Diving Deeper into the Common Core State Standards for Mathematics:
Leading with the Mathematical Practices

Today's Webinar will begin shortly

Please download the webinar handout at:
http://www.carnegielearning.com/webinars/deeper-dive-into-the-common-core-mathematical-standards/

There TWO ways to hear the audio portion of this webinar:

Streaming audio through your computer's speakers

Via Telephone:
US/Canada: 866-699-3239
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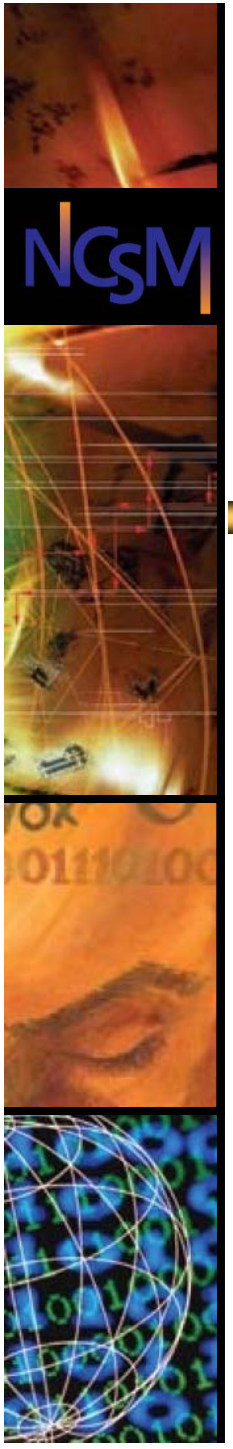

National Council of Supervisors of Mathematics

Diving Deeper into the Common Core State Standards for Mathematics:

Leading with the Mathematical Practices

www.mathedleadership.org

Presenters

Diane J. Briars, NCSM President

Valerie Mills, NCSM Central 1 Regional Director

Suzanne Mitchell, NCSM President-Elect

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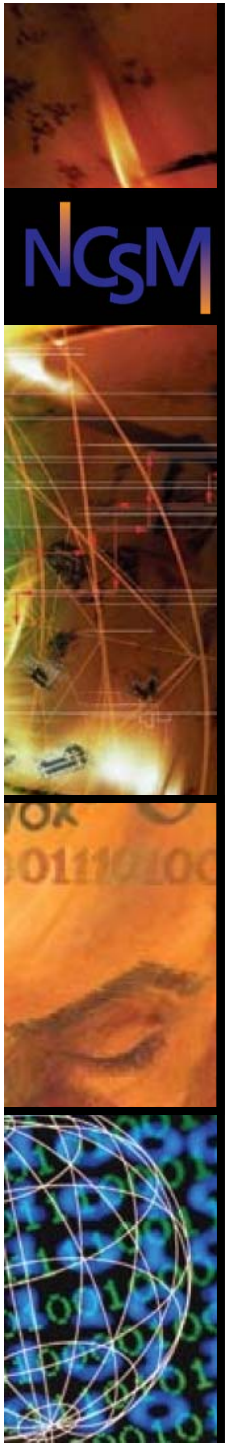

The critical first steps will be to help educators interpret and understand the CCSS and to support the development and implementation of comprehensive, coherent instruction and assessment systems… we plan to work with our local, state, and national affiliates to feature the CCSS in our professional development opportunities, including annual and regional conferences, academies, and seminars…

NCSM Joint Public Statement with NCTM, AMTE and ASSM, June 2010

Today's Goals

- Provide a close look at the Standards for Mathematical Practices
- Consider how you can support student engagement in the mathematical practices through your mathematics program.

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What is NCSM?

International organization of and for mathematics education leaders:

- Coaches and mentors
- Curriculum leaders
- Department chairs
- District supervisors/leaders
- Mathematics consultants
- Mathematics supervisors
- Principals
- Professional developers
- Publishers and authors
- Specialists and coordinators
- State and provincial directors
- Superintendents
- Teachers
- Teacher educators
- Teacher leaders

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Common Core State Standards for Mathematics

Two types of standards:

- Content Standards
- Standards for Mathematical Practice

Please have a copy of the Standards for Mathematical Practice.

They are in the webinar handout at
http://www.carnegielearning.com/webinars/deeper-dive-into-the-common-core-mathematical-standards/

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Standards for Mathematical Practice

"The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education."
(CCSS, 2010)

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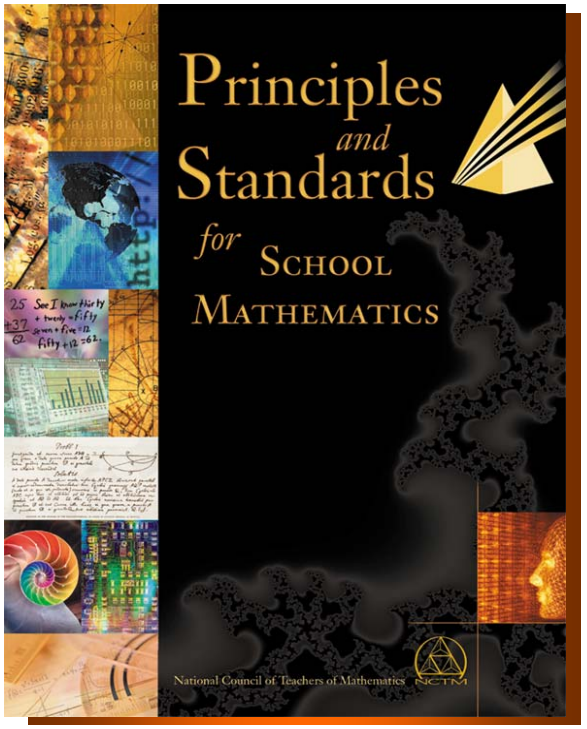
Underlying Frameworks

National Council of Teachers of Mathematics

5 **Process** Standards

- Problem Solving
- Reasoning and Proof
- Communication
- Connections
- Representations



NCTM (2000). *Principles and Standards for School Mathematics*. Reston, VA: Author.

