

Active Learning: Mathematical Argumentation and Improv



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In this session...

- Math argumentation is improvisational, active learning.
- Improv games support argumentation.
- Let's play!
 - Improv
 - Argumentation



Context: program for teachers on math argumentation

- Two years of PD
- Online and paper-based curriculum with interactive representations of high-level math
- Supports for teachers
 - Improv games for classroom norm setting
 - Focus on specific teaching moves
 - Series of PD activities that are “approximations of practice”



Context: We work in partnership with large urban districts.

- Large population of under-served and academically disadvantaged students
- High proportions of
 - African American/Black youth
 - Latino youth
 - English Language Learners
- These youth are, in too many places, lacking access to high-level mathematics.

Why mathematical argumentation?

Common Core Math
Practice 3

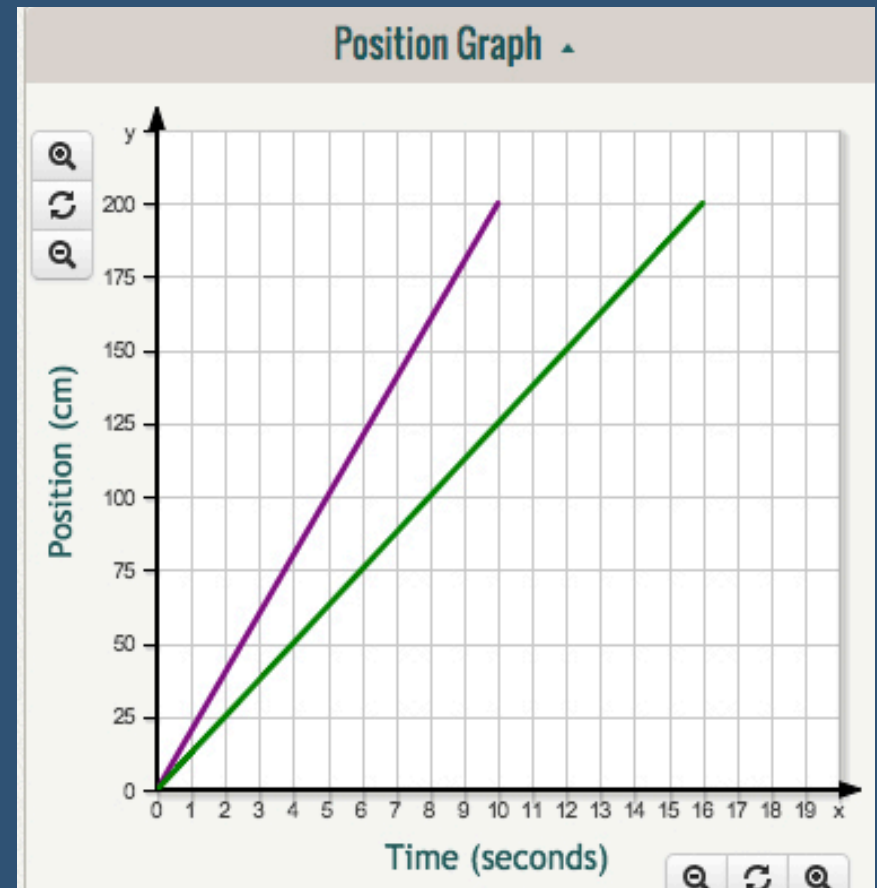
High-level
disciplinary
practice: what
mathematicians do

