MPES Conference
Oconomowoc
December 3, 2015
Essential Elements for Mathematical Success

Principles to Actions: Ensuring Mathematics Success for All

NCTM 2014
High Cognitive Demand Tasks: What is the Teachers Role?
LET’S DO SOME MATH!
The Grumpy Cow ice cream shop offers 20 different flavors of ice cream. They sell cones in four sizes: 1-scoop, 2-scoop, 3-scoop and even a 4-scoop ice cream cone.

• How many different ice cream cones are there with 20 flavors of ice cream?
• How many would there be with “n” flavors?
High Cognitive Demand Tasks: What is the Teachers Role?
Learning Intentions & Success Criteria

We are learning strategies to maintain high levels of cognitive demand of a mathematics task during implementation.

We will be successful when we can articulate ways to maintain the high cognitive demand of mathematics tasks.
Mathematics Teaching Practices

- Establish mathematics goals to focus learning.
- **Implement tasks that promote reasoning and problem solving.**
- Use and connect mathematical representations.
- Facilitate meaningful mathematical discourse.
- Pose purposeful questions.
- Build procedural fluency from conceptual understanding.
- Support productive struggle in learning mathematics.
- Elicit and use evidence of student thinking.
Did we engage in a mathematics task that promotes reasoning and problem solving?
High cognitive demand mathematics tasks are those that:

- promote reasoning
- involve problem solving
- engage students in sense-making
- are cognitively complex
# Measuring Cognitive Demand

**Webb’s Depth of Knowledge**

- **DOK 1: Recall**

- **DOK 2: Skills/Concept**

- **DOK 3: Strategic Thinking**

- **DOK 4: Extended Thinking**

**Smith and Stein**

- **Low Level**
  - Memorization
  - Procedures without connections

- **High Level**
  - Procedures with connections
  - Doing Mathematics
“Student learning is greatest in classrooms where the tasks consistently encourage high-level student thinking and reasoning and least in classrooms where the tasks are routinely procedural in nature. (Boaler and Staples 2008; Hiebert and Wearne 1993; Stein and Lane 1996)”

Principles to Actions: Ensuring Mathematical Success for All (p. 17)
How did we do?

Did we engage in a mathematics task that promotes reasoning and problem solving?
tasks with high cognitive demands are the most difficult to implement well and are often transformed into less demanding tasks during instruction. (Stein, Grover, and Henningsen 1996; Stigler and Hiebert 2004)
## Reflecting on Implementation

<table>
<thead>
<tr>
<th>Lowering Cognitive Demand</th>
<th>Maintaining High Cognitive Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name specific moves I made or things I said that lowered the cognitive demand.</td>
<td>What are some things I could have done differently to maintain high cognitive demand?</td>
</tr>
<tr>
<td>What are some moves you’ve made, or seen made, that lowered cognitive demand?</td>
<td>What are some moves you’ve made, or seen made, that maintained or deepened high cognitive demand?</td>
</tr>
</tbody>
</table>
Gallery Walk

Directions for Gallery Walk

• Hang posters on wall in assigned groups.
• Review the other posters in your group.
• Mark moves you have made with a ★
• Move to a group with posters opposite your group.
• Mark moves you have made with a ★
PHASES OF TASK IMPLEMENTATION
Preparing to maintain high cognitive demand

- Clearly articulate learning goal(s).
- Determine level of cognitive demand.
- Anticipate student misconceptions and challenges.
- Prepare guiding questions.
During Task Implementation

Maintaining high cognitive demand

• Provide directions that maintain cognitive demand.

• Ask guiding questions instead of leading questions (or providing answers).
  – Be less helpful!

• Build on student understanding.
Reflect on implementation
• Was the level of cognitive demand maintained?
• What went well? What didn’t?
• What evidence do you have that students achieved the learning goal?
• What misconceptions and challenges came up? How did you address them?
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QUESTIONS?
Learning Intentions & Success Criteria

We are learning strategies for maintaining the level of cognitive demand of a mathematics task during implementation.

We will be successful when we can articulate ways to support teachers in maintaining cognitive demand of mathematics tasks.
The Brookhill Institute of Mathematics exists to raise the mathematical literacy of every learner.
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MISSION STATEMENT
Our mission is to provide K–12 teachers and higher education the opportunity to participate, collaborate, develop, and improve the teaching of mathematics.

We are accomplishing our mission by:

- creating and facilitating mathematical education programs and conferences, bringing diverse education communities together to collaborate, learn from, and inform each other;
- developing and providing high quality professional development for in-service teachers, schools and districts, K–12;
- advocating for and supporting mathematics specialists and teacher leaders at all levels, K–12, including program development and licensing;
- continuing to provide national mathematics communities and organizations support.

UPCOMING EVENTS
12/2-12/3
WMC – MPES Conference, Oconomowoc, WI

- Brookhill Presentation: High Cognitive Demand Tasks, What is the teacher’s role?

12/4
IHE Conference - The Statistical Education of Teachers (SET), Waukesha, WI

+ View Calendar
Exciting Opportunity!!

WSMI Fellows, Cohort II

• Need to have taken two or more WSMI modules
• January - May
• Credit from UW-L
• Learn about cognitive demand
• Online
• 4 Synchronous “Live” Sessions
Thank you!

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