

CONSTRUCTING IDENTIFICATIONS WITH MATHEMATICS PEDAGOGIES, DIS/ABILITIES AND “OUR DOMINICAN SELVES”

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How do children develop identifications with mathematics over time, seeing themselves as agents in their math classrooms (or not)? This ethnographic and interview study followed nine Latino/a children with and without learning dis/abilities through two years of mathematics in a high-poverty urban school. The children participated in two distinct mathematical pedagogies (discussion-based and procedural-based) that differently constructed ability and dis/ability in mathematics. Individual children constructed unique and dynamic self-understandings as math learners over time, using the cultural resources of the multiple contexts in which they participated, including positioning through language use, ethnicity, gender, and dis/ability. Children made connections between equity and discussion-based mathematics, and between procedural mathematics and fixed conceptions of mathematical ability.

Keywords: Equity and Diversity, Curriculum, Affect, Emotion, Beliefs, and Attitudes, Gender

Purpose of the Study

As a classroom teacher and a teacher educator, I have met many children and adults who readily identify themselves as particular kinds of math learners, such as “I’m just bad at math” or “I’m not a math person.” My work asks how such self-understandings around mathematics develop. How do they change? How do these self-understandings matter for learning over time? I am particularly concerned about these questions for children who have historically had less access to high level mathematics: Black and Latino children, children from low-income families, girls, and those with disabilities. This study is situated within a high-poverty urban school with Latino/a children in order to better understand the ways in which social positioning intersect with mathematics, understanding that Latino/as continue to be overrepresented in special education particularly in the categories of learning disabilities and behavioral disorders (Losen & Orfield, 2002; Artiles et al., 2010).

Theoretical Frameworks

This study assumes that self-understandings are created through participation in social worlds. Within “figured worlds” (Holland et al., 1998), participants create and recreate particular cultural practices and discourses (Nasir & Hand, 2006), with particular habits of making sense both of others and oneself. A single mathematics classroom has multiple figured worlds intersecting within it (Esmonde & Langer-Osuna, 2011), providing multiple sets of resources for understanding oneself as a math learner. This study focuses on processes of identification, providing analysis of the process through which children appropriated various discourses and practices around mathematics (Holland et al., 1998; Bakhtin, 1981).

All figured worlds position participants, particularly in terms of gender, race, class, ethnicity and dis/ability. While all of the children in this study were officially listed as Hispanic, they described themselves in terms that moved beyond limited categories: “I speak Spanish but also English” (Ana, Second Interview) and “I am from the Dominican Republic but I was born here”

(Ruby, Second Interview). Following feminist scholars such as Gloria Anzaldúa (1987), the purpose of my work is to understand people as complex and dynamic rather than static. I also approach disability with the same attention to complexity rather than categorization. Disability studies in education (DSE) recognizes that although individuals may have natural biological variation in how they learn (*neurodiversity*), it is the social effects of difference that disable (Gabel, 2002; Reid & Valle, 2004). Disabilities depend on context for their form and meaning: an individual may be seen as learning-disabled in one mathematics classroom and not in others (McDermott et al., 2006).

Methodology and Data

As a white, non-disabled, middle class woman researching the experience of Latino/a children from low-income homes, I understand social positioning as not only a theoretical, but also a methodological issue. In order to understand the multiple figured worlds interacting in the classroom as an outsider, I needed a methodology that was sensitive to the complexity of experience. I also knew that I needed multiple interviews with children in order to understand processes of identification with mathematics over time.

Research Questions

1. In one middle school mathematics classroom, how do cultural practices construct and display particular kinds of mathematical ability and disability?
2. How do children, both labeled as learning disabled and not, construct and enact understandings of themselves as math learners?

Participants

Located in a large city, Central Academy Middle School predominantly enrolled Latinos (92%) with a poverty rate of 85%. Although this was a two-year study, this paper will focus on the seventh grade mathematics class. This inclusion class included 24 total students, 12 of which had an Individual Education Plan for learning disabilities. Students with IEPs in special education were placed into a single classroom at each grade level with two teachers, in this case a math and a special educator. Ms. Marquez, the math teacher, was Latina. She had nine years of experience teaching math at the secondary level. Ms. Alton, the special educator who joined the class halfway through, was African American. She was in her first year of teaching. Out of nine focus children, six were girls and three were boys. Six out of nine had IEPs while three did not. Two children with IEPs were also classified as English language learners. All of the children were identified as Latino/a.

