



LSCs, MSPs, SSIs, etc.:

Implications of Research on  
Federally-Funded Projects for  
Improvement of Mathematics  
Education District-Wide

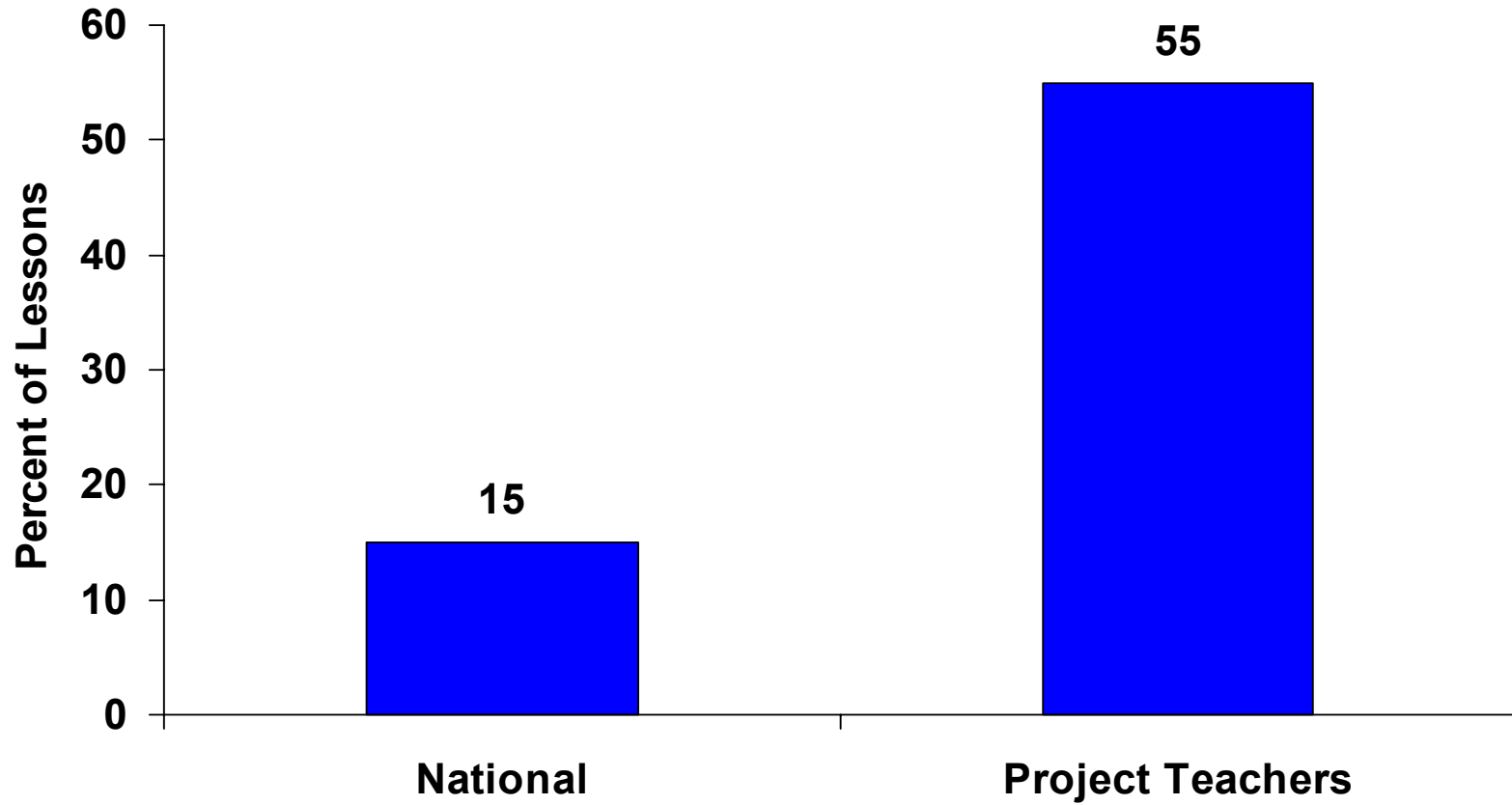



Look at the following graph.