Fosters conceptual
development

Essential for *all*
students

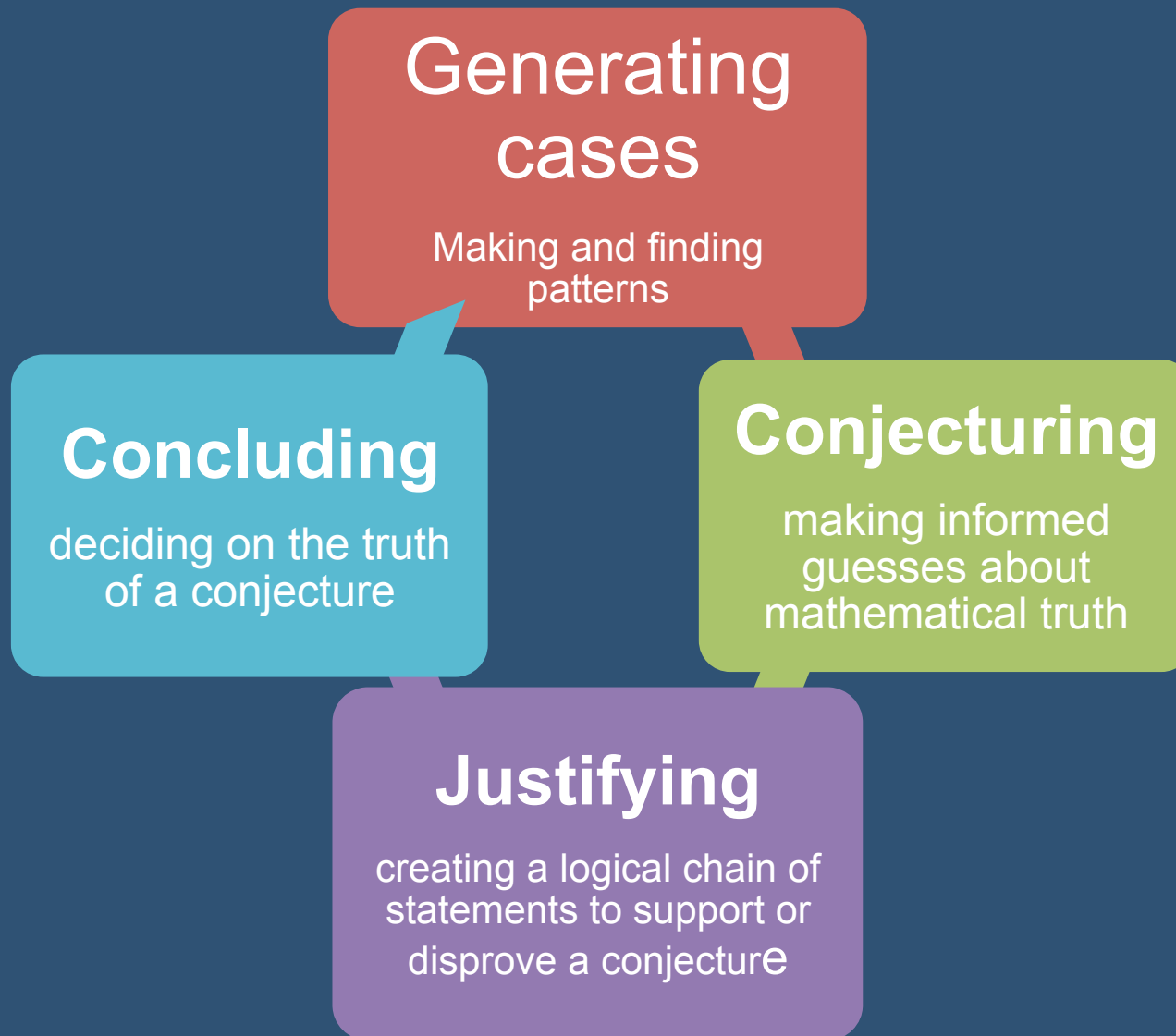
What is math
argumentation?

The social process of
deciding together
what is always true.

