AUTHORING MATHEMATICAL SELVES

by

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Abstract

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How do middle school kids develop identifications with mathematics over time, seeing themselves as agents in the figured worlds of their math classrooms (or not)? This ethnographic and interview study followed nine focus Latino/a kids though their sixth and seven grade inclusive mathematics classrooms in a high-poverty urban school. The kids participated in two kinds of mathematical pedagogy that differently constructed ability and disability in mathematics. Individual kids constructed unique self-understandings as math learners over time, using the cultural resources of multiple figured worlds (mathematical, social, special education, friendship). Most of the focus kids used conceptions of competence forged in memorization to understand themselves as learners who either *get it fast* or *struggle slow*. Other kids used alternative conceptions of competence such as persistence and creativity in mathematics. Kids narrated the critical importance of relationships and emotions in their experiences in mathematics classes.

Acknowledgments

This dissertation, first, relies on the thoughts, opinions and experiences of the people I met at Central Academy. I thank them for allowing me into their thinking.

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And, of course, my two boys and my husband. They bring me joy.

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Chapter One:

Contexts and Questions

Central Academy is a long, long subway ride from where I live. I emerge over ninety minutes after I enter the subway, always struck by the pretty park next to the school. The building itself is large, four sprawling floors. There are two discernible names outside the school, one plaque calling it a Children's Aid Society School, the other, in mosaic, the name of a Dominican poet. The Children's Aid Society was one of the first charity organizations to provide free public schooling in New York City in the nineteenth century. The use of the Dominican poet as a school name is indicative of shifts in culture and institutions after the Civil Rights Movement of the 1960s. The multiple names are not only historical, but refer to the multiple smaller schools housed in this building.

I walk through the doors and immediately speak to the security guard, giving my ID card and telling him where I am going. I walk to the elevators, noticing as I do that there is a hand written sign restricting students from using the elevator "FOR ANY PURPOSE!" When I emerge on the floor for Central Academy, I am momentarily confused by the chaos. Many teen-age kids, bodies all in motion. One boy flips upside down and lands to scattered applause. I have to smile when I realize that it is a capoiera class, using the large sunny rotunda as space. As I walk carefully through the kids, I remember feelings of embarrassment in gym class in high school, and I wonder if any of these kids dislikes how people, like me, a white woman in her late thirties, walk through their class.

I am now outside the sixth grade math class that I plan to observe for my pilot fieldwork. As I open the door, I see that the large sunny classroom is filled to overflowing with individual desks. Kids here are in motion as well, moving around the desks to sit a little closer to that one, a little farther away from there. Some kids are still rifling through their backpacks to find something. There do not appear to be any assigned seats.

The kids remind me of many sixth grade classes I have known as a classroom teacher. Kids are of very different sizes, some beginning puberty, others seem years away. All of the kids, like most humans, are various shades of brown, most falling in the medium range. I know from past experience in the school and neighborhood that the kids are almost all Dominican American. The kids are wearing the school uniform, white polo shirt, and navy or khaki pants. Colorful backpacks, bracelets and sneakers peek out everywhere. The class is about three-quarters girls and one-quarter boys.

The teachers are not wearing uniforms. Mr. Pierce, the mathematics teacher for the sixth grade, is a white man, disheveled in a halfway tucked in oxford shirt. Ms. Emerson, the special education teacher, is white, with brown hair pulled up into a ponytail and a long, colorful skirt.

As I find my way to a seat, I can feel a momentary silence around me as the students size me up. "Rude," I hear to my right, but I am not sure if this refers to me, or someone else. I squeeze into a desk as Ms. Emerson finishes copying a ratio table problem on the board.

1	*10*
2/3	

Almost simultaneously as I pull out my notebook, Ms. Emerson gives the class a direction: solve 10 x 1 2/3 individually, then, "of course, when you have tried it by yourself, talk to a neighbor." The class is a low hum of activity as the kids bend over their desks, arranged in various configurations. Ms. Emerson and Mr. Pierce walk through the disheveled rows of seats, bending here or there to talk to a student alone.

After about five minutes, Ms. Emerson directs the kids to talk about their work with a neighbor. Kids around me begin talking, but not about the problem. One kid, Ruby, begins talking loudly about, "What I got for the problem was blah blah blah." She has medium brown skin, a bright smile, long hair pulled back into an easy ponytail. After a few minutes of chatter, the two kids closest to me begin talking about their solutions to the problem. The noise gets louder and louder, and soon Ms. Emerson asks the kids to share their solutions. The kids quiet down quickly and attend to the board.

Ms. Emerson calls on the boy closest to me, Luis, to explain what he did. Luis is a lanky, light skinned boy. He begins to explain with a smile, but as he talks, his smile changes to a look of puzzlement. Ms. Emerson writes on the board to represent his thinking. His strategy is complex—he has multiplied 1 2/3 by 10, by splitting up 1 and 2/3, and multiplying each part by 10. To find 10 X 2/3rds, he wrote out 2/3rds ten times and then tried to add them together. Ms. Emerson writes 2/3 out 10 times on the board, like this:

$$\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}$$

Luis explains what he did next: "I took the 2 from there and made the first 2 a 3 and I had 1 left over." Ms. Emerson represents his thinking.

$$\frac{2}{3}+\frac{2}{3}=\frac{3}{3}+\frac{1}{3}$$

He continues down the line of 2/3rds, moving "1"s and "2" s (which are really 1/3rds and 2/3rds), making 3/3rds, so that he has "wholes." As Ms. Emerson is representing his strategy, she asks Luis questions, and restates what he says. She rewrites 2/3, splitting it into 1/3 and 1/3. Luis says that was not how he did it. Ms. Emerson stands at the board, looks out at the kids, who are now starting to whisper, and remarks on how "interesting" the strategy is. At this point even Luis is joking with a neighbor.

Ms. Emerson then calls on Ruby, the student who had made the "blah blah blah" joke earlier. Ruby's strategy was to add up all the numerators (20), and then divide that number by 3. Ms. Emerson, with students calling out the steps in the procedure, uses the long division algorithm to divide 20 by 3. She asks Luis if he got the same answer (6 2/3). He says the answer is 18. The student next to him (Arturo) whispers that he is "retarded" and laughs at his friend. Luis looks confused, and he retorts, "If she had let me do the whole thing out, I could show you."

At this point, Mr. Pierce asks Ms. Emerson if she wants to continue with this problem, or move on. Ms. Emerson, looking relieved, says yes. They move on. Mr. Pierce begins to "go over the homework," which he does by presenting one problem at a time, asking who has the answer, and then writing the answer on the board. The whole left side of the classroom, almost entirely girls, is seriously engaged in this activity. The right side of the classroom, *which is about half girls and half boys, is engaged in private conversations. (Field notes, 3/1/2010)*

This dissertation is concerned with Luis and Ruby as they participate in mathematics classrooms. Over time, how will these kids construct understandings of themselves as math learners? I use the term "kid" to refer to my twelve and thirteen-year-old participants because first, it is how they referred to themselves. Second, "student," the most frequently used general term for kids in educational research, limits them to their school selves. Is Luis a "student" at home? In this moment in his sixth grade math class, Luis was named both as someone who has "interesting" strategies and as "retarded." How did this classroom position him as abled or disabled in mathematics? How did those understandings change over time?

This field note was my first day of research. I followed Luis and other focal students through the spring in their sixth grade classroom with Ms. Emerson and Mr. Pierce, and for a full academic year in their seventh grade classroom with Ms. Marquez, a math teacher who was Dominican and Ecuadorian, and Ms. Alton, a black special education teacher. Documenting both the multiple cultural worlds in these classrooms through ethnography, as well as individual sense making through multiple interviews, I will describe the processes of identification with mathematics for these kids. I understand identification as the process through which individuals come to see themselves as agents (or not) in the world of mathematics.

Luis was only one of the nine focus kids that I followed closely, along with Ruby. Both of these kids were known for their humor. We will also meet Desi, a serious and perceptive girl with medium brown eyes, skin and hair. Luis and Desi were best friends, according to Desi, when I first come into this class. They were also friends with Carmen, a tall spirited lighter-skinned girl with straight-cut bangs and flashing dark eyes, who often worked with Rita, a quiet medium-brown skinned girl with stylish black eye glasses. Ana was a close friend as well, a graceful, poised girl with medium brown skin and dark brown hair and eyes. Federico had light skin, dark curly hair, and a serious expression during math class. Two more focal students were not in this class, but joined these kids in their seventh grade class. Clementine was enthusiastic in class, with dark skin and her hair often in a bun. Bobby, with a buzz cut and dark skin, carried around his dictionary to make sure he defined math terms correctly. To help the reader keep track, I have included a brief description of each kid in Appendix G.

All of these kids were different. While every kid had some part of their family originally from the Dominican Republic, some also had family members who were African-American[1], Ecuadorian, Portuguese and Spanish. A different family had raised each kid. Some of the kids, like Rita, spoke only Spanish at home. Others, like Luis, spoke only English. Most spoke both. Some of these kids told me about the traditional math classrooms of their elementary schools, whether local public schools or the Catholic school that Clementine attended. Luis and Rita attended a progressive public school where math class centered on problem solving. Except for Clementine, Ruby and Bobby, all of these kids had a special education label: learning disability. Because of these labels, they were in class together year after year. In this school, kids with Individual Education Plans for learning disabilities were put into a single classroom with two teachers, here Mr. Pierce and (mathematics teacher) and Ms. Emerson (special education teacher). These classrooms were called Collaborative Team Teaching classes (CTT).

As a classroom teacher in urban settings myself, I noticed that the kids who walked into my mathematics classroom seemed to have set, fixed ways of understanding themselves as math learners. I remember one kid telling me he hated math, but I also remember how much he came to love complex problem solving. I recall a girl who insisted throughout the year that she would

[1] I use the term African-American rather than black to make it clear that this particular family were long time black Americans. Elsewhere, I use the term black which is what the participants used instead of African-American.

never be good at math, no matter what. I tried in so many ways to shift her understanding, but I don't think I succeeded. Mathematics was my favorite subject to teach because I loved how powerful it made kids feel. Some kids, however, never seemed to take up that power.

This study is focused on individual kids, understood as codeveloping with the cultural worlds that immerse them. Not individual kids frozen in time, but over time. In this same sixth grade classroom, a girl named Shaundra told me that she was "not a math person." I am interested in *how* Shaundra came to this self-understanding. I designed this study to offer insight into the processes through which kids come to identify with mathematics, or not. I work with processes of identification because I interested in what makes some of these notions seem to fix, while others change. I know that these kids are immersed in cultural worlds at multiple levels, and I wonder how these social worlds influence them. I am particularly interested in how many of these kids are positioned as learning disabled, as Latino/as, as girls and boys.

Research Questions

1. Over two years, in one middle school mathematics classroom, how do cultural practices construct and display particular kinds of mathematical ability and disability?

2. Over two years, how do students, both labeled as learning disabled and not, construct and enact understandings of themselves as math learners?

3. What changes? Why? What fossilizes? Why?

These self-understandings matter for individual kids. Success in mathematics acts as a filter;

> More than any other subject, mathematics filters students out of programs leading to scientific and professional careers. From high school through graduate school, the half-life of students in the mathematics pipeline is about one year; on average, we lose half the students from mathematics each year, although various requirements hold some students in class temporarily for an extra term or a year. Mathematics is the worst curricular villain in driving students to failure in school. When mathematics acts as a filter, it not only filters students out of careers, but frequently out of school itself (National Research Council, 1989, p. 7).

Some of this filtering is done through test scores, some through choices that kids make. Our self-understandings factor into the choices that we make about how we engage in mathematics every day, from whether we enroll in a challenging math class, to whether we are willing to calculate a complicated check at a restaurant, to whether or not we will ask a question when we don't understand a concept in class. These kids, attending a school in which over 85% are defined as living in poverty, did not have the same chances of attending and graduating from a four-year college as more privileged kids (e.g. Orfield & Lee, 2005). Ruby and Luis need math to make it through the maze of schooling that leads to opportunity (Moses & Cobb, 2001).

A scholar of mathematics equity, Rochelle Gutiérrez (2002), wrote that people may need math, but math needs people as well. Mathematics is a human invention, a complex field with both abstract problems waiting to be solved and practical applications waiting to be developed. Without new minds passionate about these problems, they remain unsolved. Conscious of the overrepresentation of white male and Asian male mathematicians, Gutiérrez argued that fresh minds—female, Latino/a, black—might have fresh ways to approach these problems. Not only do these kids need math to get where they want to go in life, math needs them. Not only should Ruby and Luis be full participants in the world of mathematics, I think that both kids could contribute to that world, and in so doing transform mathematics.

Contexts as processes

Processes of identification are situated in multiple contexts. These kids were in a particular class, in a particular school, in a particular neighborhood, in a particular time/space for educational reform. These contexts are not static, unchanging entities. They are slowly moving processes in themselves, conceptualized as timescales (Lemke, 2000). Even the building that houses their school was in process, slowly crumbling. The kids lived in a neighborhood that is in process, attended a school that is changing, and were positioned through cultural institutions like special education, which are historical and also continually in process.

The context of the neighborhood. This school is set in a neighborhood in which over half of the population describes themselves as Dominican (Latino Data Project, 2008). This neighborhood, which I will call Midwood, was settled by a Cuban emigration in the 1960s, and since then, has seen steady immigration of Dominicans (Bartlett & García, 2011). Dominicans are the second largest group of Latino/as in New York City, second only to Puerto Ricans (US Census 2010). Dominicans began to immigrate into the United States after Joaquín Balaguer gained power in 1966 in the Dominican Republic, backed by the United States (Linares, 1989; Itzigshohn and Dore-Cabral, 2000). His repressive policies, along with rampant social inequality, led to consistent immigration of Dominicans to the United States. While a mix of more and less educated people have immigrated, once they entered the US most immigrants have worked in light manufacturing and service jobs (Smith, 2007). There have been significant economic challenges for Dominicans settling in Midwood. 31% of residents of Midwood live in poverty, compared to 21% in New York City as a whole (US Census 2000), although income per household in Midwood has been rising, including for Latino/a households (Latino Data Project Report, 2008).

Dominicans in New York City schools have been more segregated in schools than any other ethnic group (Ellen, O'Regan, Schwartz, Stiefel, Neal & Nechyba, 2002). Male Dominicans are more likely than any others to repeat grades (Ellen et al., 2002). Yet according to Hernández and Rivera-Batiz (2003), there has been marked improvement of the educational attainment of US born Dominicans: in 2000 almost 60% of US born Dominicans 25 years old or older had attended some college, and over 20% had completed college. This is a far higher percentage than for US born Puerto Rican or US born Mexicans.

Dominicans are a particularly transnational group of immigrants, maintaining close ties to their home country (Duany, 2011). Dominicans in the US sent $2.9 billion back to the country in 2009 (IADB, 2009). Neighborhoods like Midwood with a high concentration of Dominicans allow people to maintain connections to the Dominican Republic while living in the US (Duany, 2011). In addition, Dominican Americans frequently visit their home country (IADB, 2009). Two kids in this study told stories of spending summers in the "DR," which is how kids and adults referred to the Dominican Republic. Another kid missed two weeks of school because of a trip to the DR

Midwood is a bilingual community. I visited restaurants with menus written only in Spanish, others in English only. Bus advertisements were written in both Spanish and English. Only one kid in the class moved to the US during elementary school; all others entered kindergarten in the US.[2] Some kids lived with grandparents or parents who had immigrated from the DR. According to Bartlett and García (2011), immigration patterns are layered for this group of immigrants, meaning that new immigrants join households that have been in the US for a long period. There were varying degrees of bilingualism amongst the members of a family. Even newcomers to the country often had some familiarity with English, from classes in their home country, to watching American television shows and listening to American music (Bartlett & García, 2011). The kids in this sixth and seventh grade classes, during social moments, spoke mostly in English, moving into Spanish to sing songs, gossip, and make jokes. The kids were at

[2] I never asked kids or teachers about immigration status.

different places in their bilingualism. Some kids moved effortlessly between Spanish and English, while other kids told me that "I am not good at Spanish"(Rita, First Interview).

In an interview at the end of their seventh grade year, I asked the kids how I should describe them in terms of race and ethnicity. Their answers varied: they told me they were "from the Dominican Republic," "Hispanic," "Hispanic American," "Latino," "Latin," "Spanish people," "Hispanic and black," "somehow a little Portuguese." There was no single, accepted way to name oneself in this particular situation (the situation as being asked about ethnicity and race by a white woman researcher in a formal, taped interview). Some kids chose to answer using a distinction: "I speak Spanish but also English"(Ana, Second Interview) and "I come from the Dominican Republic, but I was born here"(Ruby, Second Interview). These ways of naming themselves preserved their multiplicity, in the face of a question that seems to imply that they can only be one thing (Sandoval, 1991). In this moment, I acted as the normalizing, essentializing voice of white power, asking these girls to see themselves as one thing. I acted as a proxy for educational research, which so often asks researchers to categorize people in ways they may not agree with.

All of the terms above contain within them a multitude of social distinctions. "Latino" encompasses a wide variety of cultures, countries and continents. I describe the range of skin and hair tones of the people in this study to give the reader a picture of the diversity of the kids. I also use them because the kids use these categories: light skinned, dark skinned, light haired, dark haired, sometimes in Spanish, sometimes in English. Different home countries have different ways of understanding the interrelations of race, languages and cultures. The Dominican Republic has a diverse population, made up of the descendants of indigenous peoples, European colonists, and blacks, some of whom were slaves (Simmons, 2008). There has been a history of discrimination in the Dominican Republic towards those who descended from African slaves (Smith, 2007). In the United States, the concept of race has been historically constructed on a black/white binary, fundamentally ignoring Latinos (Bonilla-Silva & Glover, 2004). There is inherent conflict between the racialized lens through which others understand Latino students in the US, and how they understand themselves (Fergus, Noguera, & Martin, 2010). In his second interview, which I will discuss in detail in Chapter Three, Bobby understands himself as Hispanic first and black second (Bobby, Second Interview), yet because of his dark skin and unaccented English, he may be read as African-American. I will return to race, ethnicity and conceptions of culture at the end of this chapter. For now, I stress the multiplicity within categories of race and language use.

The context of the school. Central Academy was housed on the third floor of a large urban public school building in Midwood. Although it served only kids from the neighborhood (grades six through eight), kids were admitted to the school through a lottery, not by residence. Families had to apply directly to this school in order to enroll in the lottery. As of the 2009-2010 school year, 85% of the school qualified as living in poverty. The demographics of the school were as follows: 91% of the school was Hispanic, with 6% black or African American, and the remaining 3% white and Asian students. Nine percent of the kids were classified as English Language Learners. Fifteen percent of the school qualified for Special Education, all in CTT classrooms. There were no self-contained, separate classrooms for kids with disabilities. Central Academy had a history of high scores on state exams. In 2009, 86.5% of kids in the seventh grade scored a passing (3) or high grade (4) on the state exam in mathematics, placing the school in the top 25% of schools city-wide in mathematics.

Despite success on such measures, the school was under intense pressure to maintain these scores. Teachers and kids both felt this pressure. Ms. Marquez, the seventh grade math teacher, told me "I am judged" by the test scores (field notes, 9/28/10). Their school was part of a pilot program that paid teachers bonuses based on test scores. Every teacher in the school, no matter what subject they taught, would receive $3000 at the end of the academic year if math and literacy scores were strong. Ms. Marquez spoke negatively about "teaching to the test," a practice that she saw dominating the mathematics instruction of the school (field notes, 9/28/10).

Despite this pressure, the tone in the school each time I visited was lively and happy. Almost every time I walked out of the elevator, I was greeted by activity. Kids moved freely through the corridors, not quietly or in lines. I saw mostly happy expressions on the faces of students and teachers in the hallways, with only a few moments of frustration.

This school had other challenges, particularly space, as it was sharing space with two other schools. It was difficult, some days impossible, to find space for interviewing. Teachers shared classrooms. When I visited a year after my fieldwork ended, the principal, vice principal and all the teachers shared a single office.

The context of special education. Test scores and merit pay were one way in which policy decisions influenced the life of the school. Many other policies impacted the structures and processes of Central Academy. Even though many kids were bilingual, school was conducted only in English. In the current US policy context, bilingual education has been devalued despite a significant research base supporting it (Bartlett & García, 2011). Kids who could not pass a test of English competency were labeled English Language Learners (9% of the kids at the school).

A higher percentage of kids (15% of students) were part of another policy arena: special education. Each of these kids had an Individual Education Plan (IEP), a personalized document with goals specific to their individual progress. Not all disabilities were included at Central Academy. Despite twenty years of inclusion reforms, demanding that kids with disabilities be educated alongside their peers, kids with disabilities that occur less frequently (low-incidence) are generally placed into separate classes in New York City. The school did not have separate classes for students with low-incidence disabilities such as Down's Syndrome or cerebral palsy. I did not see a kid in a wheelchair during my time there, or with any visible physical disabilities.

The disabilities that were included in Central Academy are currently termed mild or moderate disabilities, or high incidence disabilities. As the terms suggest, these disabilities are more common. Invisible in many contexts, LD is most visible within the context of schooling (McDermott, Goldman & Varenne, 2006). All of the kids with disabilities in this classroom were labeled as learning disabled, currently the largest category of special education services in the U.S (US Department of Education, 2012). Learning disabilities were formalized as a category of special education in 1977. The category was built on medical descriptions of dyslexia, a term that had existed since the 1930s to describe individuals who had significant difficulty learning to read, as well as minimal brain injury, a medical term for brain injuries of unknown origin that affected learning (Danforth, 2009).

While medical doctors and researchers had long been interested in dyslexia and minimal brain injury, the impetus for creating the special education label of learning disabilities was parental advocacy (Sleeter, 1986). Christine Sleeter (1986) noted the continuing history of segregation in schools, particularly how schools continually reproduce stratification by race and class, both by tracking (e.g. Oakes, 2005) and by providing students of different classes access to different kinds of instruction (e.g. Anyon, 1981). Learning disabilities, she argued, have served the same function—social reproduction, or how schools reproduce the hierarchy of society. In the 1950s, two major social changes influenced the development of learning disabilities; first, the increased competition between newly integrated white and black students, and second, increased demands on all students because of post-Sputnik educational reforms. These reforms called for increased testing for all students and grouping students by achievement (Sleeter, 1995). According to Sleeter, these changes created pressures on any white middle-class students who were having difficulty with reading (1995). These pressures led to the creation of the category of learning disability, which in its first few years was primarily applied to low-achieving white students from middle and upper class families (Sleeter, 1995; 1986).

In the 1950s, there were four categories of specialized education in schools, all filled disproportionately with black and Latino students: mentally retarded, slow learner, emotionally disturbed and culturally deprived (Bloom, Davis, & Hess, 1965). In subsequent years, families of black and Latino students increasingly demanded an end to this segregated system, forcing an end to the most explicitly racist category: culturally deprived. Increasingly, as black and Latino parents resisted other labels, more Latino and black students were given the new, less stigmatized label: learning disabled (Kavale & Forness, 1998). The label of learning disabilities is now disproportionately applied to students who are black and Latino (Losen & Orfield, 2002).

In the law that codified it (PL 94-142), learning disability was described as a "disorder in one or more basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, read, spell or do mathematical calculations." It was a special education label that was purposely differentiated from other categories of special education, particularly mental retardation and cultural deprivation. The legal definition continued: "The term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, or emotional disturbance, or of environmental, cultural, or economic disadvantage"(PL 94-142). Learning disabilities was defined as an *unexpected* failure to learn, unexpected because the individual had a high score on intelligence tests, was not a person from a "cultural disadvantage," and had received at least a middle-class education (Sleeter, 1995).

Since 1993, Ray McDermott and Hervé Varenne have been interrogating the cultural construction of learning disabilities, demonstrating how a preoccupation with individual performance, within a culture of meritocracy, constructs a culture in which LD must emerge (McDermott & Varenne, 1993; McDermott, Goldman & Varenne, 2006). They followed a kid named Adam across various contexts, finding that different situations made his label of learning disabled visible or invisible (1993). While he had no discernible difficulties navigating situations outside of school, Adam's learning disability became obvious in his classroom. American schooling, insisting that each student perform as an individual, creates optimal conditions for labeling students as learning disabled, a world of schooling in which adults are "professionally poised to discover LD behavior"(McDermott, Goldman & Varenne, 2006, p. 12-13).

This was certainly true at Central Academy. The school had to comply with laws regarding special education. They had to provide special educators for kids who enrolled with Individual Education Plans. The school also must constantly monitor for new "cases." Teachers and educational psychologists were trained to notice individual differences, and to use these differences to diagnosis students. While the process of evaluating kids for special education were designed to be objective, ethnographic studies of the process have found otherwise. Racial, gender, and cultural biases influenced school adults, resulting in the disproportionate labeling of black and Latino/a students (Harry et al. 2002; Klingner & Edwards, 2006). Once students were referred to special education, educational psychologists had enough flexibility in assessment tools to classify almost any child as LD (Harry et al., 2002). Voices of parents and teachers can be ignored as the discourses with more power (medical, psychological) took over formal meetings at which a child is diagnosed with a disability (Mehan, Hertweck, & Meihls, 1986; Valle & Esponte, 2002).

Disability Studies provides a different view of disability. Founded by activists with disabilities, disability studies is premised on the understanding that while "impairment" might be based on a biological difference, the meaning and consequences of that biological difference is constructed by society (Gabel, 2002). Disability studies in education grew out of disability studies, and focuses attention on disabilities in schools (Gabel, 2002). Ms. Emerson, the sixth grade special education teacher, was immersed in disability studies in education during her Masters program. She spoke openly about the cultural construction of the label of learning disability. Both she and Mr. Pierce recognized the inconsistencies of special education labeling, noting for example that some elementary schools labeled more kids, others less. Ms. Emerson created units in her English Language Arts class to tackle issues in disability studies with these kids. However, Ms. Emerson still had to regularly complete legal paperwork that reconstituted their labels. Even with teacher resistance, the culture of labeling students was reproduced.

Ms. Emerson believed that the labels of special education were untrustworthy, but also believed that her kids needed special care and protection, particularly from potential stigma of their designations. She implemented a policy of gradually educating kids about their labels. In sixth grade, while the class read books about kids with learning disabilities, most of the kids with that label did not know such words were written on their IEPs. Even at the end of seventh grade, the kids that I interviewed did not know that they had a label of LD. Ms. Emerson taught the kids about their labels in eighth grade so they would be able to self-advocate as they entered high school.

Special education has long been a space in which different, sometimes conflicting, discourses like law, medicine, psychology and education intersected (Reid & Valle, 2004). At IEP meetings, for example, the education psychologist may use psychological terms like "working memory" to explain a test result of the child, then move on to the concept of "discrepancy," a statistical term that was part of the legal definition. LD is both legalistic in its rights and processes, and medical in the conception of the child as having a disease or condition. At the end of the year, I interviewed the two sixth grade teachers together about the kids in their class. When describing Federico, a kid with a learning disability, Ms. Emerson began by placing him alone, both as she understands him in the social realm of the classroom and because his writing disability separates from others:

> **Ms. Emerson**
> Federico.
> You know, I always see him by himself,
> and I know that that is the way that he always positions himself in the classroom
> in terms of being who he is friends with or who he is not friends with
> but I also see him actually now friends with all the girls and all the boys and they all love him.
>
> I also see him as separate because he is the kind of kid who
> his inability to grasp a pencil and write
> he has occupational therapy
> his inability shines on me all the time because he always knows
> not true
> he most of the time knows what is going on in the class conceptually and he can add and subtract and do stuff in his head and he is really smart at math
> but I always find myself so distracted by the fact that I cannot read what he wrote on the paper.
> (Sixth Grade Teacher Interview)[3]

[3] I present the transcripts of interviews in a style adapted from Gee (1986). I explain this in detail in Chapter Three. In brief, the line breaks mean that the speaker paused. Space between the lines means that I see the speaker taking up a new topic.

These teachers frequently highlighted the social aspects of learning for their kids. Ms. Emerson's portrait began with his social place in the classroom. She noted that he was "actually now friends with everybody," calling into question the stability of his earlier friendships. Ms. Emerson named a special education service he received (occupational therapy) for "inability to grasp a pencil," a disability that was so visible that "his inability shines on me all the time." Federico's difficulty with writing cannot be hidden in the context of the classroom. She contrasted this "inability" with what she saw as his strengths: he most of the time understood "conceptually" (language from reform mathematics education), and "he is really smart at math." I noticed in analysis of the entire interview that the teachers were more likely to name the kids in special education as "smart" than other kids. She framed Federico here in terms of the history of LD: an unexpected failure that can be found in the individual. Mr. Pierce continued, more formally naming this disability in the psychological discourses of special education ("visual organizing") followed immediately with an informal critique ("sloppy"):

> **Mr. Pierce**
> Definitely the visual organizing thing is definitely the main thing that sticks out in my mind with him
> very sloppy
> can't really see it.
>
> He participates a lot
> sometimes his comments are a little out there
> I don't know
> but he is usually able to go back to himself.
> His comments are like don't make sense
> either he is not answering the question
> or like it's like totally out of focus from at least what I was aiming to get to.
>
> Do you have any insight on that?
>
> **Ms. Emerson**
> I would say that is an organization thing
> and he also has speech and language and processing and

> it’s organizing what you are saying to him in his head
> and then processing it through his head so that he can spit out what you want to hear.
> (Sixth Grade Teacher Interview)

In this second passage, Mr. Pierce brought up what he has noticed about Federico, "his comments are a little out there." His words were not framed in a technical discourse, but his question was directed to Ms. Emerson, the special education expert. Ms. Emerson transitioned instantly into special education discourse, naming the issue as an "organization thing" and then giving the services he qualified for as further explanation, "he also has speech and language." This was the second time that she named a service instead of a problem. She said “occupational therapy” rather than name this writing disability, which might be “visual organizing” or “visual-spatial” issues. She then explained it as "processing," a term used in information processing, a branch of cognitive psychology. She used processing to describe the speed of a person’s thinking, understood as taking in ideas from the world, making sense of the ideas, formulating language, and expressing the idea. Much of special education around “speech and language” is based on this theory. Ms. Emerson’s response jumbles together a set of legal services that Federico qualified for (“speech and language”) and terms from cognitive psychology (“processing” and “organization”). She used these discourses to explain the behavior that puzzled Mr. Pierce. But she also embedded a critique, “spit out what you want to hear," suggesting that Mr. Pierce’s expectations may affect his evaluation of Federico’s talk.

Throughout this discussion, Ms. Emerson and Mr. Pierce moved between multiple discourses to describe Federico: he was “a friend,” “loved,” “his inability,” “occupational therapy,” “conceptual,” “smart,” “visual organizing,” “sloppy,” participates,” “out there,” “out of focus,” “organization,” “speech and language,” and “processing.” Neither insisted on understanding children only through labels alone, but labels, and legal service are part of

Federico's story. Perhaps another child, without a special education label, would be described as "sloppy" alone, without the psychological language of "visual organizing." Perhaps before the rise of cognitive psychology modeled on computers, Federico would only be understood as "out there" rather than having difficulties with "processing." Institutions like special education shift and change over time, bringing additional ways to categorize children.

The context of mathematics education. An additional context for this study is the current landscape of mathematics education. Mathematics education is a particularly polarized field (Schoenfeld, 2004). Mathematics educational reform is associated with the National Council of Teachers of Mathematics, whose 1989 Standards attempted to shift mathematical instruction from computational practice to problem-solving. Despite decades of reform, several large–scale studies have established that mathematics classes in the United States in general still emphasize following procedures, not understanding concepts (Stigler & Herbert, 1997; Weiss et al., 2003). This kind of instruction has become even more dominant because of increasing pressure on individual test scores (Nichols & Berliner, 2007), creating classrooms that "teach to the test." The predominance of narrow, procedural classrooms is more pronounced for black and Latino/a kids, and for those in special education. Using indicators of quality such as student engagement in rigorous mathematics, Weiss et al. (2003) found that mathematics lessons tended to be lower in quality in classrooms in which a high percentage of young people were members of minority groups, and also in classrooms in which young people were defined as "low ability."

Mathematics instruction in special education classrooms has been dominated by computational practice (Woodward & Montague, 2002; Parmar & Cawley, 1991). Calling attention to the "questionable pertinence of constructivist assumptions when designing programs for students with LD"(Fuchs & Fuchs, 2001), researchers in traditional special education have questioned whether the fundamental assumptions of reform mathematics (that children construct knowledge) even apply to children with learning disabilities. There is a public narrative in education, found in both research literature and in the beliefs of those in the field, that kids with learning disabilities need instruction that is either "explicit" or "direct"(e.g. Carnine, 1997; Jones, Wilson & Bhojwani, 1997; Fuchs & Fuchs, 2001). In my work as a professional developer for teachers, I am often told that problem solving and discussion in mathematics will not work for "my kids." When I press, I find that "my kids" might be in special education, or black and Latino kids, or kids living in poverty, or kids who are learning English. Mathematics education continues to be polarized, especially when educating those who are not middle or upper class, white (or originally from certain Asian countries), and those with disabilities. In this study, I will analyze how conceptions of ability and disability influence the kind of mathematics kids participated in.

At the heart of this debate are conceptions of mathematical ability as deeply connected to race, class, gender, and disability. Kids begin to report stereotypes about mathematics being for white kids, particularly boys, around the time they transition to middle school (e.g. Hall, 1981; Campbell, Denes, and Morrison, 2000). There are circulating public narratives that mathematical ability is inborn and innate, a troubling notion considering that such a limited demographic succeeds at the highest levels of mathematics. There has been considerable research attention paid to proving that certain mathematical abilities are innate, such as the Approximate Number System, the ability to analyze small quantities very quickly (Dehaene, 1999). A recent research paper, finding differences in three and four year olds' abilities to estimate small quantities, stated in the abstract that "these findings provide evidence for a relationship between the primitive sense of number and math ability starting early in life"(Libertus, Feigenson, & Halberda, 2011).

This line of inquiry seeks to find the biological roots of both mathematical ability and disability. By ignoring how experience might shape even very early math skills, these researchers privilege limited notions that biology is destiny. Other related research projects have been looking for the biological roots of mathematical learning disabilities, with limited success.

Social identities as contexts in process. In addition to his positioning as a disabled learner, Federico was also Latino, Spanish speaking and a boy, all further positioning him in American culture. In this work, I want to better understand Federico, not by further positioning him, not by giving him additional labels, but by situating his self in the midst of cultural practices at multiple levels, understanding Federico as an actor in multiple cultural worlds that position him.

From either a social constructivist or a biological point of view, none of these human-created categories of difference definitively exist. Race is not a biological construct (Smedley & Smedley, 2005). Even special education researchers as traditional as Lynn and Doug Fuchs (Fuchs, Fuchs, Mathes, Lipsey, & Roberts, 2001) found that there was no qualitative difference between kids labeled as learning disabled and other “low achievers.” Yet all these categories materially position people. Schools in the United States are often toxic environments for kids of color because of institutional racism--for example how the ideology of colorblindness produces a meritocracy in which individuals are blamed for their place in society, including children in schools (Murrell, 2007; Bonilla-Silva, 2010). As McDermott et al. (2006) remind us, schools are institutions particularly designed to rank and sort kids. Learning disabilities certainly exist, as the concept serves as an organizer for material existence and meaning making. In the same way, race, gender, sexuality, language use and class all exist both because they have material effects and because they are used as categories in meaning making.

Too much educational research conceptualizes race as culture: singular and static (Nasir & Hand, 2007). Such notions are not only offensive and essentializing, they are wildly inaccurate. In this classroom, while all the kids are Dominican, they did not look, act or think alike. While six out of nine focus kids had labels of LD, they did not act or think alike. If my analysis focused on what made these kids similar, I would be adding to a large body of literature that in attempting to understand others, essentializes them. Instead, sociocultural theorists conceptualize culture not as singular but dynamic, produced and reproduced between people (Nasir & Hand, 2006). There was no singular "Dominican" culture in this classroom, nor a single mathematical culture. Moment to moment interactions must additionally be understood within the context of multiple interacting levels of human development, all of which are in transformation: the personal, the interactional, and the community (Rogoff, 2003).

Na'ilah Suad Nasir (2007) contended that an understanding of learning mathematics as "a process of identification" as "becoming" is particularly useful to understanding "culture, race and learning, particularly given the multiple ways that race (and class) can influence both the practices within which one can become, as well as the trajectories available in those practices"(2007, p. 135). I intend to sketch this process of "becoming," attending both to the individual and their contexts. I recognize that focusing on "becoming" can lead to portraits of children as constantly in preparation for the future. I disagree with that conceptualization of children as fundamentally unfinished, and hope to create representations of these children that honor the complexity and meaning in their present existence, their "being."

In this introduction, I have sketched out some of the contexts that provide meaning in these mathematics classrooms. Even during my time in the classroom, these contexts shifted, institutions changed, as did the classroom and the people who create and recreate it each day. In the next chapter, I provide the conceptual framework I use to understand individuals as co developing with complex, shifting worlds.

Chapter Two:

Conceptual Framework

When I began teaching, I held two contradictory notions of schooling: education as freeing children's individuality and yet teaching as implanting information directly into their heads simply by telling them something. After reading Lev Vygotsky's *Mind in Society* (1978), I was particularly struck by this statement: "any function in the child's cultural development appears, first on the social level, and then inside the child. All the higher functions originate as actual relations between human individuals"(Vygotsky, p. 57). This description of learning turned both concepts on their heads. Vygotsky posited that children learn all that they know from other people; this process involves interaction, not just telling. A child takes up the language that they hear from another, uses it, and gradually takes that language inside their brain to form thought.

