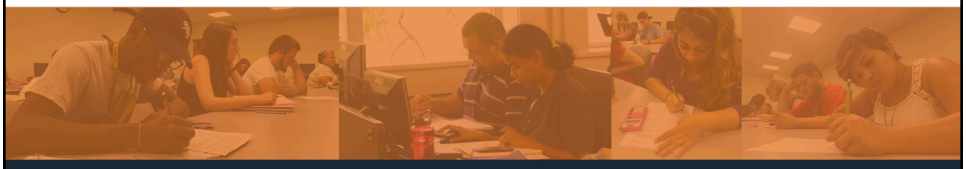
The University of Texas at Austin
Charles A. Dana Center

Going Further: Teaching High School Students to Speak the Language of Mathematics through Selecting, Sequencing, and Connecting Student Responses

Denise Thornton, Mary Davis

July 11, 2019

CAMT Conference, San Antonio, Texas



Today's Facilitators

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About the Dana Center

Equity — Access — Excellence

2019

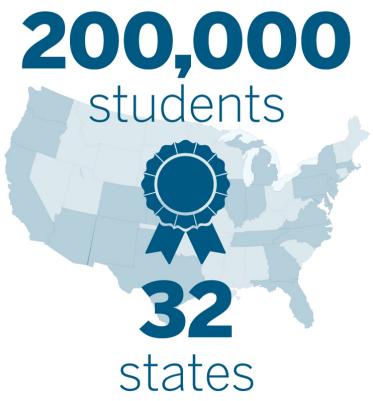
Dana Center by the Numbers

Major grant received from the Bill & Melinda Gates Foundation for our Launch Years initiative, which aims to improve student success in high school mathematics.

Dana Center by the Numbers

We provided professional development for **Department of Defense Education Activity teachers**, benefitting 88,500 students in 14 countries.

Dana Center by the Numbers



Nearly 200,000 students in 32 states were served by **Dana Center–Agile Mind courses**, recognized for their quality by multiple review panels including EdReports.

Dana Center by the Numbers

Nearly 1,000 Louisiana teacher-leaders and mentors received **capacity building support** from our professional learning facilitators.

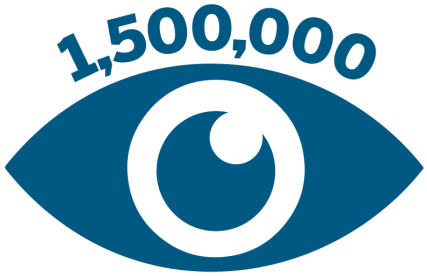
Dana Center by the Numbers

Local, state, and national organizations collaborated with the Dana Center to ensure all students have **equitable access to an excellent education**.

Dana Center by the Numbers

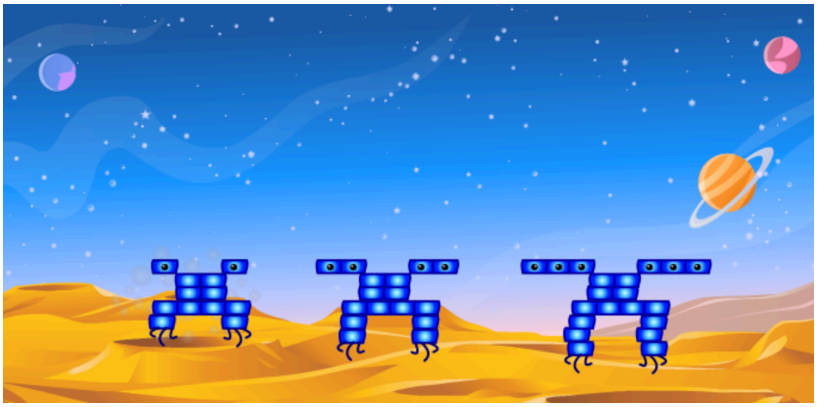
Downloads of free resources for elementary and secondary classrooms from **Inside Mathematics**.

Dana Center by the Numbers



People who viewed MathCuts–**quick, engaging strategies** for K–6 classroom teachers–on Facebook.

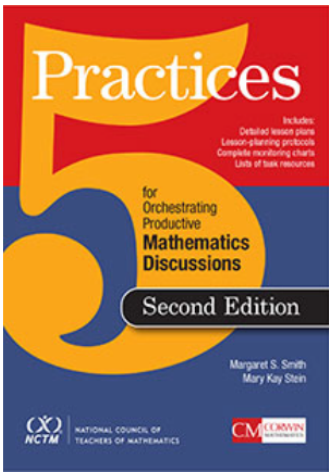
Ultimate Invaders



Used with permission of Agile Mind, Inc., the animation "The Ultimate Invaders Alien Family," which appears in *Texas Mathematics*, part of the family of programs by the Charles A. Dana Center and Agile Mind, Inc.. Available to users of Dana Center/Agile Mind programs in mathematics and science.