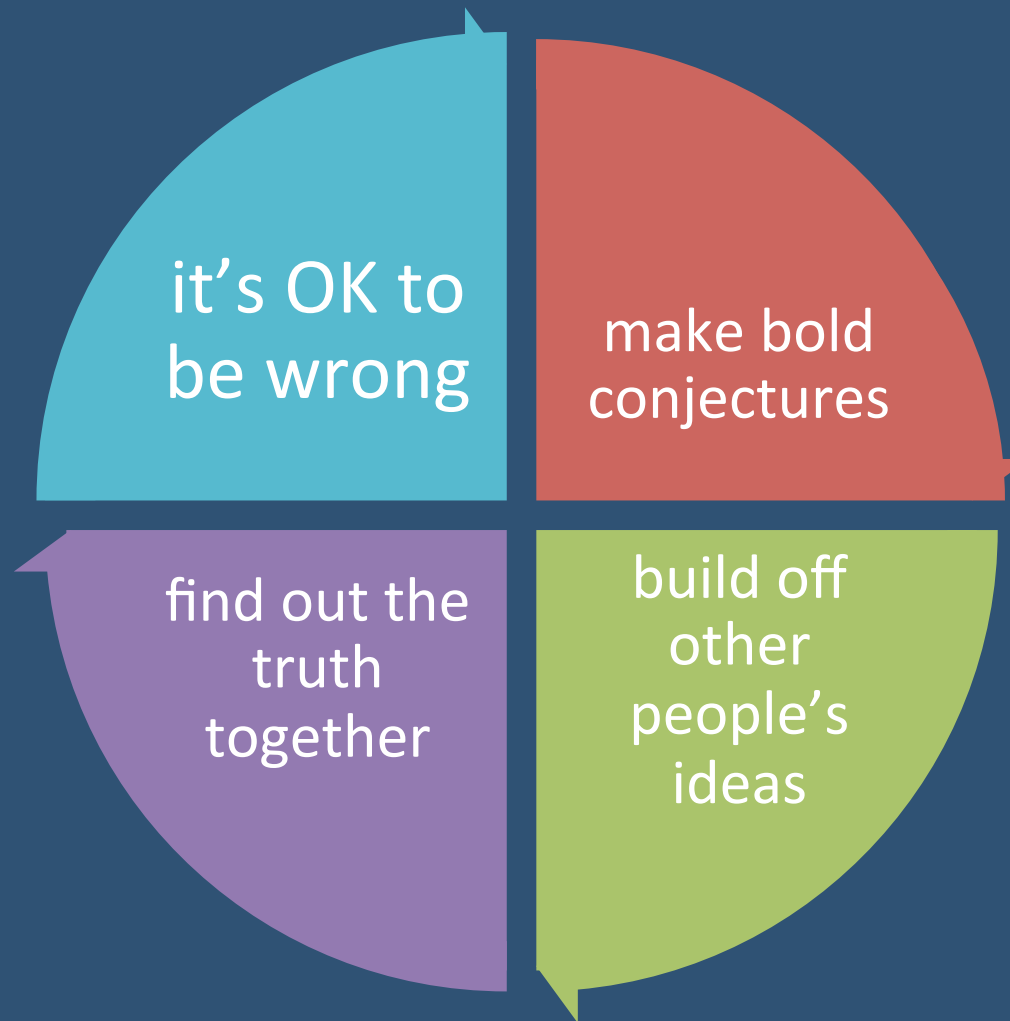


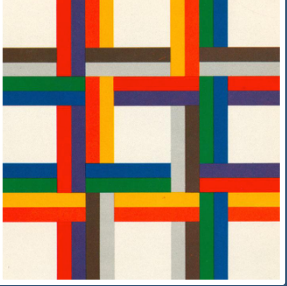
Amani says that if a line is steeper than another, then it represents a faster motion. Is this always true?

A four-part model for math argumentation



Math argumentation requires new norms.





Challenge:

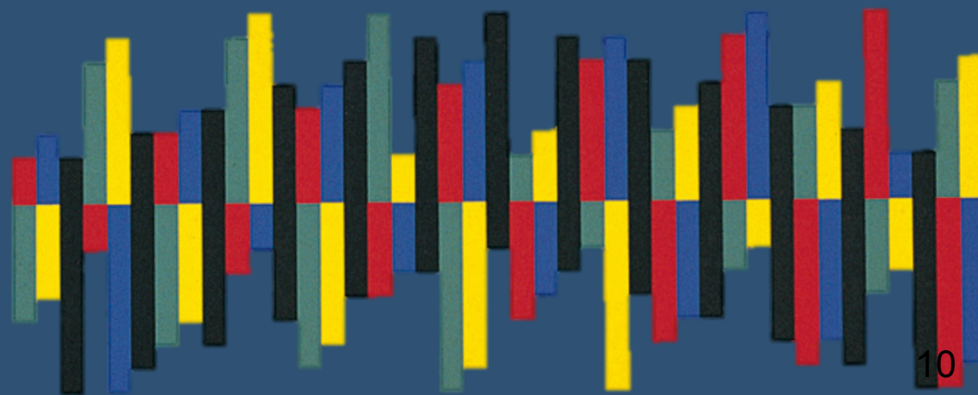
How to engage students whose home and prior school norms may not be aligned with norms for argumentation?

How about students who have not had a positive experience in math class?

Insight: engaging in mathematical argumentation is improvisational!

Effective classroom discussion is *improvisational*, because the flow of the class is unpredictable and emerges from the actions of all participants, both teachers and students.