When I became a mother, I constantly revisited these ideas. I watched fascinated as my children echoed my words, not just to learn them, but to use them as a tool. At about eleven months old, we taught Rufus the ASL sign for "more." After using it repeatedly during play with me in order to get more trains, I saw him do the sign to himself, then crawl over to get more trains. Rufus learned the sign for "more" from repeated interaction with me. He eventually used the sign as external speech, external thinking, which precedes internal thought. He then moved himself to get more trains. Language begins in interaction, then used as external speech, then eventually taken in, or internalized. Eventually, Rufus would just think "more" in his head, and then get more trains. The sign "more" moved from social interaction, to mediating his actions, to an internal sign, or thinking.

Vygotsky maintains that all "higher functions" go through this process, which includes everything deliberate that separates us from animals: language, thought, self-control of impulses and emotion (1978). When Rufus turned thirteen months, he started to climb the couch and jump off. After telling him endlessly that he had to "turn around to go down," I heard him say it to himself. He then turned himself around and began to come down safely, using the words as an external cue to himself. I began to be fascinated with the role of mediation as a tool for developing self-control. In all of these cases of learning through social interaction, the new activity or understanding was not photocopied onto the brain of the child, not directly transferred, but was transformed through the process of *mediation*. In both of these stories, Rufus's learning eventually *fossilized*, or the sequence of actions that initially took time became compressed, automatic (Vygotsky, 1978). Fairly shortly after I heard him say this, Rufus just turned himself around when he wanted to get down from the couch, without saying anything. An external cue, born in relational interaction, became internal. Rufus of course had some agency in this process— there were plenty of phrases I used to try to control his behavior that he didn't take up.

Mediators fundamentally shape the nature of thought, allowing people to take in language to make inner speech, but also to extend out our cognitive processes into the world. Vygotsky wrote,

> Even such comparatively simple operations as tying a knot or marking a stick as a reminder change the psychological structure of the memory process. They extend the operation of memory beyond the biological dimensions of the human nervous system and permit it to incorporate artificial, or self-generated, stimuli. (1978, p. 39)

Such actions allow us to extend our minds out into the world. Memory can be shared between people in dialogue, or preserved in a note we write ourselves. Or, like Rufus, we can scaffold our own memory of how to act through the gradual internalization of "turn around to go down." I saw that Internalization is sometimes misunderstood as making an exact copy of something: as mimesis (John-Steiner & Mahn, 1996). There are no exact copies because the mediation itself transforms thinking. For example, the way in which you learn 5 + 5 matters. Some kids learn that fact by a flashcard organized vertically. They will think about that fact very differently than a kid who learned to compute on a number line, or an abacus. Kids from Asia who learned computation with an abacus had different concepts of number than children who did not (D'Ailly, 1992). Rufus (now six) recently explained to me how he was thinking about some numbers in relation to each other, gesturing as he talked horizontally, suggesting that he was using some kind of internal horizontal number line. Mediation creates the form of thought, not just the content.

How individuals participate in social worlds: communities of practice

My narratives of my children echo the writings of Jean Piaget, describing the individual child learning in the world. Vygotsky's narrative differed from that Piaget presented, focusing not in interaction with the environment but interaction with others. Vygotsky also set the scene for a wider approach to child development: not the child developing alone but the child developing within larger cultural worlds. Drawing from Vygotksian theory, Jean Lave and Etienne Wenger (1991) situated cognition within particular *communities of practice*. Learning was seen as developing increasingly legitimate, or authorized, participation in a particular community. One example was apprenticing in tailor shops. As individuals entered the community of practice, they were first given a peripheral role, thus a peripheral understanding of the practice. Over time, the individual takes on more and more central forms of participation, and gradually becomes a central member of the community with access to full participation (Lave & Wenger, 1991). This analysis powerfully decentered traditional epistemology, which conceptualized learning as existing within the heads of individuals. Mathematics education took up the powerful tools of situated cognition, combining constructivism, focused on individual learning, with analysis of classroom participation (e.g. Cobb & Yackel, 1996). A branch of sociocultural theory, situated cognition (e.g. Lave, 1988; Lave & Wenger, 1991; Greeno, 1991) posited that knowledge was not something that we take from place to place in our heads, but that we enacted in particular situations; “as an aspect of social practice, learning involves the whole person . . . it implies becoming a full participant, a member, a kind of person”(Lave & Wenger, 1991, p. 53). Identity of an individual was the same as an individual’s participation status (or role) in the community of practice. Anxious to correct over a century of individualistic theories of learning, particularly in the United States, situated theories eliminated analysis of a unique individual mind altogether. These theories also de-emphasized social conflict, focusing in analysis on what makes communities of practice cohesive instead of conflicted. Participation in social worlds was not just determining what we learned, but who we were learning to become (Wenger, 1999). This was my introduction to the concept of *identity*, which I had previously understood only as the static aspects of social identity (such as that I am white, middle-class, straight, etc.). Identity now described the intersection between the social and the individual— the person that a particular culture/classroom/activity system was training them to be. This was revolutionary to me, as it provided a way to conceptualize the relationship between the social and the individual.

Boaler and Greeno (2000) were some of the pioneers in the use of this definition of identity in mathematics education. They interviewed high school kids in two kinds of calculus classes, one discussion-based and the other lecture-based. Students in both kinds of classes described the situated nature of their mathematical understandings: students in the discussion-based classrooms believed that mathematics was about connections and understanding, while students in the didactic classrooms described mathematical success as connected to performing procedures.

Many students in the didactic classrooms spoke about their disinterest in mathematics, and connected that disinterest to their developing sense of themselves as creative. The identity that they were asked to take up in mathematics did not fit with their sense of who they were becoming outside their mathematics classroom.

In mathematics education, situated cognition has established the situated nature of mathematical learning (Lave, 1998) and the power of classroom discourse to shape learning (Engle & Conant, 2002). More recently, using situated cognition to analyze identity in math classrooms, Paul Cobb, Melissa Gresalfi and Lynn Hodge (2009) created a vision of mathematics classroom culture as repeated patterns of behavior and meaning that construct identity. They described *normative identity* as a set of consistent obligations in the classroom that do not change over the year, or even within a single class. Normative identity was one size fits all. Using this pure form of situated cognition to understand mathematics classrooms, they eliminated any analysis of individuals as unique, and conceptualized classroom culture as singular.

The conflict between multiple mathematical worlds seemed to be a critical juncture, particularly for those mathematics education scholars interested in equity issues. Danny Martin, in 2000, wrote about black middle school mathematics students, situating them within the community of practice of their classroom, but also within the contexts of school, family and community. These contexts provided narratives about mathematics that were critical resources for the kids. The messages about mathematics were not always consistent across these spheres, often reflecting oppressive histories of math learning for members of the black community. Nasir, writing in 2002, also found the critical aspect of context for mathematics learning, that showed how the same kid solved mathematical problems completely differently while in different contexts. A kid who was able to solve a problem with percentages during basketball practice, could not solve the same problem written as a word problem in school. Mathematical thinking was deeply contextual, built from experience in multiple contexts. While both of these scholars used sociocultural theory, their focus on a particular group of kids allowed them to focus simultaneously on individuals and social contexts, a feat that has been difficult for other sociocultural scholars in education, who have tended to ignore the role of the individual (e.g. Cobb et al., 2009).

How individuals co-develop with cultural worlds: figured worlds

Nasir is situated in another strand of sociocultural theory: cultural historical activity theory, or CHAT. Anna Stetsenko has contextualized the work of Vygotsky and his contemporary Bakhtin in the historical context of post revolutionary Soviet Union—the flush of optimism during which the search for social justice in the context of psychology and philosophy seemed possible (Stetsenko, 2010). Developed in the Soviet Union by colleagues of Vygotsky after his death, cultural historical activity theory (CHAT) claims a more direct lineage to Vygotsky's ideas. Its most prominent founder, Alexsei Leontiev, focused on activity as the smallest unit of analysis that included interaction, emotion and learning (Leontiev, 1978; Roth & Radford, 2010). His work also established the key role of goals in shaping activity at multiple levels (collective human activity, individuals, and in moment-to-moment interactions). According to Engstrom (2001), current work in cultural historical activity theory retains the centrality of "collective, artifact-mediated and object-oriented activity system" as a unit of analysis but these activity systems are understood as multi-voiced, containing within them multiple perspectives, goals, and interests (Engstrom, p. 136). Like figured worlds, in CHAT activity systems develop over historical time. Activity systems can be characterized by contradictions, "historically accumulating structural tensions within and between activity systems"(p. 137). Boundary crossing, movement across activity systems, is a fundamental aspect of cultural historical analysis, such as the multiple "scripts" of teachers and students that intersect within one classroom (Gutiérrez, Rymes & Larson, 1995). This provides a much more dynamic approach to understanding classrooms.

Boaler and Greeno (2000) in their work, use *Agency and Identity in Cultural Worlds* (Holland. Lachicotte, Skinner & Cain, 1998). This work was unique in its broad inclusion of academic fields, connecting the ideas of Vygotsky, CHAT, Mikhail Bakhtin, Pierre Bourdieu, and cultural anthropology, all in the service of better understanding how individuals co-develop with cultural worlds. Instead of communities of practice, Holland and her colleagues proposed *figured worlds*, bringing additional attention to the importance of agentic meaning making and positioning. Holland and her colleagues further developed the concept of activity systems in cultural historical activity theory (Leontiev, 1978) and the *fields* of Bourdieu (1977). Like activity systems in cultural historical activity theory, figured worlds develop historically. Echoing Bourdieu, figured worlds are structured through hierarchy and positioning. Individuals are positioned through "greater or lesser access to spaces, activities" and "voice"(Holland et al., p. 128). Using the term *figured world*, these authors use Vygotsky's theories of play as social improvisation, which can jettison human activity further in development (Vygotsky, 1978). They imagined figured worlds as spaces in which dramas unfold, with recognizable characters and story lines. Figured worlds, "like activities, are not so much things or objects to be apprehended, as processes or traditions of apprehension which gather us up and give us form as our lives intersect with them"(Holland et al., p. 41). Within figured worlds, people develop identifications through heuristic work; making sense of the cultural tools of the figured world such as narratives, stock characters, labels and categories. In the field note that opened Chapter One, I told the story of Luis sharing his strategy in the sixth grade classroom. The concept of figured worlds allowed me to ask both what the norms and patterns were of the classroom, but also what kind of drama was playing out. What kind of character is Luis playing in this drama? Was he the outcast (Arturo called him a "retard") or intellectual iconoclast (Ms. Emerson called his work "interesting")?

I have been inspired by this concept of classroom cultures as extended play. Holland et al. described figured world as an "as if" world—a "game" imagined, and recreated (Holland et al., 1998). What if children were taught how to do mathematics by going to a school, and sitting in a classroom, separated into groups based on age? Where kids were expected to sit, and listen, and copy methods modeled by the teacher? Figured worlds are a human invention which allow us to do more than we could alone. When we operate with others, collectively imagining and acting as if school is a real thing, we are able to do school, and in so doing we are actually able to recreate centuries of mathematical development (such as the invention and acceptance of negative numbers) within a few years of schooling.

The concept of figured worlds in combination with CHAT allowed me to see classroom culture as produced in dynamic interactions. In CHAT, culture was defined as "produced and reproduced in moments as people 'do' life . . . culture is both carried by individuals and created in moment-to-moment interactions with one another as they participate in (and reconstruct) cultural practices"(Nasir & Hand, 2006). This became my working definition of culture, particularly after I engaged in ethnographic work in the classroom. This kind of dynamic understanding of activity systems, begun in Holland et al (1998) but not fully developed in its application to classrooms, deeply influenced my attention to multiplicity.

Paul Willis's ethnography of working class "lads" in Britain, theoretically oriented towards cultural studies, also influenced the way in which I understood classroom culture. In this work, there was no general culture of the kids in the school, but small cultural collectives such as the "lads," whose creative resistance to the practices of schooling contributed to cultural reproduction (1977). As part of ethnographic practice, the ethnographer looks for the groups that matter to the people you seek to understand, not the institutional categories. Instead of seeing The Classroom as The Culture, I began to see cultures in process, kids making allegiances, creating new forms together, and doing it again the next day, always a little bit different. This view of culture is far more agentic than the vision emerging from singular communities of practice.

How multiple cultural worlds shape individuals: authoring the self

Another theoretical tool expanded by Holland and her colleagues (1998) was *authoring the self*, inspired by the work of Bakhtin and Michael Holquist's book on Bakhtin, *Dialogism* (1990). Bakhtin saw existence as simultaneous co-being with and in the world (Holquist, 1990). Fundamental to this simultaneity was the self/other relationship; no one exists alone, but only in relation with others. An individual only knows the stream of his or her own experience in reality, which is constantly in flux. The individual knows others through categories, assuming that the other is a knowable entity. Both ways of knowing are incomplete, and so meaning making in the world begins with dialogue and an understanding of simultaneity: self/other continually in dialogue. Like Vygotsky, Bakhtin conceived of reality as fundamentally relational between others and the self, rejecting the Cartesian duality of mind and body.

People need to make sense of the flux of existence. Holquist wrote:

> My self must be able to conduct its work as sheer capability, a flux of sheer becoming. If this energy is to be given specific contours, it must be shaped not only in values, but in story . . .

> And this narrativity, this possibility of conceiving my beginning and end as a whole life, is always enacted in the time/space of the other(1990, p. 37).

Meaning making is central to existence, not a higher-level act of thinking that occurs only in schools, but part and parcel of every moment of existence. Narrative is one strategy for constructing meaning out of messy experience (Bruner, 1990). According to Bakhtin, we are addressed by the world, and we must answer. To do so, we arrange and rearrange discourses that we have experienced, discourses or *voices*, to place ourselves in the world.

These voices carry with them the positioning of the figured world. Words carry power, or lack thereof, from the world and into our thoughts. As Bakhtin wrote,

> The word does not exist in a neutral and impersonal language (it is not after all from a dictionary that the speaker gets his words!), but rather it exists in other people's mouths, in other people's contexts, serving other people's intentions: it is from there that one must take the word, and make it one's own. (1981, p. 293-294)

Bakhtin described *authoritative discourse* as external speech, voices with power. Initially, we author ourselves by taking voices from the outside in, or *appropriating* them. As Bakhtin wrote,

> One's own discourse and one's own voice, although born of another or dynamically stimulated by another, will sooner or later begin to liberate themselves from the authority of the other's discourse. This process is made more complex by the fact that a variety of alien voices enter into the struggle for influence within an individual's consciousness (just as they struggle with one another in surrounding social reality). (1981, p. 348)

We transform some of these voices into *internally persuasive speech* (something we believe). Even internally persuasive speech will conflict with all the many other discourses we have learned over time. Authoring is arranging and rearranging discourses about yourself, sorting through discourses that conflict, and transforming your understanding of others. The work of authoring is never finished.

Holland et al. cast the authoring of the self as a potential site for human agency. Through this process, we can rewrite our understanding of the world, provided we understand that we must use the tools the world has given us. While we cannot think what we have not been exposed to, we have a wide variety of scripts to work with, mixing and melding them together as we make our way in the world.

How individuals learn in cultural worlds: mediation and fossilization II

This process, authoring the self, resonated strongly with the process of mediated learning in Vygotsky's work (1978). James Wertsch, a sociocultural scholar, also drew parallels between Bakhtin and Vygotsky to better understand how we learn through cultural tools. Wertsch (1998) distinguished two kinds of learning*: mastery* and *appropriation*. Mastery is being able to use a cultural tool. Mastery is contrasted with appropriation, a term both used by Bakhtin and cultural historical activity theory, which means taking a cultural tool and making it one's own. Appropriation means one can use the tool flexibly (Wertsch, 1998). In either case, the cultural tool strongly mediates learning. In addition, drawing from Bakhtin, Wertsch recognizes that cultural tools are themselves positioned.

I currently prefer the term *replication* over mastery. Mastery implies the person is controlling the tool, when the opposite seems more true. When a child learns a rule for multiplying numbers and practices it until they can do it automatically, the child is not master of the rule; the multiplication procedure rules the child's activity. A better descriptor is replication, because the child is learning to repeat the practice. This word, however, too firmly suggests that the learned rule is an exact copy. All learning is different from the source we learned from- there are no exact replicas of knowledge. Yet replication as a term still better describes this part of the process, in which the intent of the learner is to replicate, not transform. This makes a better contrast with appropriation, in which the learner adapts practices and discourses for herself. I will use this distinction more in Chapter Five, when we see how the kids learned addition and subtraction of integers.

How to understand a classroom as a figured world: methodology and multiplicity

While preparing my second exam, I imagined my dissertation would be a comparison of the mathematical identities of students with learning disabilities in a reform mathematics classroom versus those in a traditional lecture based classroom. Implicitly, such a design assumed that there would be such a thing as different mathematical identities that I could compare. One day, a friend in my program told me that he too was writing about mathematical identities, but he didn't think such a thing actually existed. The thought terrified me. His next question knocked me flat: well then, what is a mathematical identity? I had no clear answer.

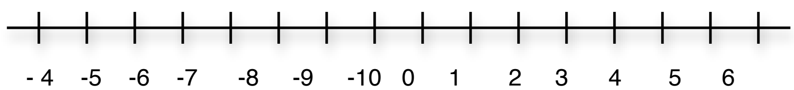
I cannot say that I found a way out of this dilemma right away. My first instinct was to reapply myself to the literature, resulting in more than one costly order of online books with Identity somewhere in the title. My way out was sideways, through my field work in the sixth grade classroom. The following field note describes parts of a math lesson in which Mr. Pierce designed an introduction to integers using money as a context. Kids were given envelopes with fifteen pretend dollar bills and fifteen promissory notes, each representing a loan of $1. The teachers, each working with half the class, gave a series of situations in which money was earned or debt was incurred, and asked kids to find out how much they had or owed now. After working several situations out in a small group, kids then worked on a sheet of problems with a partner. The class ended with a whole group discussion led by Mr. Pierce, who began to teach a rule for subtracting a negative number.

> *As I walked into the class, I saw that all the desks were pulled haphazardly into two circles. I pulled up a chair into Ms. Emerson's small group, and saw Ana and Annette with their desks pulled close together, and Lorena and Sade with their desks pulled close together. The rest of the kids had pulled up their chairs to join the circle. Tony and Arturo were on either side of*

Ms. Emerson, sitting very close to her, and immediately dominated the conversation. As Ms. Emerson began to ask the questions, all of the kids seemed to be solving the problems, and most kids answered questions. A few minutes later, after a few jokes and a few answers from Tony and Arturo, Ms. Emerson asked them to give someone else a chance, smiling. A few minutes later, after answering a question correctly, Tony got a far away look in his eye and said dreamily, "This is so fun."

One kids, Lorena, who typically did not speak in math class, answered three of the questions, each time expressing her understanding within the context of money. Her body was totally oriented towards Ms. Emerson, which was unusual for Lorena, as she often seemed to always be facing away from the work. Lorena asked a question, hesitantly at first, wondering why when you owed four dollars and then owed ten more, if you add why is the answer not positive again? How can it get smaller? When not speaking, Lorena consulted quietly with her friend Sade, whose desk was pulled right next to hers. At the end of the class, when whole group discussion of the rules began, however, Lorena sat alone, turned away from the board and talked socially, also quietly, with Ortiz who was sitting behind her.

When solving the problems, Sade used her fingers openly. Lorena used her fingers as well, but hid them under the desk as she did so. When I came over to her to talk, she did not answer my questions, and continued to look down at her work until I left. Although the teachers did not suggest a number line, several kids used one. One kid, Desi, labeled her number line like so:



Ana and Annette made accurate number lines and were able to solve problems with them, until they had to add a negative number to a negative number. All resisted moving left on the number line to add, relying on their knowledge that adding always makes the number bigger (true in the natural numbers). When I reminded them of the context of debt, Annette and Ana changed their answer and moved left on the number line.

Mr. Pierce asked me to come talk to Ortiz who was in his group, head down, and arms covering his paper. I asked him about his work, and he told me that Ms. Emerson had taught him to move right when adding on a number line and he knew that she was not wrong. He shot an angry glance at Mr. Pierce, and put his head back down.

As I moved back to Ms. Emerson's group, I saw her sitting down with Luis, who had come into class late. His chair, as always, was pulled apart from others. Ms. Emerson came up to me beaming, telling me that Luis had gotten it so quickly, clearly proud of him. I sat with Luis for a moment, and saw that of a sheet of twenty problems, the only ones he had wrong were the addition of two negative numbers. I asked him what happens when you add more debt? He stared at me, then stared at his paper, then "ohhhh." Without additional comment, he erased his answers to the two problems and changed them to the correct one.

At some point, I heard Tony singing a pop song as I worked with Sade. I walked over to them and asked them how they were doing. Tony, whom I had kind of snuck up behind, jumped in an exaggerated fashion, "ohh" and his friends laughed. I think I expected that the boys were having difficulty, but they had finished all their problems, and a quick glance up and down them did not reveal any mistakes. I told them to make up their own problems to challenge each other, and I walked away, and when I returned, I saw that they had not done

> *so, but continued to joke with each other. I gave them a "challenge" and as soon as I said that, the boys all quieted down and focused on me. I gave them three integers to add, and boys hurried to work it out, and then Tony burst out with the answer. A brief dance followed, as Tony celebrated his victory. I then wrote down a five-integer problem, and walked away. Fredo kept calling out to me when I was trying to work with another kid, telling me the answer was -32. (field notes, 5/25/10)*

On this particular day, I went into the field determined to write from the perspective of Lorena. She was an interesting kid to me, described by her teachers as having a renaissance as a student that they attributed to her close relationship with Sade. I paid close attention to what she did, but I was not able to talk with her because she refused any interaction with me. As on other days, I was drawn to working with the joking boys, Tony, Arturo and Felix, who clearly enjoyed doing mathematics. The kids in the class engaged very differently in mathematics. Some worked alone, like Luis. Others waited for a teacher to come help them, like Desi. Lorena and Sade worked together continuously, even when the participant structure of a small group discussion would seem to disallow such close collaboration. They participated differently in whole group discussion than small group discussion. I noticed that kids felt strongly about mathematics, negative and positive. Kids used tools that they learned in the past, adapting them to the demands of the current problem. They leaned on other kids to support them, checking their answers. They used a variety of methods and models here, from the number line, to a money context, to their fingers.

First, the experience made me wonder how I could label these kids in any consistent, meaningful way. Second, the experience made me question the conception of classroom culture as singular, leading me away from situated cognition and into the activity systems of CHAT and the figured worlds of Holland et al. I was still reading studies in mathematics education that look for sameness more than difference. Working in this sixth grade classroom, that view was challenged. While in general, the mathematics in this classroom focused on preparation for exams, both the state exam and classroom assessments, each teacher brought a different pedagogical style. Most classes began by "going over" homework in a whole group, led by Mr. Pierce. Discussion of mathematics tended to focus on particular strategies, not multiple strategies. For example, Mr. Pierce did not teach multiple methods for converting a fraction to a decimal, but encouraged all the kids to use long division. When Ms. Emerson ran a mathematical discussion, whether in small or whole groups, she encouraged and valued multiple strategies. She asked more than one kid to share for a single problem, while Mr. Pierce tended to ask one kid, and then move on. As I wrote in Chapter One, on my first visit to the classroom, I saw Ms. Emerson leading a discussion of Luis's strategy to multiply a whole number by a fraction. His strategy was complex, inefficient, and ultimately incorrect, yet Ms. Emerson chose him to present, valuing the creativity in his method. While his style tended to be more traditional, Mr. Pierce designed a range of activities, from more complex problem-solving tasks to worksheets designed to practice single procedures. Similar to their seventh-grade classroom, this math class offered opportunities for a wide variety of mathematical behavior, but ultimately tended to value following set procedures to solve computational problems.

Treating a classroom as a single community of practice creates a paradox. Studies like those of Cobb and his colleagues (2009) treat kids as if they walk into the new classroom as blank slates, instead of having experience in many mathematics classrooms. Consider the studies I referenced earlier which found that black children come into mathematics classrooms with mathematical competence in other situations (Nasir, 2002), and with messages about mathematics from their community and families that affect their participation (Martin, 2000). All kids walked into this classroom with experience in multiple figured worlds, and that experience seemed to matter in how they engaged in class. Kids also actively resisted the norms that might be “stamped” onto them. Cobb and his colleagues theorized resistance, but only as individual acts of rejecting the normative identity. This account lacks the subtleties of actual agency, including the complex process through which kids in schools collectively resist authority (Willis, 1977). Ortiz, for example, resisted doing the mathematics for the day, because he felt allegiance to Ms. Emerson and the methods she had taught him. Few studies of mathematical identities are responsive to such complex acts of agency.

Unable to discern a single mathematics identity, I looked for mathematical identities. I tried and tried again to see mathematical identities as things: for example toying with the idea of positive and negative mathematical identities. I found myself labeling the kids, such as a ”discussion-based learner” or a “lecture-based learner.” The longer I worked with the kids, the more difficult labeling became. I no longer look for identity. That concept is too singular, too clouded, and too easily reduced to labels.

The kids were constantly bringing other aspects of self to my attention. Ortiz’s act of rebellion was rooted in his emotional attachment to his teacher, as well as in a particularly difficult conceptual shift from adding by moving right on a number line for whole numbers, to adding by moving left for negative numbers. Ortiz insisted on what made sense to him mathematically and emotionally. The close collaboration between Lorena and Sade fascinated me, as Ms. Emerson attributed Lorena’s newfound enthusiasm and engagement in mathematics to their friendship. For example, Ms. Emerson told me that the pair had recently changed their seats from the back of their math group, to the very front row. I wanted to understand how the joking boys understood themselves as such joyful mathematics learners, particularly as some of the boys had learning disabilities and some did not. I became interested in understanding the complexity of children in mathematics classrooms, their agency and innovations, particularly over time.

In this sixth grade classroom, the kids walked into their class with friends, rather than being lined up. They were free to decide where they sat, and even how they arranged their desks. Kids in this class used their relative freedom in different ways. When I first visited the classroom, I felt unsettled by the chaotic arrangement of the desks. They were not arranged in either straight rows or small groups, but were scattered throughout the room. After spending time in the classroom, I saw that this lack of preset structure led the children to arrange the desks in ways that fit the way in which they engaged in mathematical work. Luis would walk in and pull a chair away from the other chairs, sitting either far to the back or to the front, but always by himself. Luis chose his own methods to solve problems, for example his strategy for multiplying a fraction by whole numbers. Sade and Lorena pulled their chairs next to each other in order to work closely. Collaborative rather than combative, this kind of close relationship was seen across the classroom, as groups of mostly girls (but also including some of the boys in the class) would gather tightly together to work on problems. I saw the few boys in the classroom (six boys and eighteen girls) also put their desks in another arrangement: facing each other. Tony and Ortiz did this, for example, and then worked separately with frequent taunts to the other about how far they had progressed.

The freedoms of this classroom allowed me to see the kids' social worlds. I found a strongly connected group of joking/math-loving boys (which also included Desi as a social member, but not during class). This group included Arturo and Tony, who dominated the small group discussion on integers, clearly enjoying their participation. The group also included Ortiz, who competed to finish a worksheet with Tony while simultaneously cracking jokes on each other. Ortiz often rapped while he worked. For most of the boys in this class, mathematics was fun and social, a place to engage in play with your friends. Following Willis, I began to see the distinctions that the kids made, both through their words and their actions. In this sixth grade class, I could see the joking math-loving boys as a dynamic set of individuals who acted fairly consistently in class: moving between rapping, taunting each other, and solving math problems as quickly as they could. Working in this process, I did find patterns in the kids' behaviors, but they were unexpected to me, not my preconceived categories.

Desi identified herself as part of that group, but acted differently in math class. She tended to sit and wait until a teacher came to her, not talking or joking. Working with her on a worksheet of addition and subtraction of integers, Desi told me, "Normally I would be "zooming out. We" (which seemed to include at least Ortiz and the other boys around her) generally "zoom out" during class. That was "why most of us like to" sit next to the window, cause then "I am in my own little planet" and "in my world" (field notes, 6/9/10). At the end of class, Desi would fall in with the boys, part of the crowd, yet she seemed separate in the disconnected way in which she participated in math class.

Reading Barrie Thorne's ethnography of the ways in which gender was constructed in two elementary schools (1993), I respected how she took the actions and thoughts of kids seriously. She explained the process of gendering in schools, accounting both for the social construction of gender and the varied ways in which kids created and resisted limits. She used play to help her understand gendering, which has also been important in the way I understand figured worlds.

Reading ethnography also inspired me to communicate complex ideas by bringing the persons and the theory alive. Adam, the central character in McDermott's study (1993), provides a narrative and a central character about how disability is contextual. Kathleen Collins (2003) provided me another pivotal character, telling the story of Jay, a black fifth grader, over two years of his life in a suburban school. Jay loved science, particularly bugs, but was continually positioned as a disabled learner in his classroom. Her work, like Thorne's, developed new theoretical ground while staying deeply connected to people. These kids remain in my mind, embodying deep theory. I sometimes walk into a classroom, and see the Jay, sitting in the back of the room, desk separate from the other kids. I hope that my writing can honor the kids I worked with in this way.

How to understand people in figured worlds: positional and narrative identities

Doing fieldwork helped me out of one theoretical predicament, allowing me to jettison one single identity, yet threw me into innumerable others. I began to explore the ways in which Holland et al.(1998) flexibly used notions of identity. Drawing from Holland et al.(1998), mathematical scholar Ilana Horn (2008) described both the *narrative* and *positional identities* of kids. Most broadly, the ways in which others position you can be understood as positional identities. Ways in which you narrate yourself become narrative identities. Horn combined these two concepts, defining mathematical identities as "both the self-understandings students develop about their relationships to the subject of mathematics and the understandings that are assigned to them through their position and encounters in the social world" (p. 204).

To me, however, these concepts are only useful when used more flexibly. Any attempt to force consistency does not work. Recall the fundamental paradox of existence Bakhtin presents: we only know ourselves, but we categorize others. We must use the categories of the other to narrate ourselves:

> The Bakhtinian just-so story of subjectivity is the tale of how I get my self from the other: it is only the others' categories that will let me be an object for my own perception. I see myself as I might conceive others see it. In order to forge a self, I must do so from outside. In other words, I author myself. (Holquist, 1990, p.28)

These two aspects of reality—positioning others and narrating ourselves— are interrelated, on-going processes. Yet Bakhtin recognizes these two sides of reality (you and others) as an irreducible simultaneity—a duality that cannot be simplified. In this way, I chose not to theoretically combine these terms, but to find them in the processes of positioning and narration.

In their work (perhaps to avoid being applied too categorically by people like myself), Holland et al.(1998) avoided precise delineation of either positional identities or narrative identities, defining them differently at different points. Generally, however, positional identities, also called relational identities, are connected to embodiment, like the way the girls in Nepal felt about their experience being shouted at by a neighbor who denigrates them for their lower caste (Holland et al., 1998):

> "Positional identity, as we use the term, is a person's apprehension of her social position in a lived world: that is, depending on the others present, of her greater or lesser access to spaces, activities, genres, and, through those genres, authoritative voices, or any voice at all."(Holland et al., p. 128).

Positional identities are characterized by one's understanding of what kind of access you have in that world.

Narrative identities, also called figured identities, are closely related to the figured aspects of these worlds—the ways in which people are imagined in these worlds. Participants in Alcoholics Anonymous (AA) learned to shape and reshape their personal narratives within the parameters of an AA story, and in so doing they learned how to narrate themselves in that figured world (Holland et al., 1998). Narrative identities can follow *scripts* about what certain kinds of people should do, scripts that develop in the figured world. In this classroom, Desi narrated herself as part of a group, "we generally zoom out." Using "we," she spoke not just for herself, but for a group. Desi was naming a script for how a group acts in math class, not positioning them, but creating a story around their activity in class. Other kids followed other scripts in this classroom, like the kids who loved to race through worksheets or the kids who liked to sit in front of the class and answer Mr. Pierce's questions. All of these kids not only did these things, but they narrated them as well, in ways that created depth in my portrait of the classroom. Desi taught me that there was another group of kids, who chose to sit by the windows, who *chose* to "zoom" out.

These two terms overlap, or not. Holland et al. referred to them as "dependent, but not co-incident processes"(p. 286). Positional identities can remain under the surface, unacknowledged, but then once noticed, create the opportunity to rethink positioning. Narrative identities are also in development, such as the way in which members of Alcoholics Anonymous shape and reshape their life stories as they participate in AA. Throughout my work, I tried to hold on to the idea of these identities as processes, which allowed me to analyze what is happening over time.

Let me explain positioning and positional identities with an example, again drawn from the sixth grade classroom. In my interview with the sixth grade teachers, which I presented in Chapter One, I asked them to map the classroom for me. I gave them a card with the name of a kid on it, and asked each teacher to tell me about each kid and then place her or him on a map of the classroom. I did not specify how the map should be organized. The teachers described kids who "get it," "get stuff," "gets the answer," "understands what is going on," and "picks it up very quickly." These constructions assumed that mathematical knowledge was a thing that can be possessed. Ideally, "getting it " was done speedily. According to Mr. Pierce, another important feature of ability was being "neat" and "thorough" in your work. He placed emphasis on scores on classroom tests and state exams, naming kids by their scores.

For Ms. Emerson, the most valued marker of ability was creativity. This led to a disagreement about who were the "top" students. Both teachers agreed that two girls, Elyse and Mikela, were top students because they were "brilliant," with strong conceptual understanding. Both students consistently scored highly on classroom tests. Ms. Emerson wanted to add Luis to that group, saying that,

> **Ms. Emerson**
> Luis doesn't care what you want as the teacher,
> he is like,
> *no this is the way that I did it*,
> and *this makes sense to me*,
> and he also,
> is the most motivated kid in our class
> um
> to teach himself.
>
> For example he wanted to learn how to multiply divide and subtract fractions so badly that every day I was giving him problems,
> and when I came back after the break,
> he showed me a notebook,
> that was pages and pages of him just giving himself problems and trying it and trying it over and over again.
>
> So he has this desire in him for math that I just don't see in other kids,
>
> And –
> this on tape,
> Luis will make up something new that is new to the math field for sure.
> Like I would not be surprised that when I am older I hear about Luis and how he is somebody who came up with a new theory or something in math
>
> He is,
> he cares in a way that these two don't care about math.
> um,
> these two being Elyse and Mikela.
> (Sixth Grade Teacher Interview)

He was a top student, not because he scored highly on tests, but because of his desire and motivation. Ms. Emerson used the narrative of Luis filling up a notebook to explain this "desire." Mr. Pierce responded:

> **Mr. Pierce**
> Yeah yeah yeah yeah,
> He is also,

he is not a traditional—

It is interesting to talk about who are the best students,
because I definitely hear how we were taught,
calling him on a certain level the best student,

yet it depends on how you categorize it,

from a traditional perspective,
I can name ten students who can probably do things more effectively,

but he's got the strengths that they don't have.
Interesting.
(Sixth Grade Teacher Interview)

Mr. Pierce saw disjunction between the ways in which he and Ms. Emerson positioned students. He attributed this difference to the ways in which they themselves experienced mathematics. Ms. Emerson responded, critiquing the way in which the “traditional students” act in class:

Ms. Emerson
I definitely see the more traditional students as parroting back what you want to hear,
as a teacher,
and parroting back the strategy that the book tells you is the strategy that you have to do.

And the reason that I think he is smarter,
well not smarter,
well,
yeah,
I mean,
in math,
because he is not just parroting back,
and he will not accept not fully understanding everything you are doing conceptually.
(Sixth Grade Teacher Interview)

Ms. Emerson named Luis as “smarter,” took it back, then returned to the claim, qualifying it, “in math.” To her, smarter was not “parroting back,” but situated in Luis’s approach to learning math, his passion, how he insisted on understanding.

As we saw from the first field note in Chapter One, Luis’s position was uncertain in this classroom. Ms. Emerson named his strategy as “interesting,” while Arturo named Luis as a “retard.” In this interview, Ms. Emerson wanted to position him as one of the top kids in the class; he was “smart” because he “is not just parroting back” and has the “desire” for mathematics. Mr. Pierce did not reject this out of hand, but responded, “I can name ten students who can probably do things more effectively.” Naming Luis’s positional identities and narrative identities would be a futile conceptual exercise. But noticing how he was positioned and how he was narrated by his teachers gives us significant understanding of this figured world, and Luis’s place in it.

The teachers framed some kids as unsuccessful in mathematics. One way such children were understood was that the child lacked “knowledge” and “basic number concepts.” These kids, only four in the class, were also described as having “trouble absorbing what we show him,” “when we have discussions he can get lost,” and “really super struggling.” Students who were “struggling” in this way were named in emotional terms. Lorena, who lacked “basic number concepts,” was fearful. Rita, who came into the classroom without “basic” number skills, was named as “the uber-special ed kid,” — defined as not only “struggling” academically, but “crying” all the time.

At several points, Mr. Pierce talked about a “mismatch” between kid’s performance in class and their test scores. Describing one child, he said,

> **Mr. Pierce**
> I knew coming in she got a four on the state test,
> and then when you see her in class
> it was like the most frustrating thing,
> she wouldn't do anything.
> It was like,
> not a four[4] student,
> and it was like there was such a disparity between the test score and who she was.
> (Sixth Grade Teacher Interview)

Countering immediately, “what does it mean to look like a four?” Ms. Emerson challenged this practice of naming students by their test scores. Kids were also positioned by disability status.

[4] The state test was scored either 1, 2, 3 or 4. Four was the highest possible score.

