the teacher to make student mathematical thinking the object of consideration by the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

…to **build** on student thinking.

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

0. Invite/allow students to share their mathematical thinking

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

0. Invite/allow students to share their mathematical thinking (elicit)

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

0. Invite/allow students to share their mathematical thinking (elicit)
1. Make the object of consideration clear

Mathematical Opportunities in Student Thinking

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

0. Invite/allow students to share their mathematical thinking (elicit)
1. Make the object of consideration clear (make precise)

Mathematical Opportunities in Student Thinking

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

0. Invite/allow students to share their mathematical thinking (elicit)
1. Make the object of consideration clear (make precise)
2. Turn the object of consideration over to the students

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

0. Invite/allow students to share their mathematical thinking (elicit)
1. Make the object of consideration clear (make precise)
2. Turn the object of consideration over to the students (grapple toss)

Mathematical Opportunities in Student Thinking

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

0. Invite/allow students to share their mathematical thinking (elicit)
1. Make the object of consideration clear (make precise)
2. Turn the object of consideration over to the students (grapple toss)
3. Orchestrate the students' process of making sense of the thinking

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

0. Invite/allow students to share their mathematical thinking (elicit)
1. Make the object of consideration clear (make precise)
2. Turn the object of consideration over to the students (grapple toss)
3. Orchestrate the students' process of making sense of the thinking (orchestrate)

Mathematical Opportunities in Student Thinking

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

0. Invite/allow students to share their mathematical thinking (elicit)
1. Make the object of consideration clear (make precise)
2. Turn the object of consideration over to the students (grapple toss)
3. Orchestrate the students' process of making sense of the thinking (orchestrate)
4. Facilitate the extraction of the important mathematical idea

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

0. Invite/allow students to share their mathematical thinking (elicit)
1. Make the object of consideration clear (make precise)
2. Turn the object of consideration over to the students (grapple toss)
3. Orchestrate the students' process of making sense of the thinking (orchestrate)
4. Facilitate the extraction of the important mathematical idea (make explicit)

Supporting teachers

- MOST Framework
  - focuses attention on the mathematics;
  - identifies which student thinking has significant potential to further student understanding of important mathematics
- Building Prototype
  - provides insight into how to use MOSTs to facilitate student learning;
  - solidifies the vague notion of "using student thinking"

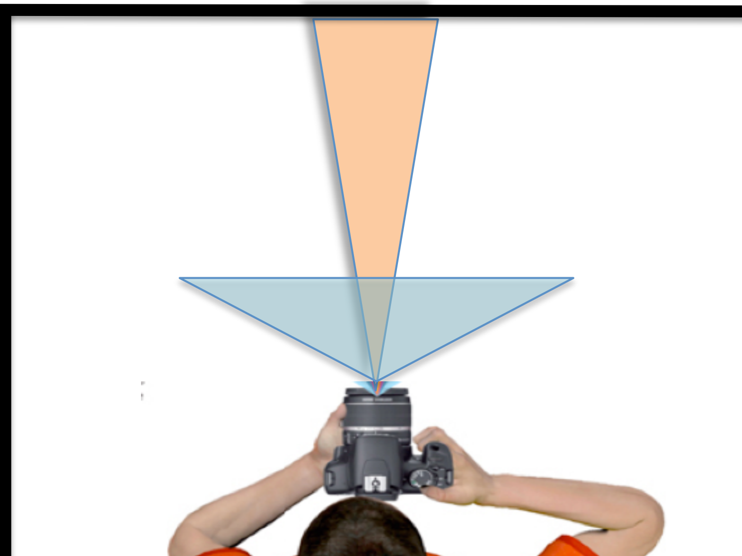
Clarification Questions?

