Session 362

Using Visual Representations: Engaging **all** students with the standards for mathematical practice

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NCTM
February 27, 2018
Washington, DC

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This material is based in part upon work supported by the National Science Foundation under NSF Award DRL-1417895. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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In this session

- What are visual representations?
- Zooming in on one math practice: Argumentation
  - About our project
  - Improv games and classroom norms
- Math activity 1: Parallelograms
  - Classroom vignettes
- Math activity 2: Distributive Property
- Discussion
- Teaching moves

Visual representations are...

Ways we can **make sense of** and **communicate** an idea besides using written or spoken words or symbols.

Geometric figures

Enactment

Sketches

Graphs

Gestures

Manipulatives

Number lines

Visual representations help *all* students...

- Engage their prior knowledge
- Model quantities and relationships in story problems
- Create connections between concrete and more abstract ideas
- Communicate what they are thinking (even when they don't have the words to explain what they mean)

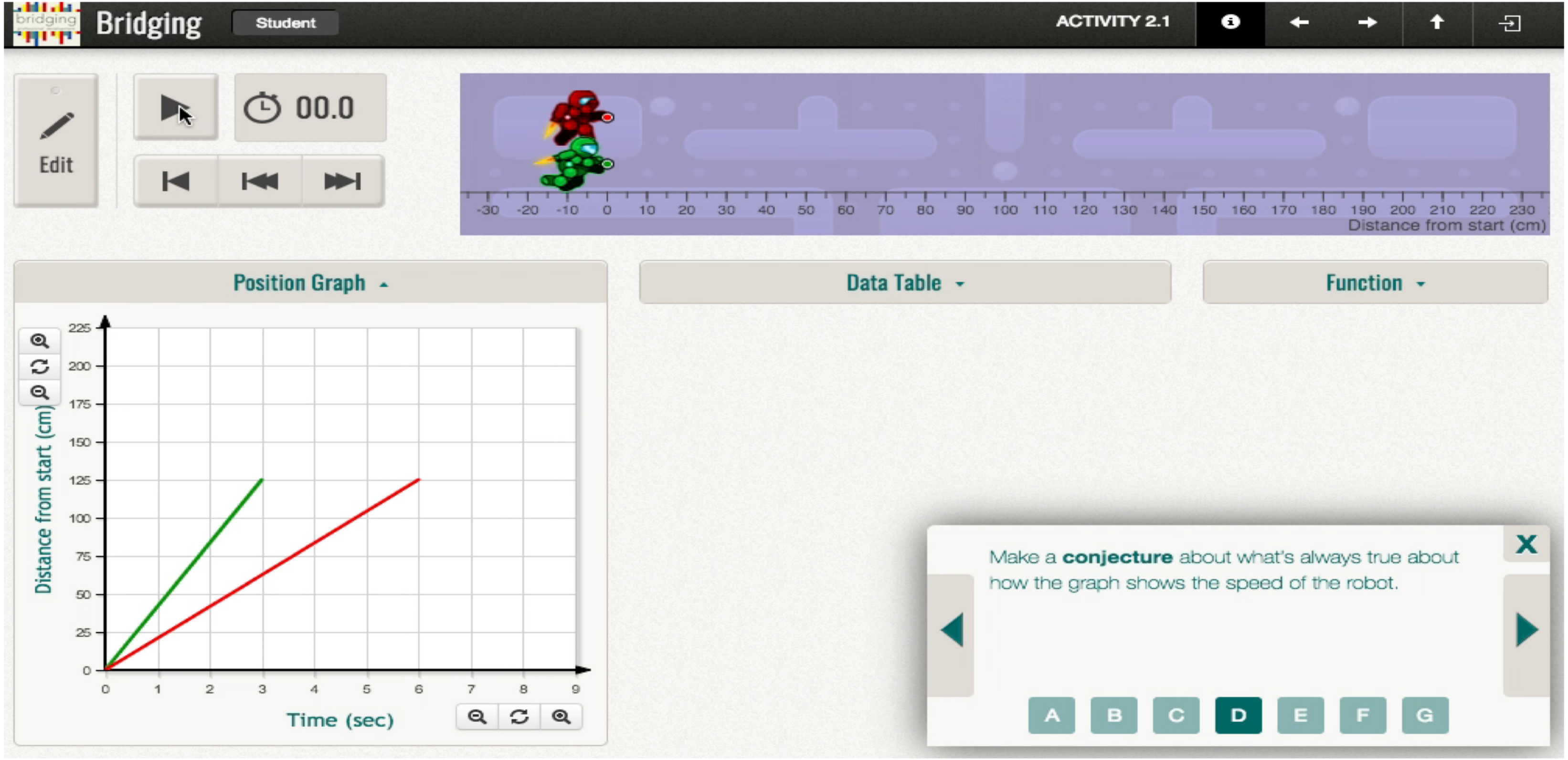
(Arcavi, 2003; Hershkowitz et al., 1989)

Focus on one mathematical practice: Argumentation

- Argumentation is about creating and *justifying* mathematical statements that might be true—*conjectures*.
- Argumentation does not have to be based only on verbal communication.
- Even if students are not highly verbal or fluent with symbols, they can still visually express their arguments and complex ideas.