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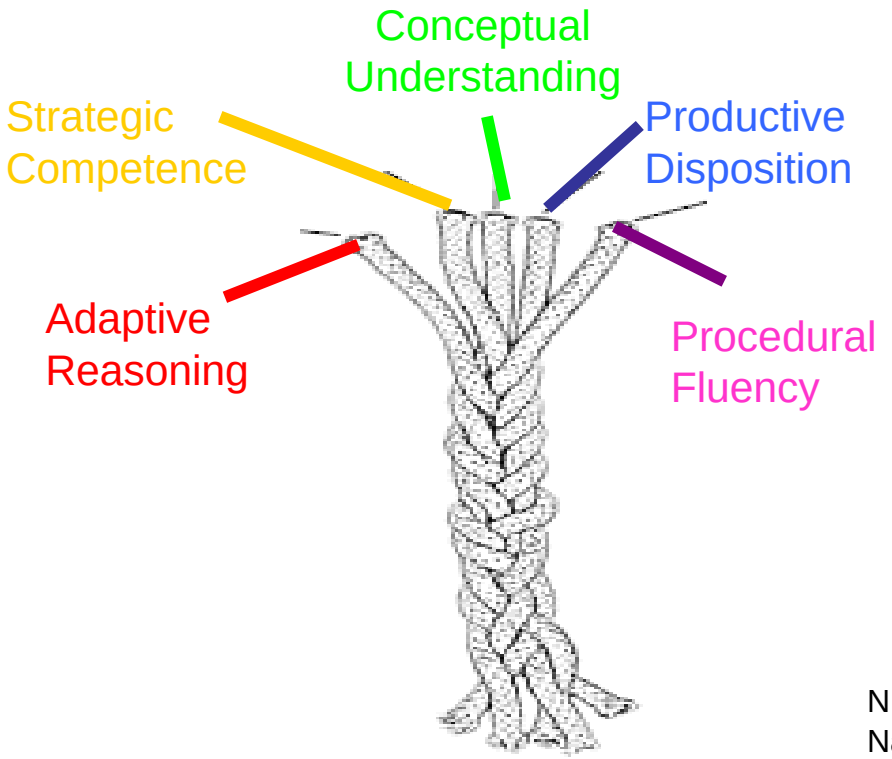
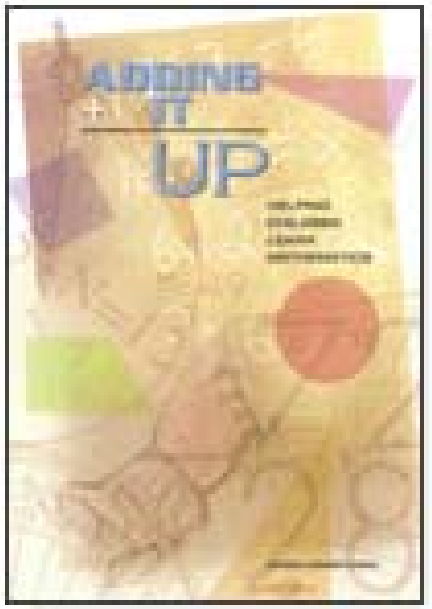
Underlying Frameworks

Strands of Mathematical Proficiency





NRC (2001). *Adding It Up*. Washington, D.C.: National Academies Press.

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Strands of Mathematical Proficiency

- ***Conceptual Understanding*** – comprehension of mathematical concepts, operations, and relations
- ***Procedural Fluency*** – skill in carrying out procedures flexibly, accurately, efficiently, and appropriately
- ***Strategic Competence*** – ability to formulate, represent, and solve mathematical problems
- ***Adaptive Reasoning*** – capacity for logical thought, reflection, explanation, and justification
- ***Productive Disposition*** – habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

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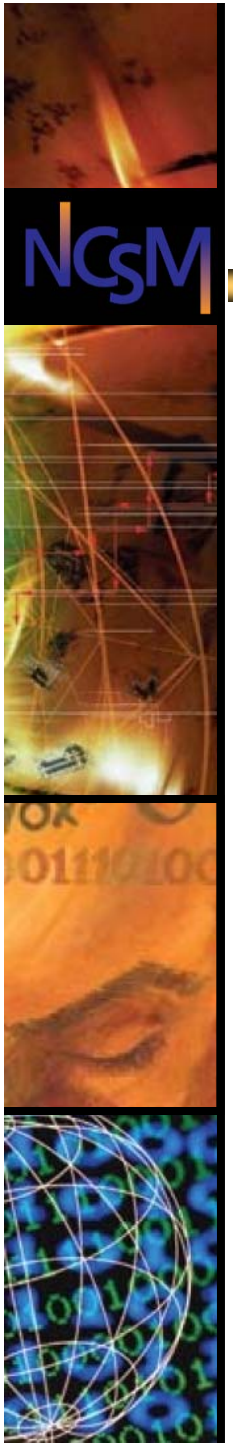

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

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The Standards for Mathematical Practice

Take a moment to examine the first three words of each of the 8 mathematical practices… what do you notice?

Mathematically Proficient Students…

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The Standards for [Student] Mathematical Practice

Consider the *verbs* that illustrate the student actions each practice.

For example, examine Practice #3: Construct viable arguments and critique the reasoning of others.

Highlight the verbs.

Discuss with a partner:

What jumps out at you?

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Mathematical Practice #3: Construct viable arguments and critique the reasoning of others

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and-if there is a flaw in an argument-explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

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Mathematical Practice #3: Construct viable arguments and critique the reasoning of others

Mathematically proficient students:

- understand and use stated assumptions, definitions, and previously established results in constructing arguments.
- make conjectures and build a logical progression of statements to explore the truth of their conjectures.
- analyze situations by breaking them into cases, and can recognize and use counterexamples.
- justify their conclusions, communicate them to others, and respond to the arguments of others.
- reason inductively about data, making plausible arguments that take into account the context from which the data arose.
- compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and-if there is a flaw in an argument-explain what it is.
- construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades.
- determine domains to which an argument applies.
- listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

