

Developing Teaching Expertise (DTE): Supports for K-5 Mathematics Professional Development/Developers

Kara Suzuka (klms@hawaii.edu) and Timothy Boerst (tboerst@umich.edu)

BACKGROUND

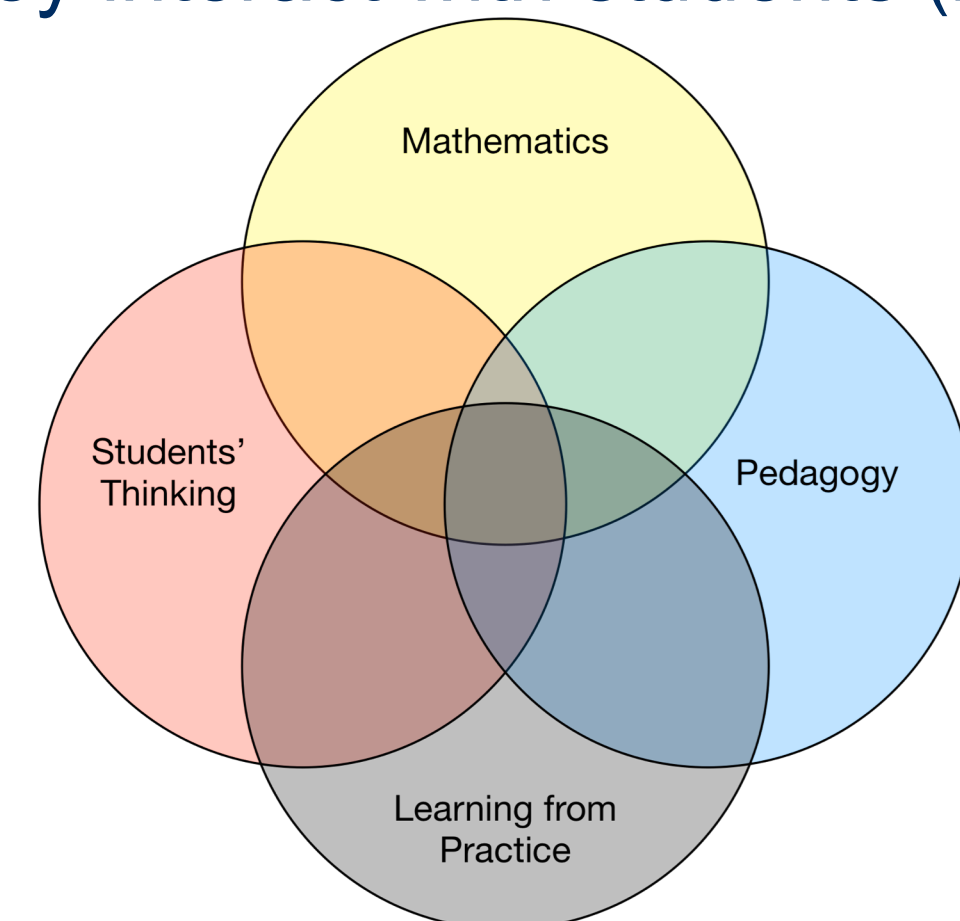
Teachers must use knowledge flexibly and fluently as they interact with students with the aim of helping those students become proficient with mathematics.

To develop this capacity, elementary mathematics teachers need professional learning opportunities to develop knowledge and skills that are tied to and *usable* in practice.

This type of professional development, aimed at helping teachers develop integrated and usable knowledge, requires skilled facilitation.

OUR APPROACH

1. Create PD modules that integrate mathematical content with other core elements of teaching knowledge and skill – and ground these opportunities in classroom practice
 - Integrated and connected knowledge is more robust (Bransford & Schwartz, 1999)
 - The work of teaching requires teachers to use knowledge flexibly and fluently as they interact with students (Lampert, 2009)



2. Design these modules as educative materials (Davis, E. et al, 2017) to support the work and learning of PD facilitators/leaders

RESEARCH QUESTIONS

- Can practice-based approaches to designing PD materials support/enable facilitators and teachers to work in integrated ways on mathematical knowledge and skills for teaching?
- Can elementary teachers significantly improve their Mathematical Knowledge for Teaching (MKT) in PD contexts that integrate core elements of mathematics teaching knowledge and skill?

