

What do teachers need to know to provide worthwhile learning experiences in mathematics?

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Please note ...

- This is just the introductory slides. The presentation will include discussion of actual survey items designed to measure aspects of teachers' knowledge.
- If you would like to engage with the items prior to the presentation you can take the survey now.
- An anonymous link to the survey is provided in the final slide.

Mathematics teacher knowledge

- Need better measures than levels of mathematics courses taken
- Teaching mathematics requires specialised knowledge of mathematics
 - Beyond mathematics skills and knowledge
 - Includes aspects such as forms of representation, explanations, understanding students' thinking ...

Mathematics content knowledge

- Teachers need:
 - Deeply connected knowledge of content knowledge
 - Specialised ways of understanding mathematics content
- Ball et al. Mathematics Knowledge for Teaching
 - Common content knowledge
 - Specialised content knowledge
- BUT
 - Deep knowledge of content does not guarantee that teachers can provide rich mathematics learning experiences

Types of knowledge

- Shulman (1987)
 - 7 knowledge types
 - Content knowledge
 - General pedagogical knowledge
 - Curriculum knowledge
 - Pedagogical content knowledge (PCK);
 - Knowledge of learners and their characteristics
 - Knowledge of education contexts; and
 - Knowledge of education ends, purposes, and values
- Beliefs
- Confidence

Pedagogical Content Knowledge

- More than the combination of content and pedagogical knowledge
- Shulman
 - the particular form of content knowledge that embodies the aspects of content most germane to its teachability

Pedagogical Content Knowledge (Hill, Ball, et al.)

- *Knowledge of Content and Students (KCS)*: Content knowledge + knowledge of how students think about, know, or learn this particular content. Includes knowledge of typical conceptions and what makes topics hard or easy to learn.
- *Knowledge of Content and Teaching (KCT)*: Knowledge of the ways of representing and exemplifying mathematics that make it comprehensible to others.
- *Knowledge of Curriculum*: Knowledge of the programs and resources available for a topic and when to use them.

Pedagogical Content Knowledge (Chick, et al.)

- Clearly PCK, e.g.,
 - Knowledge of typical student thinking
 - Knowledge of cognitive demand
 - Knowledge of useful representations and examples
- Content knowledge in a pedagogical context, e.g.,
 - Profound Understanding of Fundamental Mathematics
 - Knowledge of mathematical structure and connections
 - Procedural knowledge
- Pedagogical knowledge in a content context, e.g.,
 - Getting and maintaining student focus
 - Goals for learning

CEMENT project

- Involved 7 Australian universities
- Focussed on providing measures of PSTs' knowledge of mathematics for teaching
- Online instrument
- Informed by international and Australian research
- 3 scales:
 - Beliefs (BELF) (10 items) – Likert scale
 - Mathematics Content Knowledge (MCK) (10 items) – MCQ
 - Pedagogical Content Knowledge (PCK) (10 items) – MCQ
- BELF across all tests
- MCK and PCK each had 5 core and 5 random items
 - Allowed for equating across test forms and a larger pool of items

Our approach to designing items

- Tried to cover a diversity of mathematical topics
- Tried to cover a range of PCK issues
 - Representations and models
 - Explanations
 - Identifying and dealing with misconceptions
 - Sequencing topics
- Constrained by the need for automatic scoring

Complete the survey

The presentation will include discussion of some of the MCK and PCK and beliefs items.

The presentation will be interesting even if you are seeing the items then for the first time but if you would like to preview the items you can take the survey before the presentation.

To take the survey, click on the link below, or copy and paste it into a browser.

- It should take about 45 minutes and some questions are intended to make you think quite hard.
- Your response will be completely anonymous.

http://utaseducation.us.qualtrics.com/SE/?SID=SV_6XbFFGJcgZxHSpn

Thank you