To learn more about the family of programs, see http://www.agilemind.com/programs/mathematics

5 Practices for Orchestrating Productive Mathematics Discussions



— Smith, M. S., & Stein, M. K. (2011). *5 practices for orchestrating productive mathematics discussions.* Reston, VA: National Council of Teachers of Mathematics. Available at http://www.nctm.org/Store/Products/5--Practices-for-Orchestrating-Productive-Mathematics-Discussions

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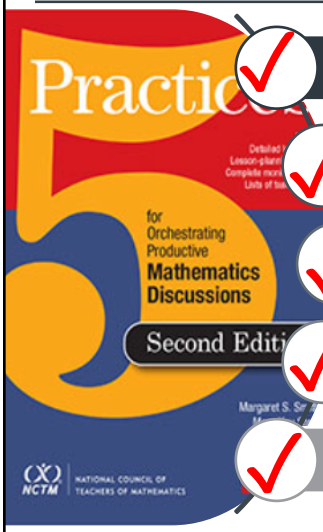


- *Anticipating* student responses prior to the lesson
- *Monitoring* students' work on and engagement with the tasks
- *Selecting* particular students to present their mathematical work
- *Sequencing* students' responses in a specific order for discourse
- *Connecting* different students' responses, and connecting the responses to key mathematical ideas

Orchestrating productive discussions

Work in triads.

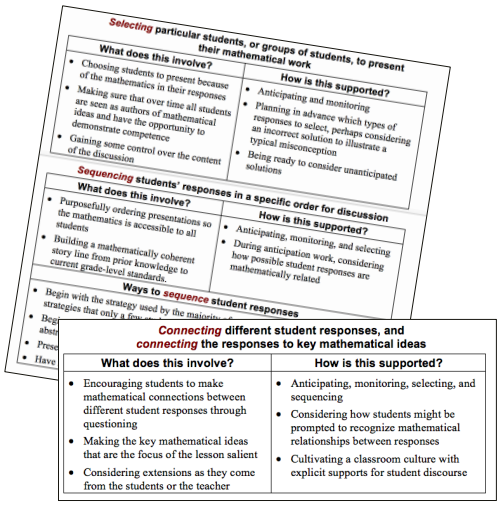
1 – Selecting

2 – Sequencing

3 - Connecting

Read your assigned practice.

- Make note of important takeaways.
- Be prepared to share.



Selecting **particular students, or groups of students, to present their mathematical work**

What does this involve?	How is this supported?
• Choosing students to present because of the mathematics in their responses • Making sure that over time all students are seen as authors of mathematical ideas and have the opportunity to demonstrate competence • Gaining some control over the content of the discussion	• Anticipating and monitoring • Planning in advance which types of responses to select, perhaps considering an incorrect solution to illustrate a typical misconception • Being ready to consider unanticipated solutions

Sequencing **students' responses in a specific order for discussion**

What does this involve?	How is this supported?
• Purposefully ordering presentations so the mathematics is accessible to all students • Building a mathematically coherent story line from prior knowledge to current grade-level standards.	• Anticipating, monitoring, and selecting • During anticipation work, considering how possible student responses are mathematically related

Ways to *sequence* student responses

- Begin with the strategy used by the majority
- Beg
- Prese
- Have

Connecting **different student responses, and *connecting* the responses to key mathematical ideas**

What does this involve?	How is this supported?
• Encouraging students to make mathematical connections between different student responses through questioning • Making the key mathematical ideas that are the focus of the lesson salient • Considering extensions as they come from the students or the teacher	• Anticipating, monitoring, selecting, and sequencing • Considering how students might be prompted to recognize mathematical relationships between responses • Cultivating a classroom culture with explicit supports for student discourse

Orchestrating productive discussions

Selecting particular students, or groups of students, to present their mathematical work

What does this involve?	How is this supported?
• Choosing students to present because of the mathematics in their responses • Making sure that over time, all students are seen as authors of mathematical ideas and have the opportunity to demonstrate competence • Gaining some control over the content of the discussion	• *Anticipating* and *monitoring* • Planning in advance which types of responses to select, perhaps considering an incorrect solution to illustrate a typical misconception • Being ready to consider unanticipated solutions

— Adapted Smith, M. S., & Stein, M. K. (2011). *5 practices for orchestrating productive mathematics discussions.* Reston, VA: National Council of Teachers of Mathematics.

