

The seal of North Carolina State University is centered in the background. It features a circular design with a central tower, surrounded by the text "NORTH CAROLINA STATE UNIVERSITY".

Examining the Field of Research on Mathematics Professional Development

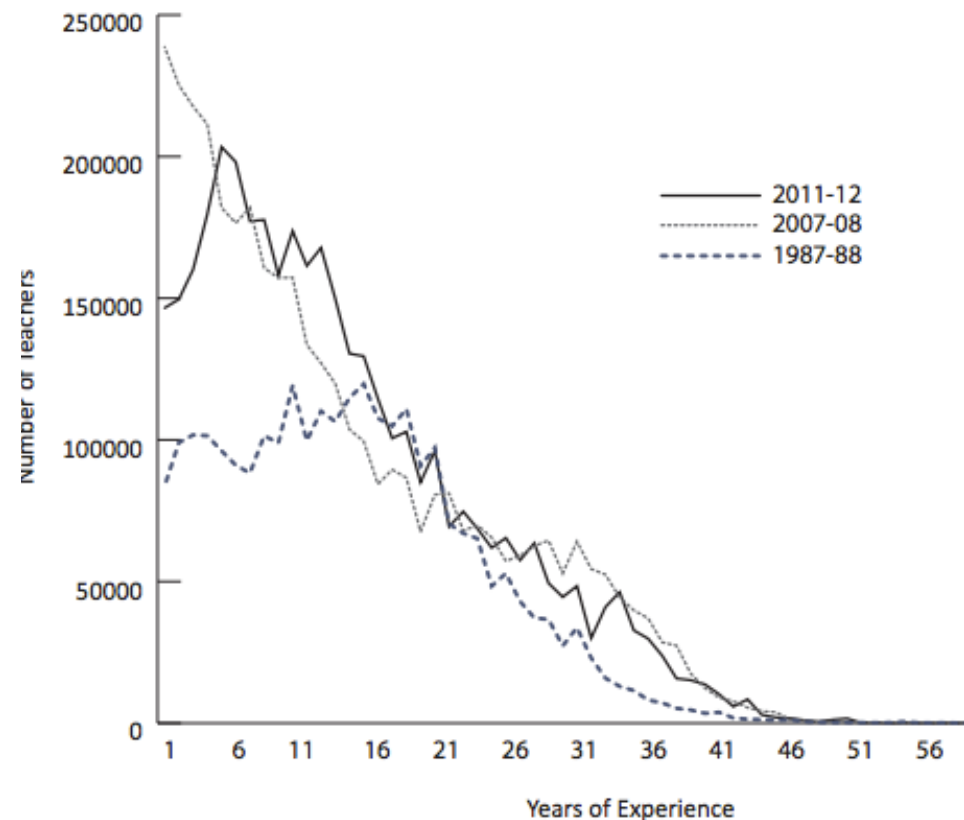
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Why research on PD?

- Teaching matters!
- PD as a major policy mechanism
- 99% of 4M American school teachers attend PD every year (NCES)
- The teaching workforce is greener (CPRE)



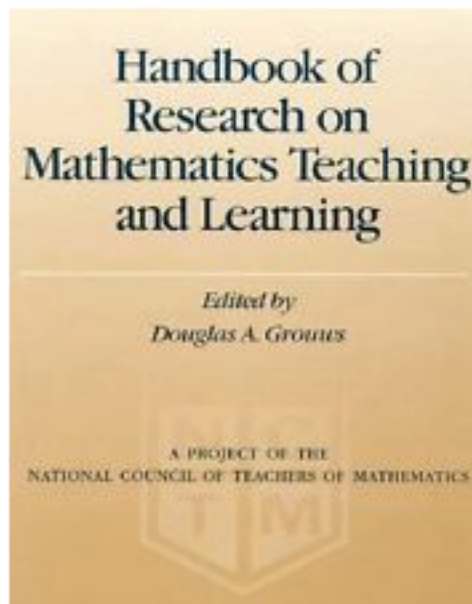
Ingersoll, Merrill & Stuckey, 2014

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Goals for this presentation:

- Share findings across two studies that examine the state of the field;
- Make recommendations to move the field forward;
- Suggest that we do not know much but we know a lot.

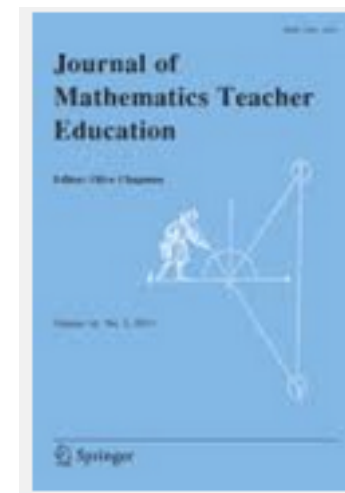
I think most of what I have to say
 is because we are
 a relatively new field of research



