2010 Mathematics Standards of Learning Institute

Modifying Mathematical Tasks to Promote Problem Solving

Helena, MT

Dan Meyer: Math class needs a makeover (12 min)

MAP Home
- Project goals
- Products
- The Team
- What's on this site?
- Who can use the MAP materials?

Can you help?

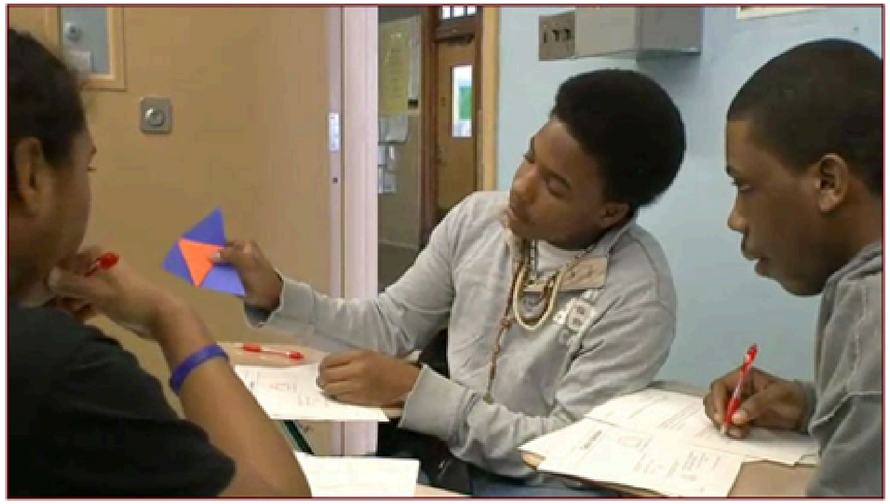
Sample Work Needed

Would you be prepared to send us samples of students' work on the *Classroom Challenges*, to support the

The Mathematics Assessment Project

"And I'm calling on our nation's governors and state education chiefs to develop standards and assessments that don't simply measure whether students can fill in a bubble on a test, but whether they possess 21st Century skills like problem solving and critical thinking and entrepreneurship and creativity."

President Obama, 1 March 2009.



New for 2013: Ten new 'Classroom Challenge' formative assessment lessons for Middle School are now available, including the first five lessons for Grade 6.

A draft Brief Guide for teachers and administrators (PDF) is now available, and is recommended for anybody using the MAP *Classroom Challenges* for the first time.

Project goals

The project is working to design and develop well-engineered assessment tools to support US schools in implementing the Common Core State Standards for Mathematics (CCSSM).

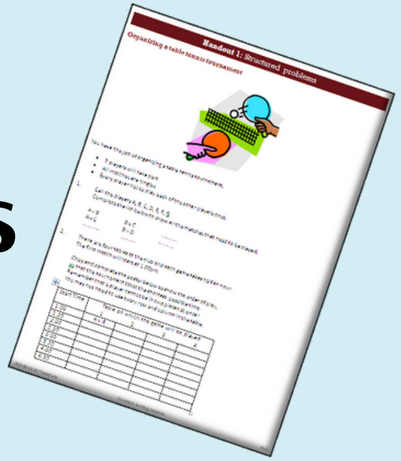
Products

Tools for formative and summative assessment that make knowledge and reasoning visible, and help teachers to guide students in how to improve, and monitor their progress. These tools comprise:

- **Classroom Challenges:** lessons for formative assessment, some focused on developing math concepts, others on non-routine problem solving.
- **Professional Development Modules:** to help teachers with the new pedagogical challenges that formative assessment presents.

Promoting Problem Solving and Critical Thinking

Do the Task:



- Solve the task – “Organizing a Table Tennis Tournament” individually

- While you are solving, list the mathematical or problem-solving decisions that are being made for students.

Promoting Problem Solving and Critical Thinking

Reflect on the task:

- **Discuss your methods for solving**
- **Discuss the decisions that are being made for students**

Promoting Problem Solving and Critical Thinking

Revise the Task:

- With your group, discuss how the task could be revised to return decision-making to students.
- Record your group's revisions. Be able to justify.
- Share your group's revisions and why individual revisions were made

Decisions Being Made for Students

Students are told:

- How to code the players (A, B, C, D, etc.)
- To list all the matches that need to be played
- How to systematically organize these matches
- How to tabulate the order of play
- To remember that players cannot play on two tables at once

Structured vs. Unstructured

Compare and Contrast:

- **Compare and contrast your group's less-structured version of the task with the version on the next slide.**

Organizing a table tennis tournament

You have the job of organizing a table tennis league.