Data Collection and Analysis

I made twenty-six visits to the ninety-minute seventh grade mathematics class. For each visit I wrote field notes and twelve classes were also video-recorded and transcribed. Using grounded theory (Glaser, Strauss & Strutzel, 1968), I developed claims about the cultural practices and positioning of the math classroom, and then tested those claims concurrently. To understand the mathematical practices, I separated the ninety-minute class periods into different activities, coding each segment for type of mathematical pedagogy. I carefully tracked children's learning of integers over time, using data from participant observation, analysis of video recordings, student work and a final assessment of computation.

I interviewed the nine focus children twice in their seventh grade year. The first interview was semi-structured, in pairs to increase discussion. The final interview was individual. I analyzed these interviews through narrative analysis (Riessman, 2007).

Results

Ms. Marquez's classroom followed a fairly consistent schedule. Children came in, sat in assigned seats, and quietly began to solve a Warm Up math problem. Ms. Marquez would then lead a discussion based on the problem. Ms. Marquez would then split the children into three groups. On most days in the fall, children rotated between these groups, sometimes working independently and at other times with a teacher.

Early in the fall, Ms. Marquez asked me if I had noticed the "two different sides" of her math class, what she called "critical-thinkingish" and "state-examish" (field notes, 9/28/10). I had noticed that most of the ninety-minute classes began with 30-45 minutes of "critical thinkingish" math, or discussion-based math, before shifting to "state examish" or procedural math. Each way of doing mathematics had its own set of discourses, practices and positioning. I understood each as a separate figured world.

The figured world of discussion-based mathematics emphasized the practices of problem-solving and discussion, particularly sharing multiple strategies and asking questions. During discussion of Warm Up problems in the fall, Ms. Marquez typically asked for multiple strategies, listening to the children's answers and representing their thinking. When children disagreed, she facilitated discussion, using strategies such as revoicing (O'Connor & Michaels, 1996). In the fall, children also occasionally worked in groups on open-ended problem solving which also emphasized multiple strategies. Ms. Marquez spoke with a questioning voice during these activities, placing accountability in the hands of the students (Engle & Conant, 2002).

The work in the second half of the class tended to be procedural mathematics. Children were given packets of work sheets in order to practice a new procedure or review an old one. In the figured world of procedural mathematics, valued practices were being able to solve a range of computational problems independently and quickly, ideally using only memory. The discourses of procedural mathematics were concerned with efficiency and speed. During procedural mathematics, Ms. Marquez emphasized following already determined procedures, placing accountability in the teacher.

Ms. Marquez always began a mathematical topic using discussion-based practices and gradually transitioned to procedural work. Work on integers began with extended discussion of multiple strategies to solve integer addition and subtraction problems, often modeled on the number line. One week later, these discussions were replaced with memorization of set rules for addition and subtraction of integers. Once the rule was established, children tended to use the rule because it had the most status. By the middle of the year, children told me the number line was a "crutch" and "for beginners" (Federico, First Interview).

Some children used the figured world of discussion-based mathematics to understand themselves as math learners. One boy, Luis, explained the difference between discussion-based math and procedural math: "problems that give you problems" versus "worksheets which are nothing" (Luis, First Interview). Luis preferred discussion-based math, enjoying this kind of work so much that he would sometimes hide open-ended problems under his worksheets, working on them secretly. His narratives about mathematics emphasized his persistence in problem solving and his creative solutions. More commonly, children used the figured world of procedural mathematics to understand themselves as math learners. A girl named Ana told me in an interview that she was the kind of learner who had to "practice and practice" until she "got it" (Ana, First Interview). Many children emphasized two kinds of math learners, those who "get it right quick" and those who "struggle" (Arturo, First Interview).

In the fall, children engaged in both kinds of mathematical practices. Out of thirty-four different class activities documented in the fall, twenty were procedural and fourteen were

discussion-based. In the second half of the year, the balance shifted. From January until May, Ms. Marquez eliminated almost all discussion-based math, focusing instead on preparing for the test. Out of thirty coded activities from January to June, twenty-eight were procedural and two were discussion-based.

