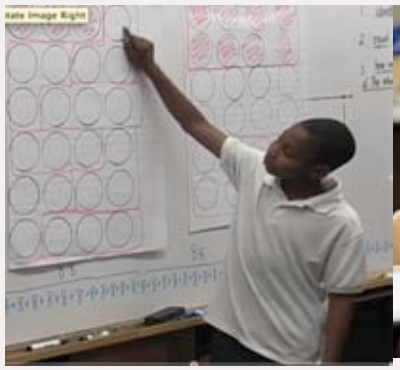
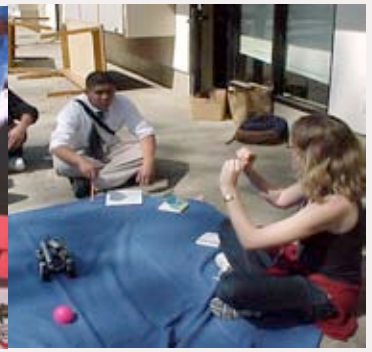


Teachers and Teacher Education

The National Mathematics Advisory Panel Report

Deborah Loewenberg Ball

University of Michigan

October 6, 2008

National Mathematics Panel Forum • Washington, D.C.

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A short pre-test

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1. Which are myths? Which are true?

Mark M (myth) or T (true).

a. The number of mathematics courses that a teacher has taken is a good predictor of how effective he or she will be.
b. Most high-performing countries use math specialist teachers in the upper primary grades.
c. Creating professional learning communities is at the heart of effective professional development.
d. Individual teachers can have a significant impact on students' learning.

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2. Do you YOU know math well enough to teach third grade?

$38 \div 4$

Write **four distinctly different** word problems that correspond to this division expression, representing different interpretations of the meaning of division, and with different possible numerical answers, depending on the context.

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The urgency of framing and understanding the problem

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What is "the problem"?

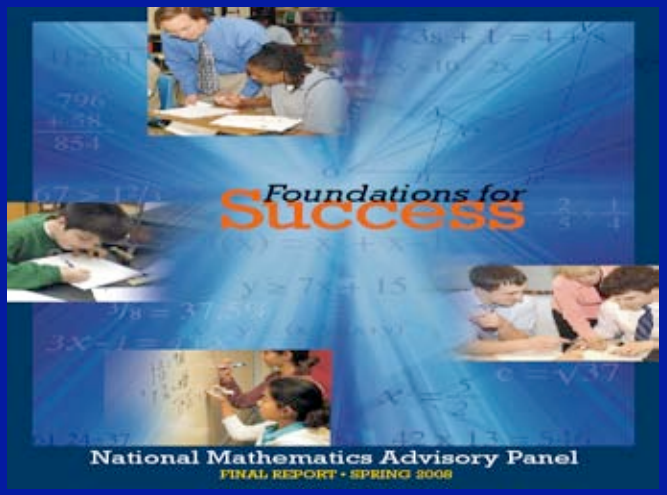
1. Too many students not learning mathematics well enough
   - For citizenship, continued mathematics study, global competitiveness
   - Social acceptance of not being good at math
2. Pervasive inequality
   - Unequal distribution of mathematical success by race, social class
3. Weak capacity for improvement
   - Public understanding, support, investment
   - Teacher shortages, weak interventions, thin professional knowledge base
   - Teacher educator development and resources

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What is also the problem?

- Repeated efforts to "solve" the problem that fail (alone) to improve mathematics learning
- Thin understanding of teaching and learning in schools (e.g., overemphasis on materials)
- Underestimation of the power of and skill required for effective instruction

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What can we "harvest" from the National Mathematics Advisory Panel report?