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## Percent of K-12 Mathematics Lessons Rated Highly





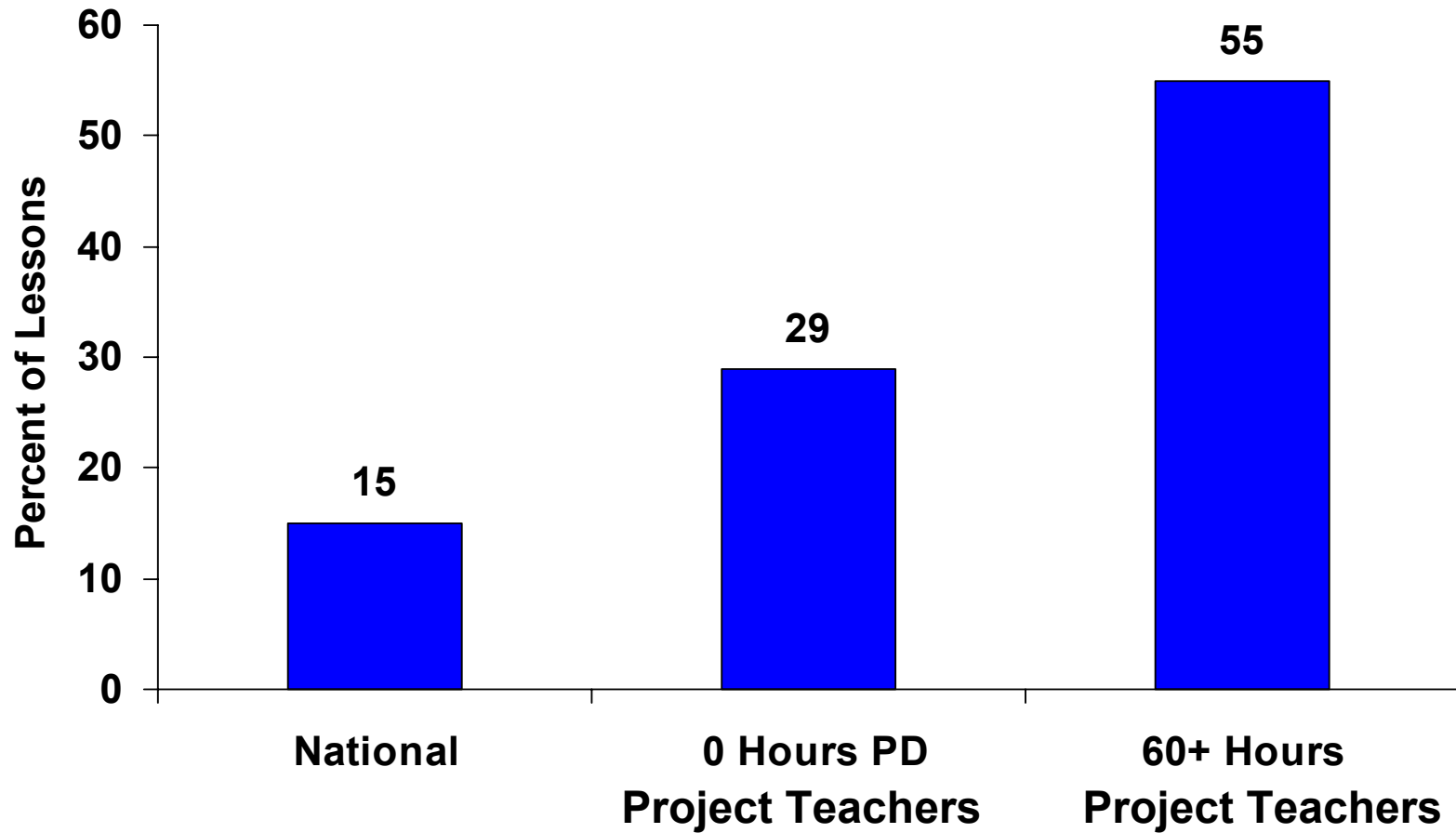
Based on this graph: How confident are you that this would be an effective program for your district? Why?