-- Dr. Keith Sawyer, 2004



We use warm-up improv activities for establishing norms

Aligned with research on productive learning environments for Black, Latino youth and ELL

- Provide high-energy modalities
- Foster sense of belonging
- Kinetically rich experiences bridge everyday experiences and academic content
- Make explicit the norms for argumentation

What are improv activities?

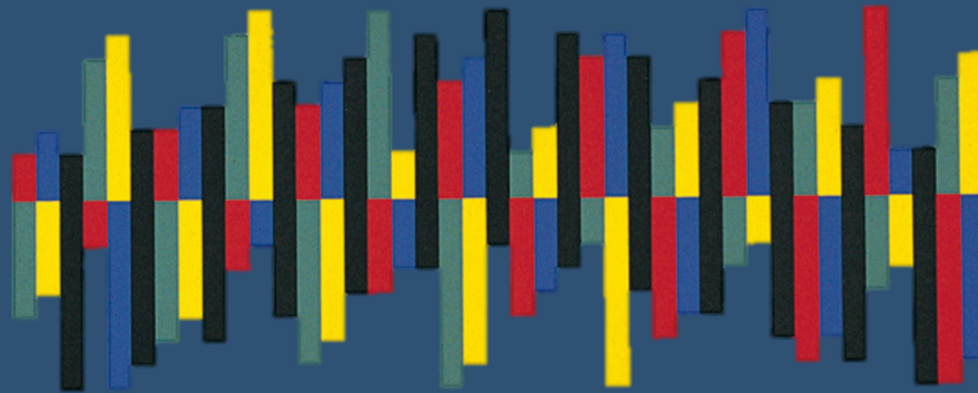
- Games come from improvisational theater
- Rules structure freedom to participate
- Similar to freestyling



Lin-Manuel Miranda at
the White House

We do improv with teachers in our workshops.

Teachers do improv with students in their classrooms.



TOP 10 RULES OF IMPROV

10. Show up
9. Make mistakes, and make them BIG
8. Pay attention
7. Do or Do Not Do
6. Take responsibility - blame yourself
5. Be obvious
4. Make your partner look good
3. Say YES
2. Keep the ball in the air
1. Take care of each other