The teachers sometimes switched into the discourses of special education to describe certain students, like Federico, described in Chapter One.

The teachers positioned kids in various different ways, along different axes. There was creative versus “parroting back.” There was “gets it” versus “super struggling.” And there are the discourses of the test (she was a “four”) and of special education. In the integer lesson that I described, Tony was positioned as “getting it,” both by his actions—sitting close to the teacher, dominating discussion—and through the response of Ms. Emerson. Yet the teachers named Tony as someone who was “struggling.” Once I was deep enough into the figured world to understand them, these kind of complex incongruities kept me from naming kids one way.

Bakhtin wrote of how even a single word can carry the reminder of an event situated in a particular space and time (Leander, 2002; Bakhtin, 1981). When Mr. Pierce so casually called a girl “a four,” he condensed and reduced experience into shorthand. Time and social space are reified through artifacts, fossilized into routines or individual words (Morson & Emerson, 1990). I frequently hear teachers do this same thing. They will tell me about “my twos”— the kids in the class who last year scored a two on the state exam. Test scores are such important artifacts in this system that they become positional identities for kids. For me, identities capture both the dynamic processes of labeling, and also moments in which a single label gains prominence and stability. “Four” was a positional identity, a social position to which this girl was assigned.

It is important to trace the progression of cultural artifacts through which interaction around identity is mediated. I have also seen kids sit at desks on which a sign reminds them of her or his most recent state test score. This sign provides another positional identity for a kid, one that the kid may use in different ways as she authors herself. All of the labels that the teachers used to name the kids in their class developed over time, and all become cultural resources to understand oneself in the math classroom. Hopefully, your head is spinning, because this idea still spins mine; identities form, then may mediate successive experiences in that figured world. Identities, whether positional or narrative, become in turn resources for authoring the self.

How individuals conceive of themselves as agents in cultural worlds: identification

Over a year later, almost finished with my year of data collection, another fellow student asked me, “So, processes of identification?” She furrowed her brow and asked, “What are you actually going to find?” At that point, I had no idea how to answer her. I could detail ways in which each of my focus kids had changed, but I did not have a consistent way to understand that as identification (or not) with mathematics. I shifted from singular identity to understanding identities as part of a process, but I did not have a theoretically sound definition of identification.

Holland et al. (1998) discussed identification at the end of a chapter about the figured world of romance at a university. They described how young women at the university talked about romance, detailing how they describe the characters that populated that world and the story lines that they expected. They also talked about positioning, how certain women were positioned as skilled or unskilled in the world of college romance. Status seemed to indicate both whom you could date, and the positioning within your relationship. At the end of this chapter, Holland et al made the striking choice to understand this world of romance as a space of expertise and learning. Certain women were committed to getting better at understanding and navigating this world, while other participants bowed out; “Salience, identification, and savior faire (expertise) appeared to develop together in an interrelated process—a process that was continually supported and shaped in the context of social interaction.”(p. 116). This particular quote is underlined in several colors in my well-worn copy of this book. Indeed, over time I have used this quote to help me develop my current understandings of identification and mathematics.

Holland and her colleagues use Dreyfus (1984), who investigated how people become experts in a study critiquing computer cognition. Instead of understanding an expert as one who follows increasingly complex rules, Dreyfus argued the opposite—novices and advanced beginners follow rules, while experts do not. He postulated five stages of expertise: novice, advanced beginner, competency, proficiency and expert. In his first two stages, the individual's knowledge is formulated around rules that they have heard from others. The rules mediate their action in an unfamiliar domain. I recently moved into a new house with a tricky driveway. As I learned the maneuvers, I talked aloud, reminding myself to cut the corner just so at a particular point. As a learner progresses, they develop competencies which allow them to move more freely in the system, and think creatively. We internalize the rules and use them without conscious thought. Eventually, I learned to park without talking myself through it. This process echoes the mediated learning process of Vygotsky (1978), extended by Wertsch (1998), a process that ends in fossilization, a "compression" in which "ever larger segments of activity become the elements in our attention"(Holland et al., p. 118). Work on expert mathematicians reflects this shift from replication to appropriation. Studying the use of representation in mathematical problem solving, Stylianou and Silver (2004) found that beginning adult math students followed rules and procedures, while expert mathematicians played with multiple representations to solve problems, forgoing rules for exploration with multiple representations.

Describing ever more advanced stages of competency (competence, proficiency and expert), Dreyfus incorporated emotion and salience into his argument. The shift from competency to proficiency is accompanied by a qualitative shift in the relationship between the individual and the system, a shift that involves emotion. Someone who remains competent, but not becoming more of an expert, fails to take the situation to heart, to be immersed in it, to believe it. People developing into experts are "gripped" by their performance, heart and mind and body all engaged in the work. Identification is the process proposed by Holland et al. that takes a person through this journey in their relationship with a system. Holland et al. define identification as "the formation of a concept of self as an actor in the culturally devised system"(1998, p. 120). A person in AA may eventually recast their own life story as the AA story, identifying themselves as full participants in that community, defining themselves using the cultural tools of that world. This is not a passive acceptance of a culturally devised world, but seeing oneself as a person with agency in that world.

I use identification, then, to describe a long-term process. Authoring the self describes both the short term, moment-to-moment arranging of voices, as well as the long term narratives we write and rewrite about ourselves. Authoring the self is a way in which we make sense of multiple figured worlds. Identification, as I am using it, focuses attention on the way in which individuals author themselves over time in a particular figured world. It is a useful term for mathematics education, then, because it is focused on the long-term process through which individuals craft relationships with mathematics, particularly whether kids see themselves as actors in the world of mathematics, and would then invest themselves into developing additional expertise.

Goals become important in this discussion. To become more identified with a particular subject, to move along in expertise, one must want to do so. For something to become salient and compelling, people must not only take up a system, and see themselves as part of that world, but they must also take on the goals of that system. Mathematicians solve problems. You need, at the most basic level, to want to solve problems. Holland et al. write about the figured world of romance becoming desire. What we think of as a separate, individual emotion—desire—

develops in the context of social relationships and activity. The figured worlds of a math classroom become motivation, Luis's "desire" to know more mathematics. Motivation in mathematics develops socially and through particular forms of activity. Yet educators conceive of motivation as residing within the individual alone.

As suggested by my description of the sixth grade classroom, kids were asked to do different kinds of mathematics. What do I mean by processes of identification with mathematics then? Which kind? It can never be mathematics in general, because we don't form relationships with the general. Kids form relationships with the mathematics they experience. In these classrooms (both sixth and seventh) kids have different kinds of mathematics experiences and this can form relationships with different kinds. They may be motivated differently within the different sorts of mathematics. In addition, within each of these kinds of mathematics (described in detail in Chapter Four), kids are actively, constantly positioned by the teacher, by classmates and by themselves.

In their work, Holland et al. use the work of Dreyfus to make the point that salience, expertise and identification codevelop. They do not use the categories in this stage-based theory to describe individuals; nor will I. If we think about something as basic as learning to drive, we do not simply progress through a set of categories and emerge as finished. The other day, Rufus, sitting in the back seat of the car, told me that I was having trouble parking the car because I was "afraid." He was right: I scratched our new car the week before doing the same thing. Faced with a difficult driving challenge, I move back through the stages of expertise, back to when I first learned how to park and I talked to myself. Emotion and motivation follow me every step of the way. Which brings me to another critique of these stages. In this formulation of expertise, emotions factor in only at the level of competence. One cannot progress beyond competence unless one identifies with the world involved. Well what about beginners? How do they progress through without the desire to learn more mathematics, or to do well in school? Stylianou and Silver's study of expert knowledge in mathematics does not suggest to me that we encourage beginners in mathematics to only apply rules in a rote manner, rather, that beginners might progress further and learn more through the kind of creative engagement experts perform (2004).

Throughout my year of analysis, I became more and more convinced that the story I was telling was about the felt experience of being in math class, including the emotions, memories, relationships, and knowledge. I am drawn to subjectivity as a way of tying together all these felt strands. Emotions and relationships have a way of falling out of academic arguments. I currently think of subjectivity as our ongoing process of feeling, both the flux of experience (Holquist, 1990) and the space of authoring (Holland et al., 1998). Subjectivity is interconnected with learning, with attention, with memory, with motivation.

After describing identification as the process of seeing oneself as an agent in a figured world, perhaps conscious of the individual being perceived as acting alone in this definition, Holland et al. remind us of the critical importance of relationships in this process. The individual is not alone negotiating the figured world of the activity—not at all (although my driving example makes it seem so). Instead, a web of relationships mediates every aspect of the process. Lorena and Sade sit close together; Luis talks with Ms. Emerson; Tony, Arturo and Felix playfully race through the work. We learn as we work with others, and we also learn the heuristic habits that define a figured world. Luttrell writes of the "web of care" that characterizes young people as they engage in unceasing activity to build and strengthen connections with others (Lico & Luttrell, 2011). This web of care creates the possibility of learning, since as Vygotsky stressed, it is the *interaction* between people that mediates learning. Others help a person see the importance of the activity, teach them rules, demonstrate competence and not. As we see here, close friends worked together in math, which both strengthened their relationship (not always) and shaped their knowledge.

Relationships with teachers also matter tremendously. In a study of two groups of women, reflecting back on their schooling as they entered adult education programs, Luttrell (1993) found that the women organized their view of schooling around "teacher's pets." Most of these women, which included a group of white working-class women raised in a city and a group of black working-class women raised in a rural environment, spoke about feeling uncomfortable in school, and related those emotions to class differences between teachers and kids. Stories revolved around either being or not being the "teacher's pet." Other girls were picked to be the teacher's pet because they were the children of professionals, or lived in the suburbs rather than the city, or lived in the city rather than the country, had the right clothes, the right shade of skin color, or acted feminine in just the right way. As these differences suggest, these women believed that class and race mattered significantly in how they were treated by teachers. Some of these women had been teacher's pets, and spoke of the experience as if ashamed, of taking up a role that again made them "uncomfortable."

As I will discuss in Chapter Six, being "comfortable" was a word that echoed through my interviews as well. Kids talked at length about their relationships with their teachers, whether they "got their attention"(Desi, Second Interview). Kids' narratives of their mathematical experiences frequently featured the voices of their teachers, interwoven within narratives. Like Luttrell, I believe that people's experiences in school are about far more than how much knowledge they gained, rather the "material and ideological conditions under which students and teachers enter into relationships of knowledge, power and care"(p. 541).

How individuals author themselves in cultural worlds over time: mediation and fossilization Part III

Studying identification takes time because identification takes time:

> Forming an identity on intimate landscapes takes time, certainly months, often years. It takes (and makes) personal experience to organize a self around discourses and practices, with the aid of cultural resources and the behavioral prompting and verbal feedback of others. It takes the heuristic developments of dispositions and savoir faire to imagine the world and to identify with the figured world. Conceiving oneself as an agent whose acts count in, and account for, the world cannot happen overnight. (Holland et al., 1998, p. 285)

In Chapter Seven, I detail how the focus kids changed over time in their mathematics classes. To understand identifications as changes, shifts, I had to analyze their self-authoring across time through the interviews. I used narrative analysis to do this (explained in Chapter Three). In order to theorize these changes, I returned to concepts of thickening and fossilization. *Thickening* describes the process through which kids become associated with particular roles, or positions, in a social space (Leander 2002; Wortham, 2005). Stanley Wortham described how over the course of a year in a social studies class, one particular girl became identified as an outcast. Her positional identity thickened over time. His analysis was powerful, but did not include the kid's perspective. Wanting to expand into kid's own self-understandings, I borrow Vygotsky's term: *fossilization*, and use it to describe the process of understanding oneself through the experience in cultural worlds. Some aspects of our selves, from the routines that seem to make up our lives, to the ways in which we make meaning of experience, can develop consistency over time. For Vygotsky, behaviors can become fossilized (Vygotsky, 1978). From a Bakhtinian perspective, life repeats because the process of being addressed by the world, and responding, is never ending; *being* itself is constantly cyclical. Without routine behaviors, we would always have to be making new meaning of experience. I looked for how certain self-understandings became more fixed over time. For Bakhtin, both change and stabilization of a person's self-understandings are part of the process of dialogue with the world.

In this study, I explore how self-understandings develop through experience in figured worlds, and through the meaning making that kids do as they are addressed and answer in these worlds. Kids don't just learn mathematics in their math class, they learn how to name themselves as math learners. I am interested in understanding this process, and in doing so connecting the thread that runs through this chapter: process. In the end, there will not be a checklist of which kids developed Identification with Mathematics. For now, I am satisfied that I better understand identification as a process, interrelated with authoring the self, positioning, motivation, salience, expertise and relationships.

Chapter Three:

Methodology

McDermott, Goldman and Varenne (2006) wrote that it can be dangerous when a researcher focuses on individual children in the context of American schools, particularly those that the system already defines as different. This kind of attention can lead to finding more differences and deficits in the individual children. In addition, the focus on the child can distract from critique of an oppressive system. In one study group during graduate school, out of eight students committed to social justice in education, I was the only one who was planning to do analysis at the level of children. My colleagues shared the concerns of McDermott et al. (2006). These critiques of research at the level of children, particularly children who are labeled as different and deficient, are critically important to me. I made the choice to work with children (and their teachers) in my study because I believed that their contribution would be irreplaceable. However, I remember these critiques throughout the process, hoping to work with as much thoughtfulness and care as possible. I begin with these critiques because they illuminate the stakes of my methodological decisions.

This chapter first describes some of the larger choices that framed my work. Second, I focus on ethics and relationships. The last section of this chapter details my ethnographic work and analysis, interviews and narrative analysis, and mathematical data collection and analysis.

Critical Methodological Choices

Some choices were made when I decided on my conceptual framework. Many methodologies would not work for my purposes. A group of authors with similar research questions, led by Melissa Gresalfi, did "field work" retrospectively through video analysis (Gresalfi, Martin, Hand & Greeno, 2009). Also with similar research questions, Ilana Horn's work used materials gathered by others (interviews, field notes), again retrospectively analyzed (2008). I knew that because I understand the classroom as a complex space, as a figured world, my physical participation in that space was necessary. I do not think I could have discerned much of what I learned here from video someone else took. Experiencing events with the participants allowed me to better understand the perspectives of the kids.

My interest in identification, a long-term process, meant that I needed to do longitudinal analysis, not just provide a snapshot of a classroom and children. In addition to the sixth grade visits in the spring, I visited Ms. Marquez's classroom once a week for an academic school year, coming before class began and staying a bit to chat with Ms. Marquez. Without the sixth grade pilot work, I would never have been able to see transformations across classrooms. Without a full year of ethnography in seventh grade, I would have missed critical shifts in this classroom.

I also needed interviews. To me, neither the interviews nor the fieldwork were primary in this study; it was their relationship that was absolutely necessary. In the interviews, kids gave me a different perspective on the classroom, which deepened my analysis. They reminded me of so much that I had forgotten about being a student, like the way it feels when a teacher looms over your shoulder to check your work, telling you "do this do that"(Ana, Second Interview). Without the interviews, how would I be able to explore the identification process for Rita, a quiet girl who probably would never have revealed such things in class? I also needed to do more than one interview. Without two, I would not have been able to see change, such as how Desi shifted in the way she named herself as a math learner. I interviewed a total of twelve kids, nine of them twice. That nine were my focus kids.

Mathematics scholars Roth and Radford (2011) recently published a study grounded in cultural historical activity theory and Bakhtin, analyzing the connections between interaction, mathematical learning and emotions. The book-long study analyzed a single moment in the class, when a small group was trying to find an algebraic pattern. The design of the study, while it analyzes the behaviors of the participants in extreme detail (like the emotions of each moment), did not include interviews with the children involved in these emotions. Their rationale, following activity theory, is that activity is the smallest unit of analysis that incorporates emotion, learning and interaction, and had to be observed. Here we have educational researchers pointedly gazing at kids and attributing emotions to them. In my opinion, work such as mine, looking to see how subjectivity affects mathematical learning and identification, requires the participation of kids, not just the observant eye of an adult.

Cobb et al. (2009) have critiqued work on mathematical identities because of a lack of analysis of mathematics. I planned a longitudinal study to closely follow mathematical learning of one topic over time. I wanted to be able to describe how kids learned mathematical content, over time, and how this learning subsequently affected identity.

These were the non-negotiable aspects to the study. There were plenty of places in which I had to negotiate. My first major decision, made right after the proposal meeting, was to decide where I would do my work. As I wrote in my proposal, I had already done fieldwork with a group of sixth-grade kids in a school in Midwood. Ms. Emerson, one of the teachers in that class, was particularly supportive of me continuing my research with these kids. She saw this particular group of kids as distinctive, having unique perspectives on school and themselves. Ms. Marquez, the seventh grade teacher of these same kids (all of the kids with IEPs move together from class to class) welcomed me into her classroom by the middle of September.

I also had some firm parameters for my participants. I wanted to study kids in middle school, particularly seventh or eighth grade. In the pilot study for Urban Math that interviewed kids in sixth, seventh and eighth grade classrooms, we found that sixth grade kids did not reflect as openly on their classroom as did seventh or eighth grade kids. We heard more extended opinions from the slightly older kids.

I also wanted to study a classroom in which there was diversity. Yet, as I have already described, I am working in one of the most segregated neighborhoods in New York City, in a school that is 91% Latino. As I began to get to know the kids, this concern fell away. I did not see them as a monolithic group, rather a very distinctive group of individuals.

In my proposal, I wrote that I would chose focal kids based on heterogeneity so that common aspects of the process could emerge. I looked for heterogeneity based on positioning, and social categories such as labels of disability, racial and ethnic categories, and gender. I wanted to choose as many kids as possible that were in both classrooms (both the sixth and seventh grades I followed). I looked for kids with interesting or important stories to tell, and interviewed as many as I could in the middle of the year (in pairs). Desi, for example, had a strong story-telling style, able to narrate her experience with extended stories. Luis stood out in his classroom for his distinctive approach to math, and thus was an important focus kid. Rita's story about no longer liking math was important, as I was studying the process of identification. Clementine stood out once I had heard her narrate her memories of doing mathematics. I interviewed twelve kids for the first round of interviews.

I then needed to choose the final focus kids from those twelve kids. I wrote a memo about each kid, telling the story of his or her year paired with preliminary analysis from one interview. I then looked for patterns across the kids as a whole, and identified kids who best represented those patterns. Luis for example, was an example of a kid who narrated himself using the discourses of "critical thinkingish" mathematics. I also made some choices based on representing social categories. One of the focus kids I chose, Ortiz, decided not to do a final interview, limiting my choices amongst boys. For my final nine focal kids, there were six girls and three boys. All of the focus kids identified as Dominican (with one child Dominican and black/American and another Dominican and Ecuadorian). Six had special education labels of learning disabilities, and three did not. Seven were in my sixth grade pilot study.

When I wrote the proposal, I intended to focus on rational numbers (fractions, decimals, and percents). In my first meeting with Ms. Marquez, she told me that "fractions are a pit" and she avoided them as much as possible. Fractions are notoriously difficult for kids. Ms. Marquez, knowing that kids came into her classroom with misconceptions about fractions, found the topic too difficult to teach. As it was not a focus of the seventh grade test, she avoided it. About a month later, she told me about the disagreements in the math department about teaching integers (see Chapter Five). I continued to take careful notes whenever fractions came up, but I realized by January that the real story of the year was integers. Not only was it difficult for many kids to memorize the rules, there was conflict over the status of models. The kids saw integers as particularly important, using them to symbolize the difficulty some associated with seventh grade mathematics.

My proposal included a clinical interview, in which I would interview kids individually, asking them mathematical questions to see their individual strategies. I decided not to do this interview because I had not yet finished the first round of interviews. It proved to be very difficult to find space and time to do the interviews (more on that below). I decided to focus on the two narrative interviews and leave out the clinical interviews. I did add an integer question into almost every interview.

Another change from the proposal was the mathematical autobiographies. My plan was to encourage kids to tell stories about their history as mathematics learners by having them write and share mathematical autobiographies in small groups. I worked with kids in small groups, first brainstorming possible topics to discuss and then writing a short narrative. I had planned to do this twice in the year, but I was disappointed in the first set of autobiographies. For many kids, they were very short and felt forced. Something about the way I introduced the exercise encouraged the kids to give me what they thought I wanted, school scripts such as “Math is everywhere.” I asked kids to share their stories with the small group. Only then did I hear a richer set of stories. Clementine and Bobby both told powerful stories of their histories of math learners, which I videotaped. If I could do mathematical autobiographies again, I would deemphasize the writing, and try to encourage oral storytelling. The stories that I heard spoken aloud during this exercise, I heard again (Clementine and Bobby) in interviews. Because of this limited use of this exercise, I do not describe it in more detail.

My choices did not end when I began writing. In writing this dissertation I had to make important choices. One of the first was how to name the kids, as I wrote in Chapter One. In various drafts of this project, I have called them students, kids, children, adolescents, and young people. In the classrooms I worked in, both children and adults used the word “kid” most often, followed closely by “student.” Student is just one aspect of the person. Kid is a more inclusive term, although perhaps somewhat informal. I decided on using kid, since student limited the kids to one possible identity.

Another choice was verb tense. I kept my field notes in the classic “ethnographic present,” which helps the reader feel a part of the action. However, such a use of the present tense can give the illusion that the cultural worlds of this classroom continue unchanged

(Emerson, Fretz & Shaw, 1995). I decided to use the past tense for both ethnographic and narrative analysis.

These are the major changes and the most important choices that I made in my work. In the following sections, I explain the work in detail: ethics and relationships, ethnography, interviews, narrative analysis, mathematical analysis and credibility.

Ethics and Relationships

Ethics. In this study, I thought of ethical behavior as being both thoughtful and careful. I focused on being thoughtful during data collection and on being careful during data analysis. In order to be thoughtful to the people involved during my study, I first presented the study as a choice. I tried not to give any kid the impression that she or he had to work with me. Even when kids did return parental consent forms and student assent forms, I respected their privacy if they did not want to speak to me at any time. Kids gave me clues about this, looking away from me or hiding their paper. I tried at all times to pay attention to the feelings I saw in kids and teachers, and to respect whether they wanted to talk more or wanted the conversation to end.

Most of the time, kids wanted to talk more. Part of being thoughtful was minimizing my role as a distractor during class. I wanted to be thoughtful to the teachers, who had welcomed me into their classrooms. I adopted a much quieter persona as a researcher than I usually have with kids, speaking softly and avoiding big dramatic moments. Here, I am not suggesting that I was somehow absent from the classroom, an objective eye floating above it all. Such a notion is impossible, as I influenced the class just by walking in. I just wanted to be able to develop relationships with kids and observe them doing mathematics, while not making the teachers' jobs even more difficult. Because I was an adult, kids expected me to help them with their work. It was tricky to negotiate this with kids in a thoughtful way. I did not refuse these constant requests, but tried to avoid positioning kids as not knowing, or that they should always look to the teacher for answers. I dealt with ethical issues during fieldwork (Federico and teasing, which I describe in the next section) and interviews (how I handled the questions on gender and race). Field notes frequently were places in which I thought through ethical issues.

When I finished data collection, I began to think about the term careful. I was careful about protecting the privacy of my participants throughout the process. I have changed details about the school so that it would be more difficult to recognize. I did not tell people where I was doing my research. I was particularly careful about this because during my fieldwork, almost all of the kids in the study were unaware of their disability status. They knew that they had an IEP, but not for what kind of disability. By the end of eighth grade, however, the kids had the same information that I have about their disabilities.

Almost all of my focus kids have expressed interest in reading my "book" when I finally finish. I did present them with some of my analysis at the end of their eighth grade year. I have further thinking to do about next steps with my participants, and how I may further disguise participants for publication. I have some kids who wish that I would use their real names. Carmen (not her real name) felt that because I was not using her real name, she would not get the credit for her great ideas.

The second major issue that I had during data analysis was being careful about how I represented the meaning making of participants. In narrative analysis, I explored the emotions of the kids, and how they made sense of their classrooms. I want to be exceptionally careful about the claims I make about the subjectivities of others. This theme emerges throughout Chapter Six and Seven, the two narrative analysis chapters.

Relationships. Throughout my fieldwork, I worked to position myself as an interested adult. I wanted to hear kid's opinions about math, so I had to develop relationships with kids around math. This was generally successful with members of the class. Some kids, especially ones who had seen me in their classroom the year before, seemed to enjoy telling me about math. I remember the day in January when Desi rushed up to greet me, telling me she had something to tell me about math. This confirmed that she saw me as an interested adult, someone to save her story for. This enthusiasm presented a problem when I could only chose a limited number of kids to interview.

There were other kids who clearly did not want to develop a relationship with me. I think that some kids, particularly those who were positioned as "struggling" in mathematics, did not want my attention. Lorena in particular was fascinating to me, but she was very clear that she did not want to talk to me. For example, she would not respond when I spoke to her, turning her face to the other side. I had to give her the privacy she wanted, conscious that my interest must have felt uncomfortable to her. This was one of many times when I noticed how my emotions were part of my work as a researcher.

Barrie Thorne (1993) wrote powerfully about her feelings about the kids in her study. One girl provoked feelings of disgust, another respect. Her writing was critical for me, as it allowed me to analyze the feelings I was having about the kids. Following the lead of Kleinman and Copp (1993), I used my emotions as a part of my analysis: recognizing them and looking for reasons either within my history or in the context. Without these authors, I think I would have ignored negative feelings I had about certain kids. In the beginning of my study, I had trouble liking Bobby, who chastised other kids about their mathematical skills. Over time, I developed a relationship with Bobby and better understood what prompted him to be so rigid. Later in this chapter, I analyze in detail my interview with Bobby, which brought up issues of race that made me uncomfortable. Again, I did not ignore this discomfort, but have brought my emotions into my analysis.

I also had difficulties throughout the year with a group of boys who teased Federico. Ortiz and Tony both teased Federico, referring to how poor he were and how he smelled. Another day during a small group work, Tony began by teasing Federico, which was then taken up by Vinny. Vinny and Federico then began to speak to each other in increasingly angry tones, now taunting each other about being poor. These were the type of moments that were most difficult for me as a researcher. As a teacher, I would have intervened. But what was my role as a researcher? I tried coming closer, hoping the proximity of an adult would change their behavior, but it did not. I moved away, unsure of what to do. After writing about this issue in field notes, I saw another instance of teasing towards Federico. I then decided to bring my concerns to Ms. Marquez. I did not see Federico teased again for the rest of the year.

Building relationships with the kids was part of my research design because of my concern with equity. Even within the subfield of mathematics educational research concerned with equity, there have been studies that eliminated race from their analysis because it was not explicitly mentioned (e.g. Gresalfi, 2009). Kid talk about race (or any other social identity) is extremely limited in mathematics education literature (Martin, 2008; 2009; Nasir, 2011). I knew from experience that kids did talk about race, and class, and gender, and sexuality, and disability in math class. I believe that discussions of this kind are limited by the methodologies of mathematics education. During two-week teaching experiments, or analysis of a limited video sample, or occasional visits using a observational guide, kids may very well not talk about these issues around a researcher (or a video camera). Kids will wait until they are comfortable before sharing serious feelings, or making certain jokes. This is another reason that field work was necessary— I felt that as a white researcher, I needed to invest time in relationships if I wanted kids to share their thinking with me on such complicated topics.

Even though my focus was on kids, I needed to develop relationships with the adults in the setting as well. As I wrote in the proposal, my research relationships were clouded in the sixth grade pilot project because I had previously worked as a professional developer for the two teachers. They would turn to me in the middle of classes and ask me what to do.

This taught me to be clear with the seventh grade teacher about my role. Ms. Marquez welcomed me into her classroom, even as I told her that I was not there to provide her with professional development. She often took the time to talk to me after class, sharing her thoughts about the lesson, or more often, her kids. She felt deeply about her mission as a teacher, and was highly respected by her kids. As will become clear in Chapter Four, Ms. Marquez was genuinely conflicted about the pedagogies that she used in her classroom. At one point, I thanked her, and she instead thanked me. She told me that she really enjoyed our conversations— just having someone to talk to about mathematics and pedagogy was helpful to her. At the end of the kids' eighth grade year, I visited the school. I had sent Ms. Marquez a draft of Chapter Four, and I wanted to hear her feedback. I expected to hear what she disagreed with, or had questions about. Instead, she told me that reading that chapter was the most powerful form of professional development she had ever received.

I felt more conflicted about my relationship, or lack of relationship, with Ms. Alton, the special education teacher who came into the classroom in January. She was always friendly and helpful, but we only sat down to talk once, and so I never developed a relationship with her. As I will detail in Chapter Four, her entrance into the classroom came at the same time as other changes, which cast her as a villain. In hindsight, I should have addressed this problem as it emerged, and made a point to sit down with her. Taking care to develop a relationship would have added complexity to my analysis.

Ethnography

Ethnography begins with field work: immersing oneself in a social setting, participating in common, everyday practices, and developing relationships with members of that setting (Emerson, Fretz & Shaw, 1995). Ethnographic work attends to processes and meanings, particularly those of the members of the social setting. In this study, I focused on the meaning making of the kids in the class. While in the classroom, I sat in the seats with the kids, doing work with them.

Analysis. As I worked in the classroom, I jotted down notes, particularly direct quotes. Each day after observation, I wrote field notes: detailed descriptions of people, activities, and the meaning that people make of those activities. These were time-consuming, usually taking me more than three hours to document a ninety-minute class.

I utilized a grounded theory approach, writing memos to develop theories about what I noticed about the positioning and cultural practices in the classroom (Glaser, Strauss & Strutzel, 1968). Memos are analytic pieces written in an informal voice, designed to develop ideas through the writing. Through memos I developed theories about the classroom, which I then checked through continuing participation in the classroom. For example, in the beginning of the kids' seventh grade year, there was a huge emphasis on the red and green cups that were stacked on each desk. Ms. Marquez asked the kids to display the green cup when they understood, and the red cup when they were confused. I began to develop a theory that the kids who used the cups to display confusion were those with the highest mathematical status in the classroom. In subsequent trips, I recorded who used the cups, and found that in general my theory was correct, with one exception: Desi. This is an example of the ongoing theorizing that is part of fieldwork. My next move would be to look carefully at the exceptions to patterns I found.

Writing memos was extremely important for me in my quest to see the classroom not as a familiar, but as an unfamiliar space. I posed this question to myself: what is the game being played here? Like Holland et al. (1998) who describe figured worlds as places where people play imaginary games, I looked for the ways in which people made this cultural world play by some rules and not others. At one point, I listed all the ways in which each kid was being ranked in that space. I noticed several charts detailing individual homework average, others who had made honor roll (see Appendix B). Homework was stamped and graded as Ms. Marquez walked around, a number quantifying their performance. Exercises such as these sharpened my ability to see the classroom anew, to recognize the constant focus on individual performance.

While I was able to record direct speech to some degree in my field notes, I wanted to be able to analyze transcripts of teacher and kid talk in the classroom. I videotaped eleven lessons over the course of the year. I transcribed all my video and audio data myself, since in so doing I was able to immerse myself in the data. Alongside each transcription, I worked on analytic memos, preserving the analysis that can come only from extended and careful study of data. This attention to language was important for documenting such details as exactly how Ms. Marquez named the three ability groups at the end of the year ("my group," "my independent group," and "Ms. Alton's group"(transcript, 4/13/11)).

My second rationale for video was to allow me to keep my focus on the experience of the kids, knowing that I could return to the video if I wanted to analyze the lesson or teacher talk. I often left the video capturing the class as a whole while I sat with a particular group, so that my field notes document their participation while the transcript allows me to document the whole class discussion. I then analyzed the video to help prove and disprove claims, such as how I theorized a split between two kinds of mathematics in the classroom.

Every time I brought video into the classroom, I felt its effects. Certain kids clamored to be on the video recorder, most memorably Carmen. I have many moments of video that record her fixing her hair in the camera, or asking me to turn the camera on her. There were a few students in the class who did not want to be filmed. I made sure that they were not, without making a fuss that would further embarrass them. On girl in particular would eye my camera nervously when I took it out, never perfectly sure that I would not record her. At these moments, I wondered about my use of the camera. It aided analysis, for sure, but did it make my gaze too strong on these kids? I also found that some kids would forget that the camera was on. I have several recordings of kids gossiping, or flirting, or teasing each other. I chose not to transcribe these moments because I felt intrusive, recording kids that were unaware that I was still recording.

Since this section deals with my work with the participants in the field, I will end it with one final concern. What benefit did the participants receive from this work? In my Institutional Review Board application, I wrote that the participants would not receive any benefit from this study. Yet, as my relationships grew with kids, I think that they did benefit from having an active listener. My participation created a space in which they felt it was appropriate to tell stories about oneself in school. Some kids clearly relished the interviews, telling me long stories. This expectation—that their opinions about their classroom mattered—perhaps helped them formulate stronger opinions about themselves as math learners than otherwise. Through this practice of telling Rachel stories about yourself and math, the relationship between yourself and mathematics may become clearer.

Whether this aspect of their participation was a benefit or not is unclear, as perhaps it encouraged certain kids to name themselves as not liking math. As I write later in the chapter, I worry that some of the questions I asked in the final interview may have encouraged kids to see themselves as fixed kinds of math learners. That is the very opposite of my intention, yet it emerged from my work. Perhaps, when my work takes another form, I can revisit this issue of benefit with the kids. I wonder if, like Ms. Marquez, they would welcome reading my analysis in some form and contributing to further iterations.

Interviews and Narrative Analysis

Following Holland et al. (1998) and Bakhtin (1981), I am interested in processes of authoring the self (both moment-to-moment and longer term) and how these processes contribute to identification with mathematics over the long term. Recognizing that an individual participates in multiple figured worlds, and that each world has its own voices (or discourse practices), I want to see how an individual takes up, and possibly transforms these voices. Thus, I required evidence of kids talking about themselves as math learners both in the process of classroom activity and in reflective space and activity, i.e. the interview. Because I am looking at a process, I needed multiple interviews so that I can analyze change over time.

Before I detail how narrative analysis contributed to my study, I want to emphasize another aspect of relationship. As I worked with the kids during fieldwork and interviews, I paid close attention to my relationships. At the core of these relationships was respect— I listened to the kids, taking their words seriously. I know this mattered to them. For my entire first year of fieldwork, I focused on analysis of the figured worlds of the classroom. The following year, data collection complete, I worked on analysis of individual kids through the interviews. The relationships that I had built during the fieldwork were critical during this phrase because they reminded me that I was writing about a complex individual that I knew and respected.

Interviews. An interview is the chance to focus attention on the meaning making of a one (or more) persons. That meaning making occurs necessarily in interaction with at least one other person, the interviewer. As I designed the interviews I tried to plan that these dialogues would bring the most possible meaning-making opportunities into the conversation.

Design of the interviews. In my proposal, I planned to interview the focus kids three times, one of which was a clinical interview. I planned that all interviews would be individual; assuming that kids would be able to share more about their history as mathematics learners if no other child was present. Both of these decisions I changed during the course of the study. I had both practical and theoretical reasons for these choices.

The first was the practical limits on my ability to interview kids. By the first week of November, I had emailed Ms. Marquez several times about wanting to start interviewing. The only times she could arrange was at lunch and during her own class, so I began by taking kids out of her class. Before class on the morning I was to start, Ms. Marquez took me on a tour of the building, going to the very few places in the building that afforded privacy. We were turned out of the main office. We were turned out of empty classrooms, since all would be in use during the math class. Finally, we found a spot two floors below. Ms. Marquez popped her head into a small windowless office, asking if I could use the room. When she was told yes, she pulled me into the room and introduced me to the speech therapist. Immediately I had concerns. Should I use this room, apparently the only private space I can find in the school? Or would the presence of a special educator in the room influence how the kids talked to me about themselves, or special education? I felt I had no choice, so I nodded and smiled and thanked them both.

Ms. Marquez and I raced upstairs to the classroom for the start of class. As I took Luis back downstairs into the room to begin the interview, he chuckled at the spot I picked. He called the room "the dungeon," not because of the presence of the speech therapist, but because the dean of kids, in charge of discipline at the school, also shared the room. In the middle of our interview (which also included a fire drill) the dean of kids came in to get something from her desk. Luis immediately joked with her, asking her if she had any dead bodies hidden in the room. After further inquiries, I found that this one tiny room was also the place in which all kids with Individual Education Plans did their yearly testing. So this one room that I chose was both the site of major disciplining, special education assessment and special education interventions. This spot was too loaded with meaning for interviews, containing possibly troubling traces of many of the figured worlds that I wanted to explore with kids. It also reminded me of the secrecy associated with the practices of special education, here explicit in the secret space—the dungeon—that was used for both discipline and special education practices.

After negotiating for several weeks, Ms. Marquez and I decided that I could interview kids during lunch in her classroom, as long as they were able to eat lunch. This meant that I had a very limited time each visit for interviews: rather than ninety minutes to use for multiple individual interviews each visit, I now had only the twenty-five minutes of lunch each visit. In order to use the limited time well, I began interviewing kids in pairs during their lunch break in the very beginning of December. While Ms. Marquez left the room during this time, there were often other teachers and kids in the room. I was concerned that the presence of other people might make the kids uncomfortable. The kids, however, seemed comfortable with the arrangement, possibly because it was their own space, or perhaps because it was semi-public. They especially enjoyed the pizza lunch that I provided. The room itself became part of the interviews, as the kids would use artifacts from the room to make their points clear. Clementine, for example, gestured to the board to show me an example of the kind of "gibberish" that confused her in math class (First Interview).

