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# Reflections on Language and Mathematics Problem Solving: A Case Study of a Bilingual First-Grade Teacher

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# Background

- Reform initiatives value teachers' understanding of student mathematical thinking (NCTM, 2000).
- Research demonstrates impact of PD learning communities in which teachers inquire about their practice and analyze student work (Kazemi & Franke, 2004; NCTM, 2000).
- Research on effective PD for teachers of ELLs is still lacking (Télliez, 2004).

# Research Purpose

- This study explores
  - The impact of classroom-based PD on teacher's understandings of teaching mathematics to Latina/o students;
  - Issues of language and culture with which the teacher grappled while engaged in reflecting on students' mathematical thinking.

# Theoretical Framework

- Cognitively Guided Instruction (CGI) (Carpenter et al., 1999) and the importance of teachers constructing models of children's mathematical thinking (Franke et al., 2001)
- Sociocultural construction of knowledge and research on communities of practice (Rogoff, 1995; Vygotsky, 1978; Wenger, 1998)
- PD as inquiry into practice through the analysis of student work (Kazemi & Franke, 2003)
- Current research on PD of bilingual teachers (Varghese, 2004)

# Professional Development Design

- Classroom based teacher-researchers collaboration
- Weekly researchers' visits to the classroom to:
  - Model CGI problem-solving lessons
  - Co-plan problem-solving lessons
  - Observe teacher implementation of CGI approach
  - Meet for debriefing conversations after each session

# Methods

- Part of ongoing longitudinal qualitative study
- Data analyzed for the purposes of this case study involves:
  - Field notes from classroom visits (N = 29)
  - Audiorecording of debriefing sessions (N= 21)
  - Teacher interviews (N = 2)
  - Videotaped classroom sessions, Fall 2007 (N = 3)

# Case Study (Merriam, 1998)

- Ms. López, a bilingual 1st grade teacher
  - Native Spanish speaker, originally from Peru
  - Bilingual certified teacher
  - Has taught for more than 10 years
  - Mathematics instruction is in Spanish
- Urban elementary school in New Mexico
  - Promotes bilingualism and biliteracy
  - Standards-based mathematics curriculum
  - 86% Latino population
  - 99% free or reduced meals
  - Large Mexican immigrant population

# Teacher's Beliefs about Teaching Mathematics and Bilingual Education

- Teaching mathematics

*If a child has...a solid number sense concept, then the child may be able to not only relate a problem to the problem itself, but to life. I think the big idea is that they build, not only for first grade but for later in the other grades and for life \_ is that **whatever they are learning, that they can see that connection: how related it is to life, to everyday life.** (Interview, November 2006)*

- Teaching in a bilingual program

*And then again the first year that I taught. I was doing the math in English; but the kids were not understanding. And then I realized, you know: **what's the point of teaching in English? I think it's important that they build their own native language,** in this case Spanish, they [need to] build academic language to be successful later. (Interview, November 2006)*

# Findings--Curriculum (1)

Ms. López gained insights about:

- Integrating contextualized problem solving into standards-based curriculum (Turner et al., 2008)

*This curriculum does not work a lot with story problems. They give one example which is very simple and then the kids get hooked on that example. They all do the same example with different animals and different people but the same thing.* (Interview, April 2007)

- Becoming the authority in relation to curriculum implementation

*When I first started, I would follow what the book says and as I was learning more, I realized what was more important. It's like, "Oh, this is really not that important, it is OK" and I will touch on it, but it's not crucial, so I **made my own decisions of what I think is more important*** (Interview, November 2006)

# Findings--Curriculum (2)

Ms. López grappled with:

- Scaffolding children's thinking so that they value mathematics in their everyday lives
- Seeing a disconnect between the homework and parents' background knowledge (Civil, 2002)
- Reconceptualizing her role as mediator between home culture and curriculum by promoting more parent involvement through:
  - Adapting homework so parents can understand it
  - Encouraging parents to participate in early morning activities
  - Designing and implementing workshops for parents to experience CGI problem solving.

# Findings--Language (1)

Ms. López reflected about:

- Difference between everyday language and academic language (Bielenberg and Wong Fillmore, 2004/2005; Valdes, 2004)
- Need to extend the mathematics language in the classroom so that students can express themselves and explain their thinking (Khisty & Chval, 2002; Moschkovich, 2007)

*...if you are not used to explaining your reasoning, in Spanish, or whatever language you talk, if you don't know the vocabulary, you are not going to be able to explain. (...) when we look at specific words that they use, **specific vocabulary that we use in math, (...) it's not (...) a vocabulary, that you use everyday, so it has to be taught (...) and practiced.** (November 2006)*

## Findings--Language (2)

Ms. López grappled with:

- Deconstructing her view of students as lacking vocabulary and understanding students' linguistic resources to express their thinking

*I've noticed the language part, the fact that the kids, I don't [want to] say that they have a limited language ability, but the fact they cannot explain, verbally, many things, you know. They call things, "esto, esto, lo otro" [this, this, or that] They don't have a specific vocabulary for some things. (Interview, November 06)*

## Findings--Language (3)

- Building on the differences between academic vs. everyday language

*Well I look at the academic language, native language \_ Spanish \_ and the everyday language. And it is not the same. And the majority of the kids that I have here, their level \_ it's not limited language, but it's daily everyday common language. At home, they don't receive - the majority - do not receive academic language. (Interview, November 2006)*

# Implications

## Need to rethink PD for bilingual teachers

- Creating ‘situated’ PD communities “that promote the practice of shared inquiry grounded in teachers’ work” (Crockett, 2002, p. 609).
- Validating bilingual teachers’ agency in terms of enacting curriculum and language policies (Varghese, 2004)
- PD focusing on mathematics reform curriculum in articulation with issues of language and culture to enable teachers to make decisions that meet the needs of Latina/o students

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