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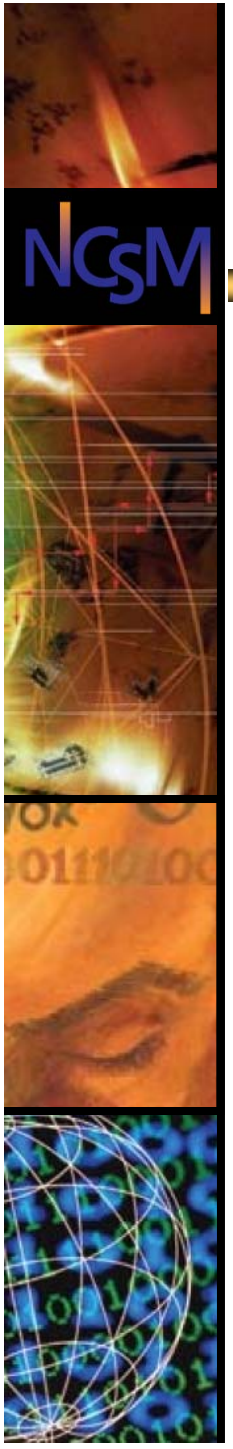

Mathematical Practice #3: Construct viable arguments and critique the reasoning of others

Mathematically proficient students:

- understand and use stated assumptions, definitions, and previously established results in constructing arguments.
- make conjectures and build a logical progression of statements to explore the truth of their conjectures.
- analyze situations by breaking them into cases, and can recognize and use counterexamples.
- justify their conclusions, communicate them to others, and respond to the arguments of others.
- reason inductively about data, making plausible arguments that take into account the context from which the data arose.
- compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and-if there is a flaw in an argument-explain what it is.
- construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades.
- determine domains to which an argument applies.
- listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

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The Standards for [Student] Mathematical Practice

On a scale of 1 (low) to 6 (high),

to what extent is your school/district promoting students' proficiency in Practice 3?

Evidence for your rating?

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The Standards for [Student] Mathematical Practice

SMP1: *Explain and make conjectures…*

SMP2: *Make sense of…*

SMP3: *Understand and use…*

SMP4: *Apply and interpret…*

SMP5: *Consider and detect…*

SMP6: *Communicate precisely to others…*

SMP7: *Discern and recognize…*

SMP8: *Notice and pay attention to…*

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Standards for Mathematical Practice

- Describe the thinking processes, habits of mind and dispositions that students need to develop a deep, flexible, and enduring understanding of mathematics; in this sense they are also a means to an end.

SP1. Make sense of problems

"….they [students] analyze givens, constraints, relationships and goals. ….they monitor and evaluate their progress and change course if necessary. …. and they continually ask themselves "Does this make sense?"

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Standards for Mathematical Practice

AND….

- Describe mathematical content students need to learn.

SP1. Make sense of problems

"……. students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends."

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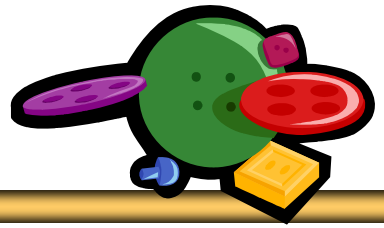
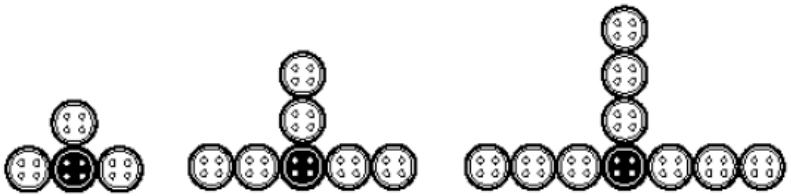
Buttons Task



Gita plays with her grandmother's collection of black & white buttons. She arranges them in patterns. Her first 3 patterns are shown below.



Pattern #1 **Pattern #2** **Pattern #3** **Pattern #4**

1. Draw pattern 4 next to pattern 3.
2. How many white buttons does Gita need for Pattern 5 and Pattern 6? Explain how you figured this out.
3. How many buttons in all does Gita need to make Pattern 11? Explain how you figured this out.
4. Gita thinks she needs 69 buttons in all to make Pattern 24. How do you know that she is **not** correct?
   How many buttons does she need to make Pattern 24?

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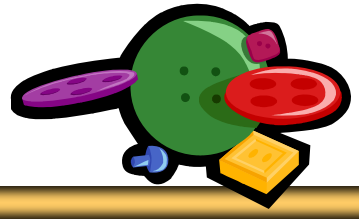
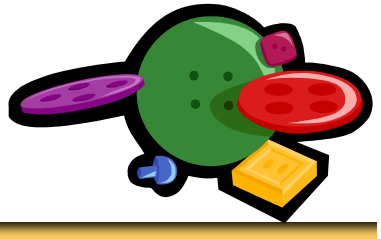
Button Task



1. Individually complete parts 1 - 3.
2. Then work with a partner to compare your work and complete part 4. (Look for as many ways to solve parts 3 and 4 as possible.)

Buttons Task-Solutions



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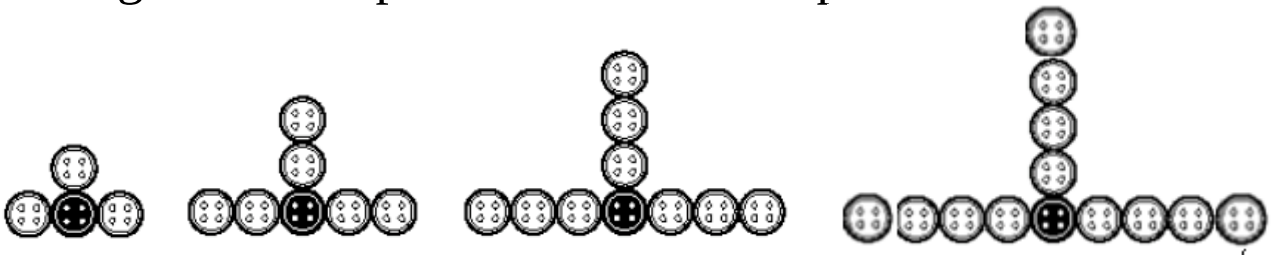

Pattern #1 **Pattern #2** **Pattern #3** **Pattern #4**

1. Draw pattern 4 next to pattern 3.
2. How many white buttons does Gita need for Pattern 5 and Pattern 6? Explain how you figured this out. 15 buttons and 18 buttons
3. How many buttons in all does Gita need to make Pattern 11? Explain how you figured this out. 34 buttons
4. Gita thinks she needs 69 buttons in all to make Pattern 24. How do you know that she is **not** correct?

