

NCTM 2009



Assessment and Mathematical Representation: Providing ELLs with Opportunities to Make Sense of Decimals and Fractions.

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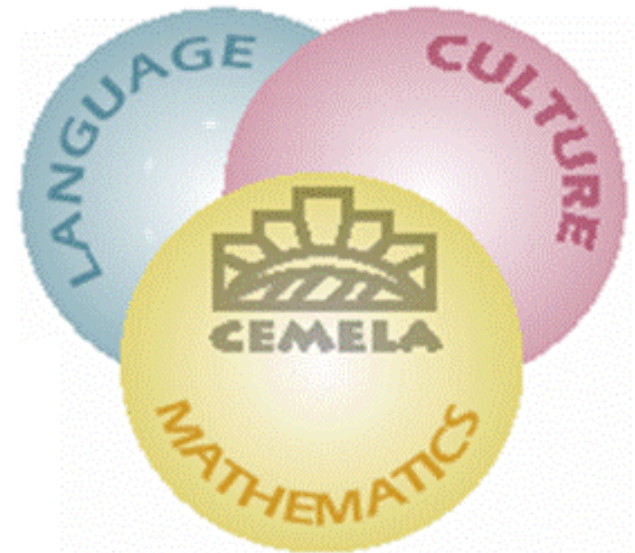


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CEMELA



- The Center for the Mathematics Education of Latinos/as
 - The University of New Mexico
 - The University of Arizona
 - University of California, Santa Cruz
 - University of Illinois at Chicago
- CEMELA
 - Interdisciplinary,
 - Multi-university consortium
 - Focused on the research and practice of the teaching and learning of mathematics with Latino students



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Session Goals



- Introduce a formative assessment tool—
Interactive Interview Protocol.
- View and analyze video clips using the
assessment tool with an English Language
Learner.
- Share research findings on how ELL students
demonstrated their understanding of fractions
using the Interactive Interview Protocol.

First, we ...



- Provide some background on immigrant students in U.S.
- Discuss formative assessment and the interactive interview protocol.
- Introduce a conceptual framework that relies upon the notion of “teaching for diversity” and social-constructivism.

Immigrants in the U.S.



- Over the past several decades, there has been a large influx of immigrants into the United States. The number of ELLs enrolled in schools in the U.S. increased 57% from 1995 to 2006 (NCELA, 2007).
- These immigrants are a heterogeneous group that challenges simple generalizations.
- Over 50% of all immigrants in the U.S. are from a Latin American country; the majority are from Mexico.

Low Expectations for ELLs



- For years, researchers have documented how low academic expectations are often the norm for racial/ethnic minorities such as ELLs and students living in poverty (e.g., Ferguson, 1998; Grant, 1989; Zeichner, 1996).
- When immigrant Latino/a students speak with an accent, use English words incorrectly or speak in Spanish as a means to express themselves, educators, peers and community members may assume they lack the capacity to perform well in mathematics (Gutiérrez, 2007; Moll & Ruiz, 2002; Moschkovich, 2007).
- Studies have documented how educators of Latino/a students often make the memorization of math facts, algorithms, vocabulary and procedures the focal point of their instruction, rather than teaching students using complex, challenging problems (Flores, 2007; Moschkovich, 2007).

Deficit Perspectives



- “Deficit perspectives” attribute lower levels of academic achievement to specific ethnic/racial groups based upon characteristics such as lack of fluency in English, life experiences that do not parallel those of the dominant society, or low family income (Khisty, 1995; Lubienski, 2007).
- Instead of looking at students and their communities through a deficit lens, they can be viewed as having funds of knowledge such as knowing one language and learning another, having experiences that are richly grounded in their culture, and having extensive mathematics experiences in their daily lives (Moll & Ruiz, 2002).
- If educators build on the attributes students possess and treat them as mathematically competent, there is greater potential for increased academic success and an enhanced mathematical identity (Empson, 2003; Turner, Celedón-Pattichis, & Marshall, 2008).

Challenging Deficit Perspectives



- To counteract deficit views of ELLs, researchers have documented how their prior knowledge, language and culture must be integrated into instruction and assessment tasks (Abedi & Gándara, 2006).
- ELL students benefit from the use of their home language and other feedback techniques; they benefit from the translation and explanation of key words and sentences, by reflecting on their own thinking, assessing their own errors and having teachers and peers revoice their explanations (Abedi & Gándara, 2006; Borjian, 2008; Lockwood & Secada, 1999).
- Instruction for ELLs should be supportive of students using resources such as gestures, concrete objects such as drawings, and the use of their first language to communicate their mathematical thinking (Moschkovich, 2002).

Formative Assessment



- There are two categories of classroom assessments; summative and formative.
- Summative assessment formats focus on what students know at a given time (Guskey and Bailey, 2001).
- Formative assessments differ from summative assessment in that the focus is not just on summarizing students' learning, but on using student learning data to inform instruction.
- Examples of formative assessments:
 - Peer assessments
 - Individual interviews
 - Student portfolios.