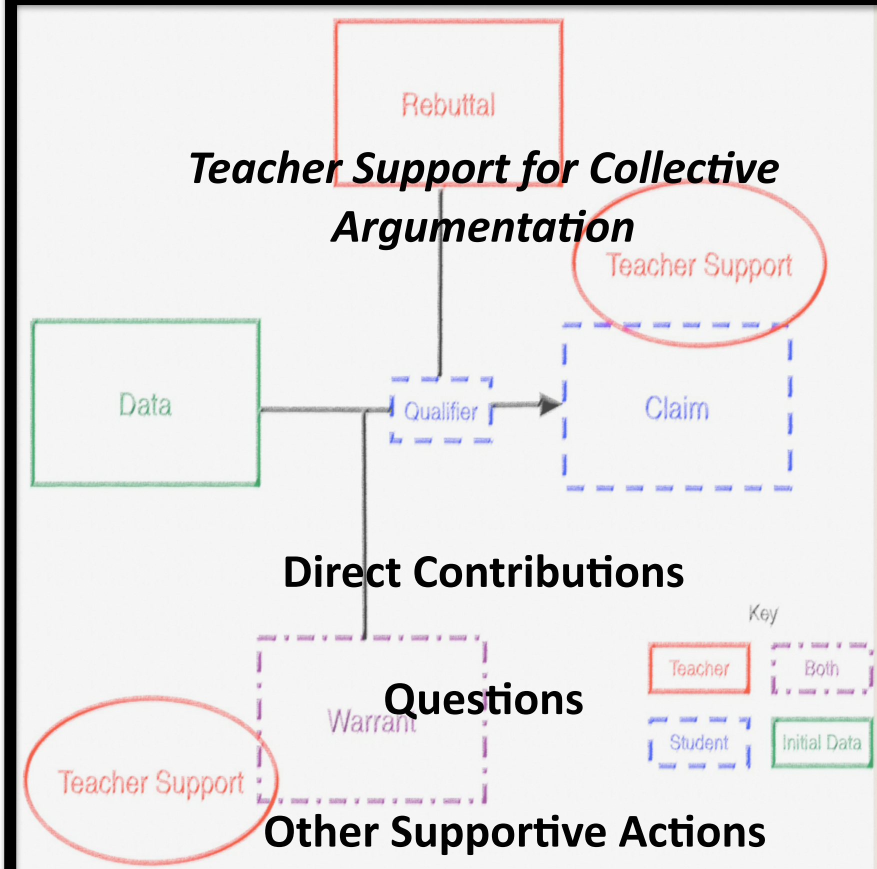
For more information, see

LeveragingMOSTs.org

Talk Moves

- Talk moves as tools
- Goals address purposes of talk and obstacles to talk
  - + Goal 1: Clarify and share one's own thinking,
  - + Goal 2: Engage with the thinking of others,
  - + Goal 3: Deepen one's own reasoning,
  - + Goal 4: Engage with the reasoning of others.
- Teachers develop new roles as facilitators





Mathematically significant pedagogical **O**pportunities to build on **S**tudent **T**hinking

Building on Student Mathematical Thinking

Make student thinking an object of consideration for the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea.

0. Invite/allow students to share their mathematical thinking (elicit)
1. Make the object of consideration (make precise)
2. Turn the object of consideration over to the students (grapple toss)
3. Orchestrate the students' process of making sense of the thinking (orchestrate)
4. Facilitate the extraction of the important mathematical idea (make explicit)

Discussion Questions

Research	Teacher Development	Teaching

- What connections did you see across the projects and what questions do you have?
- What affordances and constraints seem to result from different focal length choices?
- What else needs to be known to understand teacher discourse moves and their impact on student engagement with learning mathematics?

Similarities across Projects

Talk Moves	Collective Argumentation	Building on MOSTs
Goal 1: Help individual students to clarify and share their thinking so that it can be heard and understood.	*Questions*: Requesting an Idea, Method, or Elaboration *Other Support*: Informing, Repeating, Promoting	Practice 0: Eliciting Practice 1: Make Precise
Goal 2: Help students to orient to others and listen to what others say.	*Questions*: Requesting an Idea, Elaboration, or Evaluation *Other Support*: Directing, Repeating	Practice 1: Make Precise Practice 2: Grapple Toss
Goal 3: Help students to work on deepening their own reasoning.	*Questions*: Requesting an Idea or Elaboration *Other Support*: Directing, Promoting, Repeating	Practice 3: Orchestrate Practice 4: Make Explicit
Goal 4: Help students to work with the reasoning of other students.	*Questions*: Requesting an Idea, Elaboration, or Evaluation *Other Support*: Directing, Repeating	Practice 2: Grapple Toss Practice 3: Orchestrate