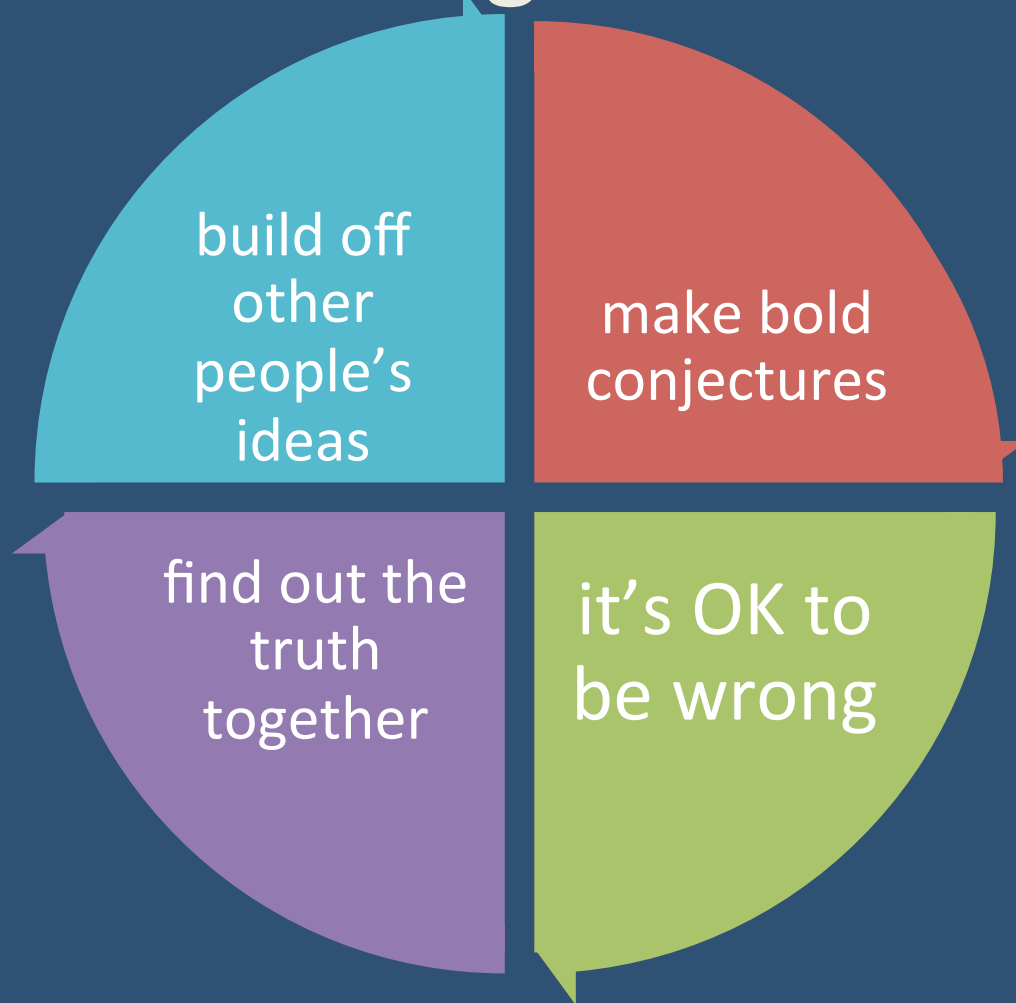
Let's play: *Gift Giving*



Let's play: *Gift Giving*

- Stand facing your partner.
- There's a huge closet of unlimited gifts behind you.
- One person is the **giver**, another person is the **receiver**.
- The **giver** offers the receiver a wrapped gift from the closet.
- The **receiver** opens the gift and gratefully describes (and names) the gift.
- The **giver** responds with an explanation of how and why the gift was selected and why it would be enjoyed.
- Then switch roles.

What does the game have to do with norms for argumentation?



Teacher M played Zip Zap Zop— introductory game

- Students stood in circle, facing each other.
- First student said “Zip” and tossed an imaginary ball to another student.
- That student caught the ball, said “Zop”, and tossed it to a third student.
- The next student said “Zop” when catching the ball. They continued until all had had at least one turn.

Teacher M's students connected the game to argumentation norms

1. “It connects because when we were doing zip, zap, zop, we were going back and forth and it's like speaking, but actually a game. And when we were doing the argument we are also doing the same with ideas instead of using zip zop zap.”
2. “We was speaking loudly enough so everyone can hear.”
3. “When we were making our conjectures, it's okay if we are not right the first time as long as you try.”
4. “Because like, if discussion takes time, one person's doing at a time and nobody's talking over each other.”



Now that you're warmed up:
let's do math
argumentation!

In your
booklet

First: Sums of Consecutive Numbers

- Make a conjecture.
- Justify it using diagrams, words, symbols—or a combination.

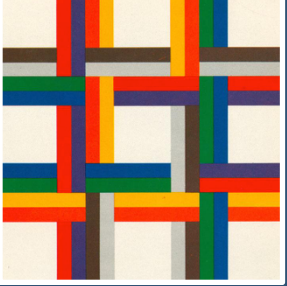
Later: Patterns in Coordinates

- Generate lots of conjectures.



Sums of Consecutive Numbers

- Make a conjecture—what is always true about the sums?
- Justify it using cubes, diagrams, words, symbols—or a combination!

