Research in the Math Classroom: Using it and Doing it

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Introducing NCTM’s updated “Linking Research and Practice” Position Statement
Hosts

Melissa Boston, Duquesne University

Mike Steele, Ball State University
Special Guests

Dr. Margaret “Peg” Smith,
University of Pittsburgh
Professor Emerita
Special Guests

Dr. Lori Hart
Dr. Kayla Blankenship
Dr. Maria Porras Monroy

Orange County Public Schools & University of Central Florida
What words or phrases come to mind when you hear the word “researcher” or think about research?

What words or phrases come to mind when you hear the word “practitioner” or think about practice?

Mentimeter: [https://www.menti.com/al677hz1ukiz](https://www.menti.com/al677hz1ukiz)
Some Definitions…

- **Practitioner**: one who engages in teaching (K-12, college, teacher education or professional learning)

- **Researcher**: one who engages in collecting data or evidence (formally or informally) to answer questions about teaching and learning

- **Classroom**: K-12, college, teacher education, other professional learning setting
How have you engaged in using and doing research in practice?

Mentimeter: https://www.menti.com/al677hz1ukiz

Using Research in Practice:
• How have you used research in your practice?
• What questions have you looked to research to answer?

Doing Research in Practice:
• What topics or questions have you researched in your classroom (K-12, college, or teacher education/professional learning), formally or informally?
Declarations

1. Mathematics education research must be ethical and comprehensively address critical problems.

2. Research should identify high-leverage, effective, equitable mathematics practices shared in useful, actionable ways.

3. All educators build knowledge of mathematics education research and practice.

Collaboration provides integrated perspectives for addressing critical issues that lead to enhanced mathematics teaching and learning experiences for each and every student.
Connecting Research and Practice

“What positive outcomes will the knowledge generated from research create, and how will that knowledge be used to enhance the teaching and learning of mathematics?”

“The practice of teaching mathematics informs the research knowledge base, and research outcomes contribute to the practice and professional knowledge base for teaching....
Blending Our Roles as Researchers and Practitioners

“professionals with primary roles as practitioners should engage in generating research, and these activities should be encouraged and supported within the teaching profession.”
Creators of research

- Analyzing data to develop frameworks and tools
- Sharing findings with the research community

Consumers of research

- Collecting data
- Noticing patterns
- Making and testing conjectures
- Modifying tools

- Using research-based tools
- Sharing strategies with practitioner colleagues
University-based mathematics educators

- Creating a theoretical framework
- Designing a tool to collect classroom data
- Testing a set of practices first observed in classrooms
- Working on a professional development partnership
- Developing a lesson planning tool based on a theoretical framework
- Identifying patterns in teachers’ practices
- Listening to questions teachers ask about their practice
- Using someone else’s professional development tools
Classroom-based mathematics educators

- Testing and comparing different pedagogical practices
- Designing and conducting an action research inquiry
- Iterating and revising mathematical tasks and lesson plans after implementation and analysis
- Working on a professional development partnership
- Informally noticing patterns in student work
- Designing and teaching lessons
- Changing teaching and collecting data on what students learned
- Analyzing student work with a framework to identify patterns
University of Central Florida
Dissertation Title:
Exploring the Challenges of First Grade Students' Non-Exit from Mathematics Intervention: A Comparative Analysis of Mathematics Instruction and Best Practices during Intervention

Dr. Lori Hart
Orange County Public Schools, 4th Grade Math Teacher
Title 1 Math Interventionist
I noticed that first grade students were not exiting from Tier 2 Intervention.
I analyzed tasks and task implementation using the IQA and also analyzed teachers’ beliefs about math intervention.

I noticed that first grade students were not exiting from Tier 2 Intervention.
I analyzed tasks and task implementation using the IQA and also analyzed teachers’ beliefs about math intervention. I found implementing the Effective Teaching Practices from *Principles to Action* supports students in Tier 2 intervention. I noticed that first grade students were not exiting from Tier 2 Intervention.
“By collaborating to identify practical implications and applications of research and to develop useful tools for practitioners or policymakers, research that foregrounds the problems of practice can help move research into practice.”
Dr. Margaret “Peg” Smith

University of Pittsburgh
Research Projects:
QUASAR, COMET, ASTEROID, ESP

Author,
Teacher Educator, and
Professional Development Provider
Dr. Margaret “Peg” Smith

“That’s what happened to the Tape Roll Task!”
Stein, Grover, & Henningsen (1996)
- Different tasks require different levels and kinds of student thinking.
- The cognitive demands of a task can change during instruction.
- Mathematical tasks with high-level demands are the most difficult to implement well. [575]

Stein & Lane (1996)
- Consistent engagement with high-level tasks leads to the greatest learning gains for students. [233]

Henningsen & Stein (1997)
- Classroom-based factors shape students' engagement with high-level tasks. [484]
Practitioner Articles/Chapters
- Selecting and Creating Mathematical Tasks (MTMS, 1998)
- Characterizing the Cognitive Demands of Tasks (NCTM, 2004)

Research Articles:
Stein, Grover, & Henningsen (1996)
- Different tasks require different levels and kinds of student thinking.
- The cognitive demands of a task can change during instruction.
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- Consistent engagement with high-level tasks leads to the greatest learning gains for students. [233]

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- Classroom-based factors shape students' engagement with high-level tasks. [484]
Practitioner Articles/Chapters
• Using CD tasks and students’ intuitive strategies to teach measurement (NCTM, 2003), to solve missing value problems (MTMS, 2003), and to teach algebraic reasoning (NCTM, 2004)

Books for Practitioners
• Narrative cases of mathematics instruction that exemplify research-based pattern of teaching and learning through the lens of the MTF and focus on specific mathematical ideas (2005).
Research Articles:

Stein, Engle, Smith, & Hughes, 2008
- Codified a set of practices for facilitating productive discussions of CD tasks from the study of an experienced facilitator.