- Think about it individually
- Talk with a neighbor

# Reason for skepticism #1

The professional development participants may have had better mathematics instruction to begin with.

## Percent of K-12 Mathematics Lessons Rated Highly



## Reason for skepticism #2

The program may not be effective in your context:

- Teachers in your district might be different in important ways
- Your district may not have the capacity/resources to implement the program with quality


# My talk has several main points


1. There continues to be a gap between the research and practice communities.

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2. Both communities would be better off if that gap were bridged.

3. But cautions are in order.

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4. Researchers need to be honest about the limitations of our work

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5. Practitioners should move ahead with their best understanding based on current evidence, but at the same time recognize the limits of that research.



I'm going to share some research findings/lessons learned I think are worth your consideration, as long as you keep their limitations in mind.



# Bridging the Gap Between Research and Practice

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# **“Scientifically Based Practice: It’s About More Than Improving the Quality of Research”**


Deborah Stipek, Dean of Stanford’s School of Education,  
EdWeek, March 23, 2005.

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**“Most research evidence is published in places and forms that only other researchers visit and can comprehend.”**



**“Practitioners’ decisions are based primarily on their own intuitions and experience and occasionally on advice from colleagues, principals, or workshop leaders.”**




**Periodically researchers are asked to focus on problems of practice and make their findings accessible to practitioners.**




**And practitioners are asked to  
base their practice on research.**

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It makes little sense for teachers  
(or schools, or districts, or states)  
to continue practices that have  
been shown to be ineffective.



At the same time, both researchers who are asked to make sure their findings are utilized, and practitioners who are asked to base decisions on research, need to be appropriately skeptical about what counts as “evidence”.

## **Our research base is spotty and somewhat internally inconsistent, in part because:**


- The education research enterprise is seriously underfunded.
- Researchers use different instruments to study the same phenomenon, so we don't know which differences among studies are "real" and which are due to different measures.

- Research reports don't tell us very much about the treatment, so even if we know "it" "works" we don't know what "it" was.
- There are few mechanisms or incentives for a coherent research enterprise focused on problems of practice.


## The desire to close the research to practice gap results in pressure to act on findings before we can see if they “hold up” under further investigation

- “At the 95% level”, means that 5 times out of 100, a “finding” will be due to chance.
- If we repeated a study 3 times, and got the same result, the probability of it being due to chance would be only 1 in 10,000.


- There is no such thing as a perfect study; when a variety of studies with different limitations reach the same conclusions, we can have more confidence in those results.
- Systematic replication of studies in different contexts would give us a better idea of where those findings might apply, and to whom.



Researchers need to be honest about the limitations of what our research tells us, including what alternative explanations there might be for the particular results, and to whom the results might apply.



Practitioners need to do a bit of a balancing act—you definitely shouldn't ignore research, but neither should you rush to accept and act on the results of whatever study seems to be in vogue at the moment.



We are sometimes saved by the conservatism of experienced teachers, with their reluctance to take on “fads” that don’t make sense to them, or abandon practices that they have found to be effective.