More on Formative Assessment



- After examining 250 research studies on classroom assessment, Black and Wiliam (1998) found that when teachers focus on formative assessment, student achievement gains are “among the largest ever reported for educational interventions.”
- ELLs often enter U.S. schools performing below their English speaking peers and their academic progress usually is measured with inadequate tools that do not accurately represent their learning (Abedi & Gándara, 2006; Abedi & Lord, 2001).
- We designed a formative assessment tool to try and support the learning and achievement of four sixth-grade, English Language Learners.

Theoretical Frame



- Theoretical framework draws upon two areas:
 - (a) the notion of “teaching for diversity,” and
 - (b) social-constructivism.

First goal: Infuse notions of equity and justice into well-established theoretical frameworks.

Second goal: Push theoretical constructs that may not necessarily challenge taken-for-granted educational structures and practices that may be detrimental to Latino/a students.

Teaching for Diversity



- While much has been written about the need to implement standards-based curriculum and instruction in mathematics classrooms, little emphasis has been placed on preparing teachers of mathematics to implicitly and explicitly incorporate socially, culturally, and politically equitable instructional strategies in their classrooms, that is, “teach for diversity” (Rodriguez & Kitchen, 2005).
- Ultimately, teaching for diversity entails teachers of mathematics teaching in more culturally responsive, gender-inclusive, and socially relevant ways (Rodriguez & Kitchen, 2005).
- Research and teaching in mathematics education that takes seriously the social, cultural, and political context of learning examines how tracking affects learning, whether diverse students have equitable opportunities to learn challenging mathematics, and how race and class play out in the classroom.

Significance of Critical Studies



- The significance of these studies is that they redefine traditional notions of “effective pedagogy” (Roy & Kitchen, 2005).
- Effective teaching is viewed as more than engaging students in constructivist-based mathematics activities.
- Specifically, teaching for diversity promotes the development of students’ cultural identity, empowerment, and social justice.
- These ideals are beyond that of the equity vision put forth in the Principles and Standards for School Mathematics [PSSM] document (NCTM, 2000), which largely supports learning dominant, albeit reform-based, mathematics (Gutiérrez, 2002; Rodriguez & Kitchen, 2005) with little attention given to issues of culture and social criticism.

Social-Constructivism



- The emergent social-constructivist paradigm borrows from cognitive, constructivist, and sociocultural theories (Shepard, 2000).
 - Cognitive psychologist: Seeks to understand an individual's learning in term of internal cognitive structures and processes (Cobb, 2007).
 - Constructivist: Views the learning of mathematics as an active process of mental construction and sense making.
 - Socioculturalist perspective: Views learning as developed through socially supported interactions. From this perspective, cognition is inherently social and learning is viewed as an element of a system of cultural practices (Cobb, 2007).

Merging Teaching for Diversity with Social-Constructivism



- In the social-constructivist paradigm, classroom expectations and social norms are examined to understand how important dispositions, such as students' willingness to persist in trying to solve difficult problems are developed (Shepard, 2000).
- Teaching for diversity problematizes general references to students and considers how race, ethnicity, gender, social economic status, etc. may affect opportunities students have and how this impacts the development of student disposition.
- Teaching for diversity brings issues of cultural and linguistic diversity and equity to the forefront in all considerations having to do with classroom learning, and also with the very structures of schools and schooling.
- Overlaying teaching for diversity with social-constructivism inspires both a commitment to equitable and just educational opportunities for all learners in which each student's ways of thinking is honored.