   How many buttons does she need to make Pattern 24? 73 buttons

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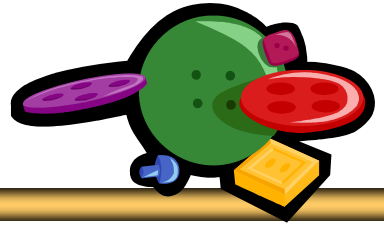
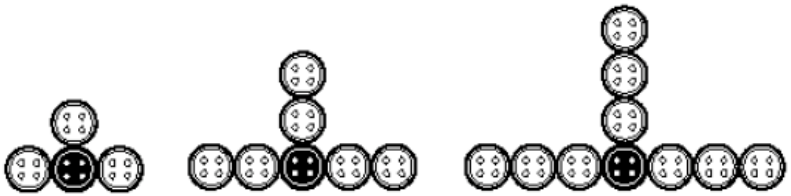
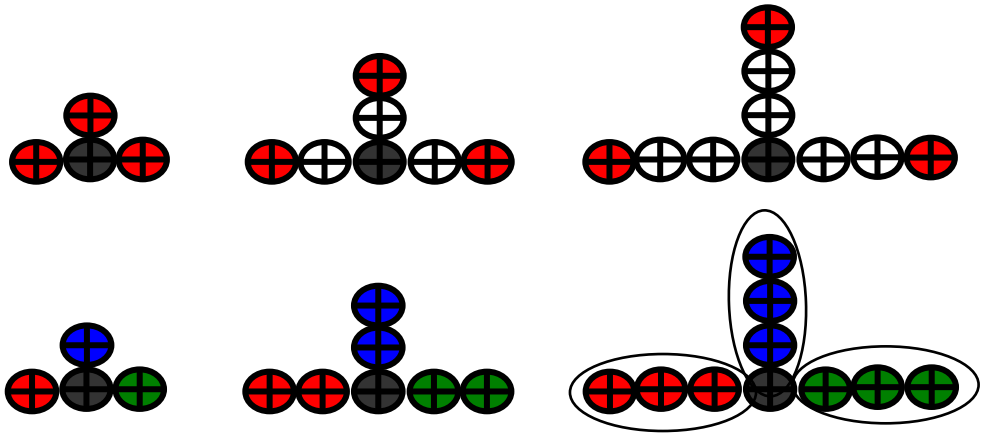
Buttons Task



How many buttons in all does Gita need to make Pattern 11? Explain how you figured this out.



Pattern #1 **Pattern #2** **Pattern #3** **Pattern #11**



- 3+3+3+3+3+3+3+3+3+3+3+1
- 11 groups of 3 plus 1
- (11 x 3) + 1

- 11 + 11 + 11 + 1
- 3 groups of 11 plus 1
- 3 x 11 + 1

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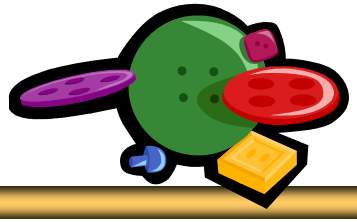
Button Task



Which mathematical *practices* are needed complete the task?

Indicate the primary practice.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
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Standards for [*Student*] Mathematical Practice

"Not all tasks are created equal, and ***different tasks will provoke different levels and kinds of student thinking***."

Stein, Smith, Henningsen, & Silver, 2000

"***The level and kind of thinking in which students engage determines what they will learn***."

Hiebert, Carpenter, Fennema, Fuson, Wearne, Murray, Oliver, & Human, 1997

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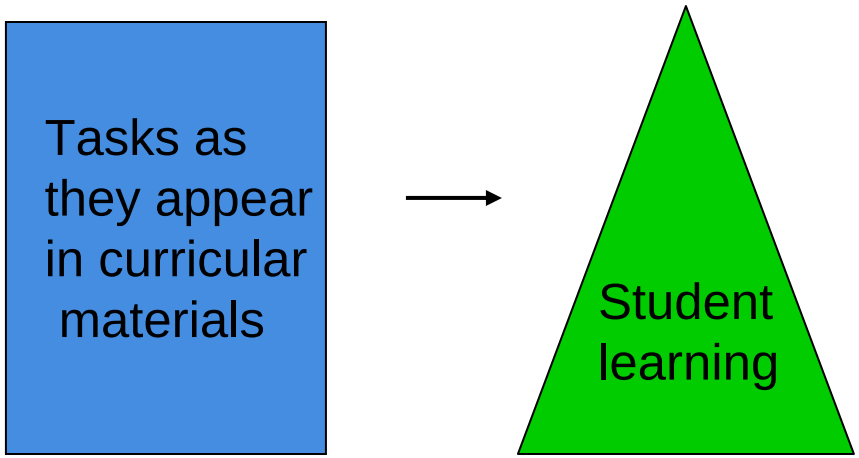
The Nature of Tasks Used in the Classroom …

Will Impact Student Learning!



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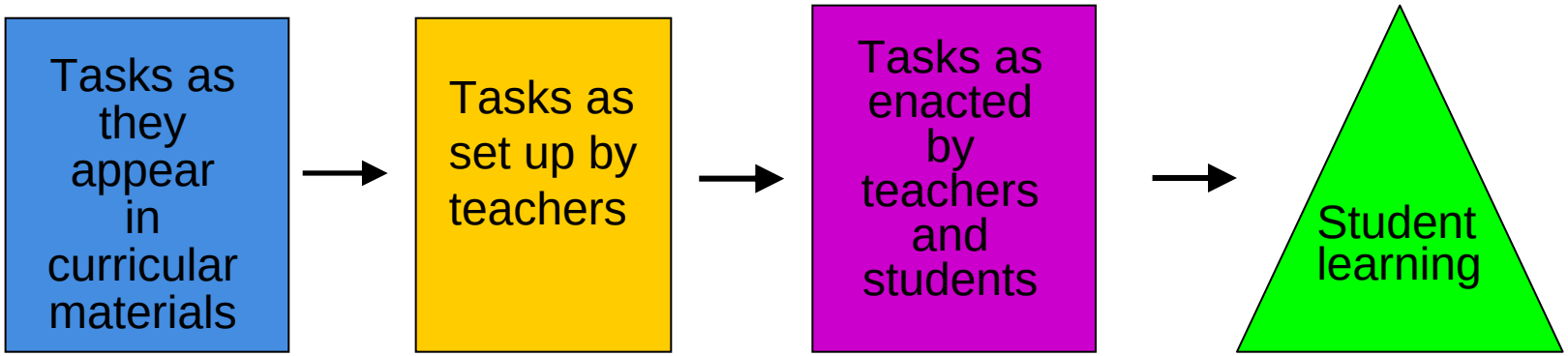
But, WHAT TEACHERS DO with the tasks matters too!

