Exploring Children’s Mathematical Thinking

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Children’s mathematical thinking is an important field of study and a powerful tool for helping prospective and practicing teachers learn to provide effective instruction to children in grades K–12.

- Effective K–12 Teaching
  - Informs teacher decision making
  - Widely accepted as essential

- Field of Study
  - Research agenda
  - “Noticing” children’s thinking

- Teacher Learning
  - Teaching & community work
  - Prospective & practicing teachers
Noah (Grade 1): A baby elephant in the zoo weighed 488 pounds. Over the summer, she gained 145 pounds. How much did she weigh at the end of the summer?

488 + 145
8 tens + 4 tens is 12 tens
12 tens is 100 + 2 tens
8 + 5 = 13 = 1 ten + 3
2 tens + 1 ten + 3 = 33
400 + 100 + 100 = 600
600 + 30 + 3 = 633

“I added the tens first, and I got 12 tens and I had 100 out of those so I added that to the 100s. Then I used my tens that were left which was 2, and then I added 8 plus 5. And 8 plus 5 equaled 13 so then I had 3 tens and 3 loose ones which was 33. Then I counted up my hundreds and I got 6 hundreds.”
What Did We Learn About Noah’s Mathematical Thinking?

- Strategy was different than most adults’ strategies
- Strategy was not “taught” & needs to be elicited
- Strategy was mathematically powerful
- Strategy reflected Noah’s understanding about place value (grouping by 100s, 10s, and 1s)
- Strategy gives us a good starting point for instruction—next steps should build on Noah’s existing understandings

So What?

- Extensive knowledge base about children’s mathematical thinking developed over the past 40 years
  - Children’s informal knowledge
  - Developmental trajectories
- Extensive evidence of the positive effects on student learning when teachers elicit and build on their students’ ideas
- Extensive evidence of the positive effects on teacher learning
  - Teachers who learn how to learn from their students’ thinking can continue learning throughout their careers
- Teaching and learning mathematics is more fun!
Children’s Thinking & My Work

- Children’s thinking is the centerpiece of my teaching at the university & in the community
  - Non-threatening, respectful, and productive way of interacting with teachers
- Conducted research on children’s mathematical thinking
- Conducted research on teachers’ learning when children’s mathematical thinking is central
  - Current focus on the hidden practice of teacher “noticing”

Teachers’ Noticing

- Everyday noticing vs. distinct patterns of noticing for groups of professionals (Goodwin, 1994; Mason, 2002)
- Our focus for noticing — how, and to what extent, do teachers notice children’s mathematical thinking?

  *Child says or does something [ ] and then the teacher responds.*

  - Attending to the details of children’s strategies
  - Interpreting the children’s understandings reflected in the strategies
  - Deciding how to respond on the basis of children’s understandings
What Have We Learned About Noticing and the Development of Noticing Expertise?

- Noticing children’s mathematical thinking is complex
- Construct contributes to efforts to decompose practice and identify core activities of teaching (Ball & Cohen, 1999; Ball et al., 2009; Grossman & McDonald, 2008; Lampert et al, 2010)
- Expertise is not automatic but can be learned through sustained professional development
- Long-term professional development matters
- Expertise in attending seems to develop first & expertise in deciding how to respond seems to develop later

Community-Engaged Scholarship

- Tool for supporting prospective and practicing teachers
- Collaborations—learn with and from teachers
- Rich research area with questions arising from both theory and practice
- Integrated stance reflected in other work in the School of Education in multiple content areas