Orchestrating productive discussions

Sequencing students' responses in a specific order for discussion

What does this involve?	How is this supported?
• Purposefully ordering presentations so the mathematics is accessible to all students • Building a mathematically coherent story line from prior knowledge to current grade-level standards	• *Anticipating*, *monitoring*, and *selecting* • During anticipation of work, considering how possible student responses are mathematically related

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Orchestrating productive discussions

Ways to ***Sequence***

- Begin with the strategy used by the majority of students before moving to those strategies that only a few students used.
- Begin with a strategy that is more concrete and then move to strategies that are more abstract.
- Present strategies that address common misconceptions.
- Have related or contrasting strategies presented one right after the other.

— Adapted from Smith, M. S., & Stein, M. K. (2011). *5 practices for orchestrating productive mathematics discussions.* Reston, VA: National Council of Teachers of Mathematics.

Orchestrating productive mathematics discussions

Connecting **different students' responses, and** ***connecting*** **the responses to key mathematical ideas**

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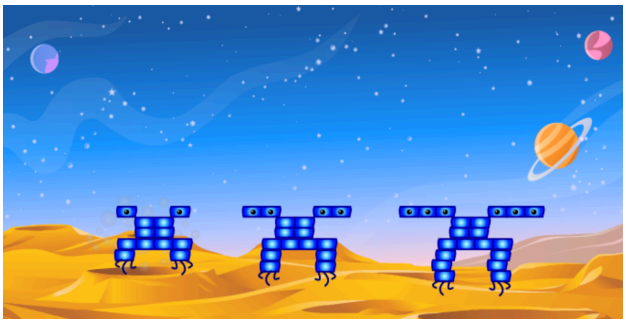
Recall the Ultimate Invaders problem from Session 1.

Learning Goal:
Students will understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities are related.



Credit: Agile Mind, Inc.

Turn and Talk:

- Discuss at least 2 student responses you would anticipate for the Ultimate Invaders problem.

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Orchestrating productive discussions

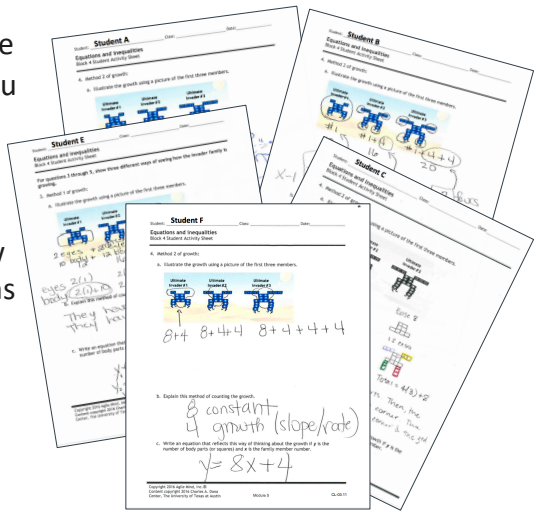
With your group, analyze the student work samples for strategies and misconceptions. Then...

- ***Select*** student work that would best represent the strategies noted in the ***Anticipating*** section or that would help build understanding of the math.
  - In the **Planning for Mathematical Discourse** tool, make note of which students used the anticipated strategies and describe the strategy used.
- ***Sequence*** the selected student work in the order that your group determines would best help the students make sense of the math and make note of the sequence.

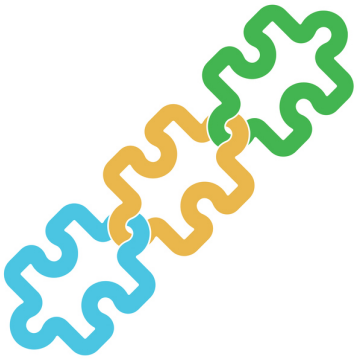
Orchestrating productive mathematics discussions

Tape the student work to the chart paper in a way that you think supports student learning.

Write notes to describe how you would make connections between the students' strategies—and how you would connect these strategies to the learning goal.



Orchestrating productive discussions



CONNECT your knowledge of the the 5 Practices to what you already know?

EXTEND your thinking in new directions?

CHALLENGE previous thoughts or ideas?

Engage with the Dana Center

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Conference Hashtag: #CAMT2019

Contact Information

Visit the Dana Center at utdanacenter.org

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