The Mathematical Tasks Framework



Stein, Grover & Henningsen (1996)
Smith & Stein (1998)
Stein, Smith, Henningsen & Silver (2000)

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www.Inside Mathematics.org

A reengagement lesson using the Button Task

Francis Dickinson
San Carlos Elementary
Grade 5

- http://www.insidemathematics.org/index.php/classroom-video-visits/public-lessons-numerical-patterning/218-numerical-patterning-lesson-planning?phpMyAdmin=NqJS1x3gaJqDM-1-8LXtX3WJ4e8

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Learner A

3. How many buttons in all does Gita need to make Pattern 11?

34 buttons ✓ 1

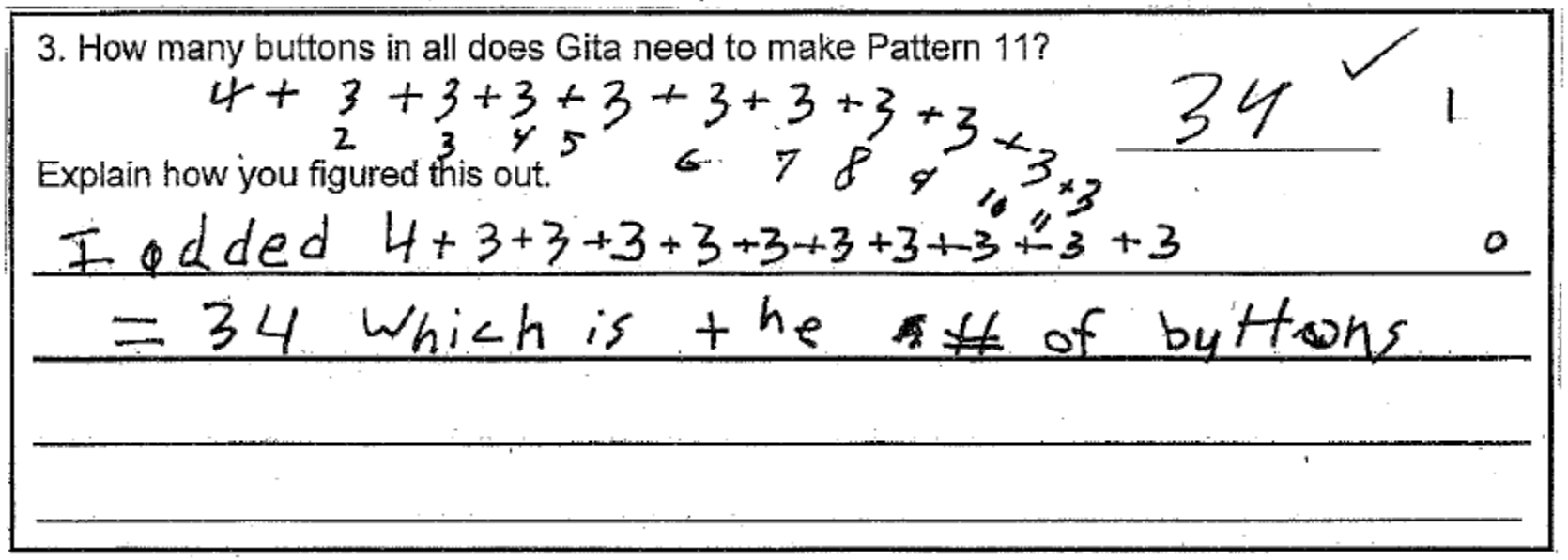
Explain how you figured this out.

1 x (11 x 3) + 1 = 34 buttons

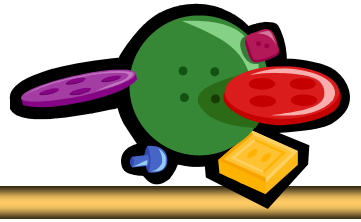
I added one for the black button 1

in the middle

Learner B


3. How many buttons in all does Gita need to make Pattern 11?
4 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3
34
1
Explain how you figured this out.
I added 4 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3
0
= 34 which is the # of buttons

Button Task Revisited



- What might a teacher get out of using the same math task two days in a row, rather than switching to a different task(s)?
  - Address common misconceptions
  - Support students in moving from less to more sophisticated solutions

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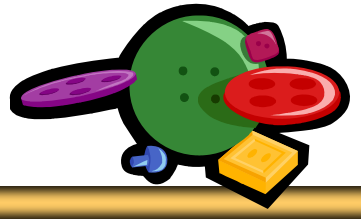
Button Task Revisited



Which of the Standards of Mathematical Practice did the students engage in when they revisited the task?

Indicate the primary practice.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
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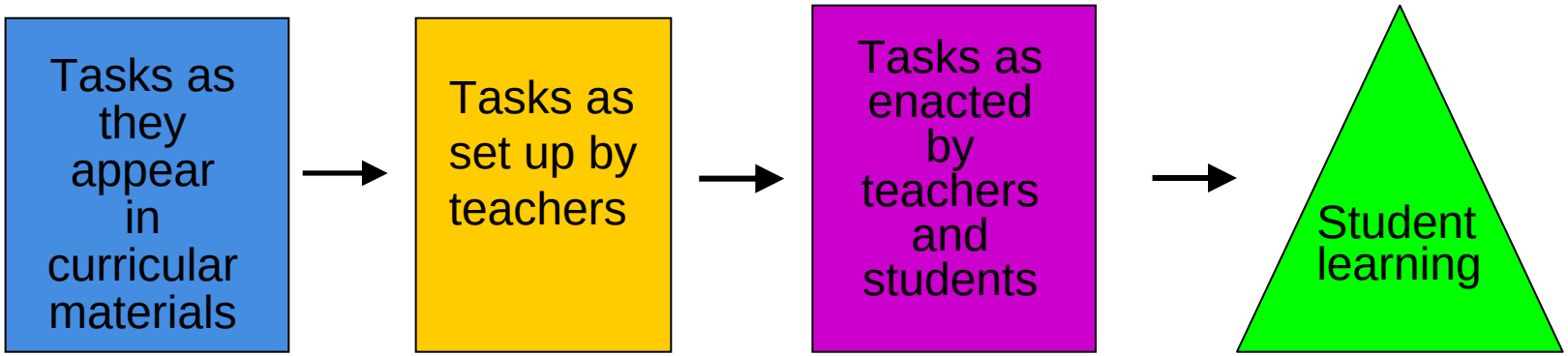