1992



1997

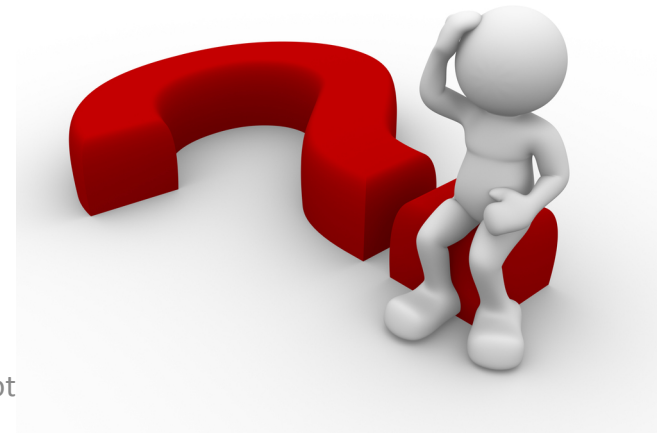


1998

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This emerging field is yet to define:

- Who we are
- How we relate to other stake holders
- What we do
- What we consider quality
- How to make ourselves visible



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The two studies:

Yoon & Sztajn, review from 1992-2010

—from an NSF funded project, under review

Sztajn, Borko & Smith, review from 2005-2014.

—for the upcoming Math Ed Handbook

 I first present the perspective and approaches used in each study and then I present findings across the two studies.

1. Yoon & Sztajn: Improving Professional Development Research Through Systematic Descriptions of Interventions

- PD Research is at a crossroad (Hill, Beisiegel & Jacob, 2013)
- Focus on outcomes narrowed definition of PD research to RCT & meta-analysis
- Focus on outcomes narrowed definition of effective PD to the “fab-five.”



➔ We need to attend to the “inputs” of PD

“When an intervention or treatment is implemented, the intervention or treatment should be described in sufficient detail so that its key features can be identified and used to account for results, and be compared with related interventions and treatments”

American Educational Research Association. (2006). Standards for reporting on empirical social science research in AERA publications. *Educational Researcher*, 35(6), 33–40.

EXAMINE DESCRIPTION OF PD IN RESEARCH REPORTS

Research questions:

- What is included and what is missing in descriptions of PD programs presented in research reports?
- How are the PD programs characterized in these reports?
- What do we know about the design and conduct of mathematics PD being studied by researchers?

- Framework:
 - Substance: theory, goals, content
 - Structure: context, organization, activities
 - PDMA with 123 questions
- Method: Synthesis Research (Cooper, 1998)
 - Data Collection (lit review)
 - Data Quality (relevance)
 - Data Analysis

- Search term and data bases
- Between 1992-2010
- Resulted in 2,776 non-duplicated reports
- Pre-screening: 578 total papers collected
- Selected a random sample of 366 papers
- 173 papers passed and were coded

2. Sztajn, Borko & Smith: Research on Mathematics Professional Development

- Attention to studies using all types of research methods
- Privileging meta analysis has led to (false) claims that we have no knowledge about PD or no good research on PD
- Research on PD is beginning to accumulate knowledge (so, what do we know?)
- “Fab five” are necessary but not sufficient

PROVIDE AN OVERVIEW OF THE FIELD

Research question:

- What do we know from research that examines the design or the effect of one mathematics PD program?
- What do we know from research that seeks to understand what it takes to bring PD programs to scale and the issues that need to be considered in scaling up?
- What do we know from research that compares different mathematics PD programs?

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- ERIC search on PD and mathematics
- 2005-2014
- 20 selected journals
- 202 papers matched our interests
- Sorted them based on Borko's 3 phases
- Looked for larger programs of study
- Added papers

Some General Findings about Math PD

- We are, indeed, a new (and exploding) field: more than half the studies Yoon & Sztajn coded were from 2005-2010, with 1/3 from 2008-2010
- Most research journal papers about PD present PD developed and facilitated by university faculty
- Papers focus on PD that supports ambitious instruction (but differ on assumptions about how to get there)

Some General Findings about PD

- The design of PD is complex with programs reporting many goals, many tools, many formats—it is hard to “disentangle” the field by features of PD design or models of PD
- Few PD programs can be followed over time
- We do not have agreement on what to report about PD design (missing data was the major challenge in Yoon & Sztajn)

A few findings from Yoon & Sztajn

- PD using PLC, videos, and about algebra/geometry were significantly more common between 2005-2010
- 100 of 173 papers reported on theory; constructivism, social constructivism and situated learning were the most cited
- Reports on PD focused on PCK were more likely to discuss theory

A few findings from Yoon & Sztajn

- 91% of the reports stated the PD goal (s), with PCK, SMK, and student thinking as the most cited PD primary goal(s)
- PCK was the most common goals for PD for HS, Curriculum Materials for MS, Student thinking for ELM
- Most PD had combination of PCK and SMK as primary and or secondary goals, with only 9 studies reporting content as sole goal.

A few findings from Yoon & Sztajn

- Contextual information on teachers (98%) was more prevalent than information on these teachers' students or their schools (62%).
- 92% reported on teacher grade-level or band, 43% reported teachers' years of experience, 14% reported if public/private school, only 5% reported on students' ELL status
- Most PD reporting their location happened at schools.