My narrative makes several points about Design versus improvisation in research. As I had to adapt to the research site, I had to accept time limitations that made individual interviews unfeasible. I interviewed the kids in pairs, which I had done during my pilot interviews, but had decided against for my dissertation research. My initial rationale for paired interviews was that pairs can produce more talk in general than individual interviews for kids at this age. My rational for individual interviews was that kids would be more comfortable sharing stories of their math histories. And a further drawback was that my first interviews, with Luis and Desi, were individual interviews in the "dungeon," while the rest of the first set of interviews were paired interviews in the classroom. I considered whether I needed to interview Luis and Desi again, this time in pairs. I decided against it, for there seemed to be as much difference as similarity between the individual and paired interviews.

However, I did notice that the paired interviews had at least one noticeable element that the individual interviews lacked—disagreement. I tended not to disagree with kids during interviewing. Kids did tend to disagree with each other when one made a claim about herself or himself or the classroom that the other disagreed with. This kind of interaction proved to be very interesting in analysis of positioning and meaning making. Federico, for example, positioned himself as a "chistoso," one of the joking boys of the classroom (First Interview). Elisa, who was being interviewed with him, challenged this view, telling him he was actually a "shusher."

Federico then qualified his involvement with the chistosos, explaining when and why he did associate with them. Because of their interaction, I learned more than I would perhaps have learned from an individual interview with Federico. In citing the interviews, to conserve space, I call this same interview (Federico, First Interview) at times and at other times, (Federico and Elisa, First Interview).

And yet, for the final interview, I chose individual interviews. I prepared carefully for these interviews, collecting all the data that I had on each focal kid. Most of the discussion during that final interview was designed for that individual kid alone, for example bringing up a particular moment of their work in math class. I am glad that I had such focused time with at least nine kids at the end of the year, although once again, we ran into space issues. I planned those final interviews by first interviewing those that I was positive would be my focus kids, and then putting the kids that I was not sure of at the end of the list. And, as I should have predicted, I was not able to do my last day of interviewing because all private rooms were being used for state exam re-takes.

Both interviews were semi-structured; I planned questions but did not insist on controlling the conversation. I wanted kids to feel that they could bring up topics that they thought were important. For the first interview, I designed a full Protocol (Appendix C) but I did not follow it. Discussion tended to vary greatly depending on the individual or the pair. The bulk of time was spent talking about their current math classroom and their histories as math learners.

The final interview, as I wrote above, was based heavily on preliminary analysis of my entire data set about each kid. These interviews were full of relevant narratives. The full protocol is in Appendix D. I was particularly pleased with the stories that I heard in response to these questions: “What was the story of your year in math?” I followed up that question by bringing up specific moments in class to discuss. I was able to work directly with my own developing theories about a kid's experience, asking them for their own take on particularly memorable moments in the class. I asked Rita, for example, about a moment in which she got up and almost shouted at Ms. Marquez for "forgetting about the variable" in an algebra problem (field notes, 1/4/11). By directly asking Rita about that moment, I was able to get her perspective on a moment that was important in my analysis. For each moment I picked, the kids recognized that moment. This reassured me that these were critical moments in the class for them as well.

In the second interview, I asked the kids: "If there are certain kinds of math learners, and there may be or may not be such a thing, what kind are you?" A bit later in the interview I asked kids the same question, this time from the point of view of their teachers, families, and friends. These questions were designed so that I could hear a label, a category, about themselves as math learners. I wanted to know, first, if such a thing existed. I wanted to make sure in how I asked the question that they could reject the question outright. Yet no kid did. All of the kids answered these questions, some using single words, others descriptions of processes. My concern, which I did not formulate until analysis, was that I was forcing them into naming themselves as particular kinds of math learners, which may make them more certain that there *are* different kinds of math learners. That effect would be the opposite of my intentions in this study. I want to complicate simplistic notions of "a math person," or "fast at math," rather than encourage kids to see themselves in a limited way.

On the other hand, their answers have allowed me to look at how kids described themselves across the kids, rather than focusing on each kid alone. For example, I found that kids were most likely to use the binaries of fast/slow, get it/struggling to understand themselves, as we explore in Chapter Seven. Looking back into my entire data collection, I saw that this pattern was also present in fieldwork and the first set of interviews.

The final questions were the most complicated to analyze, as I had a level of emotion around that question that I did not have for other questions. It was important to me that kids had a chance to name themselves, rather than me naming the kids in terms of gender, race, class, ethnicity and disability. I had tried with some kids to pilot this question during the first interviews, but I was not direct enough. I asked, "How would you define yourself?" without being clear I was looking for social categories, and so Luis defined himself as "baseball" and "family." While those are critically important to Luis, and I respect that, I also wanted to be able to name Luis in more traditional categories. This final iteration of the question was designed to give them choice, but also to give them parameters:

> Last question. When doing research, we usually collect information about each person's gender, ethnicity etc, like on the census. People who read my paper will want to know some information about you. But I want you to pick how I describe you based on gender, ethnicity, race, etc. (*Pause to discuss terms*).
> - What gender are you?
> - What race or ethnicity best describes you?
> - Do you have an I.E.P? (What is an IEP?)
> - Does that have anything to do with math? (*repeat for all their answers*)

I regret the way in which I first asked about gender. When I read over the transcripts, I can see how nervous I am to ask the kids about race, ethnicity, etc. Perhaps because of this nervousness, I posed the gender category as an easy choice. Here was how I posed the question to Ana:

> **Rachel**
> So I try to,
> so that is the reason that I made this study is because I wanted to,
> sometimes I think we don't talk very much about how the kids experience the class,
> how kids feel about what they are learning in class.
>
> So that is what this study is about,
> so when I am doing that study,
> I need to report,

like,
about the kids.
I need to sort of do a picture of the kids,
so I need to say the gender of the kids.

Ana
okay

Rachel
What gender do you choose? [Smiling]

Ana
female. [Laughing]

Rachel
I am just asking.

Ana
I can't be a guy,

Rachel
You don't want me to change you into a guy? [laughing]

Ana
oh no.
(Ana, Second Interview)

Throughout this exchange, Ana and I are laughing and smiling. I am giving the impression that gender is an easy choice. What if I had been asking a kid who was questioning their gender? I then go on to ask about race and ethnicity, and when I ask about that my face turned serious.

I had one particularly troubling moment while asking this question about race and ethnicity in my interview with Bobby. Bobby, who was one of two more dark skinned kids in the class. He first told me that he was Hispanic and black, but then immediately changed that to Hispanic and American:

Rachel
Okay,
I'll say the city you live in,
because it is a big city,
and this is a school in New York City somewhere and blah blah blah.

And so the different things that I have to
to like say when I am like explaining a person's point of view,
I say their gender,
So?

Bobby
Boy,
male.

Rachel
Whether or not,
what race or ethnicity the person is?

Bobby
I'm Hispanic and black.

Rachel
Hispanic and black.

Bobby
NO,
Hispanic and American.

Rachel
Hispanic and American.
What is the difference to you?

Bobby
American is you were born here,
you're like in a good neighborhood.

Black,
even though I think,
black,
not like to be racist,
but being in bad neighborhoods,
around my aunt,
she lives in [street names].
and that is like a really bad area.
(Bobby, Second Interview)

According to Bobby, black was connected to living in "a really bad area." Later in the interview, Bobby distinguished between black and American in that Americans are "calm." He continued to build upon this idea, creating a difference between black and American, talking about people in his aunt's neighborhood who he identified as black, and who were "not calm." He very clearly delineated how he and his mother were not black, because they were calm and because they were "medium" in how much money they had. Bobby, speaking in an interview with a white woman, separated himself from blackness, and instead identified as Hispanic and American. He also clearly worked to put himself and his family into the middle class, which he described initially as the "medium class."

I felt so troubled by this discussion during the interview; I remember feeling lost, uncertain of what to do. Should I challenge what he is saying about black people living in bad neighborhoods, about not being "calm," as this notion felt related to a history of racist stereotyping of blacks in American as loud? How could I not call him on this, and still consider myself anti-racist? Or was I misunderstanding him? This was the most emotional moment for me in my interviewing. The choice I made in the moment was to keep asking questions.

Upon reflection, I believe that my nervousness about this question comes from white privilege, that those with power can avoid troubling discussions of race. As I continued to ask questions, another troubling idea came into my head. Was this a performance for me, a white "medium" class woman? Was he telling me what he thought I already believed? This made me even more upset. I tried another strategy. I restated some of his comments to him, for example that black people did not have a lot of money, and he immediately said that was not true, "I know many black people that have MONEY, real MONEY." Yet I did not contradict his comment about blacks not being "calm," and I regret that.

Even if these narratives were in some ways a performance for me, the white lady, they also felt like voices from his family. In that sense, they seemed to be messages for Bobby about who he was, and who he was not. In that sense, this distinction between black and American may not have been as racialized for Bobby as it felt for me—he may have been imagining both groups of people as having dark skin. It certainly recalled the argument of Bonilla-Silva and Glover (2004) who contend that Latinos have to deal with the black/white American binary in ways that are different from their home countries. Bobby seemed to be exploring how to define himself using the limited terms available.

Again, I write about my emotion in this interview because emotion is a powerful tool in analysis. By paying careful attention to my emotions, I was able to first, remind myself of the white privilege that at some level made me want to avoid this conversation. Second, I forced myself to find multiple possibilities for meaning, good practice while analyzing any interview. Lastly, I saw the complexity of naming oneself in terms of social identity played out once again. Again, I forced kids into labeling themselves and others. Why did I need him to name himself based on such troubling terms? Why could I not have accepted Luis's answer from his first interview, defining himself as "baseball" and "family?" This reminded me that as a researcher, I continue to categorize. By forcing him to name himself, I put myself in that position. Yet would it have been better if I had just named Bobby?

Recording interviews. As I wrote in my proposal, I videotaped all interviews. As I was hoping that kids would tell narratives about themselves as math learners, I wanted to see those narratives performed with gestures, pauses, and facial expressions. So, as I began my interviews, I used a small video camera to record the kids telling me stories, except for the one kid who preferred not to be recorded. That kid was Ana, during our second interview. I had only the video recorder with me, so I just faced the camera at myself, and began to record. As I began transcribing that interview, I became extremely uncomfortable looking at my own face. I cringed watching my own reactions to Ana, such as how I smiled when I asked her about gender, and looked serious when I asked her about race and ethnicity. I also realized that a critical connection between my theoretical framework and my methods were missing: if I believed that interviews were truly dialogical, why did I just point my camera at the kids, rather than at the kid and myself? I still had six interviews left, so these remaining interviews recorded both myself and the kid. I could tell while analyzing these interviews that I had captured something important for my analysis. There was laughing in all of the interviews, and with this angle, I could see who laughed first and why. I regret not videotaping interaction from the beginning.

Teacher Interviews. At the end of the sixth grade, I interviewed Mr. Pierce and Ms. Emerson together in order to learn more about how they understand the positioning of their kids. During this interview, I asked them to map their classroom for me. I handed them cards with the names of kids, and asked them to take turns placing them down on the table, explaining where they put each kid and why. I gave no explicit direction about which kid characteristics should dictate their placement. I planned to repeat this interview with Ms. Marquez and Ms. Alton at the end of the seventh grade year, but once again, time and space limited my choices. On the scheduled day of our interview in June, we went on that same tour of the private spaces that I went on with Ms. Marquez in November. We finally ended up in the cafeteria with only twenty minutes left to talk. While I had the cards with the kids' names in my pocket, I felt that if we picked kids randomly, I could not make sure that we talked about focus kids, so I led a more general discussion of how they saw the kids in the classroom, and then made sure that we spent time talking about each of the focus kids.

Narrative theory

After conducting the interviews, I began the process of analyzing them. To do so, I drew on a strong research tradition spanning multiple disciplines: narrative analysis. Narrative is a critical element in many theories of how people make meaning of our experience. Sociocultural theorists like Jerome Bruner (1990) emphasize narrative as perhaps the most critical tool we use to shape experience into meaning. Developmental psychologist Katherine Nelson (2010) has traced the development of children's narratives over time and narration constructs memory for young children. She and her colleagues have shown how kids gradually take in the narrative style of their parents (Nelson & Fivush, 2004). Narratives are critical tools for understanding our experience, and narratives themselves are shaped by our interaction with others, as well as the figured worlds in which we operate.

My particular use of narrative analysis is heavily influenced by Bakhtin's theory of the addressivity of experience, and the response of the authoring self (Bakhtin, 1981; Holquist, 1990). Narratives hold a critical place within Bakhtinian theory: a way in which the authoring self, engaged in the process of becoming, makes sense of multiple experiences, which are always engaged with language and power. Skinner, Valsiner, and Holland (2001) used Bakhtinian theory to analyze an interview with a Nepali adolescent. They situated their analysis within a particular "figured world," delineating relevant positioning for the speaker. Skinner et al. analyzed the positioning of the voices that the speaker uses, as well as the way in which he orchestrated voices. In my work, I will find narratives (moments when a person is making meaning through stories, categories and labels) in interviews, field notes, and mathematical autobiographies.

In the tradition of narrative analysis, the analyst first carefully records and transcribes instances of talk that include narratives. I first transcribed all talk in the interviews, attending to pauses, gestures, expressions, interruptions, and emphasis on certain words. The researcher then finds the narratives within larger stretches of talk. These narratives can be analyzed thematically, structurally, or dialogically (Riessman, 2006). Narrative analysis is distinct from other kinds of analysis in that analysts tend to preserve larger segments of talk (narratives), rather than analyzing individual words. This process contains many choices for the analyst.

One perennial concern is the definition of narrative. What counts as a narrative? Perhaps the most influential definition is that of Labov and Waletsky (1967) who first studied oral narratives from a structuralist point of view. They defined narrative as minimum of two sequential clauses that refer to actual events. I chose Desi as a focus kid because of the powerful stories that she told me about learning mathematics. Yet, as I analyzed her interviews through a this lens, I saw that if I took up this definition of narrative, I would leave out much of her most important talk. Speaking about the importance of effort in the classroom, Desi told me that, “No matter how hard something is, you can always like make your goal and set it and be able to accomplish it if you put in effort because nothing should be impossible for you” (Desi, Second Interview). Under Labov’s guidelines, this is not a narrative because it is not a discrete event. Yet it is clearly an instance of Desi’s meaning making. At another point in her interview, Desi tells me “I am slow,” describing herself as a math learner. This is neither a discrete event, nor two clauses. Yet this kind of self-understanding is critical for my research questions.

Because I began with authoring the self as a conceptual framework, I looked for authoring in different segments of talk (narratives, meta-language, and even individual words). In order to find evidence of authoring the self, I looked for voices, such as the voice of Ms. Marquez that I hear echoed when Desi says, “No matter how hard something is, you can always make your goal.” I also paid attention to the narrative aspects of individual words, such as “slow” as Desi uses it. While this is just one word, so not a narrative in any formal sense, in my analysis I saw how Bakhtin (1981) describes a word or mention of an event carries with it the traces of that event. Narratives can be evoked with just a word, and perhaps in time the narrative is forgotten and the label remains. This is the kind of process that I am looking for in this study, so I paid close attention to the relationship between narratives placed in time and space, and words like “slow” which come to stand in for time, space, or a process.

After one identifies narratives, or the critical moments of talk within the interviews, another set of choices around my transcripts appears. I also tried to preserve the interactions between the people in the interview by preserving my words. Extracting only the narratives of the interviewee, without the words of the interviewer, obscures the fact that these narratives were told in response to a question or comment. They are in response, as all communication is. I also used a variant of the presentation of James Gee (1986). I separated narratives into units that were about the same topic, although it might include several utterances (turns of talk) from each speaker. Within individual utterances of a speaker, I separated the utterance into what Gee (1986) called stanzas. As in poetry, a stanza marks a shift in topic or meaning. I also made line breaks after each noticeable pause, also a technique of Gee. I put reported speech, or clearly identifiable voices, in italics. Most of the kids would introduce the use of reported speech by saying, “Oh,” or “I’m like.” Sometimes this reported speech would be internal speech, but was still set apart in this way. I put words that the speaker accented heavily in capital letters, and also included descriptions of gesture.

By arranging my transcripts more like poetry than prose, I was able to look much more carefully at structural elements. Such careful attention to pauses, for example, helped me see moments in which it is hard for the kid to name something. At one point, Federico says that “It was hard for Desi because of her—" (Federico, Second Interview). He then pauses, and reframes his words so that he does not have to continue (perhaps unwilling to name Desi's disability)? Here, I present a narrative from Desi's second interview, first presented traditionally, and then secondly as I arranged it for analysis.

<u>"I remember like learning algebra" presented in traditional style</u>
Desi
I remember like learning algebra and I remember that at first I was really confused, and then the next day I was extremely good at it and I was like, whoa, I like letters and stuff. I'm like I really like algebra and Ms. Alton one of my teachers, she's like wow Desi you are actually really good with letters. I'm like yeah I know that's weird, and then I actually felt really happy and I remember like some of the stuff, and now I feel like show it to me and I will be able to do maybe a problem or something, cause it is mostly stuck in my head and there are other ones that I won't remember.

<u>"I remember like learning algebra" presented in a style adapted from Gee (1986</u>)
Desi
I remember
like
learning algebra
and
I remember that
at first
I was really confused,

and then
the next day I was actually really good at it

and I was like, *whoa, I like letters and stuff* I'm like *I really like algebra*
and Ms. Alton
one of my teachers,
she's like *wow Desi you are actually really good with*
letters.
I'm like *yeah that's weird*,

and then I actually felt really happy
and I remember like some of the stuff,

and now I feel like show it to me
and I will be able to do maybe a problem or something,
cause it is like
mostly stuck in my head

and there are other ones
that I won't remember.
(Desi, Second Interview)

The second presentation highlights the meaning of the narrative, as the separated stanzas allow me to see the progression of events, and Desi's evaluation of these events. Instead of a jumble of ideas, here the ideas are separate, easier to analyze. Because the pauses mean a line break, it reminds me to pay attention to how the narrative was said. This narrative begins slowly, with more pauses in the first stanza. The second stanza rushes by with few pauses. It also calls attention to the end of the narrative, where Desi creates a distinction between what is "stuck in her head" and what she "won't remember." She leaves the listener with what she cannot remember, perhaps a message to me, the interviewer, that she might not remember if I asked her a question right there about algebra.

My analysis tended to blur all three categories of narrative analysis: thematic, structural, and dialogic. Thematic analysis focuses on what the participant talks about in their narratives. For example, I collected how the kids described themselves as math learners. Some kids described themselves as "slow," while others described themselves as "quick." I looked for patterns across the interviews— in this case I found that the most frequent ways to understand oneself as a math learner was on the binaries of fast/slow or get it/struggling.

I also used structural analysis, highlighted in the excerpt above from Desi's interview. When I look carefully at how the story is being told, paying attention to the actual structure of the narrative, I am using the tools of structural analysis. In the narrative above, we see how Desi arranges the evaluation of the narrative (her opinion) through reported speech, both Ms. Alton and her own thoughts, arranged as spoken words. Desi often used this pattern, first describing an event, then narrating her own thoughts or a conversation with others to tell me how she evaluated this event. Structural analysis was extremely important in my work because it gave indication of change over time. Kids changed the way in which they told stories. For example, for Rita, my analysis centers on how she changed the structure (as well as the content) of her narrative of herself in mathematics, from “I am good” to “I don’t like it.”

Per Linell (1996) wrote that all analysis of talk is “double dialogic”; first dialogic at the level of heteroglossia (Bakhtin, 1981), or multiple voices in dialogic within the speech of one person, and secondly dialogic in its immediate context, the interview. After identifying a narrative and arranging it for analysis, I analyzed the context: who is telling the story, to whom, in what context? Second, I identified what voices are being used—perhaps an internally persuasive voice, or the voice of a parent, teacher or peer filtering into speech. Sometimes voices are quite clearly set apart as reported speech, either through aspects of performance (like imitating someone’s voice), or as understood in the context of the story (Skinner et al., 2001).

When I identified voices in the narratives, I then had to find some evidence of where these voices come from. In the case of reported speech, that voice was usually identified, such as when Desi reports what Ms. Alton says, “wow Desi you are actually really good with letters.” I know who said this to Desi, but this can also be an individual instance of a larger, circulating voice, here the idea that a person is “good” with particular kinds of mathematics. This is a *public narrative*, a widely circulating story that an individual takes up and voices. One public narrative that was important to my analysis was what I called the bootstraps, or individual effort, story. Both adults and kids in this classroom brought up the story of how individual effort is important, or pulling oneself up by your bootstraps. In other analytic traditions, this could be understood as an ideology, or a discourse of individuality. Here, I use the concept of public narrative first because it emphasizes that it is a story, thus calling universal truth into question, and second because the term “public” emphasizes how the story circulates through culture.

While I was analyzing the relationship that kids saw between race, ethnicity, class, language and mathematics, I tried to leverage popular media to disentangle the public narratives about ability and mathematics. In a search on the Internet, I found many non-academic sources discussing the difference between boys and girls in mathematics, as well as many pieces about why Asians (and Asian-Americans) were “better” at math. It was much less common to find an article that specifically named Latinos as good or bad at math, even with the “achievement gap” public narrative so prevalent in academic writing. I found something similar in the narratives of the kids: it seemed easy for the kids to talk about the difference between boys and girls in math, but not about differences in ethnicity and race. Desi was the only kid who narrates a specific connection between ability, ethnicity/race and mathematics: that people from Japan are “good” at math (Second Interview).

The kids constantly brought my attention to the second level of dialogic analysis: interaction during the interview. Interviews are dialogues. My questions elicited certain narratives, and my responses further shaped the narratives I heard. I shaped the interview by who I was, and what kids believed I was interested in (math). Carmen apologized for going “off topic” by talking about science class during her interview, reminding me that the kids saw this interview as constrained in certain ways (Second Interview). All the interviews, whether done in pairs or just myself and the kid, were exercises in dialogic meaning making. I felt that I could not pull out “narratives” of these interviews without carefully considering my own role in the construction of meaning.

In the paired interviews, the relationship between the kids was also important. I chose the pairs to make the kids as comfortable as possible. My first paired interview, for example, was Rita and Carmen, who were close friends and frequent math partners. I knew from sitting and chatting with them in the classroom that they would talk freely not only about themselves, but about what they knew about each other. In our interview, just as they did in class, Rita and Carmen made it clear that they understood themselves as math learners in relationship to the each other. Carmen named herself as a "visual learner," and Rita responded, just as she did during class, "she is, I am not." I could see that these phrases they were repeating to me, voices from their sixth grade teacher on multiple intelligences, were important in the way that they understood themselves as well as how they worked together in class. Rita was presumed to be good at certain tasks, Carmen others. Arturo and Ana also told me what kind of learner the other was, both attributing more competence to their friend than they did to themselves. In every paired interview, I analyzed the interaction between the kids, in light of what I knew about them in class.

Through all of these aspects of narrative analysis, mixing dialogic, structural and thematic analysis, I looked for evidence of change. I looked for change in positioning through language, like how Desi began to name herself as "slow." I looked for change in how particular narratives were retold, such as Rita's story of her relationship with mathematics. I used multiple methods of analysis to trace change through narratives and field notes, looking for change and fossilization of change across time.

Mathematical analysis

There were two major aspects to my mathematical analysis in this study: analysis of pedagogy through ethnographic work and analysis of the learning of integers across time.

Analysis of mathematical pedagogy. The first kind of analysis was concurrent with my ethnographic work. During my pilot project in the sixth grade, as well as in Ms. Marquez's seventh grade classroom, I documented the mathematical pedagogy of the classroom. I was building on past work in mathematics education that looks for the identifiable patterns in pedagogy across time such as patterns in teacher talk, questioning and discussion (e.g. Cobb & Yackel, 1996; Boaler, 1997; Boaler & Greeno, 2000). For example, I wrote about the practice of "going over problems" in the sixth grade classroom, during which Mr. Pierce would pose one question at a time from the homework, ask kids to raise their hands to answer it, and write their answer on the board. Sometimes a kid would share a second method, but most of the time, the routine offered one method to solve a particular problem. These lessons followed an IRE sequence: Initiation (teacher), Response (kid), and Evaluation (teacher)(Mehan, 1979).

My analysis differed from other work in mathematics education because rather than finding the dominant norms of pedagogy, I also noticed conflict and difference. Although most discussion in the sixth grade classroom was run by Mr. Pierce, and followed an I.R.E. sequence, other lessons did not. Ms. Emerson tended to ask for multiple strategies during mathematics class. I paid attention to these differences. Mathematics education tends to describe classrooms along a binary: classrooms can be either reform or traditional, discussion-based or lecture-based. Most classrooms that I have experienced were some combination of discussion-based and lecture-based. But this hybridity is ignored by the practices of mathematics education.

It is also possible that I knew the subtleties of these classrooms in more detail because of my methodology; ethnography asks the researcher to see the meaning for participants, while mathematics education asks the researcher to use the terms of the field to apply to the classroom. In the seventh grade classroom, I found that Ms. Marquez saw her mathematics classroom as two distinct “halves:” one set of activities designed to develop critical thinking, and another set of activities designed to prepare kids for the state exam. Certainly there is overlap between this distinction and the categories of Boaler and Greeno (2000). The people in the world make one distinction, and the outside researcher names the other. By naming these two parts of the class ““critical thinkingish”” and ““state examish”,” I center the meaning making of participants, thus deepening my analysis. Through grounded theory, I created arguments about these two kinds of pedagogy. Again, analysis meant writing field notes, developing theories in memos, and looking for support and contradiction of those theories in subsequent fieldwork. In this case, I was looking for evidence of these two “halves” of her classroom.

I coded all the activities (both in field notes and video) for either “critical thinkingish” or “state examish” pedagogy. Video allowed me to document the language practices that went along with each kind of mathematics. I split each class period (ninety minutes long) into discrete activities, and then classified the activity as critical-thinkingish or state-examish. I also categorized the “cognitive demand” of each discrete activity (Stein & Stein, 2000). Almost every activity classified as state-examish was *procedures without connections* within that framework. Most activities classified as critical-thinkingish were *procedures with connections*, with two instances of *doing mathematics*. Perhaps this analysis will be highlighted in future work with this data, but I chose not to include this analysis in my data chapters because it takes focus away from the categories used by Ms. Marquez.

Computation with integers. Integers were my focus mathematical topic. I was able to document change over time, first in the pedagogical practices used to teach integers, and second in the strategies and model use of individual kids. In order to analyze integers, I combed through field notes and transcripts, looking for every instance of work with integers. I created a separate data collection that included only work with integers. I analyzed each example that I had of kids solving (or not solving) computational problems with integers. For each problem, I classified the kind of problem (such as subtraction of a negative number), whether or not it was correct or incorrect, and the model used. By model, I mean the context or representation that the kid used while solving the problem. For example, some kids would think of integers as money and debt, while others would think of a metaphor of sandbags and airbags on a hot air balloon. Some kids used these metaphoric contexts to guide their thinking about integers. Other kids used mathematical models such as directed movement on a number line or canceling. Using this data, I collected a history of solving integer problems for individual kids.

I then wrote an analysis of the history of each focus kid solving integer problems over the one year of instruction in integers (May 2010 – June 2011). I used not only the evidence of kid's problem solving, but their related talk integers. For example, all the focus kids discussed their work with integers in interviews. Some told me what strategies they used; others discussed the status of various models. To present an analysis of individual learning in integers, I combined analysis of their computation with their thoughts and feelings about the topic.

While most of the data on integers was collected during fieldwork, I also created two assessments, given to the kids by Ms. Marquez at the end of their seventh grade year. The first (Appendix E) consisted of sixteen addition and subtraction problems with integers. I designed the assessment to include all the problem types for computation with addition and subtraction with an unknown sum or difference (for more on these problem types, see Chapter Five). There were two problems adding a positive plus a positive ($5 + 6$), four problems subtracting a positive number ($3 - 9$ and $-2 - 7$), two problems adding a negative number from a negative number ($-7 + -2$), four problems adding with both a positive and a negative number ($-2 + 7$ and $5 + -9$), and four problems where a negative number is subtracted from either a negative or a positive number (-7 - (-2) and 8 - (-2)). The back of the assessment asked kids to explain how they solved the problems, "What tools or methods do you use to solve integer problems? Be as detailed as possible." All but one of the kids answered this question in detail. This first assessment was designed to give me a sense of how much the kids remembered of their work over the year in computing with integers. I also had noticed patterns in solving different problem types (with subtraction of a negative number presenting the most difficulties) and I wanted further evidence whether this theory was valid.

The second assessment consisted of two problems in context (Appendix F). The first asked kids to find the total elevation of a building including a basement. The second asked kids to find a negative drop in temperature. The second assessment was designed to see how kids would solve problems with negative numbers in context. I had only observed one instance of contextual problem solving with integers in the seventh grade year, and I wanted to see if there was a difference between kids' ability to solve problems in or out of context.

Validity, credibility and trustworthiness

All readers of my work should be questioning my claims, wondering if my methodologies are sufficiently careful and if my analysis can be supported through the evidence I present. While traditionally these questions fall under the term validity, I agree with critics who distrust this word because limits our work, forcing it to fall under positivist theories of knowledge, particularly experimentation (Mishler, 1990). My research, hoping to better understand complex human processes at multiple levels, cannot be reduced to an experimental model. Elliot Mishler proposes trustworthiness as an alternative way to frame this important question. This trustworthiness develops within a community, and so I can follow the careful practices of other researchers to increase the trustworthiness of my account. Similarly in mathematics, the standards for proof are "a conclusive argument," within the community of mathematicians (Hersch, 2009). I can claim that my account is coherent and credible, based on established processes in ethnography and narrative analysis. The final determination of my work will be judged in the community of researchers, based on whether or not my work becomes part of ongoing academic conversations.

There are four aspects of the process I followed that strengthen the credibility of my claims: 1) attending to conflict in the data, 2) systematically building and testing claims, 3) triangulating using multiple kinds of data and 4) transparency in my use of data. During both ethnographic work and narrative analysis, I looked for both conflict and coherence in my data. I noticed that most analyses of mathematics classrooms presented only coherence, only presenting the norms of discourse, for example. The very idea of norms, which has dominated analysis of classroom cultures in mathematics, privileges similarity rather than difference. I found something interesting in this classroom by looking for the conflict between two kinds of mathematical pedagogy within one classroom.

During my fieldwork, I developed claims about the classroom. After formulating claims in memos, I went back into the classroom in order to test them. Earlier in this chapter, I used the cups as an example of this process. Another example is my claim that kids made choices about mathematical models based on the status of that model. I developed that claim in the late fall of my field work, when I noticed that Rita and Carmen used cross multiplication incorrectly rather than use a more accessible method just shared by a classmate. My intuition in the moment was that they wanted to use the method with more status. I wrote about this intuition in a field note, and then developed it into a memo. As I continued my fieldwork, I looked for more evidence to support or contradict this claim. I found that kids did make choices about mathematical methods based on status, and found many examples relating to operations with integers on a number line. At the same time, not all kids saw all models the same way. A few kids saw the number line as a better way to add and subtract integers. So the claim became more complicated, a more credible representation of the classroom and kids that I studied.

My third strategy for producing credible research is interrelated to testing claims. Triangulation refers to using multiple sources of data to support claims. This strategy was at the heart of my study, built into the design: both interview study and ethnography. For example, I found evidence for my claim about the status of mathematical models in my fieldwork, but also through interviews. Not only did I observe kids making choices based on status, but they narrated that choices, telling me that the number line was a “crutch”(Federico, First Interview).

The last strategy that I mention is transparency. One aspect of transparency is producing full narratives rather than just using short quotes, so that the reader can assess claims themselves. These longer excerpts make my dissertation longer, but I believe they are an important factor in establishing credibility. Another aspect of transparency is a full and complete description of the choices that I made in my research. Oftentimes in mathematics education, I read methodology paragraphs that read as if there were no choices, obstacles, or difficulties in the research process. Rather than pretend that this study has always gone according to plan, this chapter has detailed how it has not. This gives my readers a chance to assess my choices, and decide what to do with the information I provide. In this chapter I wrote about a difficult interview with Bobby, during which I made choices that I regret. This type of reflectivity is critical if I want my readers to trust my work. I have been inspired to take these kind of risks with my writing through Luttrell’s writing about process (Luttrell, 2000; 2005) which allows the reader to see how and why she made choices as a researcher. This type of reflexivity is quite rare in educational research, particularly mathematics education.

Mishler argues that case-based studies are as scientific as population-based and variable-centered research, because case-based studies situate people in contexts (Mishler, 1996). For a study such as this one, looking at individuals out of context would be nonsensical. Catherine Riessman argued that narrative research based on cases is generalizable because it creates theoretical propositions (Reissman, 2008; Bryman, 1998). A strong tradition of case-based research in psychology underlies the major theories through which we currently understand human development (e.g. Piaget, Lewin and Erikson). Case-based research not only contributes to the development of increasingly refined theories, but it also serves an educational purpose. Medical schools use case studies to educate future doctors on the complexity of individual cases. In the same way, I hope that my work, although I studied a small group of people, can teach those who would teach mathematics. Ideally, my work can illuminate how the mathematics classroom feels from the perspective of kids. This is no small feat, as teachers are trained to see children with the eyes of experts, quantifying and classifying children, particularly those with disabilities, rather than emphasizing with them.

In the end, I hope that the portraits of kids that I sketch are as powerful as those I have read, and that, like those authors, I finish reading wanting to know more about that kid. Wendy calls this the “need to know more stance”(Luttrell, 2010). Rather than defining, pinning down people in our research, we create the desire in the reader to ask questions. This kind of interaction with educational research, we hope, can lead educators to develop the need to know more stance about kids.

Chapter Four;

The Figured Worlds of Seventh Grade Mathematics

In my fieldwork, I tried to always arrive a few minutes early for Ms. Marquez's second period mathematics class. The young people in her class, who traveled together to all of their classes in seventh grade, would spill out of their art class down the hall and slowly make their way to Ms. Marquez's class, only two doors down the hallway. There was a sense of release as they emerged from the narrow door of their class. They made use of their limited freedom in the halls to talk in small groups, or sometimes play illicit games of tag. They formed circles of talk, often one with Luis at the center of his group of mostly male friends: Arturo, Ortiz, Tony, and also Desi, a girl. Separate groups of girls would also make tight circles of talk; often Ruby, Carmen, Ana, Rita and Lorena were deep in conversation. In these groups, particularly the girls, there was often physical affection; Lea resting her head on Clementine's shoulder as they talked to other girls, and the constant tagging and play fighting of Federico, Pedro and Bobby. Certain young people flitted between groups, never quite entering, notably the tag-playing boys, who would then end up in their physical play. Others, like Amparo and Elisa, made their way immediately to the space by the wall in which they were expected to line up, and waited there. Often Amparo or Bobby would strike up a conversation with me, while the other kids, engaged in their talk, didn't seem to notice that I was there until we were all inside the room.

Ms. Marquez emerged from the classroom, all business with nary a smile. As they saw their teacher the young people would slowly move into two lines, a boy line and a girl line, beside the wall. Ms. Marquez would wait, saying nothing, until most of the young people in one line were silent and still, and then she would tell that line to enter the classroom. Most days, that line was the girls. Ms. Marquez would wait a bit longer for the boys of the class to still their bodies and their voices to enter the classroom. I would walk in behind the boys, struck by how colorful their classroom was, filled with light thanks to the wall of windows which looked out onto a park. The other three walls were covered in posters, almost all made by teachers, which documented particular mathematical procedures and classroom procedures. The young people would move directly to their desks, sit down, and take out their notebooks to copy the mathematical problem written on the board as a “Warm Up.” Soon the class was mostly silent as the young people copied the problem and began to work on it silently. Ms. Marquez, usually a student teacher (there were three in the classroom throughout the year), and from January to June, Ms. Alton, would circulate between the desks, checking off homework and answering questions.

These young people entered this mathematics classroom as social beings that are deeply engaged in establishing and strengthening their “webs of care”(Lico & Luttrell, 2011), here their friendships. They entered this classroom marked by categories with particular meanings, such as learning disabled, girl, boy, Dominican, English Language Learner, and many more. They entered as people with histories as math learners in schools and outside of schools. Of all of the kids I have mentioned thus far in Ms. Emerson and Mr. Pierce’s sixth grade classroom, all but two have continued on to Ms. Marquez’s math class. Only Sade and Shaundra moved into another class, and so both Lorena and Rita lost their math partners and close friends. To follow the CTT model (coteaching with two educators and about 40% kids with IEPs), the kids with IEPs must be placed in the same classroom each year. What might become a trial if the kids do not form strong bonds, here seems a strength. No matter what the new class will bring, at least this group of kids, with their strong affinities for each other, will stay together. And they needed to support each other. As Desi moved from sixth grade to seventh grade, she talked in interviews about the difficulty of the transition. She was still stuck in the "sixth grade mode." Seventh grade felt "weird and different" in all of her subjects, got "us scrambled"(Desi, First Interview). So what was so new about Ms. Marquez's classroom? This chapter will describe the multiple figured worlds that interact within this classroom.

The Figured World of Schooling

Kids walked into Mr. Pierce and Ms. Emerson's classroom freely from the hallway. Entering Ms. Marquez's classroom was an entirely different matter. The kids needed to make two lines, one for girls and one for boys. They had to stand still and straight, and stop talking. When the kids entered the room, they moved to their assigned seats. Luis, for example, was no longer able to pull a chair to the side. Kids were not allowed to make their own pairs, as Lorena and Sade had done.