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Headlines related to teachers

1. Teachers' mathematical knowledge matters; strongest signal with content measured close to its use in practice.
2. Lack of evidence to identify effective practices in teacher education or professional development.
3. Preparing some K-5 teachers to teach mathematics only (i.e., "math specialists") may be one way to manage the scale of the need
4. Teacher pay may be a possible lever to distribute teachers better and to provide incentives for the hard work it takes to help pupils learn

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Rationale for what is included

1. Directly related to the Panel's charge
2. Sufficient evidence that could responsibly support policy recommendations
3. Adequate time and resources to pursue

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Teachers

- Persistent evidence that a large proportion of the variability in student achievement gains is due to who the teacher is
- Less clear from the evidence exactly what it is about particular teachers that makes them more effective
- Need to know how more effective teachers differ from less effective ones and how to measure this

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Teachers' mathematical knowledge

- Overall signal: teachers' content knowledge is a positive factor in students' achievement.
- Number of courses, degree, or certification in math do not predict student achievement gains at K-8 and very inconsistently at high school level
- Closer measures (tests of relevant knowledge) show stronger signal

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Teacher education

Lack of evidence overall about:

- Features of teacher preparation or professional development produce changes in teachers' knowledge or their students' learning
- What features of teacher preparation or professional development produce changes in teachers' knowledge or their students' learning

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Teacher pay

- Salary differential between teaching and other technical fields is large.
- Location-based pay can keep experienced teachers in high-need schools.
- Performance pay for teachers can enhance students' achievement.
- Lack of evidence overall on:
  - How to best design teacher pay schemes to enhance student achievement (e.g., individual or school; competitive or not; levels of compensation)
  - Whether and how location-based pay helps to attract teachers to high-need areas

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"Mathematics specialists"

- Different models of "math specialists": lead teacher, elementary math teachers, math coaches
- Promising to explore the use of full-time mathematics teachers in elementary schools.
- Lack of evidence overall on whether math specialists (any model) lead to greater gains in student achievement

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What's missing in the report, and why?

Not part of NMP charge or scope

- Teaching and learning mathematical topics and skills beyond algebra and its key foundations
- School working conditions
- Role of students' out-of-school experiences and other influences
- Parental and public attitudes toward mathematics
- What it takes to intervene successfully at scale

Insufficient evidence for policy

- Effects of particular curricula
- Instructional practices that focus on and redress inequities
- Effective forms or practices of teacher education
- Specifics about the mathematical preparation of teachers

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What's missing because of lack of resources, time, or priority?

- Mathematical practices as core content (e.g., reasoning, proving, representing, defining)
- Effects of other instructional practices (e.g., homework, writing, individualized instruction)
- Teachers' knowledge, skills, and dispositions other than mathematical knowledge
- Designs for school improvement and how they work

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Next steps: Using the NMP

1. Focus on areas of progress and substantial agreement; build on and extend those
2. Strengthen teachers' opportunities to learn mathematics for teaching practice
3. Develop measures of that knowledge that can be related to instruction and student learning
4. Use strong research designs to study alternatives in professional training (preservice, early career support, professional education) for their impact on teachers' effectiveness

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Lessons from success

1. Teaching is a professional practice that must be learned, and continuously developed. (e.g., Japan, China)
2. Improving students' learning requires a focus on instruction:
   - Provide sufficient detail
   - Provide for professional learning (and "unlearning") about content for teaching, about good student work and how to produce it with actual kids
   - Involve multiple stakeholders
   - Attend to coordination and incentives

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Where should we place our bets, given what we know (and what we don't)?

- Build a usable knowledge base for instruction
- Provide much more detailed instructional guidance
- Provide systematic professional training for successful practice
- Learn how other professions prepare practitioners (e.g., Grossman) and consider similarities
- Install sustained professional opportunities for continuous improvement, connected to the actual tasks of practice in settings
- Coordinate policy signals, curriculum, assessment, professional education

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The post-test: Checking your answers

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① Larry has 38 cookies. If he packages them in bags with 4 cookies in each bag, how many bags can he fill? (measurement, 9)

② Bill has 38 cookies. If he distributes them equally among 4 of his colleagues, how much will each person get? (partitive, 9½, or 9 r2)

③ Ida has 38 pupils. If she wants to arrange the classroom into tables that seat 4 people, how many tables does she need? (measurement, 10)

④ Wade has 38 commemorative Red Wings pencils and wants to make 4 equal-sized packs of pencils. How many pencils will be in each pack? (partitive, 9, with 2 pencils left over)

⑤ Camilla has 38 cm of licorice. She wants to cut the licorice into 4-cm. lengths. How many lengths will she able to make? (measurement, 9 ½)

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