A few findings from Yoon & Sztajn

- PD span from 1 week to 3 years
- Most of the PD lasted between 25-40 hours
- PD on content have longer duration; PD including PLCs have longer span
- Mostly face-to-face; most online PD were college courses
- Most PD with a summer component also had school year follow up
- 83% reported activities connecting to practice

Findings from Sztajn, Borko & Smith

Phase 1

- We organized our phase 1 discussions around three tools:
 - Frameworks of student thinking
 - Video clips
 - Math Tasks

Sowder (2007) organized around knowledge types and embedded discussions about: student work, cases, lessons and curriculum materials.

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Findings from Sztajn, Borko & Smith

Phase 1

- PD using **framework of student thinking** has expanded beyond arithmetic , but still more common in PD for elementary teachers
- Show impact on both teaching (noticing, acting based on students' answers, 5 practices) and on student learning
- Teachers find the frameworks useful to help them make sense of students
- These frameworks allow for PD discussions focused on what students can do
- Teachers benefit from multiple years of PD
- Individualized vs whole class instruction*

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Findings from Sztajn, Borko & Smith

Phase 1

- **Video clips** provide a shared experience to explore mathematics, mathematics teaching, student thinking
- Usual PD sequence: solve the problem, discuss the mathematics, watch and discuss the video
- PD using video changes teachers' discourse to focus on the mathematics and on student learning.
- Teachers can learn to become more analytical and use evidence in PD using video
- PD using video supports changes in teaching; teachers can learn to elicit and probe student thinking
- Use of video from participants or others*

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Findings from Sztajn, Borko & Smith

Phase 1

- A usual design for PD using **tasks** is “experience” the task then “teach” the task
- Tasks used to develop SCK in parallel with knowledge about students and teaching
- PD on tasks use research-based frameworks about tasks and instruction
- Teachers can learn to select and use high cognitive demand tasks.
- Some of these changes can sustain after the PD ends
- Change in beliefs to change practice vs. change in practice to change beliefs*

Phase 1 Research Trends

- Stronger connections between PD design and practice
- Attention to changes in teachers and teaching
- Growing situative perspective on learning with attention to teachers' participation and discourse as evidence of /learning
- Attention to the processes of learning
- Emerging attention to sustainability of PD
- Emerging attention to differentiating PD
- Mostly qualitative and correlational work –we need more work that supports causal claim about student learning.

Findings from Sztajn, Borko & Smith

Phase 2

Questions about bringing PD to Scale:

- What must PD facilitators know and be able to do in their practice?
- What is entailed in the preparation of PD facilitators?
- Can the PD program be scaled and implemented by facilitators other than the PD designers?
- What is the impact of the larger contextual features within which PD is offered?

Findings from Sztajn, Borko & Smith

Phase 2

- **Role of facilitators** is underdefined and understudied (lots of recommendations few research)
- Practices of facilitators: orienting the group to the task, sustaining an inquiry stance, maintaining a focus, and supporting collaboration Creating collegial relationships and setting discussion norms
- Planning differs if PD is more or less specified

Findings from Sztajn, Borko & Smith

Phase 2

- **Facilitator preparation includes:** analysis of videos from previous PD sessions; meeting to analyze tasks they will implement next; planning and rehearsing for work with teachers.
- Usually are extrapolation from the literature on teacher preparation, using pedagogies of inquiry and pedagogies of enactment.

Findings from Sztajn, Borko & Smith

Phase 2

- **Implementing PD at scale** seems to take two main approaches: development of PD materials and work with districts.
- PD materials: fidelity becomes an issue; initial research shows programs can be implemented with fidelity and result in teacher learning.
- Work to build capacity: usually part of larger reform efforts, train-the-trainer model, requires substantial support, combination of external expertise with job-embedded support

Findings from Sztajn, Borko & Smith

Phase 2

- **PD context:** We should expect PD to vary across context and designing PD without understanding its context is risky.
- Teachers' instructional autonomy, access to expert, collaborative opportunities, organizational climate, and support from leaders impact teachers' participation in PD and the impact of the PD on their instructional practice.

Phase 2 Research Trends

- Progress compared to lack of knowledge in 2004
- PD curricula can be developed and implemented
- Districts can build internal capacity for PD.
- Important factors: facilitators knowledge, preparation and support; ability to adapt to local contexts.
- More research on facilitation practices and contextual support is needed

Findings from Sztajn, Borko & Smith Phase 3

- Only 3 studies:
 - Synthesis across 170 projects (Battery et al, 2007)
 - Applied similar framework across PD (Marra et al, 2010)
 - Compared two implementations of PD with common features (Garet et al, 2010)
- There are different ways to conceptualizing studies across PD but little to discuss here...

We know a few things about MPD

- Much progress compared to 2014: we are beginning to accumulate knowledge in phase 1 and conceptualize what phase 2 is.
- Phase 1 remains mostly qualitative—need connections to teacher and student learning
- Phase 2 is showing attention to facilitation, access to expertise, context—need more research on scale up
- Phase 3 remains minimal (and perhaps should until we know more from phase 1 & 2!)

Back to my initial claim...

We do not know much but
we know a lot...

Thank you!

Questions?