When entering the classroom, these kids needed to turn into students— to adopt the bodily stance, the voice (or lack thereof), and the docility of the student as defined by Ms. Marquez. They must get into lines, sit in desks, copy math problems, remember math procedures, silence their voices, and suppress their urges to socialize. In the space of the classroom, bodies were limited to a certain range of motion, to certain activities, and voices to a certain volume and kind of talk. A figured world is a world of activity, in which people together create and recreate a particular set of activities. This figured world is very familiar to me, as it must be to many. I engaged in these same practices, year after year, in my own schooling.

This class began at 10:15 each morning, and ran for one and one-half hours. The kids in the classroom were together all day in all their classes. This class occurred right after their art class, and before lunch. The room, with a wall of bright windows that faced a park, was arranged two ways during the year, first, in sets of two desks, all facing the front chalkboard. After Ms.

Marquez was given a Smartboard (a digital projection system), she rearranged the desks into groups of four. During the class, kids rearranged their desks into larger groups of eight. Almost every inch of the walls was covered with teacher-made posters.

The class followed a fairly consistent schedule. Kids came in, sat in assigned seats, and copied down the aim and standard of the lesson in their notebooks. Working independently, they solved two to four math problems called the "Warm Up." Ms. Marquez then asked the kids to talk about the problems with their partners, the kids seated next to them. This routine of partner talk was well established in the classroom. Ms. Marquez (or occasionally a student teacher) would then lead a discussion of the problems, which she called "going over" the problems. This whole class discussion was as short as fifteen minutes and as long as forty-five minutes. Sometimes there was an additional whole group discussion called "Math Slang," during which the teacher and kids collaboratively constructed definitions of mathematical terms or rules for new procedures.

In the second half of the class, Ms. Marquez split the class into three groups of eight. On Ms. Marquez's cue, kids arranged their desks into three long tables. Of these three groups, one was led by Ms. Marquez, one by the student teacher, and one was independent work. On most days in the fall, kids rotated between these groups. The first exception, the first class I observed, was primarily Ms. Marquez checking off required school supplies for each kid. On another occasion early in the school year, the kids worked in pairs to solve a problem. During another visit the kids took a standardized test for the entire period.

Ms. Marquez spent a great deal of time in the beginning of the year setting up what she called "procedures." Procedures included lining up, passing in homework, and using the red cups on the desks to indicate a question (more on the cups to follow). Posters hung around the classroom detailed various procedures, like the correct way to enter the room (Appendix A: Figure 1) and another entitled “S.L.A.N.T.,”(Appendix A: Figure 2). The SLANT sign directed kids to,

> Sit up straight
> Listen attentively,
> Ask questions,
> Nod your head, and
> Track the speaker

Ms. Marquez did not create this acronym. I had heard it at several different schools. It is a circulating practice of schooling, designed to remind kids of the way they needed to hold their bodies, the way a *student* should act. In my experience it was limited to urban schools with high poverty rates, and thus part of a larger figured world of schooling kids in urban settings. These teacher-made posters are artifacts of that figured world.

The kids described Ms. Marquez as a “strict teacher,” comparing her particularly to their sixth grade teachers. Kids tended to value Ms. Marquez for this quality. While at first Ms. Marquez used a slow, clear, calm tone to repeat procedures, over time, she adopted a more confrontational, quick tone for kids when they were not following procedures. Ms. Marquez called this tone, “attitude” (field notes, 1/4/11). She told me that she needed it for “this population.” Her assumption, part of this figured world, is that these kids in particular, perhaps because of their ethnicity, or the majority who live under the poverty line, need a strong, strict voice from their teacher. Using this voice, she named a group that was not working quietly as “sixth grade babies” (field notes, 9/28/10). This choice of words reflected a distinction that Ms. Marquez, and the kids, often made between the behavior expected of a seventh grader, versus that of someone in a lower grade.

Two messages were especially prominent throughout the year in this figured world of schooling: asking questions and personal responsibility. Asking questions was part of a practice called Accountable Talk, another circulating practice designed to help kids participate in discussions. One large poster, entitled "Respectful Discussion Accountable Talk," listed particular sentence starters to help kids ask particular kinds of questions, such as "I agree with____" and " why do you think that?" Kids used these to scaffold their conversations during whole-group discussions. Another poster documented why asking questions is important. A third listed what to do when you don't understand; ask questions (Figure 3: Appendix A). Kids were encouraged to ask questions during discussion, supported by the prompts, but asking questions also meant that kids had to admit when they did not understand so that they could get help.

On each desk was a red and a green cup. In the first two months of school, Ms. Marquez stressed the use of the cups throughout class. If a kid had a question or was confused, the red cup should be slipped over the green, upside down. If the kid did not have a question, the cup on top should be green. After carefully following the use of the cups over the first two months of school (after which they were no longer used), I found that the only kids who used the cups were those with high mathematical status in the classroom. Most of the kids who actually used the cups were those who were also demonstrating their understanding in other ways, participation in discussion, grades, etc. The kids who did not understand the material almost always kept their cup on green, keeping their confusion as invisible as possible. Late in September, Ms. Marquez calls out Desi for this practice.

> *In the middle of this discussion, Ms. Marquez Desi volunteers that she (Desi) doesn't understand anything. Ms. Marquez stops the discussion, and focuses attention on Desi. She asks Desi if she was planning to walk out of the class not understanding something. She squarely focuses on this being Desi's responsibility, and asks the class to tell Desi what she should do in the situation— use the cups. If you do not understand, put your cup to red so that a teacher can conference with you. Ms. Marquez says that this way, when Desi then does*

> *understand, she can feel better about herself. Desi turns her cup to red, and in a few minutes, Ms. Marquez directs the student teacher to go over to Desi's desk. (field notes, 9/14/10)*

Asking questions was the responsibility of each child as an individual. Desi was doing just as she did in her sixth grade classroom, waiting for help. From Ms. Marquez's point of view, Desi was not taking responsibility.

The second prominent, interrelated message was the importance of individual responsibility. Kids were evaluated on their behavior individually. Kids were graded individually. And Ms. Marquez talked a great deal about their responsibilities. This message was connected to the theme of being a seventh grader. When Ms. Marquez called so much attention to Desi for not turning her cup to green, she was making an example of her, trying to stress for all the kids how learning was the responsibility of each kid alone. As I write this, I remember how often I stressed this with my own students. Ms. Marquez makes it explicit that not only was it their responsibility to do their homework, but learning itself was their responsibility, not the responsibility of the teacher. On 10/19/10 she told the class that if they had done their homework, "you would not be super duper confused right now," and that "you are responsible for your own learning . . . I can't give you my head."

Tied to individual responsibility was the practice of sorting kids based on individual achievement. All around the classroom were artifacts that documented who had done what work, and what score they received: Star Points, How Many Books Have We Read, and Have We Done Our Math Homework? (Figures 4 – 6: Appendix B). All of these posters had the name of every kid along with their rankings or score based on the various parameters. Other signs were reserved for only certain kids, like the Math Honor Roll poster, updated after each grading period. Perhaps the most critical artifact of kid ranking was Ms. Marquez's grade book, in which she ranked and sorted kids based on homework, quizzes, tests, and classroom. It was part of Ms. Marquez's job not only to teach these kids mathematics, but also to rank and sort them individually. This seemed like common sense to the participants in the world.

Another common sense feature of this figured world is how mathematics itself is understood as intrinsically related to grade level, a conception of mathematics that is typical in American schools (Horn, 2007). Mathematics is understood as a set of skills, progressively harder, mapped onto the backbone of schooling: graded classes based on age. Paul Lockhart (2009) calls this "ladder" conception of mathematics "the ladder to nowhere," because kids and teachers focus only on the next step, and not the actual doing of mathematics (solving problems). This conception of math leads kids to frequently assess their own competence by what level of math they were doing, whether it was for "babies" or not. Just as these kids are urged to act like seventh grade kids, they are told again and again that they are now learning more difficult mathematics: *seventh grade math*. Each year, whatever was learned in previous years is dismissed, as kids are told that this year will be the most challenging yet. In interviews, kids equated seventh grade math most often with integers. Full of pride, Federico told me how his fifth grade teacher taught him seventh grade math.

Positioning in the figured world of schooling. This figured world was jammed full of positioning. As McDermott et al. (2006) remind us, schooling in America is organized to notice and name ability and disability. In order to keep this system functioning, teachers and parents must convince kids to participate willingly in this system. The kids in this class respected Ms. Marquez for her teaching and her knowledge of mathematics. They also seemed to generally buy into her message of personal responsibility for learning. After Ms. Marquez publicly called out Desi for not using the cups, Desi changed her behavior. By the next week, she began to ask questions in class when she did not understand and raised her hand to indicate confusion. While in her sixth grade classroom, Desi would wait for a teacher to come help her, Desi reconfigured herself to fit into a new meaning system. It was her responsibility *to try to understand*. Desi became the only kid in the class with low math status who used the cups (defining math status by teacher comments). Perhaps she used the cups as a mean to gain status. Perhaps her developing relationship with Ms. Marquez was important enough to her for her to change her behavior, to believe this storyline about how a student should act in this world.

In September, Ms. Marquez told me that Desi was "confused"(field notes, 9/28/10). By December, Ms. Marquez remarked on the changes in Desi: she has more "confidence" now(field notes, (12/7/10). From Ms. Marquez's perspective, Desi the "confused" kid was being replaced with Desi the "confident" kid because Desi changed her behavior to fit Ms. Marquez's expectations. In Chapter Seven, there is further analysis of Desi's changes throughout the year, particularly how she took up public narratives of effort and personal responsibility.

Another way to see how kids internalize positioning was how they interact with other kids. Some kids used the voice of a teacher to address other kids, a practice I call *schooling*, both because it was a voice associated with school, and because it connected the process of being schooled, or taught, by another. A conversation between Lea and Bobby offers a telling example of this practice of schooling. During one class, I listened in to Lea and Bobby. Lea had no answers written on her paper, just the problem. She was saying nothing, staring straight ahead, while Bobby lectured her in a voice quiet but firm, "I know you learned this because you were in the sixth grade" (field notes, 10/12/10). Lea said nothing. Later that same day, Ms. Marquez was standing behind Bobby, asking Lea a question, to which she responded so quietly that Ms. Marquez could not hear. While Ms. Marquez waited, Bobby mouthed, "I know you can speak louder than that, Lea." Bobby was schooling Lea in the practices of being a proper student, recycling a voice he has heard from teachers or family members to teach Lea how to behave. Lea never responded to Bobby with anything but silent refusal.

Kids, like Lea, did not uniformly accept and recreate this figured world. There was resistance. Lea's resistance was silent. During the fall, Lea rarely spoke in class, and would often not even respond to adults when directly questioned. She, like other kids with low mathematical status in the class, did not use the cups to publicly display ignorance. Another kind of resistance was louder, such as the jokes of Luis and Ortiz. Even as Lea resisted certain practices, she participated in most. She slouched by the wall as the girls line up to enter the classroom, following the rule, but without the bodily stance that Ms. Marquez modeled, and other kids, such as Ana, routinely demonstrate.

The figured world of school in this classroom used circulating public narratives about individual responsibility to create storylines for the kids. A good student was one who tried hard, and tried even harder when she or he did not understand. A good student did all their work, and received the highest score ever on all the rankings around the room and in Ms. Marquez's grade book. This figured world provided scripts for the right kind of participation in discussion (Accountable Talk) and even the right way of arranging your body (SLANT).

Multiple Figured Worlds of Mathematics

One day early in the fall as the leaves were turning bright colors, visible out of the many windows in this classroom, I sat down with Ms. Marquez to discuss the class. Ms. Marquez ventured an explanation of her pedagogy: "you probably noticed," she said, "that there are two halves in my class— the "state examish" part and the "critical thinkingish" part" (field notes, 9/28/10). She presented this as her struggle: both deliver high test scores and cultivate critical thinking skills.[5]

Ms. Marquez understood her teaching practice as "switching" between these two kinds of mathematics, *"critical thinkingish"* mathematics and *"state examish"* mathematics. I found considerable evidence of this switching in her class. Most of the ninety-minute classes in the fall began with 30-45 minutes of "critical thinkingish" math, before shifting to "state examish" math. As I wrote in Chapters One and Two, many studies in mathematics education seeking to understand how pedagogy shapes identities are constructed on a similar dichotomy (e.g. Boaler & Greeno, 2000; Cobb et al., 2009). Ms. Marquez's first teaching job was in a school that used a textbook based on constructivist learning theory. In this program, kids learned through solving context-based problems. Ms. Marquez spoke of wanting to use that textbook again, but not having the freedom to do so. Mathematics classrooms, like all other classrooms, are situated in larger institutions in which test scores matter most. Ms. Marquez was embedded in such a system, and it mattered greatly for her instruction. Central Academy had high test scores in mathematics, particularly at the seventh grade level (in 2009, 86.5% of kids scored a passing or high grade on the state exam in mathematics, placing the school in the top 25% of schools city-wide in mathematics). As one of just two seventh grade math teachers, Ms. Marquez felt constant pressure to keep scores up.

"critical thinkingish" Mathematics. Class always began with a problem called the "Warm Up," written on the board before the kids entered the room. The kids were asked to copy down the problem and solve it, first independently and then with their partner. After partner discussion, Ms. Marquez would lead a whole group discussion on the problem. While Warm Up

[5] Here is where many math educators would take exception. It is possible to have a critical-thinkingish curriculum in which kids score well on standardized tests.

problems were often just bare computational problems, the discussions that followed emphasized multiple kid strategies, as well as questioning and justifying answers. These discussions were important in teaching the kids the practices of "critical thinkingish" mathematics: sharing and debating multiple strategies, adopting a questioning position towards mathematics, and leaving answers open to debate.

During a visit in the middle of October, the kids considered which of these two negative numbers is greater: $-1\frac{1}{4} \, or -\frac{11}{5}$. Ms. Marquez asked how one can know which of two negative numbers was greater? Federico and Ruby both raised their hands, bidding for attention. Ms. Marquez called on Federico, who made a gesture evoking distance on a number line as he says, "the further away it gets on the number line." Ruby spoke next: "Let's say that it is - 4 or - 8. - 4 is bigger because it is closer to zero because -8 is further away it is more smaller"(transcript, 10/12/10). Clementine also used gesture to show how magnitude shifted as one moves away from zero. Ortiz, who used a distinctly formal version of accountable talk, began with, "I agree with Federico . . . for example if I have -2 or -10, -10 is higher to the zero." Discussion continued for almost forty minutes, venturing into multiple strategies for converting rational numbers in various forms, and the relationship between fractions and division. Ms. Marquez never gave an answer, but accepted the answers given to her, asking kids to debate the possible solutions.

This was the most common "critical thinkingish" routine in the classroom: open-ended class discussion of computational problems. During this routine, Ms. Marquez typically listened to the kids' answers, represented their thinking on the whiteboard, and then summarized their thinking. When kids disagreed, she facilitated their discussion, using strategies such as "revoicing" (O'Connor & Michaels, 1993), rephrasing the kid's strategy and connecting it to the strategies of others. These open-ended whole class discussions, which occurred almost each time

I visited in the fall, often took over 30 to 45 minutes of a 90 minute period. After one such session Ms. Marquez smiled as she professed ignorance of the answer, ”I’m not sure, and we will have to keep working on it” (field notes, 10/5/10).

Ms. Marquez had three kinds of routines that were “critical thinkingish”: open-ended whole group discussion, small group problem solving, and a vocabulary routine called Math Slang. During the last routine, kids brainstormed all they know about a mathematical term, gradually building to a common definition through discussion. On 9/14/10, Ms. Marquez asked the kids to help her build a definition of a mathematical term, "multiples." Bobby pulled out a dictionary and began reading a definition. Ms. Marquez stopped him. She told the class, indirectly positioning Bobby, that she wanted them to construct these definitions themselves—“this is helping us construct the ideas.”

When Ms. Marquez was doing “critical thinkingish” small group problem-solving, she used mathematical problems that would not lead to one single answer. She made these problems “critical thinkingish” by eliminating the leading questions that often accompany complex word problems in textbooks. On 10/5/10, Ms. Marquez asked kids to investigate the hot dog/hot dog buns problem: if hot dogs come in packs of 8, and hot dog buns come in packs of 6, how many should you buy so that you have the same amount? She asked the kids to find all the points at which they would have the same number of dogs and buns. She valued the confusing aspects to these problems, and allowed kids to explore these problems in pairs without direct assistance.

Voice in “critical thinkingish” mathematics. Ms. Marquez had a particular way of speaking during this kind of activity: an open, questioning voice. When using this voice, Ms. Marquez ended sentences with the intonation of a question. She spoke softly, and made moves to maximize kid discussion, minimizing her own. She seemed to use the voice to remove her authority, asking the kids to step into the discussion.

The kids also had a particular voice here: Accountable Talk. Kids used these prompts to scaffold their conversation. Defined through analysis of transcripts, Ruby and Ortiz contributed most to whole class discussion. Just as he did during the discussion on 10/12/10, Ortiz began most utterances with, “I agree with ___” or “I disagree with __ because,” just as they were written on the poster of Accountable Talk. His tone seemed formal and stiff in these moments, leading me to wonder if this was an example of authoritative voice (Bakhtin, 1981), a voice with power that was still felt as outside oneself.

During one class (10/19/10), Ms. Marquez led a small group in solving integers, focused on the problem 3 – (-9). I walked over to see Ritchie and Ruby disagreeing about which direction on a number line to move when solving – (-9). Encouraged by Ms. Marquez to clearly state his “conjecture,” Ritchie did so. Ruby, however, was not convinced. Ms. Marquez encouraged Ritchie to try again, to find the right words to explain his ideas. All the kids were intently listening to this exchange, including Desi, who was so engaged that her body stretched way out of her chair towards the white board on which Ms. Marquez was representing various strategies. This moment exemplified the practices of “critical thinkingish” mathematics as Ms. Marquez imagined it: engaging in discourse about mathematical problems, presenting one’s ideas to a group and defending them. Reflecting on this moment, Ms. Marquez was proud of the group’s discussion. She named it as an instance of what she was working so hard to instill in her kids — “voice” (field notes, 10/19/10). While I am using voice to describe circulating discursive practices that individuals take up and make their own (or not), Ms. Marquez used the term to describe engaging in mathematical discussion. A minute later, her tone turned bitter, “and they never get to use that voice in the rest of their math classes." Ms. Marquez was critical of the pedagogy used in the eighth grade math classes, during which kids had few opportunities to engage in discussion.

While leading open-ended discussions, Ms. Marquez often mentioned that they needed to “move on.” During the Math Slang discussion described earlier (9/14/10), she followed her comment about “construct the ideas” almost immediately with “we have to move on.” I found this to be a telling moment. Ms. Marquez was trying to do “critical thinkingish” work like building communal definitions, but her eye was always on the clock.

“state examish” mathematics. In the fall, Ms. Marquez always began a mathematical topic using “critical thinkingish” routines and gradually transitioned to “state examish” work. Ms. Marquez introduced Lowest Common Multiple (LCM) by giving a “critical thinkingish” problem about trying to buy hot dogs, which come in packages of eight, and hot dog buns, which come in packages of six. A few days later kids presented a procedure for finding the Lowest Common Multiple that they recalled from their previous classes (list the multiples until there is one multiple in common). By the following week, the procedure had changed. Instead of listing the multiples and finding the multiples in common, kids were asked to write the prime factorization of each number, and then to use prime factorization to find the Least Common Multiple. That day in the classroom, I struggled to understand why we were doing it that way. Kids were able to use the first method— listing the multiples —and were confused about what steps to follow to use the new method, prime factorization. I wondered why Ms. Marquez was so focused on this particular method, particularly when I did not see evidence of kids understanding the rich connections between prime factorization and multiples (Fosnot & Jacob, 2010). In late November when I saw the kids take a standardized test, called an “acuity” test, designed to test what kids should have learned so far based on the pacing schedule of the textbook, I understood why Ms. Marquez had focused on that one method. Here are my field notes:

> *As kids take the test, I grab a copy and read it. I was totally shocked. I guess I should have assumed that Ms. Marquez was taking this whole test-prep thing seriously, but I did not know how closely she was connecting the "state examish" side of the class to the actual test, which will be very similar to this interim assessment. I understood why she was teaching certain procedures, because they were called for exactly how she had been teaching them. Like using prime factorization to find both the Lowest Common Multiple and the Greatest Common Factor, which were called for in the test, and was limited to using this particular method alone. (field notes, 11/16/10)*

Moreover, the few questions that looked different than how kids had been taught were confusing to them. Kids asked questions about one particular set of questions, adding and subtracting integers on a number line. The jumps on the number line were not how Ms. Marquez had represented addition and subtraction, and kids did not know how to make sense of this representation. When Ms. Marquez was teaching to the test, she believed that she must match procedures and representations exactly to the format of the test in order for kids to recall the procedures.

Voice in "state examish" mathematics. In my time in this class over the year, I was struck much more by forgetting than remembering. Most kids did not easily recall procedures, while some (Jack, Ritchie) never seem to struggle at all. By 10/ 27/10, kids had a whole range of procedures to remember, and Ms. Marquez's goals shifted to ensuring that kids memorized these specific procedures. For the Warm Up, Ms. Marquez assigned a set of review problems from topics that they studied thus far. As the class began the work, Ms. Marquez gave a monologue that explained the practices of "state examish" mathematics:

> **Ms. Marquez**
> There is also a whole bunch of stuff that I have put up on the wall to remind you about some of the things that we have gone over in class so far [*gesturing to posters*]
> so if you need to look at it while you are reviewing that's great.
> On that wall you have dividing integers,

prime factorization,
multiplying integers,
what absolute value is,
subtracting integers,
adding integers,
GCF how to find it,
LCM on the back wall how to find it.

Use these things that are posted,
use the charts that are posted to help you if you
don't remember something [*all in a gentle tone*].

Right now you should not be looking around [*shift to a stronger voice, stance changes, arms crossed*]
you should be on task,
this is how you waste time

So back here,[*returns to gentle voice*]
like I said,
some of you are trying to REMEMBER how to do these questions,
so no one is going through their notes,
as a way to help us kind of review,
some of the topics we have gone over,
so I don't see anyone trying to do this with their notes,
you are trying to see if you remember and that is good so if you get stuck you should be looking through your notes and or you should be looking up here,
some stuff has been posted to try to help you,
okay,
and you have the red cups to ask questions. [*sarcastic*]
(Transcript, 10/27/10)

In this excerpt, Ms. Marquez sketched out the practices necessary to be a competent "state examish" math learner. One must be able to solve a range of disconnected mathematical problems independently, ideally using only memory. If memory fails, use the cultural tools that stand in for memory in this classroom: notes and the posters. Kids in this class used these posters all year long to remind them how to execute mathematical procedures. The voice that Ms. Marquez uses to talk about both "state examish" mathematical procedures was very similar to her initial procedures voice: clear, strong and direct. In this passage, she shifted between this voice, a gentle voice that seems targeted at kids who are having trouble remembering, and her more sarcastic “attitude.”

“critical thinkingish” discussions also included more procedural discourse. At one point on 10/12/10, when kids were engaged in an open-ended discussion on ordering integers on a number line, Ms. Marquez asked, “If we have an IMPROPER FRACTION and a MIXED NUMBER *(-1 ¼* or *-11/5)* how can we compare?” (transcript, 10/12/10), emphasizing the capitalized words. This signaled to kids that it was a procedural question, asking if kids recalled how to convert a mixed number to an improper fraction and vice versa. Bobby, Jack and Mario all enthusiastically raised their hands for this question. These three kids, along with Pedro and Hugo, were the kids most likely to answer a procedural question.

When Ms. Marquez did this kind of “state examish” activity with her kids, she began by exploring the topic with kids in “critical thinkingish” activities, particularly asking kids to explain and demonstrate their prior knowledge about the topic. Then, she taught a particular procedure to kids, using homework, small groups, and the “Warm Up” to review the new procedure. Kids practiced procedures many times on worksheets. Kids were expected to take notes and refer to them. Charts were posted that listed the steps to the new procedure. Testing itself was part of this figured world, as kids take practice tests frequently throughout the year. These practices centered on independent recreation of particular methods, done many times with many examples.

Ms. Marquez designed these “state examish” practices to prepare kids for doing well on a standardized test. The focus was on procedures and procedures alone without connections to other mathematical topics. The way of knowing was to know a series of detailed steps. The way of doing was to copy notes in your notebook, follow the steps on paper by yourself, answer questions in class and on tests about what the next step is, and to use various artifacts to assist you (posters, notes). The way of being was passive, one who takes in information and does it. But this passive knowing had status in the classroom. Knowing how to do procedures, particularly those few who have no trouble recalling the procedures, was desirable. Using a calculator was not, as I learned by a withering stare Lorena gave me when I proposed that she use one.

In "critical thinkingish" activity, kids know by certain kinds of doing: by exploring topics, trying different strategies, talking about their strategies, and discussing the strategies of others. This was a different kind of being, one that is made clear by Ms. Marquez's own words: "voice" and "critical thinking." She was not trying to teach certain facts or procedures, or even particular concepts in mathematics. Instead, she was trying to develop another way of being in mathematics, being a critical thinker, a problem-solver, and a solution presenter (Empson, 2003)

Positioning in both kinds of mathematics. In the fall, Ms. Marquez spent more time teaching "state examish" mathematics. Out of thirty-four different class activities in the fall, twenty were "state examish", twelve were "critical thinkingish", and two began as "state examish" and turned into "critical thinkingish". But what did Ms. Marquez value more? When discussing kids, Ms. Marquez used the terms "procedural," to describe kids who she felt excelled at "state examish" activity, and "conceptual," to reference kids who she felt were strong at "critical thinkingish" activity (field notes, 9/28/10). Ms. Marquez referred to Ritchie, Ruby, and Luis as the "top kids" in the fall, all of whom frequently engaged in "critical thinkingish" discussion. Ms. Marquez described Ritchie as "in the top one-third" and wonders if she was appropriately challenging him (field notes, 9/28/10). She does not talk about this concern with any other kid in the class. She was more positive about Luis, who was conceptually strong but struggled to remember procedures, than she was about Ana, whom she described as not good at that part of the class (referring to “critical thinkingish”). Luis was able to participate in the most conceptual of discussions, but he did not have a reliable method to divide whole numbers. Additional evidence of their high status, Ms. Marquez allowed Luis and Ritchie to make comments even when after she said that a discussion was finished.

She also privileged “critical thinkingish” by creating the enrichment folder. When kids were done with their work, they could get enrichment problems from a folder. The problems were logic problems. When a kid got a new problem, she or he could ask a kid “expert” to talk to them about the problem. This was a high status activity for some kids. Pedro rushed through his work so that he could do enrichment, which he described to me as “tricky” and “advanced”(field notes, 11/9/10). Ritchie did the most enrichment work in the class. At one point, Ms. Marquez handed Ritchie her entire book of logic problems to work through because Ritchie had finished all the photocopied selections.

“state examish” had status as well. Ms. Marquez would reliably call on Jack, Hugo or Bobby to answer questions about procedures, as when Jack talked her through the long division algorithm during the discussion on 10/12/10. When kids were asked in interviews, “Who stands out in the classroom,” they named Jack and Hugo (and Ruby, who had more “critical thinkingish” status)(Desi, First Interview; Ana, Second Interview). Desi marveled at Jack’s ability to know “how to do everything” in math class. Although Ms. Marquez attempted to disrupt the positioning of “state examish” mathematic as more important than “critical thinkingish”, procedural knowledge was more valuable to most kids. I observed kids schooling each other about mathematics multiple times in this class, but never for “critical thinkingish” mathematics, always for not memorizing something.

On 1/24/11, I found Bobby and Pedro sitting next to each other, not smiling, not making eye contact as they raced furiously to finish a worksheet.

> **Bobby**
> You are stupid
>
> **Pedro**
> You are stupid.
>
> **Bobby**
> Look who is talking,
> I am further down the worksheet than you.
> (field notes, 1/24/11)

Both of these boys were more likely to answer "state examish" questions in class, and made frequent comments about their ability to do procedures in math class. This exchange equated speed in finishing a worksheet with intelligence (stupid or not stupid). Kids would compete to be the first to complete worksheets, the first to complete test-preparation packets, and the first to complete assigned problems in the textbook. Pedro and Bobby made clear an important storyline in this figured world: the faster you do math, the less "stupid" you are.

The dominance of "state examish" practices in the spring. In the fall, while Ms. Marquez spent more time teaching the "state examish" mathematics, instruction was somewhat balanced between "state examish" and "critical thinkingish" mathematics. In the second half of the year, the balance shifted. Only two out of thirty activities were "critical thinkingish", and both were open-ended discussions. There was no more "critical thinkingish" problem solving.

Ms. Marquez told me that she was shifting instruction in order to prepare kids for the state exam, which was held for one hour on one day in May. While Ms. Marquez had mentioned the state exams occasionally in the fall, from January until May both teachers and kids made frequent references to the state exam. On 1/4/11, Ms. Marquez reminded kids that while other strategies are mathematically correct, she insisted again and again that they used "what they want on the test." The kids echoed this language. On 3/23/11, Ritchie asked a hypothetical question based on what "they" (the test makers) want. Later that same day, Amparo asked, "What are we supposed to do— I mean what do *they* want us to do." For "state examish" work, not just any effective method would do. Particular procedures are called for by "them," test-makers who become the critical arbiters of mathematical correctness, replacing the kids themselves.

Most days in the spring began with a Warm Up problem which is a review of previous learning or an introduction to a new topic, followed by a short teacher lesson that explains a particular procedure. A major difference between the fall and the spring is that these discussions were no longer extended into longer, open-ended "critical thinkingish" discussions, but were kept short by Ms. Marquez. No longer did Ms. Marquez leave discussions open, as she did in the fall. The bulk of the class continued to be group work, in which all kids completed the same worksheet (or pages in the textbook) on the new procedure.

In the spring, kids spoke often of how much they disliked their class and math, a sentiment that I rarely heard in the fall. They also talked about how much they disliked particular mathematical concepts, notably integers. On 1/24/11, the kids were on their third day of algebra. Instead of beginning this new, quite complex, topic with "critical thinkingish" work, Ms. Marquez began by teaching the procedures for combining like terms. On this day, she added in positive and negative numbers: integers. On the board is $-4x + -10x$. Clementine, echoing the disgruntled noises of kids throughout the class, told Ms. Marquez that she was "confused." Ritchie responded to Clementine, suggesting that she might be confused about the letter x, which was standing for a variable when it used to symbolize multiplication.

As Ms. Marquez began to move on to the next problem, Luis insisted on being called on, waving his arm and calling out to Ms. Marquez until she recognized him. He asked, "-4 variable minus a 10 variable, how do we know?” Ms. Marquez responded to Luis assuming that he was confused about what *x* means, reminding him that they don’t use the x as multiplication “in the seventh grade.” Luis insisted that his question was different, "That's not what I am saying, when there is a number next to a variable, how do we know WHEN to multiply?" Luis’s question reflected his past experience solving algebraic equations, and how new it is to him to be working with the expression as an object (Fosnot & Jacob, 2010). He knew that 4x meant that 4 would be multiplied by x, but when? His question was again misinterpreted as a procedural, not a conceptual misunderstanding, and Ms. Alton told him, “We don’t do that anymore,” referring to the x. He tried again to explain his question: “I feel like, but when will I know WHEN to multiply?” but his question was not recognized by either teacher. Luis then put his head down on his desk.

The next problem was *-8x - (-11x)*. By this time, it was clear that many kids had forgotten the rules for adding and subtracting integers, and so this subtraction of a negative quantity from another negative quantity further confused them. Ms. Marquez became frustrated at this point, telling the kids, " I don't know why you are confused about integers." Sitting in the back, directly behind the table of Luis, Lea, Carmen and Rita, I heard Carmen say to no one in particular, ”I am bad at algebra so I am lost, super lost in the world” and a few minutes later, “I am lost like a little child." Ms. Marquez told the kids to “forget about the variable,” and rewrote the problem as - 8 – (-11). At this point, Rita, a quiet kid who had been the only one at her table studiously taking notes, sat up onto her knees and said angrily, without being called on, “the letters are important, if you forget then you wouldn't get it right." Ms. Marquez either did not hear what Rita said, or ignored it. Carmen continued with her monologue, "the letters confuse me."

Here I see the conflict between these two figured worlds of mathematics. As the kids struggled to learn a procedure for combining like terms in algebra with positive and negative numbers, certain kids insisted on retaining the practices of “critical thinkingish” mathematics. Luis and Rita, both of whom told me that they enjoyed math and thought of themselves as good at it, are attempting to use those practices here. But questioning the concepts was an invalid move in the figured world of “state examish” mathematics. Luis could not start a discussion about the nature of a variable because the focus was on learning a procedure. Rita could not allow Ms. Marquez to transform the expression by eliminating the variable, but her protests were not heard. And throughout the incident, Carmen, who has preferred the practices of “state examish” math, was “lost.” For a “state examish” learner in this classroom, confusion about procedures triggered extreme negative self-understandings: a “state examish” learner builds their sense of competence on doing procedures correctly. So Carmen assumed that she was “bad at algebra.”

Shifts in ability and disability. During the spring, focused on test preparation, kids’ positioning based on “state examish” and “critical thinkingish” mathematics changed. In both interviews, Rita told me that she no longer liked math, because it got “harder.” I detail this change in Chapter Seven. Some kids were able to be successful in both kinds of mathematics, such as Ruby and Ritchie.

This shift in pedagogies caused some kids to appear more disabled, and others less so. Ana, who was initially a concern for Ms. Marquez, told me in an interview that she was the kind of learner who had to “practice and practice” until she “got it”(Second Interview). Ana was able to memorize procedures for adding and subtracting signed numbers, but was not able to solve non-routine problems such as 39 + x = -49, or any word problems involving these operations.

She told me that those felt different, and made her "panic." Luis, the star conceptual kid in the fall, became a concern for Ms. Marquez in the spring. Luis was not able (although he tried) to memorize the rules for addition and subtraction with integers. He only solved these problems accurately by secretly using the "giant number line in my head"(transcript, 4/13/11). Ana had the opposite trajectory in the class. By the spring, Ana was no longer a concern, as she was able to memorize and execute procedures called for on the test. She regained lost status in the classroom, and was on the honor roll in the spring semester. Both Luis and Ana were labeled learning disabled. Their differences as learners remind us that there is no one mathematical profile of a kid with a learning disability. It was their participation in different kinds of cultural practices and discourses around mathematics that disabled and enabled them differently at different points in the year.

I spoke to Ms. Marquez about this new dynamic immediately after class one day. She began the conversation by talking about Luis, discussing her confusion over his diagnosis.. When I brought up his characterization during an interview of some mathematical problems as "problems that give you problems"(First Interview), Ms. Marquez started to cry. Standing in the very public space of the hallway of her school, she told me "*that* (referring to problems that give you problems) is what I should be doing and I am not"(field notes, 1/24/11). She then became angry, decrying the test, the "200 standards I have to cover," and the test-makers themselves who profit off the situation. I include this piece to remind the reader again that Ms. Marquez is a complex character, one whose multiple understanding of math teaching and learning come from her own experience in multiple figured worlds of mathematics. She wanted to teach one way, a way in which she inspires kids to have their own "voice" in mathematics, but she felt compelled to reject those pedagogies. This choice was emotionally fraught for Ms. Marquez. These two figured worlds do not intersect seamlessly in this classroom. Their interaction caused conflict: conflict over what mathematics was, and who could be good at it.

The figured worlds of friendship in the classroom

> *I watch the kids emerge from their art class. I feel as if something has happened in this class to upset them as a group, maybe getting in trouble? Their faces are glum, they move slowly clutching stacks of books and book bags. But this sadness doesn't last for long. About two or three minutes pass and the mood shifts. Suddenly I see smiling and moving in and out of groups- two kids talk here, one wanders off and joins another group, the other kid looks around, who should I talk to? I see Desi come up to Arturo and Ana, and put her arms around them as they talk with Luis. Lea looks around, no place for her to go, looking small compared to the other kids, and it seems to me that the kids are like atoms forming molecules, bouncing around, bonding, disconnecting, bonding, doing their work in relationship with others, and I think of Wendy Luttrell's use of webs of care as a way to understand the adolescence experience. The friendships in this group of kids are strong, and in an interesting way the strongest bonds that I see are the kids with IEPs, because they have been together now for two years. So much of what they do can be understand as creating and maintaining this web, not best understood through their inner psychological need or some presumed deficit of the adolescent, but through their desire to build and maintain relationships* (Field notes, 3/30/10).

While the classroom asked the kids to turn into students, their social relationships could not be checked at the door. The kids must turn into kids, but they were still friends, enemies, boyfriends and girlfriends. What Luttrell has called the webs of care, CHAT(cultural historical activity theory) theorists would call the primary goal, the leading activity, of many adolescents—developing and strengthening relationships. In this section, I will explore the social groups within the classroom. As Paul Willis demonstrated in his ethnography of schooling, the social world is made up of groups of individuals with their own developing identities and improvised cultural practices (1977). In this class, I saw groups of kids that consistently hung out together, with strong patterns in the roles they played in the classroom and how they interacted with each other. Yet no group was static; no group had a set membership. No group had a set way of being in the classroom either, always adapting to current conditions. Kids identified at different times with one group or another, through engaging in specific cultural practices.