# Emerging Consensus on Effective Professional Development

- Content-focused
- Connected to practice
- Engages teachers in active learning
- Fosters collaboration among teachers
- Sustains focus over time

# Local Systemic Change Initiative

- NSF funded the first cohort of Local Systemic Change (LSC) projects in 1995
- A total of 88 projects were funded by 2002

# Logic Model of LSC Professional Development

Quality of PD Program



Increased Teacher Knowledge/Skills



Improved Classroom Practice



Improved Student Performance

# Local Systemic Change Initiative

- Targeted all teachers in a jurisdiction for professional development (minimum 130 hours)
- Emphasized preparing teachers to implement project-designated mathematics/science instructional materials in their classes
- Promoted efforts to build a supportive environment for improving science, mathematics, and technology instruction

# Core Evaluation Activities

- Interviews with PIs to understand the project approach
- Observations of professional development activities
- Teacher and principal questionnaires
- Classroom observations
- Teacher interviews

# Strengths of the Evaluation

- Triangulation of data sources
- Interventions used in multiple contexts
- Lots of data (e.g., 75,000 teacher questionnaires), allowing longitudinal analysis and use of HLM and other sophisticated analyses.
- Replication of studies – different cohorts of projects, addressing elementary and secondary mathematics, elementary and secondary science

# Weaknesses

- Quality control of observations was problematic
- Lack of data on impact on students



LSC professional development had a positive impact on teachers':

- Attitudes toward reform-oriented teaching in mathematics
- Perceptions of their content and pedagogical preparedness

- Limitation: based on teacher self-report data
- Typical participation was roughly 40 hours, not even close to 130 hour “minimum”

LSC professional development had a positive impact on classroom practice:

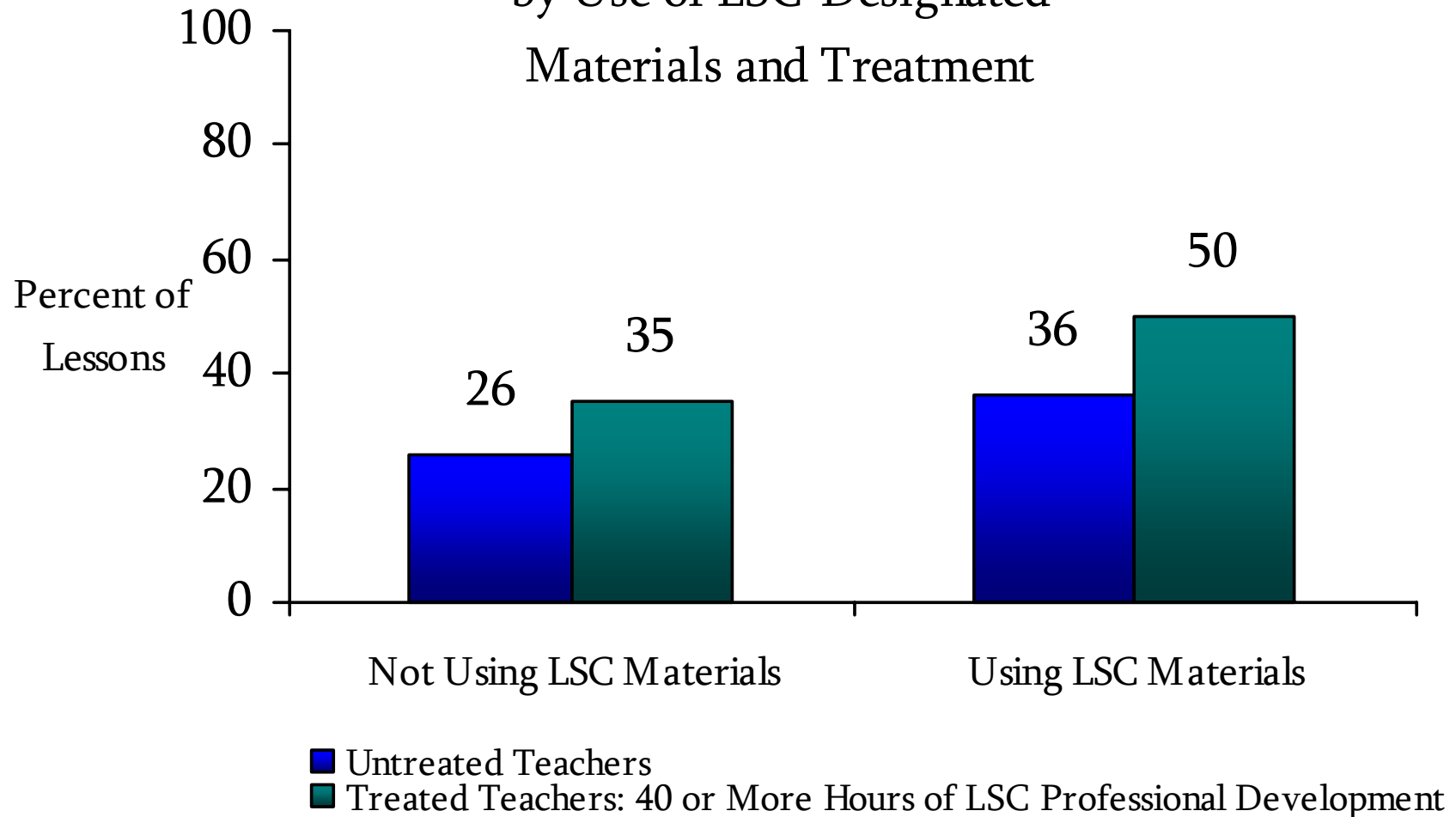
- Increased use of designated instructional materials
- Enhanced quality of content presented to students

