Preliminary Research Results: Math Teachers' Circles

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"Teachers need to know mathematics in ways that enable them to help students learn. The specialized knowledge of mathematics that they need is different from the mathematical content contained in most college mathematics courses, which are principally designed for those whose professional uses of mathematics will be in mathematics, science, and other technical fields." (National Research Council 2001)

Quantitative Research Question

Does participating in a Math Teachers' Circle summer immersion workshop result in increased Mathematical Knowledge for Teaching (MKT)?

Study Description

- Conducted over 2 summers – 2010, 2011
- Used Learning Math for Teaching Instrument
- Subscales used:
  - Number Concepts and Operations (both summers)
  - Geometry (first summer only)
  - Proportional Reasoning (second summer only)
- Offered at beginning and end of 4-5 day workshops

Learning Math for Teaching Instrument

- Developed at University of Michigan
- Extensively tested to establish psychometric soundness
- Has been linked to increased student achievement in a large scale study (Hill, Rowan, & Ball, 2005)
- Scores are standardized to a normal distribution with mean 0 and standard deviation 1

Results

	Summer 2010	Summer 2011
Sites	3	6
Total participants	49	118
Mean increase for number concepts and operation (in standard units)	.34 ($p<0.001$)	.29 ($p<0.0001$)

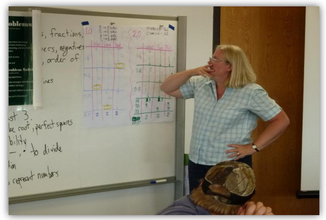
Implications

- Preliminary evidence shows that Math Knowledge for Teaching is positively impacted by MTCs
- Need not always teach MKT directly
- Although statistically significant gains were not seen in the areas of geometry proportional reasoning, further study is needed

What is Mathematical Knowledge for Teaching?

"By *mathematical knowledge for teaching,* we mean the mathematical knowledge used to carry out the work of teaching mathematics." (Hill, Rowan, & Ball, 2005).

Examples
- Explaining terms and concepts to students
- Analyzing students' solutions
- Judging and correcting textbook treatments
- Using representations accurately in the classroom
- Providing students with examples of mathematical concepts, algorithms, or proofs



Examples of Analyzing Student Work

Determine if each student is using a method that could be used to multiply any two whole numbers.

Student A	Student B	Student C
35 ×25 125 +75 875	35 ×25 175 +700 875	35 ×25 25 150 100 +600 875

Problem:
There were 64 teams at the beginning of the NCAA basketball tournament. There are 5 starting players on each team. How many starting players were there at the beginning of the tournament?

Student Responses:

1. That would be 64 times 5. I use one 10 because I know 5 times 10 is 50. Then you do that six times. That's 30, I mean 300. Then you add 4 five times, which is 25, no 20. I added it all together and got 320.

2. 64 means 60+4. So I did 60 five times, for 300. Then 4 times 5 is 20, so the answer is 320.

3. I split 64 into four parts – 20, 20 , and 20. I did each separately: 20 times 5 is 100, 20 times 5 is 100, 20 times 5 is 100. Then the last part, 4 times 5, is 20. All together 320.

Qualitative Research Question

How do participants view the workshop and its impacts on them as learners and teachers?

Study Description

- Analyzed final evaluations from three sites from Summer 2010
- Used "constant comparison" method to look for themes

Sample Final Evaluation Questions

1. Please tell us your thoughts about the workshop.
2. Please comment on how the support you received from others impacted your learning.
3. Did you learn any new approaches to problem solving this week? Please explain.
4. Do you anticipate changing anything about how you teach mathematics as a result of this workshop? If so, in what ways?
5. Please comment on what you considered to be the most useful aspects of this week.

Results

Participants reported a wide variety of gains as a *learner* of mathematics and gains as a *teacher* of mathematics.

As learners
- Challenged by both the content and problem solving
- Many had not previously been asked to work collaboratively to this extent
- Felt supported by facilitators throughout the week.

As teachers
- Intend to require more justifications and explanations from students
- Some plan to incorporate more group work, more open ended-problems and problems requiring exploration, and more mathematical discussions into their classrooms
- Reported learning teaching strategies and effective questioning techniques from observing the facilitators

Participant comments
- *"This workshop was awesome! It was great to network with other teachers to see what they are doing in their classrooms".*
- *"It was geekishly fun to really stretch your math brain and challenge yourself."*
- *"It definitely helps to get you excited for the upcoming school year."*
- *"It's really exciting to see so many people excited about math education in our state."*

Implications

Self-reported changes in teachers knowledge and practice suggest the need for a more detailed study involving classroom observations.

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