While interviewing Elisa and Federico midway through their seventh grade year, I asked them to describe their math class to me as if I had never been there. In previous interviews, kids had responded to this question conscious of my interest in math, describing what they saw as the important math aspects of the class. Elisa responded differently, sketching for me the social world of their class from the kid perspective:

> **Elisa**
> Most of the boys,
>
> not him [*gestures at Federico*],
> he's a . . .
> I really don't know what to call him type of boy,
>
> but the other boys will fool around,
> um,
> or they will help and liven up the class when it gets boring
> sometimes they will also disturb it when it is not.
> (Elisa and Federico, First Interview)

Her perception of the class was dominated by the "boys" who "fool around" who both entertain and "disturb" the class. These were the same boys who stood out for me in their sixth grade classroom, causing me to wonder why I was ignoring the girls. Elisa and Federico continued, naming for me the kinds of kids in their class: "chistosos" (jokers), "serious people" and those who are "outside." Elisa considered herself the last; "I am more like somebody who is outside. I am not chistosa, I'm not in the people that are usually hanging out with a bunch of people." Outside was only negatively defined, not being a chistosa, and not hanging out with a bunch of people. I asked if that is the first time that they have named that group chistosos, and they laughed, telling me that even the teachers know that name.

In this figured world, these groups did not have rigid boundaries. These distinctions operated less as groups with fixed membership, and more as possible identities to take up, as long as you will be recognized as such. While Elisa saw herself as outside, she also takes up the identity of the serious person. Federico made bids to be all three at different times. Taking on one of these roles meant acting in specific ways in the classroom. A chistoso made jokes, played with social boundaries, and competed mathematically to be better than others. Serious people paid close attention during whole group discussion, jockeyed to answer questions, and either competed to be the most mathematically competent (mostly boys), or placed great emphasis on working with others to solve mathematical problems (both boys and girls). Those that did not fit into either of those roles became "outsiders," as Elisa put it. Before I continue, I want to share a concern about this gender analysis. Ms. Marquez read a draft of this chapter, and the only aspect that she questioned was this analysis of gender. While she agreed that I had accurately described the dynamics of this particular group of kids, she felt that they were not typical of her classes in that the class lacked highly competitive girls in mathematics.

But for this group, certain kinds of mathematical ability, performing gender, and performing as a kid were interconnected. By using the term performing, I do not mean to suggest that kids are consciously performing a role. Performativity, as Judith Butler imagined it, is the ongoing doing of that which makes you what you think you are (1988). Performing gender is a complicated set of ongoing practices such as shaving legs or not, speaking a certain way, and being interested in certain things. These ongoing performances are always imperfect, as no one is ever the perfect male or female. In the same way, being any of these things is a matter of both taking up certain cultural practices, and being recognized in that role.

Chistosos. To Federico, the chistosos were “Luis and his lackeys.” Certainly Luis seemed to be in the center of this group: Ms. Marquez told me that Luis was the “king” and she needed to “dethrone” him (field notes, 1/24/11). The core members of this group were Luis, Ritchie, Ortiz, Arturo, and Tony. All of these boys frequently made jokes, both in class and outside. Just as the word *chistoso* means joke in Spanish, the main marker of identity for chistosos was humor. At least three times Luis made loud public jokes when Ms. Marquez was paying attention to something else, such as twice making fun of a kid from another class who came in to deliver a message to Ms. Marquez, saying “this is room 99, you don’t belong here”(field notes, 10/26/10). Luis got a big laugh for this, and the kid in question smiled at him and left the room. Ortiz made a joke during small group work about being given a white set of cards, saying with a mock offended tone, “Are you saying I’m white?” Ortiz also made jokes about how other kids smell (field notes, 10/27/10) and how much money they had (field notes, 10/27/10). Tony made jokes about whether or not another kid had washed their hands (field notes, 4/20/10) and whether a girl was a supermodel (field notes, 4/20/10). The topic of much of the humor was social boundaries: race, sexuality, ethnicity, cleanliness, and class. These jokes seem to play on Luis’s joke about the boy who did not belong in their class—who belongs and how?

At times, these jokes follow the pattern of “snapping,” as it was called in the schools in which I taught in East Harlem, a practice where kids, in my experience black or Latino boys, would trade insults in a highly ritualized format (Lee, 1993). Sometimes, these exchanges would become serious, but always for boys who were not in the core group of chistosos. For other boys, such as Vinny, Jesus and Federico, these exchanges seemed extremely serious. Federico and Vinny argued about who was more “poor,” a discussion that began playfully but became heated quickly. Part of being a chistoso was being able to treat such exchanges with humor, at least within the classroom.

Another marker of being a chistoso was the ability to perform in a hip-hop style. For his autobiography, Ortiz wrote a rap about how his mother trusts him to handle purchases at the store. During group work, I would often hear Ortiz singing rap under his breath as he worked studiously to finish a worksheet. After a state-examish lesson on multiplying fractions to find probabilities, I walked over to Ritchie's table. As I asked his group about their work, Ritchie began an improvised rap, directed at me, bragging about his skill at math, particularly his quickness at "multiplying fractions"(field notes, 12/13/10). It ended with a taunt to me: "your brain won't be able to function what I am saying." The other boys at the table (Jack, Pedro and Vinny), all shook their heads at Ritchie, shocked perhaps that he would perform with such bravado to a still unfamiliar adult. Ritchie's rap contained the critical elements of a chistoso performance. It was funny. The humor came from stressing his own mathematical ability, and calling into question the ability (the brain, even) of the target, in this case, me. It connected humor, the hip-hop genre, and "state examish" mathematical competence.

Was there a place for a chistosa? Perhaps outside of class, but no girl took on that role during class time. Desi was part of the group, almost always hanging out with the boys outside the class, but inside of class, she was serious, although quietly cynical. Carmen, who had the humor and confidence to be a chistosa, also was not during class time; she did not engage in one-upmanship or humor. She hid her humor, not displaying it. She also chose to affiliate herself with other girls, spending her time talking with her close friend Rita. Ruby, in her interviews, spoke about wanting to be seen as both smart and funny (Second Interview). But she did not align herself with these boys. Because no girl was a chistosa, in this world that Elisa and Federico sketched, girls were either serious people or outsiders.

Serious people. A serious person followed the procedures of the class without outbursts or funny comments. These kids were able to engage in both "critical thinkingish" and "state examish" practices, although most kids preferred one or the other. Ana seemed the ideal serious kid. During whole group discussions, Ana would stare at the teacher, studiously taking notes and frequently nodding. This was how Ana behaved in her sixth grade math classroom, as well as in the beginning of seventh grade. Ana would answer a question when called on, but only rarely volunteered. As the fall progressed, when her competence was called into question by the cultural practices of "critical thinkingish" mathematics, Ana stopped nodding, or even looking at Ms. Marquez during lessons. When the classroom shifted again, Ana began nodding once again, her whole body attuned to the requirements of being a student, personifying SLANT.

The importance of social relationships differentiated serious people from outsiders. Elisa saw a connection between being a serious person and being a social kid that would not occur to most adults. To her, speaking as a self-professed outsider, the serious kids are very concerned with their friendships. For the kids in this class, both boys and girls, there was a great deal of importance placed on working with friends on math problems. I saw this emphasis in my fieldwork, and kids also emphasized it in interviews, again and again. I describe this issue in more detail in Chapter Six.

Outsiders. Elisa did not like to work with others during math class, preferring to work alone. So too did Lea, and at times Federico. Being outside seemed most closely related to not identifying with the social aspects of this figured world. You were a chistoso if you joke, and a serious person if you hang around and are serious. If you were serious, choosing (or not) to hang around by yourself, Elisa defined this as an outsider. Lea seemed to be an outsider during the periods she had difficulty engaging in her schoolwork, isolated from the other kids. During the beginning of the fall, Lea sat quietly, not doing the assigned work, and giving any adult or kid who tried to “help” the evil eye. Lea changed over the year, building relationships with both her teachers and her classmates.

Boundaries and border crossings in social groups. In her study of an elementary school, Ann Ferguson found two groups of African American boys: the Troublemakers and the School Boys (2001). One group, the School Boys, adopted the official school policies and generally stayed out of trouble. The Troublemakers were more concerned with establishing a group identity closely related to their idea of blackness. Following Willis (1977), Ferguson documents the boys’ creative resistance to the official discourses of the school.

In the practices of the chistosos, one can certainly find creative reinscriptions of official practice, with plays on official discourses (hygiene, sexuality, race relations, mathematical competence), embedded in mocking exchanges with each other, and in impromptu creative output, like Ritchie’s math rap. What I noticed about the chistosos, however, were the boundaries between schoolboy and troublemaker were not so fixed. All chistosos could adopt the identity of a serious kid, when necessary, but to different degrees. Ritchie, Arturo, and Tony were able to switch into a serious person style when necessary, shifting their work habits and even the voice in which they speak. Ortiz particularly displayed these multiple voices. Each time he appears in my field notes, I hear a distinct voice— his accountable talk voice when engaging in mathematical discussion, his “snapping” voice, and his faux-serious mocking voice. Yet for Ortiz and Luis, when the classroom grouping practices change, switching between chistosos and serious people became more complicated, as we will see in the final section of this chapter. It was not their ability to perform the role that was called into question, but whether or not they could be recognized as such. In the language of figured worlds, kids saw various inter-related roles, scripts and storylines in the social world of the classroom. Analysis of the social figured worlds will be expanded in Chapter Six, when I discuss how critical relationships were in the classroom

"Ms. Marquez has a system"; Intersections with the figured worlds of special education

Throughout the fall, one kind of positioning that was absent from this figured world was grouping by ability, often referred to as tracking. Ms. Marquez assigned kids to groups randomly, so that the groups that rotated in the classroom were not designed for kids at different "levels." Privately, however, Ms. Marquez talked about kids in terms of "levels." One day she wondered aloud whether "low-level" kids know "how to start" a "critical thinkingish" problem (field note, 9/28/10). Yet Ms. Marquez did not track her classroom, although she did provide kids with options to make their work easier or more difficult (the enrichment folder, choosing a card with a hard or easy review problem during small groups).

Although there was minimal explicit discussion about special education or disabilities in the fall, kids dropped hints here and there that demonstrated their awareness of these categories. On 10/12/10, Ms. Marquez led a small group discussion about what the kids remember about integers from previous classes. Amparo made the point that she and Desi had the same teacher, but at different periods, so they must have learned the same things. Desi challenged this point, "but in our class some are faster and some are slower so she (referring to Amparo, who was in the non CTT class) got to do more stuff." Amparo looked at Desi, and then looked down. In that moment, I felt that Desi was embarrassing Amparo, not by suggesting that Amparo was at a lower level, but rather a higher one. The effects of tracking are felt not only in the lower tracks, but in the higher as well. Like the women who became “teacher’s pets’ in Luttrell’s work (1993), Amparo may feel uncomfortable about where she has been positioned.

In this school, discussion of special education status with kids was taboo. Of the kids with IEPs in this classroom that I interviewed (Desi, Luis, Ana, Federico, Elisa, Ortiz, Carmen and Rita, to name those who had been a focus of this chapter thus far), only two were able to explain why they had an IEP. Other kids told me that they did not know or that it has something to do with extra time on tests, saying, “I have time and a half”(e.g. Carmen, Second Interview). Ms. Emerson, who was the special education teacher leader in the school, believed that labels could be stigmatizing, and had developed plans to slowly inform the kids about their labels.

In my first visit in 2011, I noticed a new teacher in the class, a soft-spoken teacher named Ms. Alton. She had recently finished her special education degree, and was assigned to the classroom to meet the requirements of the kids’ IEPs. I also noticed that the groups seemed to be arranged by which kids had IEPs. After class Ms. Marquez told me that the new groups were tracked, designed to keep all the kids with IEPs together so that they could receive services from Ms. Alton (field notes, 1/4/11). One group was all kids with IEPs, another group included no kids with IEPs, and another group was a combination. She handed me a diagram, which I have reproduced in Figure 7:

All IEPs	**1/2 IEPs**	**no IEPs**
Vinny	Rita*	Ritchie
Elisa*	Tony*	Ruby
Desi*	Arturo*	Mario
Luis*	Carmen*	Bobby
Lorena*	Lea	Hugo
Ortiz*	Mercedes	Clementine
Federico*	Amparo	Jack
	Ana*	Pedro

Figure 7. Recreation of chart of new groups made by teachers.

Asterisks marked the kids with IEPs. When I asked if the kids knew this about the groups, Ms. Marquez said no, she told the kids that their class was being assigned an extra teacher so that they could have small groups led by an adult. Ms. Marquez was following the cultural practice of this school: limiting discussion of disabilities.

These groups remained the same, with only one change (Luis moving between groups), until June. In March, Ms. Marquez sent kids off to the groups naming them: “in my middle group” and “in my independent group” and “Ms. Alton will lead one group”(transcript, 4/13/11). For Ms. Marquez, two groups were hers, while the group led by Ms. Alton was not. Ms. Alton consistently led the group with all IEPs, which included Ortiz, Luis, Elisa, Federico, Lorena, Desi, and Lea. Ms. Marquez spent most of her time with her “middle group”; which included Carmen, Rita, Ana, Arturo, Tony, and Mercedes. The last group, which had no kids with IEPs, was called the “independent group.” This group, including Clementine, Bobby, Ritchie, Pedro, Jack, Mario and Ruby, worked without the supervision of an adult, quietly joking and talking as they solved problems either alone or with another classmate. When their work was finished, this group was able to do activities from the Enrichment folder or work on a test-preparation program on the computers.

The work each day was the same for all groups: a “state examish” packet of worksheets. Ms. Alton’s group moved at a much slower pace on this worksheet than the others. Ms. Alton insisted that all kids follow along the worksheet together, with her voice controlling the talk. The snail’s pace prompted Elisa to comment sarcastically at one point, “apparently we are not supposed to go on”(field notes, 3/30/11). Elisa was a very competent math learner, particularly with “state examish” procedures. Once she learned a particular way, she was able to recall and recreate the method at will. She would have been quite able to move at a faster pace than Ms. Alton allowed. I never observed a session in which there were not several loud outbursts from the kids in Ms. Alton's group. Three times I observed kids being asked to leave (Luis, Ortiz and Lorena). Ms. Alton alluded to the frequency of this practice, telling Luis and Ortiz, "this is why you are always outside"(field notes, 3/23/11). Ms. Alton never raised her voice or became angry in these moments. She spoke in a soft, clear voice at all times, even when asking a kid to leave the room.

"Ms. Marquez's middle group" group never had such an outburst, except when Luis was moved to the group. The same was true for the independent group, which was allowed to work without a teacher. While there were no "disruptive" behaviors, this group was allowed to talk about non-math related topics as they worked, as long as they finished. Ms. Alton's group was not allowed to talk about topics outside of mathematics (although they did).

Ms. Alton understood the groups as being based on "what the kids need" (Interview, teachers, 2011). In my final interview with the two teachers in the late spring, Ms. Alton discussed these groups using the discourse of special education, which often combines legal, medical and educational discourse (Reid & Valle, 2004). She began her description of each kid with a staffing ratio (either 8:1:1 or 12:1:1), legalistic jargon from IEPs that described the student to teacher ratio recommended for each child. Ms. Alton used these ratios to describe the kids "needs." She also uses the term, "he's a behavior" to describe both Luis and Ortiz. From her descriptions, it seemed as if the decision of who was in her group was based on several factors: their staffing ratio (Federico and Elisa both had a lower ratio) and whether or not they were a "behavior kid"(Ortiz and Luis). Neither of the kids was labeled with behavior disorders, but she used the term almost officially, perhaps suggesting that they should be labeled as such. Yet there were still kids in the group without low ratios or who were not “behaviors”: Lorena, Desi and Lea. These kids were not consistently able to be successful “state examish” learners, particularly recalling procedures.

The kids with IEPs who were placed into the “middle” group had all demonstrated their ability to recall and memorize procedures. There were some strong incongruities here. Both Elisa and Federico were able to perform this role of the “state examish” learner quite well but they were placed in this group because of the ratio on their IEP, suggesting a more significant disability than was visible in class. Luis had had significant mathematical status in this figured world, until the emphasis shifted from “critical thinkingish” to “state examish” mathematics. Ms. Marquez moved him to both the “middle” and the “independent” group multiple times—each time he was moved back to Ms. Alton’s group. No wonder that kids in this classroom developed more than one theory to account for these groups. The following sections describe the various theories that emerged. Throughout the theories, we can see kids in the uncomfortable position of trying to figure out who of their friends was up and who was down in the new hierarchy of their classroom.

Theory 1: “Independent.” In their interview, I asked Clementine and Ruby, both in the independent group, about the new groups that I saw in the classroom. Clementine told me about the new groups:

> **Clementine**
> Now Ms. Marquez has a system,
> that certain people are in certain groups.
>
> Me and Ruby are in the independent group,
> so because we are in the independent group,
> we get to,
> we get to do work independently because Ms. Marquez feels like we are the most people trusting. . . .
> who work more efficiently than others

(Clementine and Ruby, First Interview).

Clementine understood the groups as related to who was trusted by the teacher, who worked efficiently, who got the work done— independence was related to being a serious person. She only discussed how her group was defined, not the others, which made me wonder if the other kids were defined in opposition alone (not trusted, not efficient, not independent?). For Clementine, the groups were not made based on ability, but based on behavior, on what she perceived as the character traits of the kids.

I hear in Clementine's words echoes of Ms. Marquez. On 3/30/10, Luis was moved to the "middle" group. I heard Ms. Marquez speaking angrily to him, making him sit by himself in the back of the room. She told to Luis "you have to monitor behavior" and "my job is to teach math not to babysit"(field notes, 3/30/11). Luis was moved from the "middle" group not because he could not understand the work that they are doing, but because he was not monitoring behavior. Luis was the only kid who moved from group to group, but he was always moved back to Ms. Alton's group because of his behavior. Ms. Marquez reprimanded kids for not following the procedures of the class, but never for what could be understood as ability. So Clementine's characterization of the rationale behind the groups made sense; behavior seemed to be the primary factor in groups. But then why were kids who were not "behaviors" in Ms. Alton's group?

Theory 2: "Barely understands" versus "real quick." In their interview Bobby and Ortiz presented a different theory— the groups were not about following procedures, but about a particular kind of mathematical competence, not asking questions, but knowing "real quick." Bobby, who was in the independent group, began to describe the three groups based on "difficulty." Bobby paused before describing the third group:

Bobby
The same difficulty of
like
one group has like the people that kind of understand,
the other group has the ones that understand the most,
and then the other group has the group that . . .

Ortiz
Barely understands.

Bobby
Yeah,
barely understands,
um,
the topic.
(Ortiz and Bobby, First Interview)

Ortiz was in the group that "barely understands," while Bobby was in the group that "understand the most." Is that why Bobby paused? To avoid naming his friend in that way? Continuing after this passage, Ortiz distinguished between two kinds of learners: those who "know more," "had a lot of knowledge," who can "give you the answer like quick," opposing that group to those who would "struggle." Ortiz gave more information about the first group of people, as if "struggle" was enough to describe the last group. I saw this pattern elsewhere in the data: the word "struggle" seemed to be enough to describe some people's work in math class. This moment also allows us to see the effects these groups may have on the kids' relationships, when one friend is in the highest status group and the other is in the lowest status group.

This theory of "who understands" was more prevalent among the kids. Ruby, in her interview with Clementine, disagreed with her friend. Ruby believed that one group was the "needs more help" group, which was why they had Ms. Alton. In his interview, Luis said that he was in the "unsmartest" group, which he found difficult because he could not ask his classmates for help in that group (more on that analysis in Chapter Six and Seven).

Theory 3: "Kids who learn differently." A third theory of the groups closely matched Ms. Alton's theory that the groups provided what certain kids "need." In his June interview, I asked Federico if anything changed in his class. He immediately responded with the leveled groups,

> **Federico**
> Things started changing cause we started doing more groups separating on how the kids learn
>
> **Rachel**
> Ok,
> what do you mean by how the kids learn?
>
> **Federico**
> Like Ms. Marquez kind of separated us,
> a teacher separated teachers and separated groups,
> so this teacher would focus with these kids who learn differently than the other kids in the other class.
>
> And then this teacher would focus with the kids who learn with fast, but not so easy methods.
> (Federico, Second Interview)

The groups, from Federico's point of view, were not based on ability, but on *how* kids learn. His initial distinction was the "kids who learn differently from other kids" versus the "kids who learn with fast, but not so easy methods" (unclear whether this group is Ms. Marquez's or the independent group). Federico's group was the "kids who learn differently" group (Ms. Alton's group). Federico talks at length in this interview about different methods. It appears that he relates Ms. Alton to what he calls "easy straight methods," where as Ms. Marquez used "hard, but easy to understand, but long methods." Federico reported that he used both, for different situations. Notice how Federico makes sure to include that the "hard" methods are also "easy to understand." I describe further how Federico uses the concepts of easy and hard in Chapter Seven. In the theory of Federico and Ms. Alton, different kids learn differently, and need different methods.

Theory 4: "Labeling us." Only one kid expressed the last theory: Desi. During her second interview, I asked Desi if she liked the new groups in the spring. Desi replied, bringing in the concept of "labels":

Desi
In a way,
I liked it because I like working in groups
and I learned something else from my
peers and I learned how they
work and how they learn things and I learn ways
to learn things,

but then I didn't like some of the
like the labels of the groups,
because some of the labels

Rachel
What were the labels of the groups?

Desi
It's like sometimes the labels were like,
oh,
that
this is the group that doesn't really do much,
and then *this is the group that*
doesn't like
pay attention to much or something,
and *this is the group that is on the top*
so then it is like they are labeling us

Rachel
So like those are the three groups as you saw them?

Desi
yeah,
that's how I saw them,
because I realized that
Jack and Mercedes and Pedro and all of them
they were like in the same group,
and I was like,
they're the people that get all the high grades,
and then I was in the group with people who that
either we were rebellious and we didn't really want to do too much,
or –

I like questioning authority [sly smile],
or we were
just the people that were too lazy to do our work,
and I realized that I was in that group,
and I am like okay,
so I can tell that you are labeling me something
but just because you are labeling me this it doesn't mean that I can't do what they are doing.
(Desi, Second Interview)

Desi made a very specific critique of this practice of ability groups: she did not like the ways in which the groups labeled the kids in her class. She cannot help but notice who was in what group, once she realized that the groups had labels put on them by adults. This narrative followed one in which Desi explicitly rejected special education labels for kids, saying that the labels (she refers specifically to the label of Attention Deficit Hyperactivity Disorder) don't matter, that all kids can do it if they "put in the effort." Here, she avoided what she seems to consider as limiting labels when describing the kids in Ms. Alton's group: either the kids were "rebellious" and thus "didn't really want to do too much," or liked "questioning authority," or "too lazy." For Desi, Ms. Alton's group was filled with kids who were making choices not to "get all the high grades."

I asked Desi whether she ever talked to her teachers about these feelings, and she replied no, because while Ms. Marquez "would actually kind of agree in a way," Ms. Marques was just "trying to do the right thing for the city state." Desi connected the actions of her teachers to power, to government, because:

Desi
I think it is because they are trying to control the way that we learn,
and they are trying to
change
who,
like the way we are
and I feel like they put less effort in the group that um that doesn't really pay that much attention.
And they put a lot of effort in the group that really does . . .
because you know the leaders of the next generation or something.
(Desi, Second Interview)

Desi saw the groups as separating out kids based on who are "the leaders of the next generation," to give more effort and attention to those kids. And for kids like her, not "the top," Desi believed that adults were trying to "control the way that we learn." Desi's critique reminds me of the educational reforms post-Sputnik. Sleeter (1995) wrote how the increased demands on math and science created massive tracking in the schools, giving the best teachers to those kids who were seen as having potential. Desi did not see tracking as being primarily about helping kids like herself, more about putting effort into kids at the top.

These four theories of the groups reveal a swirl of voices about ability and disability in mathematics that circulate in this classroom. All of the figured worlds that we have thus far explored are involved. Clementine evoked the behavior expected in the figured world of being a student. Ortiz and Bobby reference state-examish constructions of mathematical ability. Federico spoke with the voice of his newly minted special education teacher. Desi moved into a realm we did not yet consider, critiquing the larger practices of power that label and sort kids in school.

Another way to understand the meanings of these groups is to look at how kids changed in them. I saw more overt defiance of adults in Ms. Alton's group than any other time or space in this classroom. The reasons for this were probably multiple: stressful atmosphere and demands of testing, rigidity of exclusively "state examish" mathematics, and testing the boundaries of a new teacher. Yet these reasons, far from being separate, were interrelated. Perhaps Ms. Marquez allowed these leveled groups in January not only because her classroom was assigned an additional teacher to fulfill a legal special education mandate, but also because she was entering a phase of the year dominated by state-examish work. "critical thinkingish" work was easier to do in heterogeneous groups, as multiple ways were accepted and valued. When there was only one accepted method, the differences between the kids became more pronounced. Not because the kids have changed, but because the curriculum has changed. Different mathematical pedagogies disable differently. Fixed grouping might make "state examish" pedagogy easier to manage for teachers. It also allowed Ms. Marquez to focus on the "middle group," the group that was more likely to make gains on the test, a common practice in schools that focus on testing (Nichols & Berliner, 2008). Schools in the US, as well as the United Kingdom, are encouraged to separate kids into three categories: those that are already doing well, those that are not likely to pass even with assistance, and the "bubble" or "cusp" kids: those who might move into the next level of testing with additional attention (Booher-Jennings, 2005; Nichols & Berliner, 2008). In this classroom, the middle group got the undivided attention of an experienced teacher, the top group got to solve problems independently (more analysis on this in Chapter Six), and the bottom group, despite its heterogeneity, worked at a snail's pace with a first year teacher.

Resistance marked Ms. Alton's group. While Luis and Ortiz had been briefly uncooperative at times with Ms. Marquez, they had always backed down after Ms. Marquez gave them "attitude." In the fall, Ortiz refused to take his hat off in class, but after a prolonged silent glare from Ms. Marquez, he took it off without a word. In Ms. Alton's group, these two boys were frequently uncooperative. Once, after a particularly chaotic class, Ms. Alton pulled me aside, telling me in a hushed whisper that these two boys were "behavior kids"(field notes, 3/23/11). This represented a shift in language around misbehavior in this classroom. While Ms. Marquez called Luis, "the king" and joked that she would "dethrone him," she never labeled him as a kid with inherent behavioral difficulties. Ms. Marquez told Luis, "You need to monitor your behavior." Ms. Alton repeatedly called Luis "a behavior" or "a behavior kid." This is a particularly meaningful shift considering that at this present moment in the history of special education, there is a category called Behavioral Disorder that is disproportionally applied to black and Latino boys (Losen & Orfield, 2002). With the arrival of an expert, and a simultaneous shift to grouping based on labels, Luis and Ortiz became "behavior kids"— kids who were defined and understood by their behaviors, ways of acting in the classroom that do not align with the way a kid should act and speak. Perhaps also missing for Luis was the opportunity to be a "critical thinkingish" math learner, lost in the maze of worksheets that was his spring.

"Becoming our Dominican Selves"; Figured worlds imbued with social positioning.

The kids in this classroom almost all identified as Dominican, with the diversity within that ethnicity very present: different amounts of family remaining in the DR, varying skin tones, and different levels of bilingualism. Issues of race and ethnicity came up in class, sometimes as jokes, and other times children referring to their ethnicity as a point of pride. While working on a textbook problem that referred to the opinions of kids in a school, Amparo joked, "Where are the people from? Midwood? Santo Domingo?" She got laughs from her peers and her teacher for that one, calling into question whether or not she and her classmates are being excluded or included in textbooks. Luis used metaphors of race and borderlands to understand mathematics. He told me that he thinks of the number line at zero as the contested border between Mexico and the United States. At another time, he thought of the problem $-5 + 4$ as sides in a war, between black and white people. At the end of one class period, Ms. Alton's group chatted about the ages and skin colors of their grandparents. At first the conversation was serious, and included Ms. Alton. The group discussed how much progress their grandparents had seen over their lifetimes. Luis, whose skin is light compared to his peers in this class, made a joke: " I look black." Another kid responded that Luis looked like "Rosie O'Donnell," perhaps playing with ethnicity but also gender, sexuality, and body types, as Luis was light-skinned, male, skinny and funny. Skin color, language, country and neighborhood came up as kids talked in the classroom.

Even though the teacher and most of the kids were also fluent in Spanish, the only time that Ms. Marquez used Spanish was to chastise kids for misbehavior. This may have been intentional on the part of the teacher, out of consideration for the handful of kids who were not fluent in Spanish. Kids used Spanish to talk socially. I once walked by Desi, Luis and Arturo heatedly speaking in low tones in Spanish, breaking off immediately as I walk by. I never heard a conversation between two kids about math in Spanish.

The absence of Spanish sent a message to kids that there was no overlap between Spanish and mathematics. Desi said it most directly in her final interview with me:

Rachel
So do you ever speak Spanish in class,
when you are doing math?

Desi
I do,
it is just that when we are excited or something,
or we are talking about a cool topic we just start like,
becoming our Dominican selves and then--

Rachel
You start becoming your Dominican selves.
Can't you be your Dominican selves in math class?

Desi
Ehhhhh.
No,
we feel as if you have to be serious in some sort of subject and then you have your fun with like,
your language.

Rachel
What if you were taught in,
um
what if you learned math in Spanish?
What would that be like?

Desi
That would be weird,
I think it would be the same way though,
because like, Ms. Marquez,
she is Spanish and she still like,
she knows what she has to do.
(Desi, Second Interview)

Desi transitioned the conversation immediately from the first person singular to the first person plural: we. She did not talk about herself as an individual, but the collective group, “our Dominican selves,” which are associated with “having fun,” versus being “serious in some sort of subject.” Math in Spanish would be “weird.” Desi set up a dichotomy for Ms. Marquez: she was both “Spanish” and “she still knows what she has to do,” suggesting that perhaps being Spanish may mean that you don’t know what to do. And what you have to do in this case, was doing mathematics.

In interviews, several kids talked to me about doing mathematics during the summer in vacations in the Dominican Republic. Ana talked about her confusion learning different mathematics in the Dominican Republic. Carmen enjoyed learning that there are “many ways” of doing mathematics from her cousin over the summer. Bobby told me the story three times of learning his multiplication facts on summer vacation while in the Dominican Republic. While Ana reported her confusion, both Carmen and Bobby enjoyed these mathematical experiences. I did not see any of this experience brought into the class through discussions.

Teacher Perspectives on Ability and Disability

At the end of the seventh grade year, I interviewed Ms. Marquez and Ms. Alton together. I had intended that this interview was as similar as possible to the interview with the sixth grade teachers, but we had trouble finding a room, and had less time. In addition, as we began the interview, I could see that each of the teachers had certain topics that they wanted to speak about.

Ms. Marquez wanted to discuss the problem of placing the kids into classes in eighth grade, and Ms. Alton had come prepared with detailed descriptions of the kid's special education labels.

The two teachers had different ways of categorizing their kids. Ms. Marquez spoke about kids as "higher-order thinking" and "conceptual," variants of "critical thinkingish". At this point, a month after the state exam, Ms. Marquez seemed to return to her concerns about developing voice and critical thinking in her kids, and also recognizing kids who demonstrated it. She named Desi and Luis as kids with these skills, as well as Ruby. Ms. Marquez spoke of being impressed with Ruby, how she could still question and wonder about math after so many years of schooling. Ms. Marquez seemed to include her own class in this critique, inferring that her class, or aspects of it at least, would drive all questions out of the kids. Ms. Marquez seemed sad when she spoke about this.

Ms. Marquez spoke about wanting to create a special class for kids like Desi and Luis, a class that would draw on their "higher level thinking," providing connections between mathematics and "social justice." Ms. Marquez wanted that class to be focused on "real world investigations." Ms. Marquez made it very clear that class would not happen. Instead, the eighth grade teachers were insisting on tracked classes. They were refusing to put kids with IEPs in the top track, because there would be "not enough support." The language of care, of supporting and guiding kids, was here used to exclude kids, something I have often seen in my time in schools. Support here means the presence of a special education teacher, and if there is no coteacher, there can be no kids with "special needs." The very language designed to protect the kids, now segregates them. Ms. Marquez seemed furious about this, but also defeated. Ms. Marquez said that she would have put Ana and Arturo in the top class, but now she cannot.

Ms. Alton had a different take on this situation. This decision was not necessarily "bad," because these "kids need support" and also "a different kind of instruction." From this perspective, kids with IEPs are qualitatively different than kids without them. This kind of kid needs something different than a regular math teacher can provide. Their difference from normal kids means that they are best grouped together. Ms. Alton pointed to the ability-based groups of the spring, saying that they had "helped" the kids by giving them a "small group to support them." She insists on this point despite the heterogeneity of her group, impossible for them to work all on the same page.

When Ms. Marquez's talk about Luis focused on conceptual strengths, Ms. Alton interrupted, naming Luis as "a behavior." She began discussion of both Ortiz and Luis with discussion of their behavior. She also spoke about kids with IEPs who lacked number sense, as if number sense is a thing that one either has or has not, rather than a description of a person's entire mental landscape of number (Greeno, 1991). This is another common way of describing kids with disabilities in math classrooms that I further take up in Chapter Five. Ms. Alton discussed children's ratio, explaining how many adults per child their IEP mandated.

Particularly in dialogue with the terms and numbers that Ms. Alton used, Ms. Marquez once again seemed to stumble when talking about disability. She questioned the disabilities of kids, particularly Luis, Desi and Elisa. She rejected the idea that kids with IEPs who were able to do grade-level procedural work (Ana and Arturo) should be separated out. Ms. Marquez seemed tired and worn out. Just as in the interview with the seventh grade teachers, the teachers negotiated multiple discourses, emerging from multiple figured worlds. The dynamic between the teachers was different: while Mr. Pierce appealed to Ms. Marquez's technical expertise, Ms. Marquez does not ask Ms. Alton to clarify her difficulties with the labeling of kids.

One way to analyze these differences between the teachers is the concept of authoritative voices. Ms. Alton was by three or four years the least experienced teacher in this group. This was Ms. Alton's first teaching job. She was still taking classes to finish her special education credential. As the expertise frameworks of Dreyfus (1984) and Holland et al. (1998) suggest, beginners use rules more than experts. A beginning in the world of special education seems likely to reproduce these various discourses with power (IEP ratios, labels such as "behavior"). Ms. Marquez's experience seems to make her less likely to accept the authoritative voices of special education that circulate through this classroom.

Conclusion

In the fall of their seventh grade year, one of the groups that the kids cycled through consisted of multiplication flash cards. Bobby was assigned the task of kid monitor. Bobby's autobiography told the story of how his uncle taught him his multiplication facts during a summer in the Dominican Republic. He refused to let the kids in his group use paper to work out the answers, insisting on memorization. He schooled the other kids if they could not recall the fact quickly enough, taking up the voice of a strict adult admonishing children: "what if it is on the test?"

Federico rebelled against these constraints, telling Bobby that he needed more time and also paper, because, in his words, "I'm slow writing and [circular gesture to his head, thinking] but I know them all. Just pressure." This voice came from an understanding of learning differences, one that I imagine came from his previous teacher, Ms. Emerson, who believed in teaching kids about their own process of learning so that they could advocate for themselves in situations like this. In Ms. Emerson's description of Federico to Mr. Pierce described in Chapter One, I hear the same description of processing. Bobby expressed his understandings of what mathematics was (memorizing the multiplication tables and being able to recite them quickly without paper). Federico expressed his understanding of who he is as a math learner (may take longer, but will get to the same result in the end). Both kids seem to have appropriated voices of teachers and family members about math, learning and themselves. They both speak with powerful voices from different figured worlds. They come, however, to an impasse: is mathematics the same as memorization, or are there alternative routes to mathematical competence?

In this chapter, I documented the gradual progression in this class from a balance between the two kinds of mathematical activity, to the dominance of "state examish" activity. I also sketched the figured world of schooling and the social worlds of the kids. Finally, we explored the advent of ability tracking in this classroom, and its connections to the figured worlds of special education. There is no one singular figured world in any classroom. Figured worlds provide heuristics for mathematics, for the right way to be a kid, for when and where to speak Spanish. The discourses of these worlds provide voices, scripts and storylines about something as seemingly simple as memorizing multiplication facts. Kids have multiple heuristics to use to make sense of themselves as math learners. Conflict abounds. And within those conflicts, amidst multiple circulating voices, each individual child must decide how to speak about themselves.

Chapter Five:

Learning and Not Learning Operations with Integers

> *"Any conceptual apparatus is created within social practice which themselves position the participants as relations. Since the practices are multiple, the sites for the creation of such relations are multiple and shifting. Thus subjectivity is multiple, not singular, and we should expect that the relation between different 'meanings' or relations within and between signifiers might have a particular effect for the subject who lives these relations"(Walkerdine, 1988, p. 30)*

Several weeks into the kids' seventh grade year, Ms. Marquez told me that she had been really bothered by a math department meeting. The eighth grade teachers complained, and not for the first time, about how the kids never remembered operations with integers. According to Ms. Marquez, her kids had always done well on operations with integers while in her class. But the eighth grade teachers continually harped in this point—why were kids entering eighth grade without knowing anything about negative numbers? Ms. Marquez was frustrated. She decided to spent three weeks rather than two teaching computation with integers. She also convinced the sixth grade teachers to introduce integers in their classes.

Ms. Marquez taught an initial three-week unit on operations with integers in October. When the class began studying algebra in the spring, integers resurfaced. This mathematical topic became a major sticking point for kids, and a site in which "critical thinkingish" versus "state examish" mathematics was contested. In Chapter Four, I documented the gradual progression in this class from a balance between the two kinds of mathematical activity, to the dominance of "state examish" activity. Integers were introduced through "critical thinkingish" activity that was gradually replaced with "state examish" activity. This chapter asks how it might matter to learn integers through these two kinds of mathematical practices. As Valerie Walkerdine proposed in the quote that opens this chapter, learning is situated in social worlds, and positioned within those social worlds. Individuals have not learned a concept like integers through a single path, or a single experience, but through years of experience in multiple mathematical worlds.