- More frequent use of investigative practices, questioning, and sense-making practices
- A greater likelihood that the classroom culture promoted intellectual rigor and student engagement

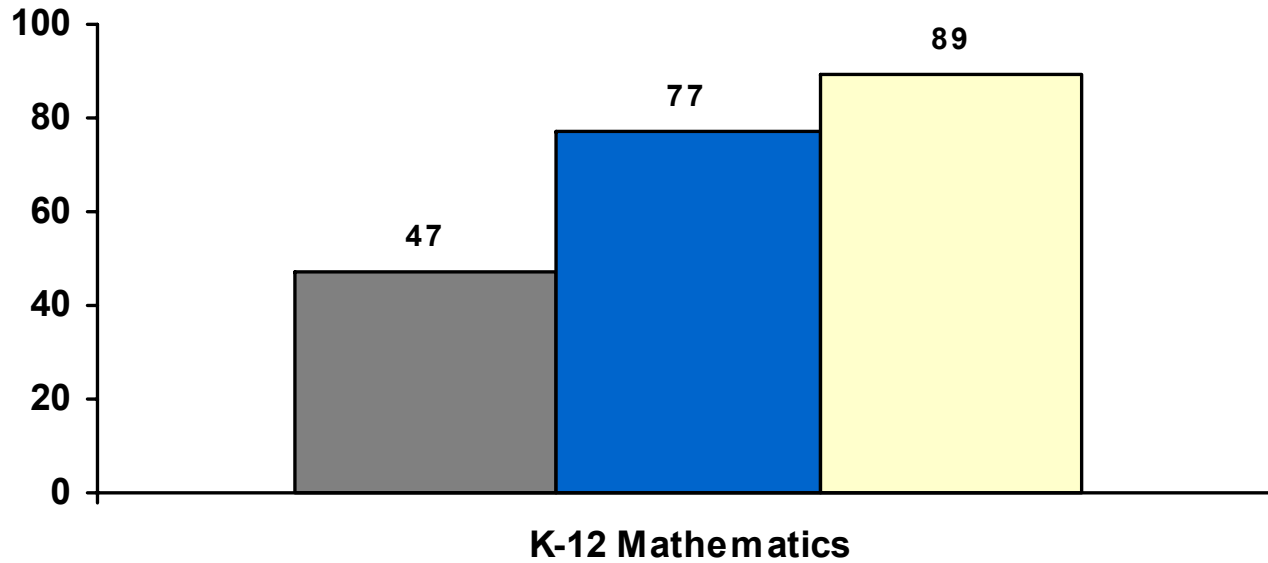
Based on classroom observations

# Impact on Classroom Practices

Highly-Rated K-12 Mathematics Lessons,  
by Use of LSC-Designated  
Materials and Treatment