Steele, Hillen, & Smith, 2013
- Provided evidence that teachers can learn through engagement in a course that included narrative cases and other practice-based materials.

Stein, Engle, Smith, & Hughes, 2015
- Provided evidence that teachers could learn a set of practices intended to support productive classroom discussions of CD tasks.
Practitioner Articles/Chapters
- Using Pattern Tasks to Develop Mathematical Understandings and Set Classroom Norms (MTMS, 2007)
- Thinking Through A Lesson Protocol (MTMS, 2008)
- 5 Practices for Orchestrating Productive Discussions (MTMS, 2009)

Books for Practitioner
- Discussion of the five practices and classroom-based examples that bring the practices to life (2011, 2013, 2019, 2020, 2024).

Research Articles:
- Stein, Engle, Smith, & Hughes, 2008
  - Codified a set of practices for facilitating productive discussions of CD tasks from the study of an experienced facilitator.
- Steele, Hillen, & Smith, 2013
  - Provided evidence that teachers can learn through engagement in a course that included narrative cases and other practice-based materials.
- Stein, Engle, Smith, & Hughes, 2015
  - Provided evidence that teachers could learn a set of practices intended to support productive classroom discussions of CD tasks.
Research Articles:
Boston & Smith, 2009
• Teachers participating in task-centric professional development can improve their ability to select and successfully enact high-level tasks in their classrooms.

Boston & Smith, 2011
• Teachers ability to select and successfully enact high-level tasks can be sustained and improved over time.

Boston, 2013
• Teachers learning about mathematical tasks was closely linked to the ideas represented in frameworks and their experiences in the ESP workshops.
Practitioner Articles/Chapters

- A strategy for engaging teachers in conversations about their practice (NCTM, 2009).
- Supporting teacher reflection and collaboration on the implementation of cognitively challenging mathematical tasks (AMTE, 2009).

Book for Practitioners

- Narrative cases of mathematics instruction that exemplify research-based pattern of teaching and learning through the lens of the MTF. Description of task-based professional development (2009).

Research Articles:

Boston & Smith, 2009

- Teachers participating in task-centric professional development can improve their ability to select and successfully enact high-level tasks in their classrooms.

Boston & Smith, 2011

- Teachers ability to select and successfully enact high-level tasks can be sustained and improved over time.

Boston, 2013

- Teachers learning about mathematical tasks was closely linked to the ideas represented in frameworks and their experiences in the ESP workshops.
Qs for Peg

- Can you talk about how some of the ideas central in your work have originated in classrooms and from listening to teachers?
- In your work with teachers, how have you thought about positioning them as collaborators in the research? How have you seen teachers take up this role as more than practitioners?
- How do you know when a research-practice partnership is effective? What are the signs?
- What are the biggest challenges when researchers and teachers collaborate?
“This research should also be influenced by the needs and issues in the classroom and provide results that are readily accessible, including tools to support practitioners and policymakers at all levels. “

“To have the desired impact, results should be reported in ways that can be shared, replicated, and applied or adapted to a variety of instructional settings…”
Dr. Maria Porras Monroy

University of Central Florida
Dissertation Title:
Impacts of Professional Development on Elementary Mathematics Teachers’ Implementation of Cognitively Demanding Tasks

Orange County Public Schools, 4th Grade Math Teacher & Team Leader
I wondered how to engage students in thinking and reasoning. I noticed other teachers had the same issue.
I used ideas from the IQA to design professional development and then analyzed teachers’ classroom practice.

I wondered how to engage students in thinking and reasoning. I noticed other teachers had the same concerns.
I used ideas from the IQA to design professional development and then analyzed teachers’ classroom practice.

I wondered how to engage students in thinking and reasoning. I noticed other teachers had the same issue.

I have implemented professional development with colleagues, looking at tasks and using student artifacts.
Dr. Kayla Blankenship

University of Central Florida:
Dissertation Title:
Promoting positive mathematics identity development in elementary students through a strengths-based, equity-focused mathematics club

Orange County Public Schools, Title 1
Math Interventionist
I noticed students’ lack of engagement in mathematics (<50%) school-wide
I analyzed my own classroom, read research about math clubs, and engaged in action research while implementing a math club. I noticed students’ lack of engagement in mathematics (<50%) school-wide.
I analyzed my own classroom, read research about math clubs, and engaged in action research around the math club.

I noticed students’ lack of engagement in mathematics (<50%) school-wide.

The “math club” program is going to be implemented at multiple schools.
Questions to consider next

• How (and where) can we share research <-> practice stories?
• How can classroom teacher voices be authentically represented in research?
• Whose teacher voices are being elevated in research <-> practices stories?


“We invite the field to collectively consider what the costs and benefits are to maintaining the status quo in terms of (re)presenting our own voices and the voices of prospective and practicing teachers that are so central to literally all of our practices...Teacher voices are extraordinary. They are powerful. Let us go forward in ways that hold those two statements at the heart of our work.”
Moral of the story

What is “actionable” from the position statement?

What has this webinar made you think about as a researcher and/or practitioner?

What has this webinar made you think about doing (or doing differently) as a researcher and/or practitioner?
Resources for Connecting Research and Practice

- *Putting Essential Understanding into Practice* series (NCTM, 2019)
- *Catalyzing Change* series (NCTM, 2020)
- “Learning from Practice about Improving the Quality of Mathematics Teacher Research” (Smith & Heaton, 2013)
Acknowledgement

The “Linking Research and Practice” Position Statement
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Questions or comments?

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