The conflict in the Central Academy's math department around integers is not unusual in schools, either in the United States or abroad. Integers prove to be difficult for kids to learn (Vlassis, 2004). A colleague told me that problems with operations with integers were a major complaint of math teachers across the high schools in which she worked. Integers are under researched, despite their prominent place in the middle school curriculum (Kilpatrick, Swafford, & Findell, 2001). Computing with integers flexibly and accurately is critical for success in algebra and beyond (Fosnot & Jacob, 2010).

In this chapter, I present a conceptual basis for understanding mathematical learning situated within the larger conceptual framework for this study. Because my overall focus is change in kids' identifications with math over time in multiple figured worlds, I wanted to trace the learning of one particular mathematical subject over time, situating the mathematical inquiry within the figured worlds detailed in the previous chapter. In this chapter, I will detail the processes of learning (and forgetting) addition and subtraction with integers from their introduction in May of the kids' sixth grade year, to a final assessment, also in June, in the kids' seventh grade year. I analyze change over time at the level of the classroom and for individual kids. The chapter ends with critical intersections between the heuristics and positioning of figured worlds and the learning of integers. This chapter traces the relationship between cultural practices of teaching mathematics, the positioning of kids and tools, and the learning of mathematics.

Conceptual Framework

In this section I will review some of the conceptual framework that I applied to the teaching and learning of addition and subtraction of integers. I use the opening quote by Walkerdine because it was extremely influential in how I developed the conceptual framework for this part of my study. As discussed in Chapter Two, inspired by Vygotsky and the scholars who surrounded and followed him, I see learning as mediated action in figured worlds (Vygotsky, 1978; Wertsch, 1998). Learning begins in social interaction. Over time, with scaffolding and practice, actions become less external and more internal, as well as condensed in time. Vygotksy called this process fossilization (1978). All learning, all interaction, is mediated. Language is the consummate mediator, but number lines and numbers themselves act as mediators as well.

When a child learns to add on a number line, the number line is both a tool and a mediator of future action. Learning to add on a number line versus learning to add using blocks lead to qualitatively different understandings of addition and number. The tools (strategies and models) we use to learn mathematics become an irreducible part of how we understand that mathematics. The first time the sixth graders learned about integers, there were multiple mediators: not only the context of debt, but the number line that emerged as a model for some kids.

As I wrote in Chapter Two, Wertsch (1998) built on Bakhtin (1981) and Vygotsky (1978) to propose two kinds of mediated learning: mastery and appropriation. Mastery describes when an individual learns how to use a tool, but does not make the tool her or his own. A child could learn how to add two numbers on the number line just by replicating the procedure taught by a teacher, without building understanding of why this process worked. In this chapter, I will use *replication* as an alternative term for what Wertsch called mastery, as I believe it calls more attention to how the child repeats a procedure without making sense of it. Mastery suggests that the child has mastered the number line, while perhaps it would be more accurate to say the method on the number line has mastered them. Agency rests in the tool, not the user. My term, replication, also has conceptual hazards, strongly suggesting that knowledge can be copied—not true. But it does describe a certain kind of action (learning): replicating a piece of information or an established process.

A second kind of learning is appropriation, in which the individual adapts the tool, making it his or her own. One could appropriate addition on a number line by exploring how it works, perhaps making connections to other mathematical understanding or representations. A child who appropriated the number line for this operation would be able to use the tool to solve a subtraction problem, for example. Even a memorized rule can be appropriated: A child could explain why a rule worked, or use an alternative representation to justify their actions mathematically. Appropriation involves deconstruction and reconstruction. This distinction between mastery and appropriation is useful for analyzing the critical moments in integer learning in this classroom. What are the mediating strategies and/or models? How is the learner using these: is she appropriating the strategy? Or replicating it?

Wertsch (1998) insisted that all mediators exist in social worlds, and just like people, are positioned. Last summer, my four-year-old nephew was trying to add two numbers. I reminded him he could use his fingers, and he glared at me, saying, "Fingers are for three-year-olds." His older brother told him that, and my nephew now will not use his fingers to add. Any mediating tool, be it fingers, a number line, or the language of the rule, will be learned in social worlds that position that tool. Walkerdine's quote that opened this chapter asks about possible effects, considering that any one individual has participated in multiple worlds of mathematics, all of which position tools and strategies. My nephew entered kindergarten this fall. I wonder if the teacher encouraged kids to use their fingers, and how he responded.

In this chapter, I draw on a tradition in mathematics education of analysis of strategies (the methods that kids use to solve problems) and models (mediating representations such as the number line or fingers). Like Cathy Fosnot and her colleagues (Fosnot & Dolk, 2002; Fosnot & Jacob, 2010), I see mathematical learning as multiple possible paths through a landscape, not a single, predetermined path. Kids move through the landscape in various ways, based on what they already know and what experiences they are given. In their 2010 work on algebra, Fosnot and Bill Jacob included a chapter on integers, yet did not include integers on their landscape for algebra, commenting on the lack of "definitive or comprehensive research on the best way to teach operations with integers"(p.111). The next section discusses what we do know first in the historical development of integers, and then the still limited literature on integers in mathematics education.

Historical development of integers. The first numbers invented were the natural or counting numbers. The next type of number that was invented was zero, which is more abstract than 1, 2, and 3. Naming *nothing* was a significant accomplishment for an early civilization. Fractions developed in Egypt to describe the result of fair sharing situations. In the Middle Ages, decimal fractions and percentages also emerged to help with computation of banking interest (Fosnot & Dolk, 2002). These numbers are all representations of magnitude (how many), and are all rational numbers. They are also representations of how much, or measurement of a continuous, non-discrete quantity, like the distance on a road. In other words, they represent something that exists, and can be measured.

The first recorded use of negative numbers comes in 250 B.C.E. in China, the third century in Greece, and the seventh century in India (Gallardo, 2005). In all three of these early uses of negative numbers, mathematicians invented negative numbers to expand the solution sets of a particular algebraic equation. The Greek author, Diophantus, rejected the negative numbers that he created, calling these numbers “absurd”(as quoted in Gallardo, 2005). Fibonacci, in the eighth century, worked with negative numbers, but remarked that such numbers only make sense in the context of debt(Gallardo, 2005).

While some of these authors wrote rules for operations with negative numbers, the idea of negative numbers did not yet take hold in the mathematical imagination. Many years later, in the seventeenth century, Blaise Pascal wrote, “I know people who cannot understand that when you subtract four from zero what is left is zero”(quoted in Hefendehl-Hebeker, 1991). The fundamental issue was magnitude. The number −4 cannot exist, for it has no magnitude. Only in the context of debt did it make sense, but it still had no status as a kind of number, regarded instead as an “auxiliary object”(Hefendehl-Hebeker, 1991).

Another major historical difficulty with accepting negative numbers as numbers was the fact that there did not yet exist a unified number line that included both positive and negative numbers, which was eventually developed by Mobius and Chasles (Hefendehl-Hebeker, 1991; Gallardo, 2005). In 1867, Hermann Hankel published, “Theorie der complexen Zahlen-system”(Theory of complex number systems). This paper reflected the turning point in a shift from understanding number as primarily about magnitude, which means a necessary connection to magnitude in reality, to understanding number as part of an abstract, purely symbolic number system. In this system, the negative numbers exist as part of a system that operates under a single set of rules. As Fosnot and Jacob wrote, one of the reasons that $-4 - (-5) = 1$ is true is that $1 + -5 = -4$ is true (2010). Because of the properties of addition in our number system, one equation cannot be true without the other. This is why the rules for multiplication and division with integers work in the way they do: because 7 x 3 = 21, and 7 x 2 = 14, and 7 x 1 = 7, and 7 x 0 = 0, then 7 x −1 = −7. Otherwise the pattern (decreasing by 7) would not continue. The rules for operations with integers were not created based on a real-world context, but so that the structure of the number system could operate seamlessly with this new kind of number, both in algebra and geometry (Freudenthal, 1983; Wall, 2010). These historical issues reappear when we try to expand children's' number systems to include the negative numbers.

Literature on teaching and learning operations with integers. Integers present a theoretical and practical challenge for teachers and researchers of mathematics. First, like Pascal, children may reject the idea of numbers without apparent magnitude. Unless kids develop some way of understanding what −2 is, they may begin to think of it as a nonsensical number. Fosnot and Jacob (2010) suggest developing understanding of −2 as net change, a concept built on equivalence. Other researchers in the realistic mathematics education tradition have developed contexts based on scores and forfeits (Liebeck, 1990) and keeping track of people coming in and out of a dance (Linchevski & Williams, 1999). All these models are similar, built on the concept of net change and equivalence. This model was not introduced in either classroom.

A study of contexts for addition and subtraction of integers used in American textbooks found that no one context was able to explain all problem types in addition and subtraction of integers, particularly subtracting a negative number (Whitacre et al., n.d.). Otherwise reasonable contexts become strained when forced to account for this kind of problem, which was the most difficult for kids to solve in this classroom. Mr. Pierce, Ms. Emerson, and Ms. Marquez all told me that if they could find a single context that would work for all kinds of problems, they would use it for integer operations.

Number lines are critically important models for negative and positive numbers, allowing for the organization of the new number system. A study on preservice elementary school teachers (Widjaja et al., 2011) found that some adults labeled number lines without regard to magnitude, just as Desi did in Chapter Two.

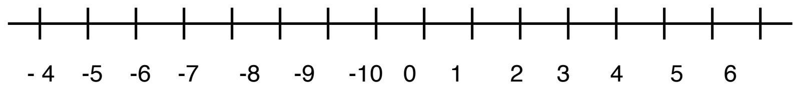


Figure 8. Gloria's number line

The number line shows a misconception about directionality of the negative numbers on the number line, as well as magnitude. The authors called this representation one of the "twisted geographies of the number line" (Widjaja et al., 2011). Other studies have echoed children's difficulties with ordering signed rational numbers (Peled & Carraher, 2007).

Integer Instruction from May 2010 to June 2011

The following gives an overview of the development of integers from May of the sixth grade until the June of seventh grade. I have given longer descriptions of many of these moments in earlier chapters. This description focuses on the general activity of the class, not individual learning, as this section is followed by individual analysis of focus kids.

Sixth grade: money, debt and sandbags. The kids in this study were introduced to integers through a context of debt, described in Chapter Two. The sixth grade teachers told a story in which the kids added more money, or added debts, while the kids acted it out with play money. During this lesson, kids primarily used the money context to solve addition and subtraction problems. They also used their fingers and the number line.

The context of money, combined with the number line and fingers, seemed to be a strong start for some kids. Lorena, who had a history of being disengaged from mathematical discussion, was deeply involved in this discussion, sharing her thoughts within the context of money. As she worked, she sat close to her friend, Sade. They used their fingers under their desks to add and subtract. For some kids, while they worked in the context of money and debt, they were able to make sense of the problems by relating it to the context, showing not only replication of the strategy, but some appropriation.

Initial work with the number line was varied. Three kids showed difficulty with the idea of moving to the left on a number line when adding. Two were able to reorganize their thinking to incorporate this new idea. Ortiz, insisting that Ms. Emerson had taught him to move to the right when adding on a number line, refused to change his thinking. He put his head down on the desk and refused to use the number line in that way.

Visiting the following week, I saw another context: sandbags. The lesson I observed came two days after the new context was introduced. During this lesson, kids worked on a worksheet of integer addition and subtraction problems. All the kids that I observed during this lesson used vertical number lines in combination with the sandbags metaphor. All thought of addition and subtraction as directed movement. The first number was where they started, and the second number was the directed motion: either adding sandbags (plus a negative), adding hot air (plus a positive), taking away an airbag (minus a positive) or taking away a sandbag (minus a negative).

As Ana confidently explained this context to the other kids in her small group, her hands moved up and down, her gestures of movement closely tied to her understanding of changing magnitude. I saw evidence here for appropriation of the context for Ana. Although powerful for her, the sandbag metaphor was not working for all of these kids. Three days after its introduction, three out of four of these kids are not able to use it independently to solve problems.

Seventh grade: the rules. Integers first appeared in the seventh grade class in October in a Warm Up that asked kids to order four signed rational numbers on a number line. As I wrote in Chapter Four, kids were able to explain the geometry of the number line with integers, even the confusing notion that negative numbers with greater absolute value are less, and further to the left on the number line. Comparing the rational numbers proved more difficult, with several major misconceptions about equivalence emerging from the discussion.

The class broke into three stations, with kids moving between them. Ms. Marquez's group was initially designed as a mini-lesson on adding and subtracting integers, but Ms. Marquez changed it to a discussion about their previous knowledge of integers. At this point, Ms. Marquez's plan was for kids to solve the problems using whatever model made sense to them, and then gradually create formalized rules. The kids discussed sandbags, number lines, and a chip model. Different kids had different relationships to models and strategies at that point: Luis was exploring the number line while other kids talked about whether or not they had understood the sandbags.

When I returned a week later, the student teacher was leading a Warm Up designed to help kids "discover" the rules for subtracting a negative number (field notes, 10/19/10). There was a struggle between the kid teacher and the kids who wanted a rule, and were frustrated with the process of having to solve problems without a rule to guide them. Other kids, like Ruby, used a model that made sense to them, the number line. This strategy of discovery learning did not result in the majority of kids appropriating the rule.

Yet was evidence of appropriation of other models in the classroom that same day, as Ms.

Marquez's small group engaged in a heated debate about directionality of operations on the number line. During small group work, across the classroom, kids were using tools such as the number line, their fingers, and their own interpretations of the developing rules. There were no set rules at this point in the classroom.

A week later (10/26/10), kids had formulated rules for all types of addition and subtraction problems. The two posters said:

> <u>Adding Integers with different signs</u>
> Subtract and keep sign of greatest absolute value
> -7 + (3) = −4
> 10 + (-20) = −10
>
> <u>Subtracting Integers</u>
> Add its additive inverse.
> - 4 − 5
> - 4 +(-5)
> -9

These posters remained up the entire year, becoming the established rules for addition and subtraction of integers. For some kids, such as Carmen, these rules were memorized (replicated) and used for the rest of the year.

That same day, Ms. Marquez gave the kids a challenging Warm Up: 49 + __= −39. This was the only instance of kids solving a problem with an unknown addend, instead of an unknown sum. Carmen had difficulty with this non-routine problem, attempting to apply the new rules. Some kids, like Ruby, rejected the number line in favor of the new rules, but then were not able to solve this non routine problem.

For the next few months, the kids worked on geometry and statistics. As I detailed in Chapter Four, January saw three major changes in this classroom. Ms. Marquez began preparing kids for the state exam, replacing all "critical thinkingish" mathematical practices with "state examish" practices. A new teacher, Ms. Alton, joined the class and kids were put into ability groups. My visit on 1/24/11 came on the second day of a new unit: algebra. Ms. Marquez told me that she dispensed with a "critical thinkingish" introduction to algebra because there was not enough time.

As I described in Chapter Four, this lesson was focused on following rules in order to combine like terms, with both positive and negative signs. When kids repeatedly had difficulty recalling the rules for integers and applying them to variables with coefficients, Ms. Marquez became frustrated, telling the kids, " I don't know why you are confused about integers"(field notes, 1/4/11). Ms. Marquez then told the kids to forget about the variable, and follow the rules of integers. She rewrote the problem - 8x - (-11x) as - 8 – (-11). Ms. Marquez was trying to help them remember the rules, but in the new context the kids did not know how to understand the variables. Ms. Marquez leads them to ignore the variables, and then repeatedly modeled this practice in subsequent lessons, encouraging replication not appropriation. After the discussion, the kids broke up into their groups to do a worksheet on combining like terms. Ms. Alton told her group that they needed to use the number line, which was met with loud protests from kids. This group rejected the number line in favor of the rules. Memorizing (replication) had more status.

On 2/1/11, I saw kids again doing repeated practice with combining like terms. Ms. Marquez now regularly modeled the practice of removing the coefficients and setting up an integer problem. This led kids to make mistakes with variables with no coefficients (such as jk in 13 jk - jk), because they did not see the coefficient of 1, simplifying 13jk - jk as 13 jk, because there was no coefficient in front of jk. In general, however, most kids were learning how to replicate Ms. Marquez's procedures with coefficients.

On 2/8/11, kids were asked to solve a worksheet of integer addition and subtraction problems in context. One of the problems was:

> Mt. Everest, the highest elevation in Asia, is 29,028 feet above sea level. The Dead Sea, the lowest elevation, is 1, 312 feet below sea level. What is the difference between these two elevations? (field notes, 2/8/11)

The kids struggled mightily with this problem. In the group I observed, no one was able to solve this problem, except Rita, whom I repeatedly asked to use a number line. The kids had trouble knowing how to translate this situation into their memorized rules. Besides Rita, I saw no one using a number line, which seemed a natural model for this kind of context.

A few weeks later, kids began reviewing every topic that would be on the test. I observed the day in which they reviewed operations with integers. Ms. Marquez began the class by asking kids to write down “everything you recall” about adding and subtracting integers (field notes, 4/13/11). While a few kids were able to recall the rules at this point, many could not, particularly my focus kids who I was following. After discussion, kids solved a worksheet of problems. Many kids solved subtraction of negative number problems incorrectly. Ana changed 5 – (-2) into 5 + (-2) because “you should add the additive inverse”(field notes, 4/13/11).

Many of the kids changed signs freely, thinking of rules but remembering only parts, or parts of other rules. Although these kids had been exposed to several contexts (sandbags, money, chips), they now worked without context or model. They worked using the language of the rules, which they had neither appropriated nor replicated. They used the rules to find answers, which were held accountable only to rules. When I asked Ana about the problem above on 4/13/11, she replied using the language of the rule. Ms. Marquez ended class by talking to kids in a quiet measured, reassuring tone about the upcoming exam, telling them it is a matter of “just remembering a couple of things” (field notes, 4/13/11). She stressed the importance of remembering, of replication.

Throughout the spring, the mood of the classroom was negative. The state exam was over in late May. When I visited in June, the kids were buoyant and happy. On this day, kids worked in groups of four on a worksheet of multi-step algebraic problems with positive and negative numbers. These groups were not leveled by ability.

Analysis of Integer Instruction. Most of the problems involving integers that the kids solved in the fall were addition and subtraction of integers where either the sum or difference was unknown. In my analysis, I separated the problems that kids were given into different problem types.

Table 1

Problem types for integer addition and subtraction

Problem type	Examples
Subtracting a positive number	3 − 9 - 2 −7
Adding two negative numbers	- 7 + −2
Adding one negative and one positive number	- 2 + 7 5 + - 9
Subtracting a negative number	- 7 - (-2) 8 - (-11)

Across all my data types (assessment, field notes, and interviews), one particular type of problem was clearly the most difficult to solve: subtracting a negative number (i.e. 6 - (-7)). This kind of problem is difficult to explain using any context (Whitacre et al., n.d.). The sixth grade teachers did not assign any problems of this type during the first day of instruction (with the money model) although kids were asked all the other types of problems. They did explain the subtraction of a negative number using the sandbags, saying that a sandbag (which sinks the balloon) was taken away. For some kids, like Ana, this proved to be a grounding context with even this most difficult type of problem.

This was the problem type that presented the most difficulty with the rule. The poster for subtracting integers gave this rule:

Subtracting integers
Add its additive inverse.
- 4 − 5
- 4 +(-5)
-9

This example is for subtraction of a positive number, transformed into addition of a negative number. Many kids did remember this language, but had difficulty using this rule to understand subtraction of a negative number. In order to solve 5 - (-2) using this rule, kids would need to understand that the additive inverse of −2 is 2. They could then change this into 5 + 2. I never heard a kid explain her or his thinking this way. Instead, I saw kids do what Ana did, changing 5 – (-2) into 5 + (-2) because “you should add the additive inverse.” For other kids in the class, they were able to memorize the rules, including this one.

When asked to solve problems that were not routine, many kids struggled to apply the rules. Solving equations with signed numbers, combining like terms with signed numbers, or finding a missing addend (i.e. 49 + __ = -39), all of these posed problems for kids who were following the rules without appropriation. Perhaps because they had little experience doing so, kids also had difficulty solving problems in context. All in all, across the year, most kids had difficulty when they could not follow the rules on the poster.

Integer Assessment. In June of the kids’ seventh grade year, the kids took two integer assessments that I had prepared. One was the Addition and Subtraction of Integers Assessment

(ASIA) and the other was the Contextual Problem Assessment (CPA).

Addition and Subtraction of Integers Assessment. The first assessment (ASIA) was comprised of sixteen addition and subtraction problems, including all problem types. The class average for the computation problems was 77% correct.

Table 2

Percentage correct on Addition and Subtraction of Integers Assessment by problem type.

	Adding two positive numbe (2 problems)	Adding one negative and one positive number (4 problems)	Adding two negative numbers (2 problems)	Subtracting a positive number (4 problems)	Subtracting a negative number (4 problems)
Average Correct	98%	91%	85%	73%	55%

Subtraction proved to be much more difficult than addition. I was not surprised that only 55% of kids were able to solve problems subtracting a negative number. I was surprised by how difficult it was for kids to subtract from a positive number, including when the answer was positive.

Table 3

Analysis of subtraction of a positive number assessment items.

Problem	8 − 2	3 − 9	-5 − 8	-2 − 7	Average
Percentage incorrect	13%	38%	25%	33%	2**7%**

I had assumed that the problems that asked kids to subtract from a negative number (-5 − 8, −2 −7) would be more difficult than those that asked them to subtract from a positive number (8 − 2,

$3 - 9$). But the most difficult problem here was $3 - 9$. The overwhelming answer to that problem was 6, suggesting that kids knew the difference, but did not know the sign. Considering that it is just a subtraction problem, I was surprised by the percentage of kids who incorrectly solved $8 - 2$. However, looking at their strategies, I can see that they did not look at it as something they might know, but as something to apply to rules to. Ana changed $8 - 2$ into $8 + (-2)$, following the additive inverse rule. She correctly solved it, but Tony, who also changed the problem into addition of a negative number, then got the answer of -6. Instead of looking for a simple problem they know, these kids applied complicated rules.

By far the most difficult kind of problem was subtracting a negative number. As in my data from field notes and interviews, kids misapplied the rule for subtraction. Almost all the mistakes could be explained by kids changing the subtraction into addition, changing $-7 - (-2)$ into $-7 + (-2)$. Seven out of eleven kids who solved that problem incorrectly answered -9, suggesting that they all used the rule incorrectly, changing subtraction of a negative number into addition of a negative number.

There was no clear distinction between kids with disabilities and kids without. Some kids with disabilities scored very well (Carmen and Elisa). Others scored at the very low end (Lorena and Ortiz). The kids who scored at this very low end both used rules in ways that did not make sense. Lorena wrote that,

> *I remember that - +- = positive and positive + ne- = positive and ne - + ne - = ne -. So that is the strategy I use and also if its - I turn it into positive and if its a positive I turn it into a -. So those are my strategies solving integer problems (*Lorena, Operation Assessment).

Lorena first seemed to confuse the rules for multiplication (a positive times a negative equals a negative, etc.) for rules for addition, but does not recall them accurately. She then says that she turns a negative into a positive and a positive into a negative. Lorena was not the only kid who came out of a year of learning integers thinking that one can just switch signs. This kind of nonsensical rule following strongly suggests that Lorena does not expect operations with integers to make sense.

Contextual Problem Assessment. The second assessment was comprised of two contextual problems involving addition and subtraction of integers. One was an elevation problem similar to the assigned problem of 2/8/11. The other was a difference in temperature problem.

Table 4

Percentage correct on Contextual Problem Assessment by problem.

	Elevation problem	Temperature problem
Percent solving correctly	42.7%	54.1%

The class average on these two problems was about 48% correct, lower than the addition and subtraction assessment (average of 77% correct). Most kids who solved them incorrectly applied rules to the problems instead of using other strategies or models. Some kids who tried to use the number line had difficulty modeling the problems accurately. There was no consistent error pattern for the temperature problem. For the elevation problem, 30% of kids wrote out the problem as -12 + 32 = 20. Kids had difficulty using rules to solve these contextual problems.

Individual Kids Learning Integers

In this section, I present individual cases of how the focus kids in this study solved addition and subtraction of integers. As I wrote in Chapter Three, I collected this data by finding evidence of kids solving problems with integers throughout my field notes and in transcripts of classes. I also included at least one integer problem in each focus kid's interview. I analyzed this data for each kid, looking for which strategies and models the kid used to what effect, over time. I also use the results from the Addition and Subtraction of Integers Assessment (ASIA) and the

Contextual Problem Assessment (CPA).

Ana. In her sixth grade class, Ana first modeled integers on a number line, struggling at first with moving left when adding a negative number. By the next week, Ana demonstrated a strong appropriation of sandbags, teaching three other kids what she knew, using gesture and talk to explain and justify moves. In her seventh grade year, Ana attributed her success with integers to connections Ms. Marquez made with sixth grade: "because Ms. Marquez was like, she was, um, oh, Mr. Pierce taught this last year with the sandbags, and when I thought of the sandbags, I was just like, ohhhh"(Second Interview). With some examples of misuse of the rule, Ana was able to mostly transition into a successful rule-user. On the ASIA, she was able to solve 88% of computational problems correctly. On the CPA, Ana solved the elevation problem correctly. In interviews, Ana discussed how stressful it is to remember rules in math, but not for integers. She was able to remember rules both during interviews and during the review session on 4/13. She wondered why other kids seemed to continually struggle. Ana was an example of a kid who appropriated both a context (sandbags), connecting that to a number line (or at least positive and negative magnitude) and was then able to master the rules as well. However, I did not see evidence of Ana appropriating the rules. While she could apply them to the limited range of problems that they were designed for, she was not able to always flexibly use these rules for problems in context, algebraic problems, and non-routine problems.

Carmen. In sixth grade, Carmen reported that the sandbags context was "confusing"(First Interview). In seventh grade, with the shift to the rules, "I started to get it a lot"(Second Interview). As the rules were being developed, before they were set, Carmen was very frustrated. Once the rules were set, Carmen was able to memorize them and use them consistently. She correctly solved 94% of the problems on the ASIA. She was able to accurately recall rules during interviews. She was not able to solve either context-based problem, which was consistent to her resistance in class to work that was not rule-based practice. When new topics were being introduced, before the rules are set, Carmen talked freely about her frustration, feeling "lost"(Second Interview). Carmen told me several times about how she liked to just look up at the board and memorize what to do, because she was a "visual learner"(First Interview). She was explicit about preferring to solve problems in math using rules, "I take the rule better"(field notes, 10/19/10). She seemed to enjoy reproducing mathematical procedures, but then had difficulty solving any problems that fell outside of the rules. Carmen was able to replicate the rules, but not appropriate them.

Ruby. Ruby began the work in seventh grade by participating actively in the first two weeks of discussion, successfully using the number line as a model to order integers, and then to add and subtract numbers. Despite confusion all around her on 10/19/10, Ruby held tight to the number line, and was able to make sense of a new concept, even though she had been taught for years that one cannot take 14 from 2. This discussion showed appropriation of using the number line to add and subtract. She was able to explain what she was doing, as well as make connections to her past learning.

One week later, after the rules for subtracting have been introduced, Ruby was initially unable to solve a non-routine problem. Rather than using the number line, Ruby tried to apply the new rules to $49 + \_\_ = -39$ was 10: "because in the rules of adding, if the signs are different, you are supposed to subtract." Ruby, who used the number line with such enthusiasm a week earlier, abandoned it for misremembering a rule.

By the end of the spring, Ruby was able to use a unique combination of the rules and computation on her fingers to help her solve problems accurately, solving 88% of problems on the ASIA correctly. She used her fingers partially because the number line was been devalued in her classroom, telling me in an interview.

> **Ruby**
> Cause they're like,
> Oh you can't always use like the number line . . .
> that takes too much time that wastes time.
> I started using my fingers.
> I would like think it in my mind then I would [counting on her fingers]
> like count it out.
> (Ruby, Second Interview)

Ruby was proud of the ways in which her strategies are individual, proud that she finds ways around straight memorization. Ruby was somewhat able to appropriate the rules, in that I saw her adapt her use of rules while solving different kinds of problems, moving flexibly between fingers, number line and the rules. She solved the temperature problem correctly, but not elevation.

Luis. In both his sixth grade and seventh grade years, Luis generally used strategies that made sense to him, valuing more his own thinking than following set rules. In sixth grade, he was able to use the context of money to solve all problem types except for subtraction of a negative number. In the fall, Luis brought in social worlds to help him better understand the mathematics, telling me that the number line “is like the border between Mexico and America”(10/12/10). The zero is the border, a strange land. This comment reminds me of the “twisted geographies” of pre-service teachers with the signed number line (Widjaja et al., 2011). Luis, attempting to work through these new conceptions of magnitude and space, used an analogy of spatial politics. However, while Luis recognizes how strange it was to extend the number line in the other direction, he was able to correctly order positive and negative numbers, on this day and throughout the year. During his interview, Luis also likened a different model, a chip model, to a “war between white and black people”, a model of cancellation. He used that model to help him correctly solve 5 + −4,

Luis
For some reason a war popped into my head,
there is 4 people in a war,
and lets say,
4 white people and 5 black people and they are fighting and 4 black people fall down,
but they beat up another 4 white people and there is only one white person,
I don't know,
this is only one way to think about it [*laughing*]
I don't know.
(First Interview)

Luis here uses the mathematical model of canceling to find the answer. Not only did Luis invent contexts when trying to understand something mathematical, he used ones with strong personal meaning, ones that reference racialized and spatialized conflict.

In the spring, Luis continued to use the number line primarily to solve problems with integers, until a brief period during test preparation in the spring when Luis tried to memorize the rules. When using the rules, even after solving a problem correctly, he reported feeling "lost"(transcript, 4/13/11). He also misremembered a rule, changing signs without meaning. Either Luis was not able to memorize these new rules, or he rejected them because they interfered with sense making. Luis returned to what he described as the "giant number line in his head"(transcript, 4/13/11). On his final assessment, Luis was able to solve over 80% of the problems correctly, and reported using the number line as a mental tool. He solved the temperature problem correctly with a number line, but not the elevation problem, which he set up as - 12 + 32 = 20. Luis had difficulty with reproducing rules, but demonstrated unusual and successful appropriation of certain mathematical models, such as the number line and cancelation.

Clementine. Clementine first talked about integers in the exploratory Warm Up (10/12/10) in which she gestured horizontally to communicate ordering on a number line for positive and negative rational numbers. When discussing that moment during an interview, Clementine again gestured to show thinking along a number line. Solving a non-routine problem (49 + __= −39) two weeks later, Clementine was one of only two kids to solve it. She used a guess and check method, starting with the smallest digit. She became so involved in her strategy that she came up to the board to make her own representation. Clementine was able to replicate the rules when they were introduced, explaining them to me during an interview.

By the spring, Clementine used a combination of the rules and her fingers. During her first interview with Ruby, Clementine solved -5 + 17 by using the rule (narrating the rule as she went). She used her fingers to count back from 17 five times. She told me that she used her fingers because she might get subtraction wrong in her head. Ruby thought of the problem differently (changing it into 17 – 5). Clementine and Ruby were able to discuss the differences between their strategies in such a way that I saw emerging appropriation of the rule. When the class was taught to ignore variables while combining positive and negative like terms, Clementine was able to replicate this procedure, including subtraction of a negative number. On the final assessments of integers, Clementine scored 94% on the ASIA, following rules. For one problem (3 – 9) that proved tricky for many kids, Clementine used a number line to accurately solve it. She was able to solve the temperature problem, but not the elevation one. She modeled neither problem, but set up equations and followed rules. Clementine shows creativity in her problem solving during the fall with integers, and is also able to master the rules during the spring. I see evidence that Clementine was able not only to replicate but appropriate multiple models and strategies for integers: the number line and the rule.

Federico. Federico participates in the first discussion in seventh grade about ordering integers on a number line, showing he appropriated that model and can explain how distance works on the negative half of the number line. During the spring I see him solve six problems with integers using rules, solving most (5/6) correctly. On 1/24/11, Ms. Alton asked her group to use a number line to help them with the integers, and over time, insisted, saying that she would not help anyone who did have a number line. Federico drew one on his paper, and started to use it, reluctantly, and complaining rather loudly about it. He was one off when counting to solve a problem with it. During both interviews, Federico told me that the number line was a "crutch" for kids who were just beginning to learn operations with integers, kids who "didn't completely understand"(First Interview). Elisa (his partner for the first interview) and Federico both explain that the number line was initially helpful to them, but that they both moved on to the rules, which they described as the correct tool for a more advanced kid (Federico & Elisa, First Interview). Federico told the story of learning addition and subtraction of integers from a beloved fifth grade teacher, who initially used the number line, but then encouraged the kids to not draw a number line every time.

Federico used rules on his final computation assessment, solving only 63% of the computation problems correctly. On the context problems, he used a rule for the elevation problem and the number line for the temperature problem. Federico solved neither correctly.

I noticed that during class, Federico was much more successful solving problems than on exams. I saw Federico working with his notes, looking at posters, and checking with partners as he worked. Based on these assessments, Federico was not able to replicate or appropriate either the rules or the number line. However, I have evidence that Federico was able to do more in class than on assessments which privilege individual memorization.

Desi. In her sixth grade year, Desi at first had difficulty using the sandbag model to solve integer addition and subtraction. In discussion, I learned that she did not yet understand how the context worked (that adding sandbags made the balloon go down). Once we clarified that, she was able to solve all types of problems (except for subtraction of a negative number) using the sandbag model and the vertical number line. In her seventh grade year, I never see Desi using any method but the rules. She memorizes the rules, using the language to talk herself through the problem solving. Desi does not seem to have any alternative method, and if she cannot remember the rule, she panics. She panics even on a test that she scored perfectly on: "I thought that I was really bad at integers, and I was panicking on the test, and then it was a 100"(First Interview). During the spring, Ms. Alton asked her group to try the number line. I saw Desi arguing with Ms. Alton about this twice, refusing to use the number line. Desi was not always able to remember the rules, however, and showed inconsistency in her problem solving with integers, for example switching signs without maintaining equivalency while solving 5 – (-2). Desi did not take the final assessments because she was absent. Desi insisted on replication as her method of learning, telling me multiple times that she wanted a clear rule from her teacher, and then she would repeat it. She wanted "one way" to solve all problems, including integers (First Interview). As hard as she works to memorize these rules, Desi does not use her own sense-making to determine whether or not she is correct, or whether a rule makes sense.

Bobby. I have a limited set of data for Bobby (only two instances of problem solving with integers besides the final assessments). When the student teacher was leading a lesson during which kids were "discovering" the rules for subtracting negative numbers, Bobby became angry (field notes, 10/19/10). He shouted out at the teacher, "but you haven't taught us the rule yet!"(transcript, 10/19/10). Later in that lesson, Ms. Marquez drew a number line on the board to help with the problem 2 – 14. Bobby solved the problem correctly using a number line. During the interview, Bobby told me that he used a number line model to solve integer problems, and then demonstrated his method enthusiastically, drawing a number line and solving a problem. On the final assessment, however, Bobby was not able to solve any problems involving subtraction of a negative number. His score was only 63%. He wrote that he used a number line to solve problems, and then added, “If you have a negative with a positive and you’re subtracting you can change the subtraction to addition, and the positive into negative.” For each of the problems that asked for subtraction of a negative number, Bobby used this rule. He turned the subtraction into addition, and then kept the subtrahend negative, for example he solved $-4 - (-6)$ as -10, suggesting that he changed the problem into $-4 + -6$. Despite these difficulties with using rules for this problem type, Bobby was one of only eight kids who were able to solve both contextual problems correctly. His work has several ways to write number sentences for both problems, many crossed out, suggesting that he tried multiple variations until he found one that made sense. Bobby seemed to prefer rules throughout the year, but in the case of integer computation, he also used a number line.

Rita. Rita also resisted using strategies other than the rule, and also struggled to remember those rules across the year. She resisted using the number line because, in her words, she was “not a visual person.” (First Interview and field notes). During context-based problem solving in class I asked her to use a number line, and she did so, becoming the only kid in her group to solve the elevation problem. Despite this, Rita consistently made the choice to use the rules rather than a number line, saying that, “the rules were posted everywhere.” Rita talked in her interview about the difficulties of integers:

Rita
Um . . . integers
It is like so,
hard,
because you have to remember the rules,
and I tried to,

the only rule I remember was the multiplication one.
That one was kind of easy but then adding and subtracting it is hard,
and I keep forgetting how to do it.
(Rita, Second Interview)

Rita admitted the number line works better, but she still preferred the rules**:**

Rita
The rules I have to like remember them.
The number line is easier because you can just skip [gesture on the line]
or whatever,
and then it's not that hard because you don't have to memorize,
just skip,
because usually you already know it
But then,
like the rules I have to memorize so I won't do it wrong.
(Rita, Second Interview)

Like other kids in her class, Rita associated computation with integers with the "harder" mathematics of seventh grade. Rita attributed her declining interest in mathematics to this kind of mathematics, "a whole long line of integers." She also resisted when Ms. Marquez tried to eliminate variables on 1/4/11, standing up in her chair and saying loudly, "The letters are important, if you forget then you wouldn't get it right!" She was able to solve only 68% of problems on the ASIA. The only problem that she used a number line to solve was correct; the rest had little work so it was hard to discern her model. She was not able to solve either contextual problem correctly, and did not use a number line or any other modeling for that assessment. At times, Rita resisted memorizing rules that do not make sense, yet she did not use other possible models because of a perception that she was a certain type of learner and because she felt that memorizing the rules was best.