Context for Research Study



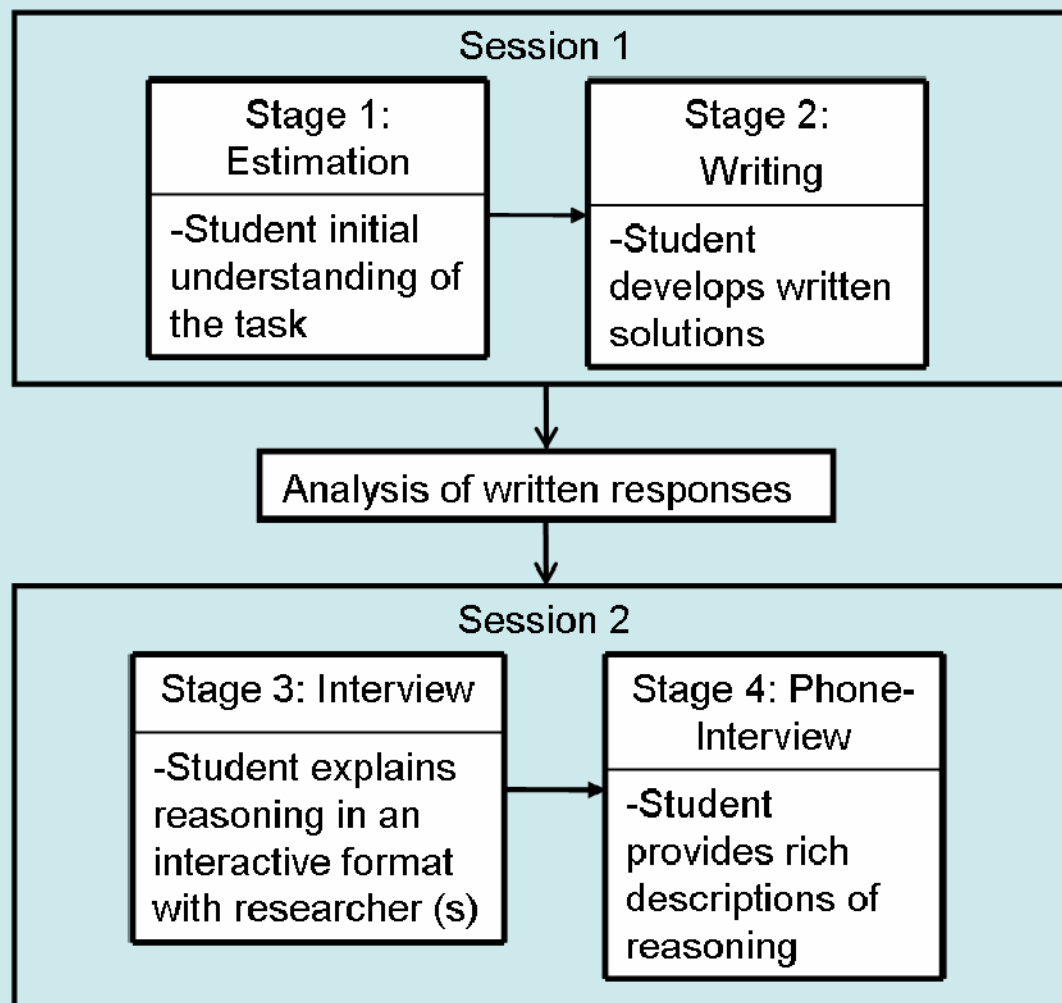
- Classroom context:
 - Connected mathematics program (CMP)
 - Rick was the teacher
 - Majority ELL students
 - School serves low-income students in Albuquerque
- The Students:
 - 4 ELL, Spanish/English students
 - Immigrants from Mexico or Mexican-born parents
 - Sixth graders

Interactive Interview Protocol



- We designed a formative assessment tool that included a series of interactive interviews.
- The protocol has four stages:
 - (1) Estimation
 - (2) Written work
 - (3) Interactive interview where students explained their work.
 - (4) Telephone-simulation interview

The Interactive Interview Protocol



Task



Ariel drove his bike $39\frac{1}{6}$ meters and Nick drove his bike $28\frac{5}{9}$ meters. How many more meters did Ariel drive than Nick?

Questions to be considered while watching the videos:

- What does the student know?
- What are the instructional implications?

Written Response



2. b Ariel drove his bike $39\frac{1}{6}$ meters and Nick drove his bike $28\frac{5}{9}$ meters. How many more meters did Ariel drive than Nick?

$$39\frac{1}{6} = \frac{235}{6} \times \frac{9}{9} = \frac{2106}{54}$$

$$\begin{array}{r} 39 \\ \times \frac{1}{6} \\ \hline 254 \end{array}$$

$$28\frac{5}{9} = \frac{252}{9} \times \frac{6}{6} = \frac{1512}{54}$$

$$\begin{array}{r} 2106 \\ - 1512 \\ \hline 594 \end{array}$$

$$\frac{594}{54} = 11$$

$$235 \times \frac{9}{9} = \frac{2115}{9}$$

$$\begin{array}{r} 39 \\ \times \frac{1}{9} \\ \hline 37 \end{array}$$

$$\begin{array}{r} 28 \\ \times \frac{5}{9} \\ \hline 1512 \end{array}$$

$$28\frac{5}{9} = \frac{257}{9} \times \frac{6}{6} = \frac{1542}{54}$$

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Looking Back



- Similar to other studies (e.g., Abedi & Lord, 2001; Lampert & Cobb, 2003; Morgan & Watson, 2002), we found that participating students' written responses gave a very limited snapshot of their mathematical reasoning and communication.
- The Interactive interview protocol:
 - Provided the means for an in-depth understanding of participating students' mathematical knowledge, reasoning and procedural ability;
 - Allowed researchers to engage in mathematical discourse with students, encourage students, provide scaffolding when students struggled to connect ideas, and to teach mathematical ideas that students could use to problem solve;
 - Provided the means for students to ask questions, to be creative, to test and revise their hypotheses, and to explore mathematical concepts deeply;
 - Positioned students as competent; and
 - Allowed for mathematical exploration without fear of reprisals when errors were made.

A Few Reflections



- It is problematic that so many high-stakes decisions such as how to place students in mathematics classes are made based upon limited assessment data (e.g., a student's result on a short-cycle assessment).
- Such decisions have a particularly adverse affect on students who speak English as a second language.
- In this study, if we had only examined participating students' written responses, we would have had a very limited snapshot of their mathematical reasoning and communication.
- By utilizing assessment formats that promote students using the bilingual resources they bring to the process, teachers can simultaneously determine what their ELL students understand while positioning students as competent and enhancing their identities as mathematical problem solvers.

Questions?



- What questions do you still have about the interactive interview protocol?
- How can the interactive interview protocol be used to improve teacher practices?

Contact Info



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