(Schifter, 2009)

An example of an argument based on visual representations



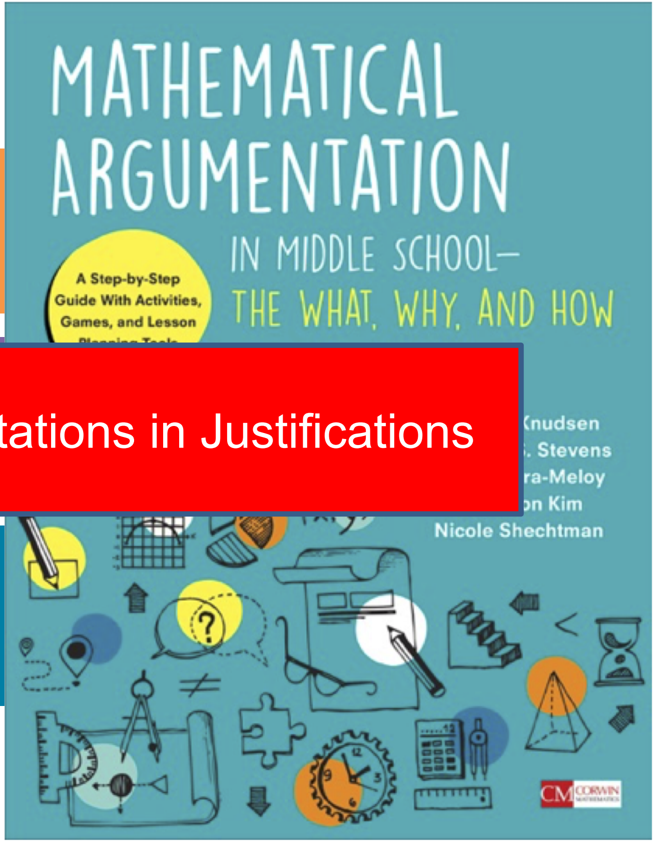
About our program

Curriculum—paper and online activities that provide *opportunities* for argumentation

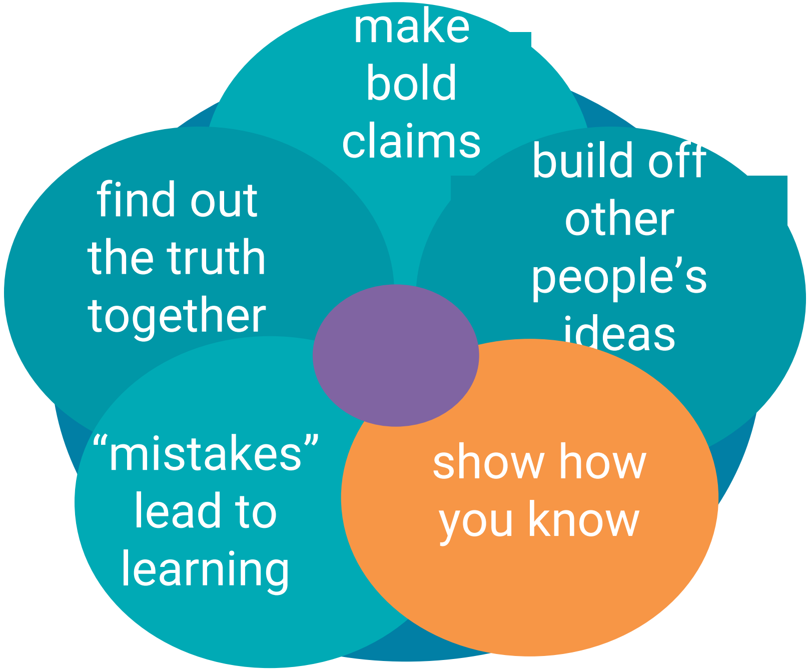
Teaching moves—qu
prompts that *support* argume

Chap 4: Representations in Justifications

Improv warm ups—games that help *establish norms* for argumentation



Argumentation requires new norms



Math Activity 1: Parallelograms

Use dynamic visual representations to investigate this conjecture:

If you make a parallelogram by collapsing a rectangle, **then** the areas of the parallelogram and the rectangle are the same.

Justify whether the conjecture is true or false.

Turn and Talk

- What visual representations did the students use?

- How did the conversations change depending on the visual representations used?
  - How was this different from what you did with GeoGebra?

- How did the teacher encourage students to use visual representations?

Math Activity 2: Distributive Property

Conjecture: a (x + c) = ax + ac is true for all x, no matter what a and c are.

Justify using visual representations.

Choose to use paper-pencil or GeoGebra

https://ggbm.at/ZXDHRgqs

Share: Affordance and drawbacks of different tools

Paper and Pencil	Dynamic Technology (e.g. GeoGebra)

Teaching Moves: Supporting the use of Visual Representations

- Providing students with a range of tools to generate representations: graph paper, 3D manipulatives, dynamic math programs
- Prompting for new representations—for example, “Could you try graphing the rows in the table as points? What shape will they make?”
- Asking students to “Show how you know”
- Encouraging students to manipulate representations in dynamic tools using premade files or web pages

Teaching Moves to Support Visual Representations in the Math Practices

- Use visual representations to **bridge to abstract thinking** (e.g., in adding sums of any two consecutive numbers, students use linking cubes to see patterns and make sense of symbolic representations, $x + (x+1) = 2x+1$).
- Ask students to **generalize** based on a visual representation (e.g., "How does this picture apply to any odd number?").
- Remind students to **pay attention** to how a classmate uses language or gestures to show their thinking.
- Provide **correct vocabulary** after students contribute a gesture (e.g., introduce new words to be more precise, or make a quick sketch to help students use mathematical language)

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