A Task-Based Approach to Teaching Math

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Goals

- Share research about using tasks in a 3-5 mathematics classroom
- Explore tasks that can be used in the classroom
- Discuss ways to organize discussions of cognitively demanding tasks
Principles to Actions

Eight Mathematics Teaching Practices:

1. Establish mathematics goals to focus learning.
2. Implement tasks that promote reasoning and problem solving.
3. Use and connect mathematical representations.
4. Facilitate meaningful mathematical discourse.
5. Pose purposeful questions.
6. Build procedural fluency from conceptual understanding.
7. Support productive struggle in learning mathematics.
8. Elicit and use evidence of student thinking.
Three Major Research Findings (p.17)

- Not all tasks provide the same opportunities for student thinking and learning.
- Student learning is greatest where the tasks consistently encourage high-level student thinking and reasoning, and least in classrooms where the tasks are routine and procedural in nature.
- Tasks with high cognitive demands are the most difficult to implement well and are often transformed into less demanding tasks during instruction.
Problem Solving

- Martha’s Carpeting Task
- Fencing Task
Sorting Activity

- Work in groups of 2-3
- Sort the cards into two groups
- Develop the criteria for each category
- Record group’s decisions on chart paper
sorting tasks

low level

high level
sorting tasks

low level

a
d

e

g

high level

b

j

k

c

f

m

h

n

i

p
selecting rigorous tasks...

low cognitive demand
- memorization
- procedures without connections
- algorithmic
- focused on producing correct answers
- require no explanation OR explanations focus solely on procedure use
- reproducing previously learned rules, procedures, or formulas

high cognitive demand
- procedures with connections
- doing mathematics
- require complex, non-algorithmic thinking
- require justification & explanations for solutions &/or methods used
- procedures cannot be followed mindlessly
- require exploration & understanding of mathematical concepts, processes, & relationships
- require considerable cognitive effort
tasks should...
- help students make sense of mathematics.
- be open-ended.
- empower students to identify & address misconceptions.
- require the application of facts & procedures AND encourage students to make connections & generalizations.
- be accessible to all students in language & offer multiple entry points.
### Implement Tasks That Promote Reasoning and Problem Solving (p.24)

<table>
<thead>
<tr>
<th>What are teachers doing?</th>
<th>What are students doing?</th>
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</thead>
<tbody>
<tr>
<td>Motivating students’ learning of mathematics through opportunities for exploring and solving problems that build on and extend their current mathematical understanding.</td>
<td>Persevering in exploring and reasoning through tasks.</td>
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<tr>
<td>Selecting tasks that provide multiple entry points through the use of varied tools and representations.</td>
<td>Taking responsibility for making sense of tasks by drawing on and making connections with their prior understanding and ideas.</td>
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<td>Posing tasks on a regular basis that require a high level of cognitive demand.</td>
<td>Using tools and representations as needed to support their thinking and problem solving.</td>
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<td>Supporting students in exploring tasks without taking over student thinking.</td>
<td>Accepting and expecting that their classmates will use a variety of solution approaches and that they will discuss and justify their strategies to one another.</td>
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<tr>
<td>Encouraging students to use varied approaches and strategies to make sense of and solve tasks.</td>
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</tbody>
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**Border Task**
5 Practices for Orchestrating Productive Mathematics Discussions

- Anticipating
- Monitoring
- Selecting
- Sequencing
- Connecting
Where to find high-quality tasks:

• Illustrative Mathematics: Common Core Math Tasks  
  www.illustrativemathematics.org
• Inside Mathematics: Common Core Task & Video Collection  
  www.insidemathematics.org
• Mathematics Assessment Project: Tasks, Assessments & Lesson Collection  
  http://map.mathshell.org
• National Council of Teachers of Mathematics: Principals to Actions Toolkit  
  http://www.nctm.org/PtAToolkit
• Youcubed tasks  
  http://www.youcubed.org/tasks/