

## Teaching High School and Middle School Students to Speak the Language of Math (Part Two)

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### About the Dana Center

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— Equity — Access — Excellence —

## Dana Center by the Numbers

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We supported **60,500 K-12 students** attending school on U.S. military bases through our work with the **U.S. Department of Defense Education Activity.**

## Dana Center by the Numbers

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At the close of 2017, the Dana Center has contributed to the **implementation of math pathways** in higher education systems, institutions, and campuses in **29 states.**



## Dana Center by the Numbers



We engaged with **118 districts in 23 states** to provide middle and high school math courses of the **highest quality**, as recognized by rigorous national and state reviews, including EdReports.org, Louisiana Department of Education, and Texas Education Agency panels.

## Agile Mind: Ultimate Invaders Task

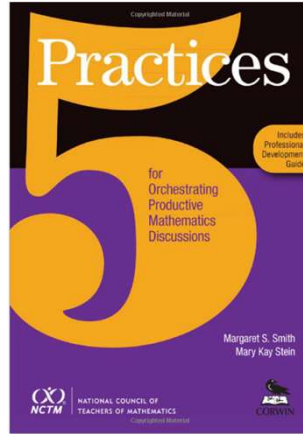


Use the  
unifix cubes  
to justify  
your  
reasoning.

Used with permission of Agile Mind, Inc., the animation "The Ultimate Invaders Alien Family," which appears in *Texas Mathematics 7*, part of the family of programs in middle school mathematics by the Charles A. Dana Center and Agile Mind, Inc.. Available to users of Dana Center/Agile Mind programs in mathematics and science.

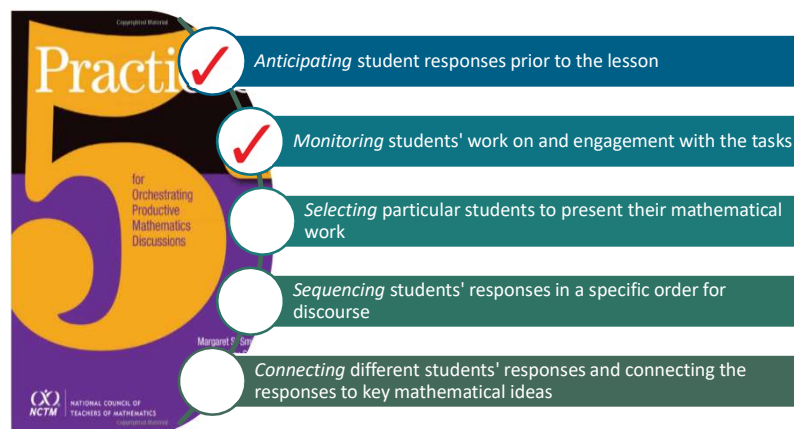
To learn more about the middle school family of programs, see <http://www.agilemind.com/programs/mathematics/middle-school-math>.

## 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>

## 5 Practices for Orchestrating Productive Mathematics Discussions



## Orchestrating Productive Mathematics Discussions

### **Anticipating** student responses prior to the lesson

What should you consider?	How is this supported?
<ul style="list-style-type: none"> <li>The strategies that students must use to approach or solve a challenging mathematical task</li> <li>How to respond to what students produce</li> <li>Which strategies are most useful in addressing the mathematics to be learned</li> </ul>	<ul style="list-style-type: none"> <li>Solving the problem in as many ways as possible</li> <li>Solving the problem with other teachers</li> <li>Drawing on relevant research when possible</li> <li>Documenting student responses year to year</li> </ul>

— 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

### **Monitoring** students' work on, and engagement with, the task

What does this involve?	How is this supported?
<ul style="list-style-type: none"> <li>Circulating while students work, watching and listening</li> <li>Recording interpretations, strategies, and points of confusion</li> <li>Asking probing questions to get students back "on track" or to advance their understanding</li> </ul>	<ul style="list-style-type: none"> <li><i>Anticipating</i> student responses beforehand</li> <li>Using a recording tool</li> <li>Observing students' actual responses during independent work</li> </ul>

— 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

Working with participants at your table:

- Sort your questions into different groups.
- Use a sticky note to label each group of questions and define how you sorted the questions into each group.
- Make note of distinctions between the categories you created.

## Question Types

Question Type	Description
<b>Gathering information</b>	Students recall facts, definitions, or procedures.
<b>Probing thinking</b>	Students explain, elaborate, or clarify their thinking, including articulating the steps in solution methods or the completion of a task.
<b>Making the mathematics visible</b>	Students discuss mathematical structures and make connections among mathematical ideas and relationships.
<b>Encouraging reflection and justification</b>	Students reveal deeper understanding of their reasoning and actions, including making an argument for the validity of their work.

## Anticipating and Monitoring Discourse

**With a partner, use the Agile Mind Ultimate Invaders task to:**

**1) Discuss how you anticipate students will respond.**

**2) Plan possible probing questions to help students through the problem.**

Anticipating and Monitoring Student Responses to Task: Agile Mind Ultimate Invaders Task	
Students will ... <ul style="list-style-type: none"> <li>Solve real-life and mathematical problems using numerical and algebraic expressions and equations.</li> <li>Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.</li> </ul>	
Column 1: Anticipate student responses to the task. Consider: <ul style="list-style-type: none"> <li>Strategies that will be most useful in addressing the learning goals.</li> <li>Strategies that students are likely to use.</li> </ul> Anticipated strategy:	Column 2: Plan purposeful questions to respond to likely student work. Purposeful questions to respond:
Anticipated strategy:	Purposeful questions to respond:
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The Charles A. Dana Center at The University of Texas at Austin

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## Reflection



How can you apply this new learning to support teachers in orchestrating productive mathematical discourse in the classroom?

## Contact Information

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