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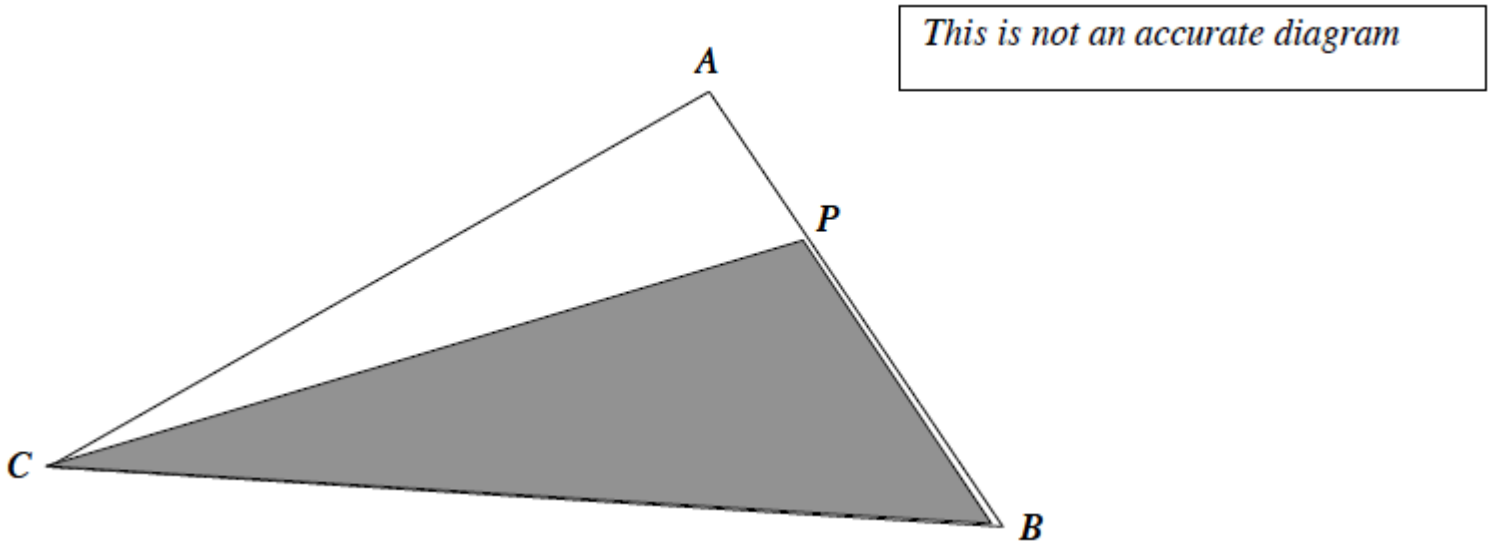
Triangles Task

In triangle *ABC*, the point *P* is one third of the way from *A*



1. Explain why the area of the shaded triangle is 2/3 of the area of triangle *ABC*.

Source: Insidemathematics.org: MARS, 2008

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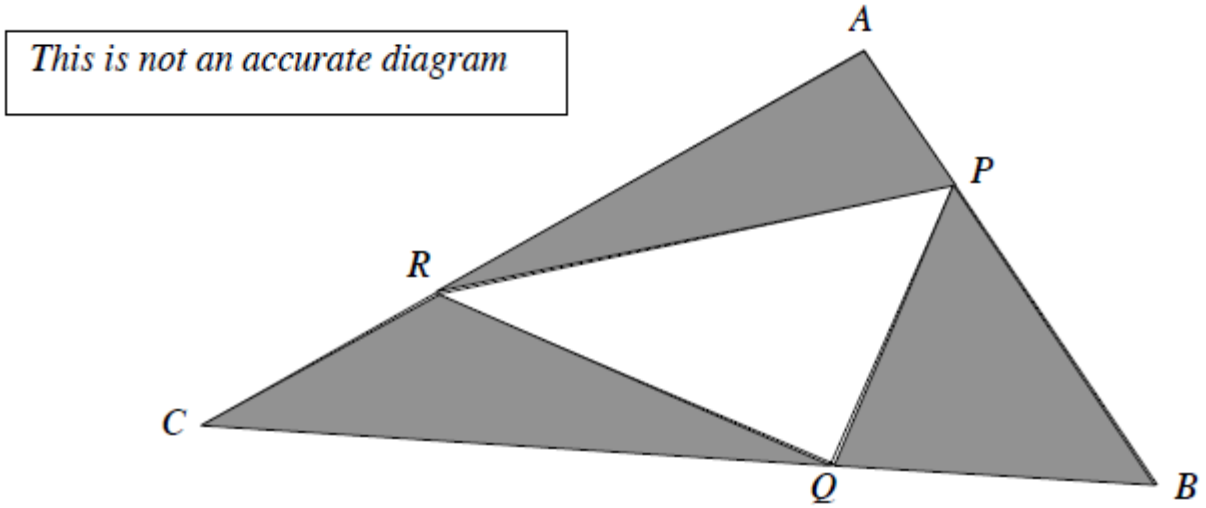
Triangles Task

Two new points, Q and R, have been added to triangle ABC. Q is one third of the way form B to C and R is one third of the way from C to A.



