Session Title:
An Assessment of Teachers’ Mathematical Meanings for Teaching Secondary Mathematics and its Implications for MSPs

MSP Project Name:
Project Aspire: Defining and Assessing Mathematical Knowledge for Teaching Secondary Mathematics

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Feedback Session

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Summary:
This session discusses preliminary results from a project to assess high school teachers’ mathematical meanings for teaching secondary mathematics. Instead of assessing the extent to which teachers are able to answer questions correctly or possess correct mathematical understandings, the instrument reveals meanings teachers actually have for ideas that are foundational to the secondary curriculum. The ideas assessed are in the areas of variable, function, equation, rate, quantity, and structure. The assessment’s items are designed so that teachers’ interpretations of mathematical situations reveal the meanings they have for the mathematics entailed in them. The session invites discussion of this approach and of implications of a focus on meanings for teacher professional development and for teacher preparation programs.

Section 1: Description of product, tool, process, curriculum, or instrument:
The Aspire Assessment of Mathematical Meanings for Teaching secondary mathematics (MMTsm) is composed of items inspired by research on students’ understandings of key ideas of the secondary mathematics curriculum and research on teachers’ difficulties conveying important ideas. As of now it contains 40 items, some open ended, some multiple-choice, and some animated. An example of an animated item is one in two parts: (1) it asks teachers to state the meaning of average rate of change that they would like their students to have. (2) The display then presents two racecars, one traveling at a constant speed, the other accelerating, where both cars cover the same distance in the same amount of time. Teachers then answer the question, “Is the meaning you of average rate of change that you stated in (1) related to this animation? Explain.” The purpose of this animated item is to assess the coherence between teachers’ meanings of average rate of change and their understandings of phenomena from which the concept arose. An example of an open-ended item is: “The function $h$ is strictly increasing and is defined for all real numbers. $h(b - 5) = 9$ for some number $b$. Which of $(b,9)$ or $(b - 5,9)$ is on the
graph of \( y = h(x - 5) \)? Explain.” This item is designed to uncover teachers’ distinctions between an input to a function and an argument of a function. Other items uncover ways teachers think about the other areas mentioned in the abstract.

**Section 2: Question, issue, or challenge that is the primary focus of the session:**
We have two questions:

1. We are devising scoring methods that both respect meanings teachers have and yet allows answers to be categorized, but are not happy with any. Our difficulty arises from the panalopy of idiosyncratic meanings that teachers reveal that are certainly not standard, and probably not effective as a support for mathematics instruction. We want to provide constructive feedback that says how their meanings are supportive or problematic for supporting sound mathematical instruction.

2. We have difficulty recruiting teachers who will pilot our instrument. We try to convey that they will get useful information in return, but they often shy from participating thinking that they will “not do well”. We have worked most successfully with teachers when they are in an MSP, so we would welcome collaborators.

**Section 3: Types of people who you think might be most interested in discussing this and offering feedback:**
PI’s, project directors, evaluators, researchers, higher education STEM faculty, higher education ED faculty

**Section 4: How will you structure this session? What is your plan for participant interaction?**
The session will:

- Open with the framing questions,
- Discuss our meaning of “mathematical meaning” and its connection to conceptualizations of mathematics teaching and learning
- Share sample items, their design and rationale, and results of
- Interpret the results in terms of their potential for helping teachers improve their teaching
- Return to the framing questions for discussion