



National Mathematics Advisory Panel

Teachers Task Group

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Progress Report

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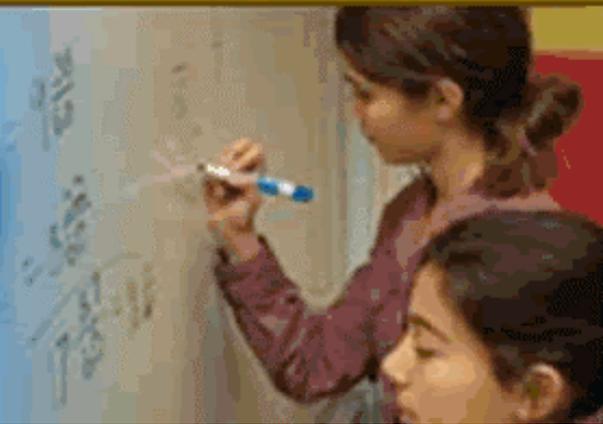
Teachers Make a Difference



1. Persistent evidence that a large proportion of the variability in student achievement gains is due to who the teacher is
2. Less clear from the evidence exactly what it is about particular teachers that makes them more effective
3. Need to know how more effective teachers differ from less effective ones (in what they know and do) and how to measure this (IP)
4. But we also pursue:
 - Strong hypotheses about content knowledge
 - Relationship of teachers' content knowledge to student achievement
 - How states' teacher assessments can rigorously measure this content knowledge
 - Questions about how to train, recruit, retain, and reward teachers who can produce consistent achievement gains in their pupils
 - How to manage the scale problem through the use of "math specialist teachers"



Questions



1. What is the relationship between the depth and quality of **teachers' mathematical knowledge** and students' mathematics achievement?
2. What is known about **programs** that help teachers develop the necessary mathematical knowledge for teaching? Which of these programs have been shown to impact instructional practice and student achievement?
3. What types of **recruitment and retention** strategies are used to attract and retain highly effective teachers of mathematics? How effective are they?
4. What models exist for **elementary math specialists** and their preparation? What evidence exists for the effectiveness of elementary math specialist teachers with respect to student achievement?



What Methods Did We Use?



- Identified the available scientific evidence
 - Electronic literature searches using PsycInfo and the Social Sciences Citation Index using search terms identified by the NMP
 - Manual searches for national reports and of relevant journals and reference lists and recommendations from experts
- Organized available evidence into categories of study strength
 - Highest quality evidence: RCTs and quasi-experiments with baseline equivalence between groups
 - Moderate quality evidence: Correlational studies with baseline controls and multiple background controls
 - Lower quality evidence: Correlational studies without baseline controls or multiple background controls
- Strength of available evidence varied by research question
- Also: gathered information for certain aspects of our questions (e.g., math specialists)



Structure of Our Report

For each of our questions:

- What we know
- What we don't know
- What is not supported by research

Overall: Draft recommendations for policy
and for research



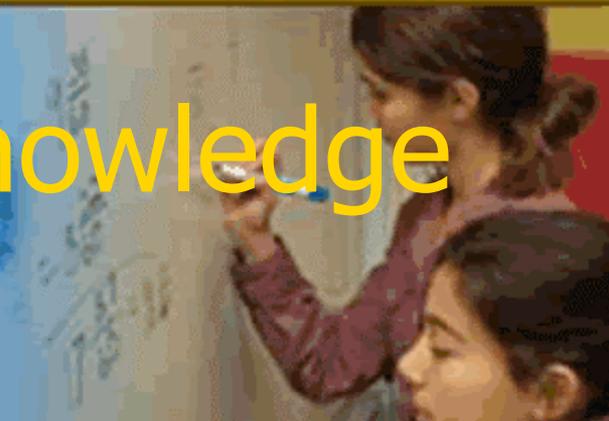
Teacher Content Knowledge Findings

What We Know

1. Overall, signal that teachers' content knowledge is a positive factor in students' achievement
2. Proximal measures (tests of relevant knowledge) show stronger signal than distal indicators (e.g., certification)



Teacher Content Knowledge Findings



What We Don't Know

1. What exactly teachers need to know to teach particular topics to particular students
2. How teachers' content knowledge affects instruction and student achievement

What is Not Supported by Research

1. Elementary teachers who take more university math courses are more effective
2. Students taught by teachers certified or licensed in math consistently learn more



Teachers' Education Findings



“Teachers’ education”: teacher preparation (conventional and alternative), induction, professional development

What We Know

- Different pathways into teaching do not produce differential effects on teachers’ effectiveness.



Teachers' Education Findings



What We Don't Know

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



Teacher Incentives



Salary: Skills-based, location-based, performance pay

What We Know

1. Salary differential between teaching and other technical fields is large
 - At entry very similar
 - Increases dramatically across first 10 years
2. Exit rate of math and science teachers greater than other teachers
 - More likely to cite dissatisfaction with salaries as one of the reasons for leaving
3. Location-based pay can keep experienced teachers in high-need schools



Teacher Incentives Findings

4. Performance pay for teachers can enhance students' achievement

What We Don't Know

1. How to best design teacher pay schemes to enhance student achievement (e.g., individual or school; competitive or not; levels of compensation)
2. Whether and how location-based pay helps to attract teachers to high-need areas



Math Specialists Findings



What We Know

1. At least three different models of “math specialists”

What We Don't Know

1. Whether math specialists (any model) lead to greater gains in student achievement

What is Not Supported by Research

1. Most high-performing countries use “math specialists” in the elementary level. (However, given differences in the education that teachers in high-performing countries may have had, regular classroom teachers may have stronger mathematical preparation.)



Recommendations for Policy Teachers



1. Teachers should at least know the mathematics they are teaching.
2. Certification and licensure exams should at least test well the content that teachers actually teach.
3. Developing alternative pathways into teaching should be explored and encouraged.
4. Salary incentives, including differential pay for teachers of mathematics, pay based on location performance, should be pursued.
5. Where there is a shortage of elementary school math teachers who have appropriate knowledge of math for teaching, math specialists can help to address this need.
(Clarification of terms needed here, too.)



Recommendations for Research Teachers

1. Studies that elaborate what mathematics teachers need to know and use, beyond what is in the curriculum, in order to teach effectively
2. Better measures of teachers' mathematical knowledge that focus on the knowledge teachers actually have to know and use in their practice, instead of distal indicators such as certification or courses taken
3. Studies that identify features of teachers' education that have an impact on teachers' effectiveness
4. Epidemiological studies that probe what distinguishes more effective from less effective teachers
5. Studies of "specialization" in teacher assignment (Are such schemes practical? Do they produce better student achievement?)