This shift in pedagogies caused some children to appear more disabled, and others less so. In the fall, Ms. Marquez saw Luis as an innovative problem-solver, while she questioned Ana's ability to understand conceptual work. Luis became a concern for Ms. Marquez in the spring because he was not able to memorize rules. Ana, who identified with procedural mathematics, had the opposite trajectory in the class. In the spring, Ana was on the honor roll, no longer a concern as she was able to memorize procedures called for on the state exam. During discussion-based activity, Luis was deeply engaged. When activity was procedural, Luis was frequently disengaged. During the spring, as the class was focused on preparing for the state exam, Luis's special education teacher, Ms. Alton, repeatedly referred to Luis as "a behavior" (field note, 3/23/11), alluding to a special education designation that Luis did not have. Both Luis and Ana had a label of learning disability. Their differences as learners remind us that there is no one mathematical profile of a child with a learning disability. Almost all the children had some kind of shift in status as the math pedagogy changed, except for a small set of children who seemed able to do both kinds of mathematics.

These two figured worlds of mathematics, that of discussion-based and procedural mathematics, were not the only figured worlds circulating in the classroom. There was also the figured world of schooling, comprised of practices such as lining up, sitting still, and talking in particular ways in the classroom. There was also the figured world of friendships, which was characterized by practices of care work, such as working together with a friend on a math problem. A girl named Esa told me about three kinds of kids in the classroom: "*chistosos*, serious people, and outsiders" (Esa, First Interview). *Chistosos* made jokes in the class, but also tended to engage enthusiastically in procedural mathematics. Serious people were those in the class who took both the practices of schooling and the practices of friendship seriously. Outsiders were those who placed less importance on social relationships. Like the groupings of the high school students that Paul Willis (1977) found in his study of working class youth in English high school, these groups were engaged not only in participating in the practices of the school, but in creatively reworking those practices. The *chistosos*, for example, used hip-hop to express their quickness at procedural mathematics, remixing the figured worlds of the classroom.

Outside of the creative remixing of the *chistosos*, mathematics was separated from language, culture and children's experiences. Luis incorporated issues of social identities into his mathematical understandings, telling me for example that he imagined zero on a number line as the border between Mexico and the United States when he was adding and subtracting integers. In interviews, children repeatedly discussed being taught mathematics at home and in the Dominican Republic in the summers. Such experiences were not part of their experience in math class. Although most children and Ms. Marquez were bilingual, math was discussed only in English. Children told me that they felt this separation. When I asked a girl named Desi if she ever spoke Spanish in mathematics class, she told me no, that Spanish was for when they were "our Dominican selves" and not for "being serious in some subject" (Desi, Second Interview). The figured world of friendship was the only one in the classroom that was bilingual.

The final figured world I found in this classroom was that of dis/ability. Throughout the fall, grouping within this class was heterogeneous. In January, I noticed a new adult in the class, a soft-spoken teacher named Ms. Alton. After class Ms. Marquez told me that the new groups were

tracked, designed to keep all the children with IEPs together so that they could receive services from Ms. Alton (field notes, 1/4/11). One group was all children with IEPs, another group included no children with IEPs, and another group was a combination. The teachers never explained to the class the reasons behind these groupings. Some children took up the discourses of schooling to explain the grouping, telling me that the highest group was “independent” because they are “most trusted” by Ms. Marquez (Clementine, First Interview). Other children took up discourses of disability that I also heard from Ms. Alton; some children “learn differently” and “need different methods”(Federico, Second Interview; Ms. Alton, Teacher Interview).

Most of the focus children took up the discourses of ability and disability in procedural mathematics to understand how the groups were formed. A boy named Arturo told me about two types of learners: those who “get it right quick” and those who “struggle”(First Interview). If you did not know immediately how to solve a problem, you struggled. If you struggle, you “barely understand”(Albert, First Interview). As procedural math dominated, children increasingly used this binary of *get it fast* versus *struggle slow* to understand themselves and others. Comparing the first set of interviews with the second set of interviews, these binaries were increasingly used to explain both oneself as a learner, and to classify, organize and sort others.

Not all the children constructed their understanding of themselves as math learners from the figured world of procedural math. Two of my focus children consistently used the discourses and practices of discussion-based math to understand themselves as math learners. In his first interview Luis did not believe that there was a difference between different learners in his math class, even though “if I am thinking about it in one way, and another person thinking about it in another way, he might be smarter than me at that, but no body is better than nobody else” (Luis, First Interview). Luis kept a similar narrative across the year, insisting on equity in the math classroom. Competence is open for each new problem, a very different conception of competence than the increasingly fixed ideas of most of the children. Luis’s words are an example of a script I heard from multiple kids: “many ways, none is better”(Carmen, Second Interview). This quote comes from a girl named Carmen, describing to me how gender operated in the classroom. Carmen understood herself using the figured world of procedural mathematics, telling me one day she was “smart” at math (5/25/10) and the next “I hate math because I suck at it”(field notes, 10/12/10), each time because of how comfortable she felt with the procedures being used. But Carmen moves out of this binary when she discusses gender and ability and mathematics, using the discourses of discussion-based mathematics. While most children used the binaries of get it fast or struggle slow to understand themselves and others as math learners, when they reflected on situations involved gender or racial equity, they used a different discourse about mathematical competence.