### Highly-Rated Lessons, by Adherence to LSC-Designated Materials



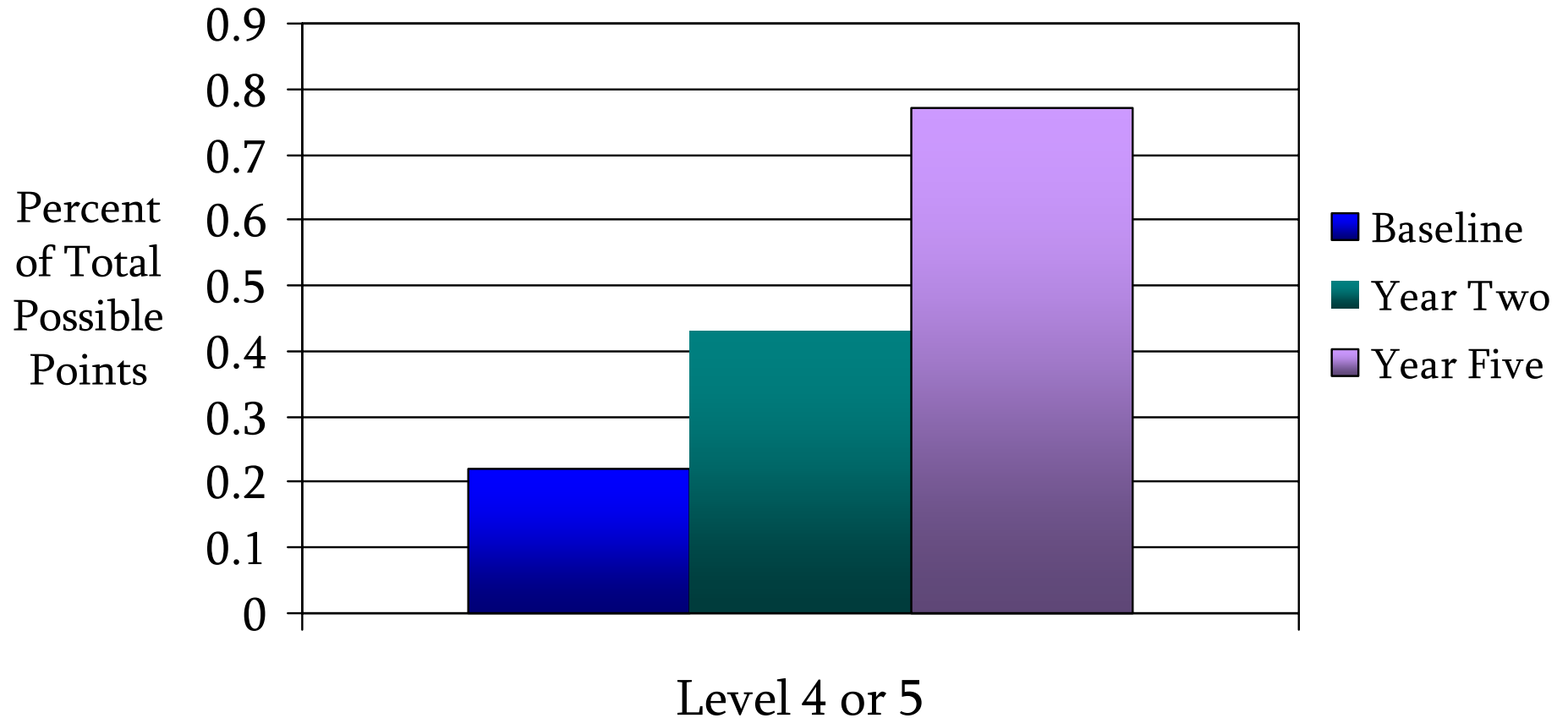
■ Hardly at all/a little ■ Somewhat/mostly □ Almost totally/exactly

PIs were encouraged to visit classrooms, and reported that teachers were doing the activities without adequate focus on the mathematics.

