



Brookhill
Institute of Mathematics

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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?

MPES 2015

*Principles to
Actions:
Ensuring
Mathematical
Success for All*

**LET'S DO
SOME MATH!**

Math Task

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?

MPES 2015

*Principles to
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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.

Principles to Actions

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.

How did we do?

Did we engage in a mathematics task that promotes reasoning and problem solving?

Defining High Cognitive Demand

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

Why is high cognitive demand important?

“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?

Why is high cognitive demand important?

“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)”

Principles to Actions: Ensuring Mathematical Success for All (p. 17)

Reflecting on Implementation

Lowering Cognitive Demand

Name specific moves I made or things I said that lowered the cognitive demand.

What are some moves you've made, or seen made, that lowered cognitive demand?

Maintaining High Cognitive Demand

What are some things I could have done differently to maintain high cognitive demand?

What are some moves you've made, or seen made, that maintained or deepened high cognitive demand?

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

Before 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.

After Task Implementation

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?

Principles to Actions

Mathematics Teaching Practices

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- Build procedural fluency from conceptual understanding.
- Support productive struggle in learning mathematics.
- Elicit and use evidence of student thinking.

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.

Vision Statement



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

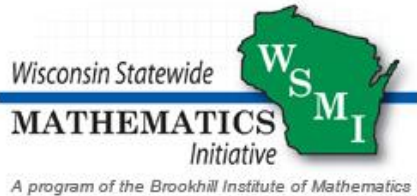
- Brookhill Presentation "High Cognitive Demand Tasks: What is the teacher's role?"

12/4

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

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PROFESSIONAL
DEVELOPMENT

APPLICATIONS AND
REGISTRATION

ELEMENTARY MATHEMATICS
SPECIALIST (EMS)

RESOURCES

CAREERS



Establish a sustainable, statewide effort for high quality mathematics education and learning!

Sign Up for WSMI Updates

First name *

Last name *

Email address *

Organization/School/District *

[Sign Up](#)

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!

President

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