2. Explain why the area of shaded triangle PBQ is 1/3 of 2/3 of the area of triangle *ABC*.

Source: Insidemathematics.org: MARS, 2008

Standards for [*Student*] Mathematical Practice

The 8 Standards for Mathematical Practice – place an emphasis on student demonstrations of learning…

Equity begins with an understanding of how the selection of tasks, the assessment of tasks, the student learning environment creates great inequity in our schools…

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Implementation Issue

To what extent do *all* students in your class, school or district have the opportunity to engage in tasks that promote attainment of the mathematical practices on a regular basis?

Please rate on a scale of

1 (low) to 6 (high).

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Leading with the Mathematical Practices

- Build upon/extend work on NCTM Processes and NRC Proficiencies
- Phase in implementation
- Consider relationships among the practices
- Analyze instructional tasks in terms of opportunities for students to regularly engage in practices.

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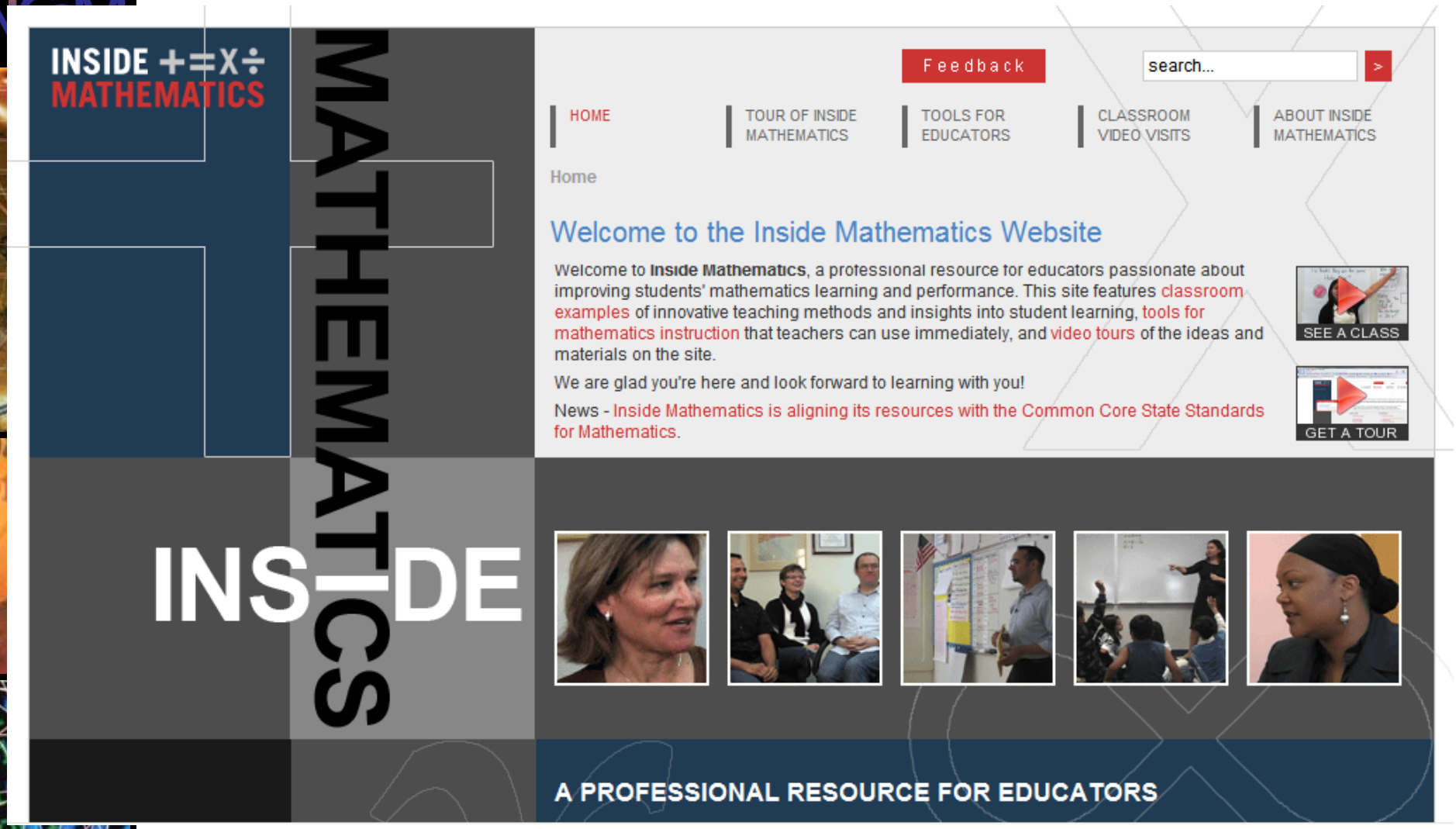
Insidemathematics.org



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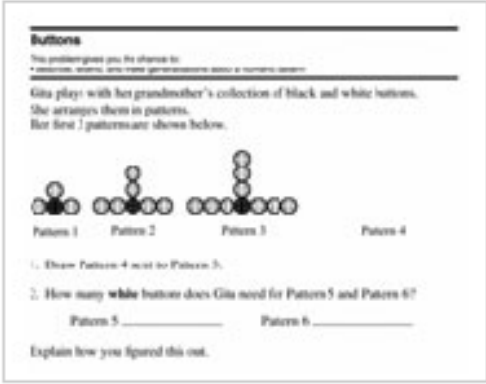
MARS Tasks

Buttons

- Task
- Rubric
- Core Mathematical Ideas and Challenges
- Questions for Teacher Reflection
- Discussion of Successful Examples of Student Work
- Discussion of Student Misconceptions
- Graph and Analysis of the MARS Task Data
- Summary of Student Understandings and Misunderstandings
- Implications for Instruction
- Entire "Buttons" Toolkit Packet (large file)

- Video


Buttons

Gita plays with her grandmother's collection of black and white buttons.
She arranges them in patterns.
Her first 3 patterns are shown below.

Pattern 1 Pattern 2 Pattern 3 Pattern 4

1. Draw Pattern 4 next to Pattern 3.

2. How many **white** buttons does Gita need for Pattern 5 and Pattern 6?

Pattern 5 _____ Pattern 6 _____

Explain how you figured this out.

