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 in 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

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 = 16.96, SD = 3.465
- Posttest: M = 19.88, SD = 3.804
- Paired t test: p<.001 (two-tailed)

Module 2
- Pretest: M = 14.94, SD = 4.21
- Posttest: M = 16.96, SD = 4.37
- Paired t test: p<.001 (two-tailed)

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:

<table>
<thead>
<tr>
<th>Integrated Core Content Element</th>
<th>Mean (5-point scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I further developed my understanding of mathematics</td>
<td>4.07</td>
</tr>
<tr>
<td>I further developed my teaching practices</td>
<td>4.12</td>
</tr>
<tr>
<td>I further developed my understanding of student thinking</td>
<td>4.19</td>
</tr>
<tr>
<td>I developed skill in using new methods for examining and improving facets of my teaching</td>
<td>4.04</td>
</tr>
</tbody>
</table>

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)

NEXT STEPS
- Dissemination of three DTE modules through the Curriculum Research & Development Group at the University of Hawaii:
  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:
- Source code for customized HTML5 multimedia “player” supporting intensive use of classroom records of practice
- Editable final versions of project documents and source files used to produce project documents