DATA

- 776 teachers and 43 facilitators participated in nation-wide piloting of modules 1 & 2 (piloting of module 3 has just been completed)
 - Across 15 states, 39 school districts
 - Facilitators included 11 higher education faculty; 25 math specialists; 7 other school-based educators
- Data collected during pilots included:
 - Pre/post surveys- focused on the four elements and module design/implementation
 - Pre/post LMT tests- focus on strand most relevant to the content of the module
 - Implementation logs and video recordings of multiple sessions
 - Materials from participant “Classroom Connection Activities”

ANALYSIS & FINDINGS: PD FIDELITY

- Project staff analyzed the video recordings and implementation logs from PD sessions, examining the degree to which planned activities matched what was delivered. An external team performed the same set of analyses on a random subset of the face-to-face meetings.
- These analyses indicated the modules were implemented with fidelity

Source: External evaluation report, AIR (2017)

ANALYSIS & FINDINGS: PD/FACILITATION FEEDBACK

Teacher responses to end-of-PD surveys indicate they found the PD helpful for developing their understanding of core content elements:

Module Content Element	Mean (5 point scale)
I further developed my understanding of mathematics	4.07
I further developed my teaching practices	4.12
I further developed my understanding of student thinking	4.19
I developed skill in using new methods for examining and improving facets of my teaching	4.04

They also found their facilitators able to help them make connections:

Degree to which facilitator made connections	Mean (5-point scale)
Connections among ideas in each session	4.64
Connections between session content and participants' own teaching	4.59

Source: External evaluation report, AIR (2017)

ANALYSIS & FINDINGS: MKT CHANGE

Participants scored significantly higher on the Learning Mathematics Teaching (LMT) measure of mathematical knowledge for teaching following participation in a DTE@ module

Module 1

- Pretest: M = 16.956 , SD = 3.465
- Post-test: M = 19.88, SD = 3.804
- Paired t test: $p < .001$ (two-tailed)

Module 2

- Pretest: M = 14.94 , SD = 4.21
- Post-test: M = 16.98, SD = 4.37
- Paired t test: $p < .001$ (two-tailed)

Source: External evaluation report, AIR (2017)

PD MODULE DESIGN

Integrated content: We conceptualize the work of teaching as interactions with students and content taking place within broader environments (Cohen, Raudenbush, & Ball, 2003; Lampert 2001). Each DTE module is designed to integrate four core elements around particular topics:

- **Mathematical Knowledge for Teaching (MKT):** *Mathematical knowledge, skill, and habits of mind that are entailed by the work of teaching*
- **Student Thinking:** *Knowledge, dispositions, and skill in anticipating and interpreting students' ideas and ways of thinking about mathematics*
- **High Leverage Teaching Practice:** *Practices that, when done well, substantially enhance teachers' capacity to support student learning*
- **Learning from Practice:** *Methods for learning more effectively from the day-to-day work of teaching and/or artifacts of practice*

Educative materials for PD facilitators: Materials are designed with attention to facilitators' work and learning (based on Davis, E. et al, 2017):

- **Principle 1: Supporting facilitator adaptations** (e.g. *Detailed session plans, customized multimedia content player, recommendations for session combining or chunking*)
- **Principle 2: Situating and grounding in facilitators' and teachers' practice** (e.g. *Videos of experts facilitating PD sessions, “virtual participants”; Classroom Connection Activities (CCAs), records of practice from K-5 classrooms, Learning from Practice protocols*)
- **Principle 3: Offering multiple forms of support highlighting important content** (e.g. *Scope & sequence overviews and connections, session and part descriptions, session overview videos*)
- **Principle 4: Providing different kinds of educative features for facilitators to take up and to address facilitators' varied needs** (e.g. *study group session recordings & materials, also features listed above*)

NEXT STEPS

Dissemination of three DTE modules through the Curriculum Research & Development Group at the University of Hawai'i:

1. **Representing and comparing fractions** (featuring Deborah Loewenberg Ball)
2. **Reasoning and explanation** (featuring Deborah Loewenberg Ball)
3. **Geometric measurement** (featuring Douglas Clements & Julie Sarama)

Documentation and preservation of other project assets for reuse:

1. Source code for customized HTML5 multimedia “player” supporting intensive use of classroom records of practice
2. Editable final versions of project documents and source files used to produce project documents