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Forthcoming Resources and Tools NCSM

- *Illustrating the Standards for Mathematical Practice* professional development materials.
  - NCSM Annual Conference session
- Tool for analyzing instructional materials in light of CCSS and related professional development activities.
  - Under development in collaboration with Bill Bush, University of Louisville, and CCSSO.
  - Target release date: June 1, 2011.

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AMTE, ASSM, NCSM, NCTM Priority Activities

1. *Advancing the Vision of High Quality Mathematics Education: Supporting Implementation of CCSS.*
    a. Toolkit
    b. Regional meetings of leadership teams
2. Appoint a Joint Committee of AMTE, ASSM, NCSM and NCTM to serve as an ongoing advisory group regarding CCSS.
3. Convene a panel of professional development experts to develop a conceptual framework for teacher professional development systems to support CCSS at the school, district and state levels.

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AMTE, ASSM, NCSM, NCTM Priority Activities

4. Convene an Assessment Working Group to coordinate the field's best guidance on assessment development and ensure that new student assessments address the priorities (e.g., mathematical practices) articulated in CCSS.
5. Develop and launch a research agenda focused on implementation of the CCSS that includes systematic study of the instantiation and implementation of the standards, monitors the impact on instruction and student learning and informs revisions of CCSS.

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Forthcoming CCSS Companion Resources

- Technical Manual
  - Highlights structural features in the standards but not highly visible, e.g., how particular ideas connect and grow across grades.
- Standards Progressions documents

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The Illustrative Mathematics Project

- Will develop a complete set of tasks for each standard
  - Range of difficulty
  - Simple illustrations of single standards to complex tasks spanning many standards.
- Provide a process for submitting, discussing, reviewing, and publishing tasks.
- Launch Team: Phil Daro, William McCallum (chair), Jason Zimba

illustrativemathematics.org

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NCSM Professional Development Opportunities

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NCSM Professional Development Opportunities

- NCSM Summer Leadership Academy
  - June 21-23, 2011, Atlanta, GA
- Fall One-Day Seminars
  - October 19, 2011, Atlantic City
  - October 26, 2011, St. Louis
  - November 2, 2011, Albuquerque

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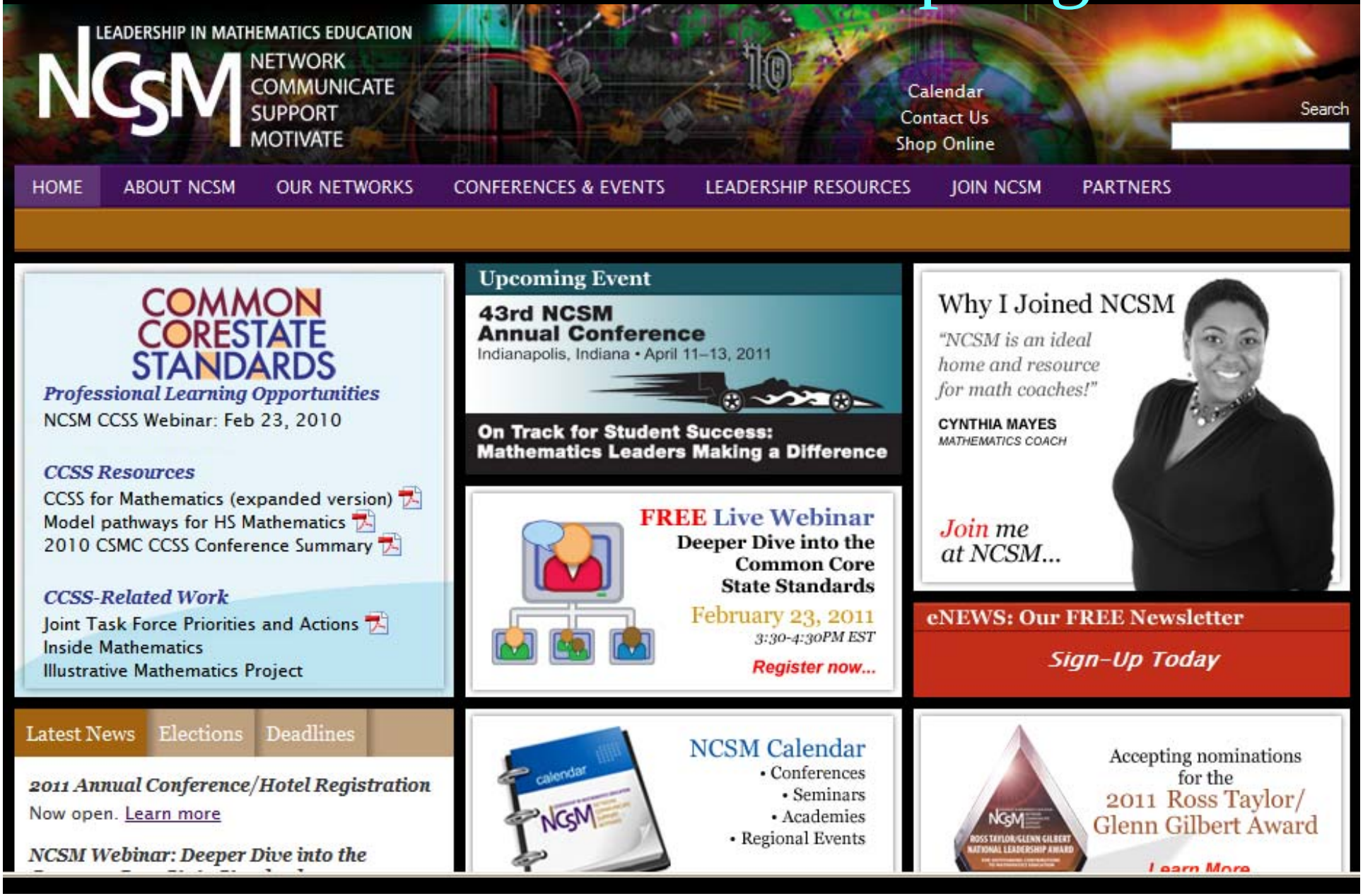

Reflection: Now What?

What actions will you take based on what we discussed today?

- What do you need to learn?
- Who will you work with?
- What do you need to integrate into your practice?
- Who will support you?

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Thank you for joining us!

Additional questions? Contact:
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Suzanne Mitchell: suzmitch@comcast.net

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