



Pre-Service Elementary Teachers' Evolving Mathematical Understandings and Beliefs

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Quantitative Survey

- Over 300 pre-service teachers (PST's) and about 100 in-service teachers have been surveyed using the *Perceptions of Mathematics* (POM) instrument.



The Project

- The goal of our project is to identify risk and protective factors related to teacher growth in mathematics.
- To date, the factors of deep or “conceptual” knowledge of mathematics, as well as beliefs about mathematics, have been studied.



Survey Results in a Nutshell

- Teachers generally have very poor conceptual understanding of elementary mathematics concepts as needed for teaching.
- This understanding can increase significantly with professional development.
- As teachers deepen their understanding, their beliefs about mathematics itself and what is important tend to shift.



Recent Qualitative Data

- 22 pre-service teachers (PST's) were interviewed at the end of their teacher education program.
- Semi-structured interviews were transcribed and analyzed.
- Interviews were conducted in parallel with the Perceptions of Mathematics (POM) year 3 survey given to all PST's.



Results

Participants' Mathematics Background

- All 22 participants described having had a very procedural background.
 - "I'm from the old school of math where it was here's a formula...and you just do it."
- Half the students described themselves as poor or at best, average, students. Only two rated their math preparation as "good".
 - "I think I just memorized formulas if they were visually given to me, and then hopefully for the test I would remember them."
- Several described a dislike or fear of mathematics. Two used the word "phobia".



At the end of the Mathematics Methods Course ...

- All the participants described an increase in their value of the use of conceptual methods.
 - “You’re going to forget all these little like procedure stuff, but if you understand why you have to do something then...you can find another way of getting it.”
- Many described an increased interest in mathematics.
 - “Now that I’m done the math course, I understand better now, and I actually enjoy math more.”
- Many discussed increasing their own knowledge, and thinking about the mathematics differently.
 - “It’s just like my eyes have been opened.”



Results continued

- Most expressed a desire to teach mathematics differently than they had been taught.
 - “My teachers screwed me up kind of. Like I feel like they didn’t teach me properly.”
 - “I knew that there was something wrong with it because I knew so many people that didn’t understand what they were learning.”
- Understandings of mathematics grew, but the need was also expressed for more program time.
 - “I was thinking that if I haven’t already, I’m definitely on the verge of making those really big connections between things.”
 - “I’m actually kind of not upset but kind of sad that it was only fractions and algebra, and it would benefit me...to have a little bit more like everything else, just to see different ways.”



Practicum Experiences

- 17 of the interviewees taught mathematics in their practicum.
- 10 of those felt they had had a very procedural associate teacher.
- 4 of these 10 did not have the opportunity to try any conceptual activities in their classrooms.
 - “Not being a strong math student, I was like I really didn’t want to mess the kids up and not have them know what they were doing, so I basically just followed the textbook only because...he didn’t really give me any sort of direction as to like fun, interesting ways.”



Reform implementation issues as described by PST's discussing their practica

- Associate teachers appeared to have difficulties in moving away from the text.
- Students appeared to dislike mathematics.
- Not all teachers taught with a conceptual method.
- Lack of knowledge in associate teachers (and PST's) on how to implement the reforms effectively.
- Manipulatives left in bins at the side of the classroom instead of being used by associates.
- Difficult for PST's to change mind frame when exposed to procedural only in previous learning experiences.
- Curriculum impedes use of conceptual methods because of a shortage of classroom math time.



Interview Participants' Final Comments

- "It's more important to learn, to actually be able to understand math rather than just plug in a formula."
- "It does not necessarily matter as long as they've figured out a way that works for them so that they can...use it instead of just like having it be a random formula they forget and then they can't apply the math in their lives later because they don't remember how it worked."
- "It was a whole new way to look at [math] and then I think it will make us better teachers because there will be kids out there that obviously have the same problems I had as a kid."
- "It's probably more rewarding in the end to know that the kid actually walked away understanding it rather than just regurgitating formulas that you've told them."



Summary

- The interview responses aligned well with the individual scores on the POM survey.
- Although participants described strong gains, half PST's interviewed expressed a desire to learn more about mathematics.
- The length of the methods course appears to be an issue. Methods courses have the dual challenge of supporting conceptual growth in mathematics for teaching, as well more methodological aspects.



Discussion Question

- How (and where) are we going to increase opportunities for PST's to deepen their knowledge of mathematics for teaching?

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