

Bilingual Teachers' Reflections on Students' Language and Culture to Teach Mathematics

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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 bilingual and ELLs is still lacking (Téllez, 2004; Varghese, 2004).
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Research Purpose

□ This study explores

- Elementary bilingual teachers' reflections on integrating language, culture, and mathematics
 - The impact of a collaborative teacher-researchers classroom-based PD
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Theoretical Framework

- ❑ Teachers' reflections (Philipp, 2007; Thompson, 1992) with particular attention to integrating language, culture, and mathematics (Aguirre et al., in preparation).
 - ❑ 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 learning (Rogoff, 1995; Wenger, 1998)
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Professional Development Design

- Classroom-based teacher-researchers collaboration (Cobb, 2000)
 - Weekly researchers' visits to the classroom to:
 - Model, co-plan or/and observe CGI problem-solving lessons
 - Meet for debriefing conversations after each session
 - PD monthly sessions with participating teachers and/or summer institutes
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Methods

- ❑ Ongoing longitudinal qualitative study
 - ❑ Data analyzed:
 - Teacher interviews from Fall 2005 to Spring 2008
 - Teacher Questionnaire
 - Field notes from classroom visits
 - Videotaped classroom observations
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Participants

- Four bilingual teachers from urban and rural elementary schools in New Mexico
 - Schools promote bilingualism and biliteracy; one school includes ESL program
 - Standards-based mathematics curriculum
 - 86% Latino population (mostly Mexican immigrants)
 - The teachers:
 - Ms. Carrera - Kinder - Novice - Mexico
 - Ms. Arenas - Kinder - Experienced - Guatemala
 - Ms. López - 1st grade - Experienced - Peru
 - Mr. Zapata - 4th/5th grade - Experienced - New Mexico
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Findings: Reflections on Culture (1)

- “...They have other cultural experiences too. A lot of times they plant with their parents and even counting the seeds or transforming the seeds. So a lot of the mathematics could come from construction. They might know...they have counted the nails for their parents sometimes... ‘Give me three.’ From construction work. Or, ‘I need three pieces of wood.’ Those are the experiences that they bring with them.” (Ms. Arenas’ Interview, Spring 2007)
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Reflections on Culture (2)



- Contextualizing word problems as a meaningful story familiar to students' lives and incorporating students as the main actors (Turner et al., 2009)
 - This requires that teachers draw from their knowledge of students, especially appealing to students' funds of knowledge (González, Moll, & Amanti, 2005).
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Reflections on Culture (3)

- Seeing a disconnect between the homework and parents' background knowledge (Civil, 2002)

 - Reconceptualizing their role as mediators 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.
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Reflections on Language (1)

- “Well, I really see a very strong relationship and the way I feel after doing it (CGI) this year is that the problem solving needs to be done in the students' native language then let them transfer into the second language. To me it's crucial...I know you need to learn English and my students need to learn English, but it's going to be way faster, if I do it, if I develop that problem-solving concept in the native language and let them transfer into English.” (Ms. Arenas, Spring 2006)



Reflections on Language (2)

- ❑ Kindergarten bilingual Classroom
- ❑ Emphasis is on retelling the story, sharing problem-solving strategies, and discussing efficient strategies.



Scaffolding Students' Verbalizations: Ms. Carrera

Analyzing Student's Representation

Mrs. Carrera's Case - Kinder

- I have 10 chickens. Each chicken has 2 legs. How many legs are there?
- Working on multiplication as a "repeated addition." Initial representation includes using 10 and 2.
- Students solve problem correctly.

Ivan's representation



10 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2
20

The image shows a student's handwritten work. At the top, there are ten simple stick figures drawn in a row, each with two legs. Below the figures is a repeated addition equation: $10 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2$. The final result, 20 , is written at the bottom right of the equation.

Impact of PD on Teachers' Understanding of Student Thinking (1)

- Students' opportunities to learn are shaped by teachers' instructional decisions and the way they enact curriculum (Boaler, 2002).
 - "I wondered if my kinders...I always believed in their ability, but I thought they are so low, I knew I could take them through addition ... but division and multiplication I wasn't sure. But they were ready, they were ready. And that's what I really learned. Problem solving works and CGI works with very young students and it works really, really good. . . I am very happy . . .because it helped them to strengthen their abilities, according to what they can do. They really have come a long way." (Ms. Arenas, Kinder, May 2006)
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Impact of PD on Teachers' Understanding of Student Thinking (2)

Insights gained on:

- Students' thinking and mathematical understanding as a result of collective (teacher-researchers) inquiry on students' work (Crespo & Featherstone, 2006)
- Strategies students are developing:

*They are using (. . .)the **counting on**, let's say that they're counting whether it's crayons or the coins or the number line I can see that they can count by tens and that they can make the jump to, to switch to the one,... to the fives. . . .* (Ms. López, April 2007)

Impact of PD on Teachers' Confidence to Teach Mathematics (1)

- “Before CGI, I had more questions...about how I was teaching mathematics, but after CGI, I think I’m understanding mathematics better myself, because I never was a good student in math.”
(Ms. Carrera, Spring 2007)
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Impact of PD on Teachers' Confidence to Teach Mathematics (2)

- “I always believe that things happen for a reason and I was kind of like, teaching 4th grade, getting into the routine of relying on the computation stuff and then I finally saw something that was a little intimidating for me, like the CEMELA program and really getting in there, but I am really glad I did it because I feel like I have really opened up and I am feeling more confidence about my teaching. I have taught for 22 years, and I am having so much fun with it (CGI).” (Mr. Zapata’s Interview, Spring 2006)
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Implications

Bilingual teachers benefited from:

- ❑ Redefining the boundaries of PD creating classroom-based learning opportunities centered on exploring CGI problem solving in students' native language and culture.
 - ❑ Ongoing reflection and analysis of students' mathematical thinking and different problem solving strategies
 - ❑ Providing Latina/o students with opportunities to solve challenging mathematical problems and explain their reasoning in their native language.
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