- 7 players will take part.
- All matches are singles.
- Every player has to play each of the other players once.
- There are four tables at the club.
- Games will take up to half an hour.
- The first match will start at 1.00pm.

Plan how to organize the league, so that the tournament will take the shortest possible time. Put all the information on a poster so that the players can easily understand what to do.

Less-structured version

Promoting Problem Solving and Critical Thinking

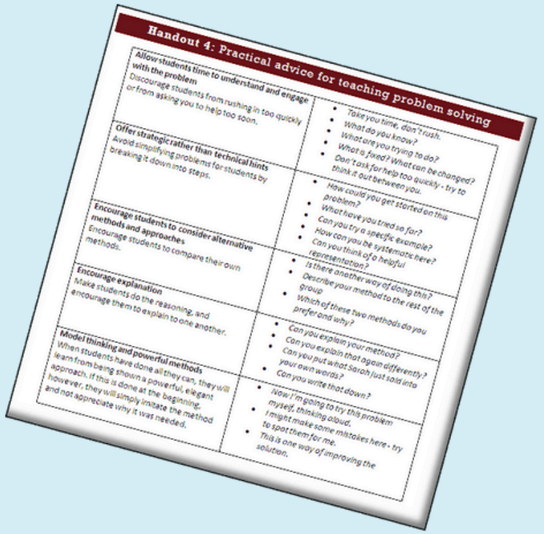
Reflect:

- **What would be the benefits of using more unstructured tasks?**
- **What challenges might teachers and students face when using unstructured tasks?**

Promoting Problem Solving and Critical Thinking

Reflect:

- Review Handout – “Practical advice for teaching problem solving”
- What do you notice?
- What do you wonder?
- What would you add to this list?



Handout 4: Practical advice for teaching problem solving

Allow students time to understand and engage with the problem Discourage students from rushing in too quickly or from asking you to help too soon.	• Take you time, don't rush. • What do you know? • What are you trying to do? • What is fixed? What can be changed? • Don't ask for help too quickly - try to think it out between you.
Offer strategic rather than technical hints Avoid simplifying problems for students by breaking it down into steps.	• How could you get started on this problem? • What have you tried so far? • Can you try a specific example? • How can you be systematic here? • Can you think of a helpful representation?
Encourage students to consider alternative methods and approaches Encourage students to compare their own methods.	• Is there another way of doing this? • Describe your method to the rest of the group. • Which of these two methods do you prefer and why?
Encourage explanation Make students do the reasoning, and encourage them to explain to one another.	• Can you explain your method? • Can you explain that again differently? • Can you put what Sarah just said into your own words? • Can you write that down?
Model thinking and powerful methods When students have done all they can, they will learn from being shown a powerful, elegant approach, if this is done at the beginning, however, they will simply imitate the method and not appreciate why it was needed.	• Now I'm going to try this problem myself, thinking aloud. I might make some mistakes here - try to spot them for me. • This is one way of improving the solution.

Promoting Problem Solving and Critical Thinking

Video Analysis:

- **Watch the video.**
  - **How did the teacher introduce the task?**
  - **Why were students asked to work in small groups?**
  - **How did the teacher support struggling students?**
  - **How did the teacher encourage the sharing of approaches and strategies?**

Learning Outcomes

Participants will be able to:

- Analyze assessments for:
  - SOL alignment
  - Level of cognitive demand
  - Format
- Modify existing assessments to raise the level of cognitive demand
- Modify existing resources to promote problem-solving

Connecting Assessment to Instruction

Group Discussion:

- How will the assessment analysis and modification work today impact planning, instruction, and assessment?

Professional Development Resources

- Online professional development modules will be provided on the VDOE Mathematics website
  - 2 modules with 7 parts total, broken into (roughly) 45-minute segments
  - Facilitators guide, all necessary documents
- Options for delivery
  - grade-level/subject area teams to work through professional development in their learning community meetings
  - Division-wide professional development

NOTES:

For more information, contact:

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