I looked not only at the way in which children constructed self-understandings, but how those self-understandings evolved over time. Over the course of the year, I saw that some children were identifying more with mathematics, while others were distancing themselves. For those who continued to predominately author themselves as agents in mathematics, some used discourses from the figured world of procedural math. Federico used discourses of disability to author himself as simultaneously fast and slow. Others also authored themselves as agents in mathematics using discourses from discussion-based math. Luis, for example, even though he was positioned as unsuccessful in the spring, still authored himself as an agent in math, citing his own persistence and creativity.

About half the focus kids did not author themselves as agents in mathematics. Two of the girls, Rita and Ana, told narratives of de-identification with mathematics, telling me repeatedly and in multiple ways—I used to like math, now I don't. Both of these girls were on the honor roll in the spring, but rejected what they described as the stressful process of memorizing rules. A final trajectory was not of de-identification, but of never identifying with mathematics. These children, also both girls, told stories of perpetual struggle and resistance around mathematics, particularly focused on troubling relationships with teachers and family members around mathematics. My focus children were fairly evenly distributed between these four trajectories. While these patterns emerged, all the children constructed unique and dynamic mathematical selves, built from materials of multiple figured worlds.

Discussion

Several strands of educational research have recently focused on the ways in which children conceptualize their own ability in school subjects. Complex Instruction, developed by Elizabeth Cohen (1999) explicitly addresses these self-understandings, asking teachers to stress multiple abilities. The work of Carol Dweck (2000; 2007) on mindsets focuses on the critical importance of these self-understandings, affecting achievement. Developing flexible understandings of one's ability that hinge on effort rather than innate ability is a critical goal of educators.

First, my work shows that pedagogy mattered for these kinds of self-understandings. Second, the connection between equity and competence demonstrated that the children had narratives of equity that they brought into their narratives when gender or race was in play. They also brought forward powerful narratives from disability studies in education about being "labeled" (Desi, Second Interview) by the way teachers perceive their disabilities. Yet that same child, Desi, would shift back into static conceptions of ability and disability when discussing mathematics. I heard narratives of equity from Desi in all areas of her educational life except for in mathematics, suggesting both that mathematics has a particularly long road ahead of us in order to change the way children think of themselves as math learners, but also that we can build on powerful narratives of equity outside of mathematics.

Finally, and perhaps most important I worked on describing the process through which self-understandings develop. The kinds of self-understandings that I saw as fixed when I began this study, such as "a math person," were certainly not fixed. Attending closely to self-understandings over time, I saw kids define themselves in different ways at different times, based on the complex context of the classroom and their lives. I learned that children engage in multiple practices in math class, are positioned within these practices, and position themselves. Through their engagement in intersecting figured worlds: procedural and discussion-based mathematics, friendship, schooling and disability, the children worked and reworked their relationships, identities and positioning. The authoring of mathematical selves was always in process, making sense of these multiplicities. But possibilities were narrowed when the curriculum narrowed, when more children used the binary of get it fast or struggle slow to understand themselves.

I found that these self-understandings mattered both in their engagement, and in the choices they make about their mathematics education. Children used self-understandings to orient themselves towards mathematics work every day. There was a dynamic, dialectical relationship between self-understandings and mathematical activity for all the children.

Mathematical ability and disability were differently defined within different pedagogies in these classrooms, causing young people with disabilities to be seen as more or less disabled as

teaching practices changed. The cultural practices of schooling and sorting children, here the intersection of high-stakes testing, special education and tracking, not only reflected, but constructed certain ideas of ability and disability. When I began this study, I expected to see ability and disability change based on pedagogies, but I thought it might be a subtle difference, not the pronounced pedagogical shift that I found. This shift, coming as it does from the conflict between mathematical reform pedagogies and current high stakes testing reforms, is not limited in scope to this classroom, but widespread. Neoliberal policies which value multiple-choice test scores above all else will continue to create classrooms in which children that cannot memorize procedures and facts are disabled.

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