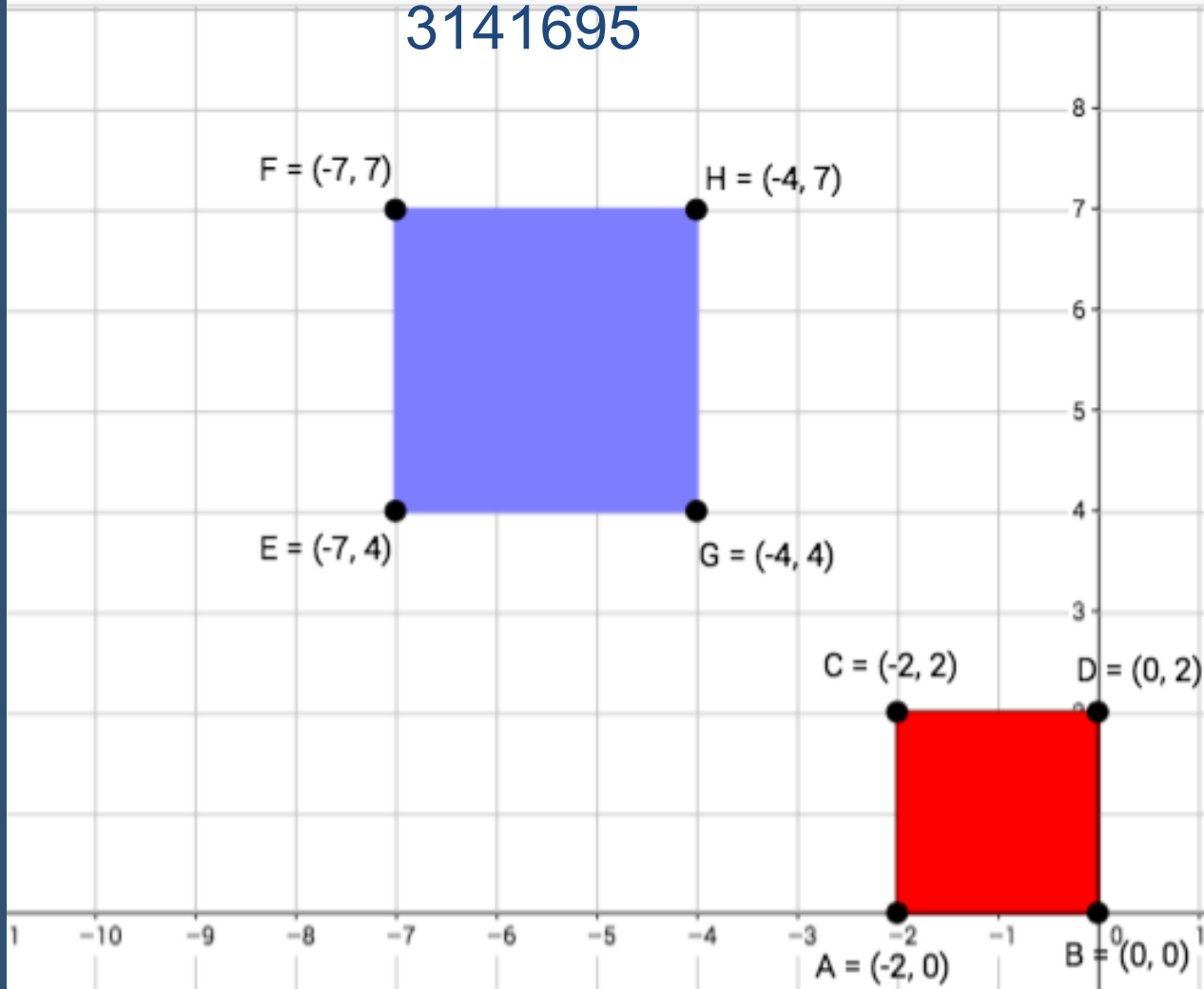


Patterns in Coordinates

- Look for patterns in coordinates of vertices of rectangles.
- Make conjectures—what is always true about the coordinates?
- Make lots of conjectures!

Online activities allow easy exploration of patterns.

GeoGebra <http://www.geogebra.org/m/3141695>



What about patterns in squares?

Bridging helps teachers learn moves to support argumentation.

elicit conjectures

- *What patterns do you see?*
- *Describe the patterns in a sentence.*

ask why

- *How do you know that?*
- *How do we know it is true?*
- *What makes you think so?*
- *Show how you know.*
- *Explain why this must be true.*
- *What's the mathematical reason it's true?*

explain to students

- *what conjecturing, justifying and concluding are.*

Evidence of Effectiveness

In an impact study, Bridging students engaged in twice as much argumentation as “control” students.

In a study of four diverse classrooms, students learned both content and argumentation skills in discourse and writing.

Current research: ongoing now

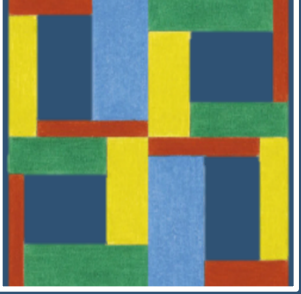
Pre-PD and post-PD (this spring) observations of 28 teachers

Does the PD affect classroom practice? How?

Case studies of 6 teachers:

In-depth analysis of how teachers take up new moves

- New teacher successfully implementing argumentation for the first time
- Experienced teacher expanding her set of moves, incorporating improv



Discussion

Your questions and ideas

How does this relate to your work?