Theoretical limitation: PIs evaluating their own “work” so they might be biased in a positive direction.

# Impact on Districts

## Continuum Rating of Extent of Support of the LSC Reforms



## Likelihood of Institutionalization of the LSC Reforms

	Percent of Projects
	(N = 61)
Level 1: Rubber Band Likely to Snap Back	0
Level 2: LSC Reforms Likely to Gradually Fade Away	2
Level 3: Minor Components Likely to Become Institutionalized	19
Level 4: Components Likely to Become Institutionalized	62
Level 5: Institutionalization of LSC Reforms Likely	17

# Challenges in the LSC:

- Preparing and deploying professional development providers
- Reaching the goal of 130 hours over five years
- Teachers changing grades
- Teacher (and administrator) turnover


## Aspects of instruction that needed additional improvement:

- Student intellectual engagement with important ideas relevant to the focus of the lesson
- Portraying mathematics as a dynamic body of knowledge continually enriched by conjecture, investigation, analysis, and proof/justification

- Adequate time and structure for “sense-making”
- Teachers’ questioning strategies
- Encouraging students to generate ideas, questions, conjectures, and propositions
- Including intellectual rigor, constructive criticism, and the challenging of ideas

# Lessons Learned in the LSC:

- Need to involve principals earlier, and more often
- Need to make sure to keep a focus on mathematics content – what is the mathematical pay-off for particular activities?
- Need to go into classrooms to see what is actually happening
- Evaluation instruments/procedures can be repurposed to help convey the vision for teaching and learning, as well as for aligned policy in support of that vision



Scaling up effective professional development is not enough; need to think about going to scale with reforms.

Elmore, R.F. (1996). Getting to scale with good educational practice. *Harvard Education Review* 66(1), 1-26.

# Statewide Systemic Initiatives (SSIs)

In the 1990's, 26 awards of up to 10 million over 5 years (and some had a second phase) for statewide reform of mathematics and science education

- Horizon Research, Inc. and Education Development Center developed a Handbook for Enhancing Strategic Leadership in the Math and Science Partnerships
- Article based on this work by Weiss and Miller in a forthcoming NCSM monograph

# Lessons Learned About:

- Designing and Implementing Interventions
- Garnering Support from Key Stakeholders
- Aligning Policy
- Scaling Up Interventions

# Designing and Implementing Interventions

- Understand the nature and extent of needs in your context
- Select effective, promising intervention approaches
- Pilot the interventions to get the “kinks” out and demonstrate their effectiveness
- Make sure the mathematics doesn’t get lost

# Garnering Support from Key Stakeholders

- Identify the key stakeholders
- Build support for the overall reform vision, not just for specific interventions
- Leverage the support of influential stakeholders

# Aligning Policy

- Identify the most influential policies and have a plan for dealing with them
- Leverage aligned policies to move forward
- Seek and create opportunities to align policies

# Scaling Up Interventions

- Develop human resources
- Develop infrastructure
- Create a system for maintaining quality


# Math/Science Partnerships

Comprehensive, Targeted, and Institute projects were funded by NSF

State MSP's are being funded by the Department of Education



Hallmark of MSPs is  
involvement of STEM faculty  
in K-12 reform



Too early to have “findings,” but should provide lessons for effective district partnerships with higher education, particularly STEM faculty




If a university wants you as a partner...


Use your leverage. Have a master plan, and make sure the work fits into it.

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If you get external funds, e.g., a state MSP, don't just make hay while the sun shines. Think about 10 years out, and what you can do with the external money that will create lasting capacity and infrastructure.



You don't need external funds to improve mathematics education in your district. Think big, but start small; take advantage of opportunities to align policies and practices; and keep moving forward.