Analysis of the Teaching and Learning of Integers

Reliance on rules encouraged replication rather than appropriation. In order for kids to be able to solve problems with integers, a new kind of number, they need a mediating tool or model. Any model begins in social interaction, and gradually internalized. In this classroom, the choice was between a metaphor of sandbags, the context of money and debt, the number line, fingers, and the rules. After being introduced to money, sandbags, and the number line in the sixth grade, and then beginning work on the number line in seventh grade, this classroom prioritized memorizing the rules. For almost all of the kids analyzed above, this emphasis on memorizing rules meant that they applied the rules in ways that did not make sense. I do not mean to suggest that rules are inherently bad for kid learning. In this case, as kids developed rules in the fall they were engaging in mathematical behavior, making conjectures about what would work, and articulating mathematical language. At that point, the rule was all about appropriation, developing flexible ways to add and subtract integers. Rules could have become part of further investigation into mathematical properties, which are closely tied to the history of the development of those rules. Why can you change $8 - 4$ into $8 + (- 4)$? One can rewrite that as $-4 + 8$, yet the same move would not be valid in subtraction (as Carmen once tried to do during class). One can envision an exploration of why the commutative property works in addition but not subtraction. This kind of investigation would be "critical thinkingish", according to the way Ms. Marquez thinks of pedagogy and mathematics.

However, within the "state examish" figured world of the spring, the rules were not appropriated in ways that made them flexible enough to be transferred to new uses. The rules offered replication alone. At a certain point in the year, the rule froze into the language on the poster, which was never changed despite widespread confusion about the use of these rules, particularly for subtraction of negative numbers. Although initially kids helped to write them, they did not change them or adapt them, except in ways that made them not work. Because they did not understand, for example, why they were using an additive inverse, or what that meant, kids tended to change and switch signs without considering what was happening to the numbers.

Some kids were able to appropriate other strategies and models. Ana was able to appropriate the sandbags, which I could see in her confident gestures indicating changes in magnitude. Luis internalized the number line and used it to solve problems. Ruby and Clementine were able to use a combination of fingers and the rules, which they were able to adapt to new situations such as combining like terms.

Kids with learning disabilities are just as diverse as kids without learning disabilities. Once again, as in our analysis of ability groups in the class, we see diversity within labels. Six out of nine kids that I described here had IEPs that included goals in mathematics, yet *none* had the same trajectory through learning integers, even though these kids have the label of learning disabled, and have been in the same math classrooms for the last two years. There is no one path to learning operations with integers. Kids with disabilities are equally as diverse as kids without. Some enjoy memorizing facts, others enjoy problem solving. Some are able to memorize facts, others are not. One strategy did not fit all.

Kids made choices about what strategies and models to use based on the status of those models and strategies. In the figured world of this mathematics classroom, the spring of the seventh grade year was a time in which “state examish” mathematics were prized. Kids valued the rules over other strategies. Particularly positioned was the number line. Several kids patiently explained to me that the number line for just for “beginners”(Federico, First Interview) or took too long. Math teachers often follow this trajectory. We begin by anchoring instruction in a useful context or model. When we feel kids are ready, we push them to the next level, to more abstract understandings of a concept, to more efficient understandings. Yet kids read these moves as valuing certain strategies and devaluing others. By creating rules that could govern addition and subtraction of integers, posting them in the room, and giving lots of practice, Ms. Marquez was pushing for more efficient problem solving. In the spring, Ms. Marquez would still represent kid's explanations of alternative strategies, but she did not ask for them. She spent much less time discussing alternative strategies. By 1/4/11, she wants the kids to have memorized the rules for integers, signaling this by her frustration that they did not remember them, and pointing them to the poster on the wall. At this point in the year, Ms. Marquez was focused on time and efficiency, which is why she did not feel she had time to do any "critical thinkingish" work on algebra, or to encourage time consuming strategies like the number line.

Ms. Marquez never outright (that I saw) told kids that the rules were better, but the kids all seemed to agree about what strategies had status and what strategies did not. I saw all of the kids in this class try to memorize the rules. Only Luis, Clementine and Ruby decided to use what made most sense to them: the number line and a combination of the rules and fingers, respectively. Most kids either memorized the rules, or were not able to, but continued trying. Kids made choices about what strategies to use based on the status of the strategy in the figured worlds of the classroom. And kids who can make their own choices are those with status in the critical-thinkingish figured world of mathematics.

Kids made choices about strategies and models based on understandings of self as a math learner. Carmen and Rita were close friends who enjoyed working together. Carmen told me she was a visual person, who can just look at something and memorize it. Rita defined herself as the opposite, not a visual person, and who will "just stick to my numbers"(First Interview). These girls were insistent on these definitions, which were developed through a multiple intelligence quiz in sixth grade. Rita told me that she would not use a number line because it was visual. Carmen told me that she used her visual strengths to memorize the language of the posters. They led me to wonder how much conceptions of self as a math learner, in this case the notions of multiple intelligences introduced in the sixth grade, influenced the choices of models in mathematics.

Relationships mattered in the learning of integers. The figured worlds of this classroom also had other effects on the mathematical development of kids. In sixth grade, Ortiz refused to move left when adding on a number line because that contradicted what Ms. Emerson had taught him. He covered his paper and put his head down for the rest of the class. Federico told me that he chose to not use the number line because of this fifth grade teacher. As we saw in the very first day of work with integers in sixth grade, Lorena's learning was supported by her relationship with Sade. For Lorena, the way in which kids were organized in her seventh grade classroom valued independence over collaboration. I never saw the kind of engagement that I saw in sixth grade from Lorena in her seventh grade classroom, possibly because the participant structure, or the norms of the activities, worked against such an interdependent partnership. Lorena's final assessment, with nonsensical rules, makes me wonder how Lorena's initially strong thinking about integers could have been better supported, both instructionally and interactionally.

Conclusion

In the end, Ms. Marquez ended up just where she had been. Once again, as in years past, her kids did very well on the state exam in May. Of all the kids with disabilities in her class, all but one (Lorena) moved into the next highest level on their state exam (four levels). But will the class remember these rules in eighth grade? A month after the test, kids are able to solve only an average of 77% of computational problems with integers. Only 29% of kids were able to solve both contextual problems. How many of these kids will be able to solve these problems in eighth grade? Or begin to apply the rules to new algebraic situations? Some kids will remember the rule, perhaps Carmen and Ana. Other kids, like Clementine, Luis and Ruby, will use some combination of strategies and models, making sure they make sense. But what if these strategies are not allowed—if fingers are banned and number lines discouraged? And for so many of the kids who struggled yet persisted, trying to remember the rules, how will they do in a few months? Will Rita, Federico, and Desi be able to remember?

If kids are able to replicate the rules only, without appropriating the rules, they seem to have difficulty understanding how to work flexibly with integers. This flexibility is necessary to use integers in advanced mathematics such as algebra. Kids who appropriated models and strategies, such as Ruby and her combination of the rules and her fingers, and Luis, with the giant number line in his head, have a better chance at being able to flexibly use these understandings to solve increasingly complex problems.

As Fosnot and Jacob (2010) wrote about integers,

> Why is −4 - (- 5) = 1 true? Most kids are not convinced when told, “It must be so.” Nor are many adults. Parents and educators sometimes offer learners explanations to try to trigger understanding- for example, “When you get rid of your debt, you gain money,” or, “Subtraction and addition are inverse operations and since subtraction takes away what was added, if we have 1 + −5 = −4 we also have to have −4 - (- 5) = 1.” But just as often, kids are simply given rules (two minus signs make a plus) and asked t o use them even if they don’t understand them. The unfortunate result is that they implicitly accept mathematics as not needing to make sense. But it is critical that young, developing mathematicians believe that mathematics makes sense.”(Fosnot & Jacob, 2010, p. 111)

Only by believing that mathematics make sense will kids work to appropriate strategies, models and strategies, making them their own. Yet we tend to teach integers as nonsensical rules. Ms. Marquez could have made different pedagogical decisions that might have resulted in more kids understanding integers, extending “critical thinkingish” work on the properties of number, as well as including more contextual problems. This chapter is not about evaluating the success or failures of her pedagogy. Instead, what I have tried to sketch is how complex the processes of learning mathematics are over time, and how tied the learning of mathematics is to the figured worlds of teaching mathematics, and the positioning of kids and tools.

Learning how to add and subtract integers (or not learning how to add and subtract integers) has been a long journey for these kids. They experienced multiple contexts, models, and strategies, all within the various figured worlds offered by their sixth and seventh grade classrooms. As Bakhtin uses heteroglossia to describe multiple circulating voices within a text or a social world (1981), so this multiplicity of mathematical experience creates heteroglossia of strategies and models for each kid. These figured worlds position both participants, and the models and strategies people use. This positioning affects the mathematical choices kids made. Relationships matter in how kids learn mathematics, both in what kind of mathematical activity kids are allowed to do, and how they understand themselves as math learners. The landscape of learning mathematics is peopled, and experienced. It does not exist only of strategies and models kids grapple with along the way, but also the deeply felt experiences that go along with learning. The experiences that these kids have had learning integers in two classrooms will move with them into eighth grade, and high school, and beyond. In order to help us better understand this history, the next chapter further explores how kids narrate their experience in Ms. Marquez's math class.

Chapter Six:

Experiencing Math Class

Particularly in the beginning of my work in each grade, I worked to put my body where the bodies of the kids were supposed to be. I sat in small chairs, barely fitting my papers on the half-size desks, and tried to pay attention to the lessons. These practices called my attention to the bodily experiences of the classroom. Carrying all their belongings from class to class in backpacks, kids had to keep that heavy backpack with them, even when moving around within the classroom. I noticed how stuck the kids were to their seats—while as a teacher and an adult I am used to freedom of movement—the kids could not move without permission. While in our seats, we had to concentrate on the work that was given us, no matter our interest in it. I had difficulty staying focused enough to finish worksheets. For kids who already knew how to do the problems, it seemed unnecessary. For kids who didn't know how, it was overwhelming. Sitting one day next to Lorena, focusing on her experience, I saw her working extremely hard to keep up, but everything took her longer. By the time she finished problem one, time was up for all four problems. In Luttrell's study of women reflecting on their school experiences (1993), the women all talked about not feeling comfortable in their schools. I heard this phrase, "feeling comfortable," repeatedly from kids in interviews, which applied to their bodies and to feeling able to do the work that was given.

These bodily experiences created strong emotions for me—even more so for the kids in the class. Watching and listening to Carmen taught me about the range of these emotions, as she frequently narrated her emotional state during class, saying such things as, "Oh yeah, I smart, yeah"(field notes, 5/25/10) and "I hate math because I suck at it"(field notes, 10/12/10). For

Carmen, as I will discuss in Chapter Seven, the emotions were particularly strong (both positively and negatively), depending on whether or not she knew exactly how to solve the problems in front of her.

This chapter is focused on the experience of mathematics class, seen through the eyes of the kids as they narrated their experience in interviews. As kids told me about their experience, they narrated it. They took memories of experience and shaped them into narratives, whether more extended, classical narratives, or short descriptions of feeling. Sometimes just a gesture communicated their experience, as when Clementine later in this chapter put her head into her hands when recalling a moment. This chapter uses the tools of narrative analysis to understand these many narratives, using both what the kids say (thematic), how they say it (structural), and how voices from multiple figured worlds dialogically interact in their narratives (dialogic). This chapter discusses relationships both with friends and teachers, emotions kids felt while in math class, and finally returns to themes about social identities in math class.

Relationships in math class

Relationships with friends. In their sixth grade classroom, these kids had more freedom: to sit where they liked and work with whomever they wanted. Because of that freedom, kids formed very close alliances with other kids in the context of doing mathematical work. According to Mr. Pierce and Ms. Emerson, those alliances were beneficial to two kids in particular: Rita and Lorena. Both entered the classroom as math learners in trouble: Rita as the "uber special ed kid" and Lorena unable to demonstrate "basic" skills in math (Sixth Grade Teacher Interview). First Rita had a turn-around through her association with Shaundra, taking on Shaundra's school habits, even her posture, and thus taking on a label of "smart." Later in the year, Lorena became close with Sade, sitting with her during math class and homeroom. Ms.

Emerson reported that together they moved from the back seats to the front seats in homeroom. Friendship was a powerful tool in transforming identities in these classrooms.

In the seventh grade classroom, the kids had fewer choices about where they sat and whom they associated with during class. Ms. Marquez chose their partners and group members throughout the year. However, within the parameters of a small group, the kids were generally free to sit next to whomever they chose, and patterns emerged. Ana and Arturo continued to work together, just as they had in sixth grade. Carmen and Rita worked together almost every day, and spoke in interviews about their strong friendship. Clementine and Ruby worked closely together. During small group time in the fall, kids moved from discussing math to social conversations, and back to math, and so on, back and forth.

Ms. Marquez spoke to me about finding a good partner for Lorena, but she was never satisfied with the different pairings that she tried. In her seventh grade year, Lorena never worked as deeply and closely with another person as she did with Sade. Other kids also never found a consistent partner and worked alone.

When the kids were separated into tracked ability groups in the spring, their ability to socialize during math time changed. Ms. Marquez ran a strictly controlled group dominated by her questions and the responses of the kids. Ms. Alton also tried to run a teacher-led group, but her group resisted this structure. Even though she insisted that only one kid speak at a time, the kids in her group only rarely complied. I saw kids teasing each other and helping each other, but more often kids working alone yet chatting socially as they did, with the voice of Ms. Alton frequently trying to pull the group into a single discussion.

The Independent group, which did not have a teacher to lead it, had a different social structure. This group collaborated to finish work as quickly as possible, often checking answers as a group. They were then able to use the computer or begin homework. The kids in this group were frequently smiling. I saw a family scrapbook being passed around once. Bobby enjoyed this social aspect to his group, “I like that because I get to get with my friends and like we could like figure it out together as one” (Second Interview). Clementine spoke about how this group was able to work independently because, “we are the most ones trusted by Ms. Marquez”(First Interview). This group was named the Independent group because they had no assigned teacher. Kids took the descriptor, *independent*, and used it to describe themselves: Clementine saw the kids as independent workers. Yet the independent group was the most *interdependent* group of the three, collaborating closely in their work without the interference of adults.

Luis, who spent most days in Ms. Alton’s group, was the only child to be in all three groups. He told me that he asked to move from Ms. Alton’s group, which he called the “unsmartest group” because,

> **Luis**
> It was harder for me to work in the unsmartest group,
> because in the unsmartest group people won’t understand but I would feel like I understood
>
> But in the really smart group,
> everybody could help everybody and . . .
> yeah.
> I felt more comfortable there.
> (Luis, Second Interview)

Luis focused on the experience of helping and not helping in the groups. In the “really smart group,” kids helped each other, then were able to talk; “everybody could help everybody.” Luis privileged helping other kids. From this perspective, the problem with the unsmartest group is that Luis could not help or get help from other kids.

In my first pilot study for this project with the Urban Math Project, a small group of researchers interviewed sixth through eighth grade kids in New York City and asked them about their math classes. Kids brought up helping in every interview. In a rigid classroom in which kids were not allowed to speak to each other, they complained bitterly about not being able to help each other. In a more flexible classroom, kids talked about how much they liked moving around the classroom to help each other. Kids work to build a “web of care” (Lico & Luttrell, 2011). The kids that I have interviewed in multiple classrooms take helping very seriously in their math classrooms, and not just the giving of help or the getting of help, but a community in which care for others in the form of schoolwork was valued. Care work made kids feel powerful: Carmen said that she “feels like a goddess” when she helps (Second Interview). Ana said that she “feels like a teacher” when she helps (Second Interview).

Ana preferred being taught by other kids, who would give a “shortcut,” as opposed to teachers, “cause teachers like, is right there, and you know, like, do this, do that”(Second Interview). She emphasized how the proximity of teachers was intimidating, insisting that particular actions be taken instantly (“do this do that”). In their paired interview, Ruby and Clementine stressed that the independent group was good for them because they were independent from teachers. They described teacher intervention in their learning as stressful, not only because of how it felt to be explained at, but because the adults tended to respond to the situation with frustration.

Ruby
Because,
when I do it,
I don't,
I can't learn with someone just doing it with me over and over again.
I have to do it by myself.

Clementine
Exactly. *[emphatic]*
That is how I feel about teachers.
They say something over and over again,
and when you try to comprehend it,

they get frustrated.

Rachel
That is when they are standing right next to you?

Clementine
Yeah [*nodding*]
They get frustrated, and when they get frustrated--

Rachel
How does that feel when the teacher gets frustrated and they are trying to explain something to you?

Clementine
[*covers face with two hands*].
(Clementine and Ruby, First Interview)

A few moments later, Clementine connected these feelings to her interactions with her mom around math,

Clementine
Like with my mom,
my mom,
she gets frustrated very easily.

So like when I am doing work with her,
she gets frustrated and I get frustrated,
and we both get mad,
so like,
we end up on terms that we never finish it.

But like let's say I am with one of my friends,
I will understand it more.
(Clementine and Ruby, First Interview)

Notice Clementine's repetition of the word, "frustrating." These frustrating interactions that Clementine described are part of the reason that she liked the Independent group— because the teacher left them alone. The independence that she so cherished also helped her learn mathematics. Like Luis and Ana, Clementine felt the pressure of too much adult intervention. She said that she liked the independent group because, "I finish my work quicker" because "I work better with people my own age.” Teachers use “a lot of terms I don’t understand,” while she and Ruby “like know, the language and how we talk, it is easier for us to do our work.” Clementine used an efficiency argument here: when kids work together we are faster.

When I spoke to kids about their math classrooms, they insisted again and again on the importance of helping their friends learn. Becoming a teacher, rather than a passive learner, gave them agency, power, and allowed them to take control over mathematical activity, as compared to being told “do this do that.” Teachers tend to think that our intervention is necessary for learning to occur. As educators we are taught to work with kids individually, but we rarely remember how intense it can feel for the adult to loom up over you, checking your work, ready to tell you if it is wrong or right. And as Clementine noted, even an adult that was trying to help can be hard to understand in this intense moment. Doing mathematics, with its wrong and rightness, can be frustrating and oppressive to kids. Their strategy to deal with these feelings was to support each other.

Relationships with teachers. In contrast to the kids who feel pressure when the teacher comes over to them, Desi felt that if a kid were not getting enough attention from their teacher, they would give up on math. I asked her,

Rachel
What does attention feel like in your math class?

Desi
I feel like the kids that are really good,
they are just *yeah,*
I got all the attention,
and everyone else is --

Rachel
But what is attention,
when the teacher comes to you,
is it certain teachers,
is it certain kind of teachers,

what is it that feels like the right kind of attention?

Desi
They feel whatever,
like Ms. Marquez she knows that I feel in that way she just doesn't say it.
I feel like she knows,
because whenever she goes to someone else that I feel like is really smart then she comes to me.

And then it is the same type of learning that she tries to give to me and then it makes me feel good because I feel equal,
not just separated,
and trying to be controlled and authoritated,
and stuff,

and that's not my thing.
the freedom that I get,
and the feeling of being an adult with respect because if you don't have respect,
then many kids are going to be like,
well what am I to you?
(Second Interview, Desi)

What can we make of Desi's final question? She addresses, "Well, what am I to you?" to teachers who do not give respect to kids. Desi's analysis reduced the teacher- student dynamic to the interrelationship between respect and attention. For Desi, attention was respect. This was a very different way of understanding teacher intervention that Clementine, Ruby and Ana suggest. Instead of finding teacher attention oppressive, Desi found being ignored oppressive. Being ignored was being controlled and "authoritated."

Desi paid close attention to who was getting teacher attention. Like her critique of the groups, Desi saw some kids with particular kinds of status ("smart") getting more attention than others. Desi even gives these kids a moment of direct speech, in which they are triumphant because of their attention, "I got the attention." Desi believed that Ms. Marquez knew how she felt about this, and so would then walk over to Desi, and give her the "same type of learning" that Ms. Marquez gave to the "smart" kids.

Willis (1977) described a contract between teachers and students, in which students exchanged obedience for the information given by the teacher. Like Desi, Clementine held set expectations for her teachers that go way beyond this contract, beyond information and obedience and into care and respect. What mattered to Clementine and Desi was a respectful relationship with their teacher, not the exchange of information. Clementine described Ms. Marquez as a model teacher, one that did not yell, that would "go over it many times without like, getting stressed out"(Second Interview). She contrasted this to her earlier narrative about her mother. Clementine retold a narrative multiple times that gave a particular script for how math interactions went with adults: when kids don't get math, teachers and family members get frustrated, then they yell. Now the kids now are trying to learn something that they don't get, while being yelled at. No wonder Clementine's narrative ends in a headache. In her final interview, Clementine says that this year has felt different for her because she was not yelled at when she did not understand. Instead, Ms. Marquez "will go over it" and she "will help me"(Second Interview). Clementine described when teachers "give up on us." Ms. Marquez does not "give up on us":

> **Clementine**
> The thing that helps is the most is that Ms. Marquez,
> she doesn't give up on us.
>
> Like,
> if we don't understand something,
> or if we are behaving really bad,
> she won't like,
> she won't give up,
> she will still help us,
> she'll make sure we get it done.
> (Clementine, Second Interview)

To "give up on us" was an extremely serious charge. It connects to Desi's question, "well what am I to you?" Those adults who are perceived as giving up on kids, who don't come to talk to certain kids, are understood to be fundamentally disrespecting (if not betraying) the kids. And the kids were carefully watching. Clementine leveled this charge against her previous math teacher. I asked her what "give up" looks like and feels like,

> **Clementine**
> A teacher that gives up,
> it is basically,
> you hand the kid work and you go,
> *here,*
> *do this,*
> *do that,*
> and they won't help you with anything,
> and they will only help certain kids with it,
> because they haven't given up on those kids,
> cause that happened last year.
> (Second Interview, Clementine)

Clementine and Desi focused attention onto their version of a contract with teachers. They watched carefully for signs of favoritism, for "teacher's pets"(Luttrell, 1993). In her study of women returning to school, Luttrell found that many women spoke about "teacher's pets" in their childhood classrooms, connecting favoritism to skin color, class, and status. The women Luttrell interviewed were still animated by the ways in which the teachers mistreated them, many years later. Desi and Clementine reenacted this drama, with voices, with emotion. These kids saw their relationship with their teacher at the core of their school experience. They expected respect, they expected to be treated the same as other kids, and are particularly sensitive to the "smart" kids getting more attention, more care, from their teachers, an issue that I will take up further in Chapter Seven.

What happens if you don't "get it"? Clementine gave us two scenarios, both oppressive. You might be ignored. Or, if you don't understand, your teacher might come and talk to you, using words you don't understand. She might get frustrated at you, yell at you, and yet will still expect you to be correct. In these scenarios, not only are kids feeling strong emotions, but so are the adults. These are not the first stories that I have heard from kids about teacher's emotions around mathematics. I rarely hear stories of teachers yelling when kids have trouble reading, but math seems to be different, eliciting angry responses from teachers. I wonder how this frustration connects to the negative memories that elementary school teachers express about their own histories as math learners (e.g. Lambert & Valle, 2010). Ms. Marquez could be sarcastic and curt about kid behavior, yet tried to never show the same frustration about learning. I could hear frustration in her voice on 1/4/11, however, when the kids keep forgetting the rules for integers; "I don't know why you guys are forgetting integers." That was the same day that she cried after class. The work of teaching and learning is emotional.

Relationships between important adults and strategies. In his sixth grade year, Ortiz became very angry when Mr. Pierce told him to go left on the number line to add a negative number. When I came over to him, his head was down, his face was stiff and angry, and he had covered his work with his arms. He told me that Ms. Emerson had taught him to move right when he added, and he believed her. No matter how I tried, he would not let go of this idea. Again and again, I saw kids make strong connections between particular individuals and particular strategies and models in mathematics. Sometimes those individuals were teachers. Federico narrates his fifth grade teacher telling him that he could not use the number line for every problem adding and subtracting integers. Federico fervently believed this, and resisted using the number line, even though he was not able to fully memorize the rules. Sometimes they were family members, such as Bobby and his uncle. Bobby schooled Federico for not knowing his multiplication facts automatically, ventriloquizing his uncle. Federico resisted, channeling the words of Ms. Emerson. Strategies and methods for mathematics are deeply connected to the relationships that kids have built with others. Using these methods, these two boys show their love and respect for the adults who taught them these lessons.

These kids remind me of learning, of mediation, and how deeply interwoven relationships are within this process. When Vygotsky wrote that, “the path from the thing to the child and from the child to the thing lies in another person”(Vygotsky, 2004, p. 532) he explained why emotions and relationships dominate kids’ experiences learning. Kids saw a clear link between people and methods in mathematics that as adults we completely ignore, seeing methods and models as outside emotions, just things. Carmen wanted one way, the teacher way. And she did not want her next teacher to teach a new way. These kids teach us that erasing and reteaching mathematics elicits emotion, because learning occurs within relationships. Ortiz covered up his paper for a reason. He would not betray Ms. Emerson (or allow the possibility that she has betrayed him by teaching him something wrong). Memories of strategies and methods were intertwined with relationships. As Walkerdine wrote, concepts are learned within social practice, always with positioning (1988). Kids have to “live these relations” as they learn mathematics, sorting through multiplicity and emotions as they go (Walkerdine, 1988, p. 30).

Emotions in math class

As I wrote in Chapter Four, kids told me about how “weird and different’ each new grade felt, taking in messages from their teachers and families about how each new grade was suddenly the serious one, the most important grade yet (Desi, First Interview). Desi narrated it thus:

Rachel
Does being a sixth grader or being a seventh grader feel different in all your subjects?

Desi
Yeah
because they get
like harder
and when we tried

like when we are working on something
it feels weird and different
cause
we're just like
Oh this year
last year they told us this
and now they are saying that we can't do this or that
so then
why were they teaching us that
if
it gets us scrambled
in our heads
(Desi, First Interview)

Each grade had this essential newness, differentness, felt as “not really sure what to do here.” That construction was echoed repeatedly in how these kids narrated learning mathematics. Arturo told me several times in class and interviews that he did not like learning new material because he did not like the *feeling* of not knowing what to do. In an interview, he differentiated between when “you feel comfortable solving problems,” and when “you are struggling”:

Arturo
It is like when you feel comfortable solving problems,
like when you get it,
It’s not like,
oh,
you are struggling [*gestures to his head, the "oh" is with a confused tone*]
but you already know what to do,
and then you just do it and then answer it,

but there's some people that struggle with it,
like they know,
oh [*confused tone*]
what to do next and *what to do first* and then,

yeah,
so some people feel comfortable they can go right away [gesture of snapping fingers]
and they get it.
(Arturo, First Interview)

Either you “get it” (cue snapping sound), or you are struggling. Arturo named the critical distinction in “state examish” mathematics here, a binary that pervaded the self-authoring of the kids, further explored in Chapter Seven. The snapping sound is important, cueing the listener into the conceptual mapping between “getting it” and speed: knowing something is knowing immediately what to do. Arturo began by narrating how he understood the feeling of knowing (and not knowing) what to do, both of which he has experienced. But then he moved into two kinds of people, showing how experience becomes named, and then names kinds of people. Arturo’s words are echoed across the kids, who explained to me how they were those who *get it fast* and those who *struggle slow*. Speed and competence were closely connected.

Clementine echoed this description, telling me that when she sees “something that I don’t understand it just looks like gibberish to me.” She continued, telling me how that feels,

> **Clementine**
> When we are doing something I already know,
> I know how to do it,
> and like I do it quickly,
> but if it is something new,
> I don't really know how to respond to it.
> (Clementine, First Interview)

“Respond” connotes emotion, as if Clementine was saying that she doesn’t know how to *feel* when she sees something new. Explaining why she no longer likes math, Rita told a story about the kind of moment in math class that has changed her mind, in which she becomes “freaked out” when she saw a “whole big line the integers things” and “forget the rules”(Rita, Second Interview). The feeling of being freaked out was related to a computation problem, one that compelled her to follow rules that she cannot remember. As Arturo said, she does not know what to do. As Clementine said, she was not sure how to respond. For these kids, not knowing exactly what to do with a math problem was a strong emotion. The goal of math class seemed to be to return to the feeling of comfortable: to know exactly what to do. Carmen, who spoke so openly of her feelings, would become angry in class when the rules were not clear. She narrated this feeling as being “lost like a little child”(field notes, 1/4/11).

Math anxiety, or “panic,” “freezing,” “stressing out,” and “blank out.” During her interview, Ana also told me that she tends to forget old topics when they move on to something new. When I asked her what kind of math learner she is, Ana told me this,

> **Ana**
> I would understand,
> but I'll get too,
> nervous and forget something.
>
> Like I will get,
> like,
> uh,
> like,
> in a math problem,
> like,
> uh,
> when she gives me a math problem,
> and I am just like,
> *okay,*
> *should know this,*
> *I need to remember*,
>
> and she is like,
> *relax,*
> *just try to remember,*
> but I,
> I'm like *I should know this already*,
> (Ana, Second Interview)

Just as in the narrative about an unsuccessful moment (mentioned earlier this chapter), Ana dialogically performed this moment, this time bringing her teacher, Ms. Marquez, into her narrative of forgetting. Notice the hesitation that begins the narrative, which echoes the feeling of not knowing, not remembering. This narrative provides a way to understand how kids take in voices, becoming internal speech, helping them control themselves (Vygotsky, 1978; Holland et al., 1998). Ana used Ms. Marquez as a voice of counsel, telling a worried Ana to “relax” and “try to remember." I can feel that Ana used this voice in internal speech when stressed in math class. I asked Ana to explain more about this feeling, and she told me, this time narrating the process more within her own body, yet still using voices to explain the process:

Ana
Cause when you are kind of nervous,
you,
forget things,

Like oh,
like when you,
you are supposed to know a problem,
I get kind of frus-,
like frustrated,

And it is just like,
I should know this,
wait,
I forgot about this,
um,
should I remember,
I just like get kind of nervous.
I don't know why.

Cause I want to know this all ready,
so I could just,
be ready for the state test
(Ana, Second Interview)

Ana narrated her feelings of forgetting, using internal speech. She connected this feeling of forgetting to the most important assessment of the year, the state test. "Be ready for the state test" was a phrase I heard often from teachers. Ana used this voice to describe her motivation, her reason for so deeply caring about remembering and forgetting.

When I asked Desi to tell me about a moment she felt successful in class, she told me about a time that she "thought she was really bad at integers" and "I was like panicking on the test" but then her grade was a 100 (full narrative in Chapter Three). I asked her why she panicked on the test:

Desi
For some reason
on tests
I tend to
like
panic
and then if I like
study something
I for--
it is like I blank out
completely

So
with tests
I don't test well.
(Desi, First Interview)

When she was asked to remember something on a test, she will first "panic," then forget: "blank out completely." Like Ana, her story ends with an adult-sounding sum up of the situation. Narratives often include evaluation, descriptions of the importance (or not) of the narrative. Both Ana and Desi summed up their narratives about forgetting with voices that I heard from their teachers ("be ready for the state test") and other adults ("I don't test well"). Their use of these adult voices to summarize their experience suggests how powerful adult perspectives are in the figured worlds of school for kids. Writing in her mathematical autobiography, Clementine added a final level, bodily pain: "I try to concentrate & I always end up with a headache when I am done with math. It doesn't help when people yell at me because I get nervous and stressed"(Clementine, Mathematical Autobiography). For Clementine, the process ends in an actual headache.

Desi narrated this process as beginning with "panic" and moving secondarily to "blank out completely." Ana also put the emotion first, then the forgetting; "Cause when you are kind of nervous, you forget things." This process begins with stress, panic, and feeling nervous. When you feel those things, you forget, or blank out. This process is very similar to the hypothetical process at the heart of math anxiety (Ashcraft & Moore, 2009). Ashcraft and Moore proposed that when a person with math anxiety solves a math problem, particularly under testing conditions, the anxiety interferes with working memory, necessary to solve mathematics problems. The person then cannot access their memory. These authors proposed that this leads kids to underperform on tests of mathematics, because of what they term the *affective drop* (Ashcraft & Moore, 2009).

Mathematics, alone among the academic subjects, has its own anxiety. The classic definition of math anxiety is "a feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations"(Richardson & Suinn, 1972). Other researchers tied math anxiety to testing situations (Ashcraft & Moore, 2009). Researchers in a variety of populations have found these feelings to be widespread; Bull (2009) in her study of 62 first year nursing students, reported 45% of the nursing students had math anxiety at the beginning of the study.

Certainly, kids in this study reported "feelings of tension and anxiety." Of the nine focus kids, three were boys and six were girls. Five out of nine kids reported strong feelings of panic when taking tests in math, or even doing regular math work. Five out of six girls reported these feelings, and none out of three boys (Arturo, whom I only interviewed once, also reported these feelings of stress). This raises questions about how widespread "math anxiety" may be in math classrooms dominated by memorization and test-preparation. Why is this a problem with Ana, Desi, Rita, Clementine, Carmen and Arturo, and not the way in which we teach (and test) mathematics? Again, we see the stunning ability of education to deflect blame from the structures of education onto the individual children. I also see how strong feelings are themselves pathologized. We will see more of this in the analysis of Carmen in Chapter Seven, who described intense feelings in math class and labeled herself as “bipolar” because of them (Carmen, Second Interview).

Desi also felt intensively in math class. She used these words to describe her experience: “confused,” “butterflies,” “panic,” “I blank out, and “I loathe.” These feelings are elicited by moments when Desi did not know if she got a math problem right or not, and also by testing situations in which Desi needed to replicate a single method under time pressure. As I will further describe in Chapter Nine, Desi’s understanding of herself as a “slow” math learner connected to “not testing well.” These themes were echoed by other kids, who also constructed understandings of themselves as not good at math because the stressful way in which they forgot material on tests or in class. Desi’s self-understanding as an individual who didn’t test well probably contributes to her not testing well. Her growing understanding of herself as “slow” at math also contributed. These fossilizations of self as a math learner, built up over time, slowly solidify into semi-set understandings of self such as “I don’t test well.” This phrase then defined Desi to herself, perhaps causing her to continue to panic on tests.

Enjoying mathematics. Thus far, while describing the emotions that kids reported in math class, I have focused on painful ones, as if all emotion in the class was negative. This was not so, although there were days in the spring, when test preparation was in full swing, that I barely saw any smiles from kids through the entire ninety-minute class. Most days, however, in both the sixth and seventh grade years, kids smiled, laughed, joked, hugged and even held hands in class.

The chistosos were downright joyful at times while solving math problems. In the sixth grade class, Tony interrupted the small group work on integers to say, “I love this,” a glowing far away look in his eye (field notes, 5/25/10). Later that same day, he and his friends Arturo and

Felix told me that the math work was “so fun.” When Ritchie regaled me with his rap about his mathematical prowess in seventh grade, his smile was wide. Carmen also had moments of joy during math class. After getting a problem right, she shouts out in sixth grade class, “Oh yeah, I smart, yeah, yeah”(field notes, 3/23/10). Kids seem to feel wonderful when they are on a roll in this kind of “state examish” mathematics. It provides a strong sense of competence; to be someone who knows mathematics is to be powerfully rational (Walkerdine, 1988).

While in general, this research project has found powerful negatives associated with “state examish” mathematics, these feelings of joy should not be ignored. This was the intense pride that Bobby felt when his uncle taught him the multiplication facts. Mathematical quickness is a rush for kids, here particularly for Latino boys, a group whose academic performance as assessed by test scores and graduation rates has not kept up with Latinas (Orfield, 2004). As a teacher, I saw this kind of intense joy in both kinds of mathematics. Tapping into the joy and pride of these kids in these moments is the work of teaching, no matter what kind of mathematical pedagogy we prefer. If this kind of engagement with mathematics could be sustained, we might see a remarkable difference in how many Black and Latino kids pursue mathematics.

Math researcher Alan Schoenfeld (1989) argued that generations of kids, trained in their math classes to answer short computational problems, think of mathematics as something that must be solved in seconds. He argued that this assumption leads kids to think that if they are stumped for even a minute, they are failing. For Carmen’s every moment of joyful excitement because she got it, there are two of complete devastation, because she didn’t. Complicated, challenging problems require a wholly different stance towards confusion. The new Common Core standards have a separate list of mathematical practices, one of which is persistence (2010).

For kids to solve difficult problems, they need to be able to move through "not knowing what to do."

There are a few kids in the class who seem to enjoy this sort of problem solving. Bobby, who at other times seemed to be rule-bound in his learning, in his second interview told me, "I struggle and I struggle and I like struggling"(Second Interview). Ruby also enjoyed mathematics, particularly devising strategies to win games. Both in sixth grade and seventh grade, Luis enjoyed problems better than worksheets. During his first interview, while describing to me the routine of the classroom, Luis made a distinction between "problems that give you problems" and "worksheets"(First Interview). Problems that give you problems make you think. They are not just things you can do, just finish, but mathematical work that engaged Luis. With a worksheet, there is no thought, "nothing." But with a problem, you can "get interested in it." Later in the interview, he talked about the enrichment work, saying that it was hard, and that

> **Luis**
> I liked it because I like challenging more stuff,
> and the more challenging,
> it is like a problem,
> the more challenging,
> the more problems in your head,
> so it makes you think about it more.
> (Luis, First Interview).

Later in the interview, Luis said that he liked math, "cause it's the most challenging subject."

Luis persisted every time he was given a "problem that gives you problems." Even when the class moved on, I saw him hide problems under his textbook and work on them surreptitiously. He liked to catch my eye and get me to come over to discuss a new strategy with him. The teacher in me could never refuse. To see a kid with such passion and investment in solving problems, even as the practice was increasingly devalued in his class, was inspiring. His love of this work created a corresponding love in me; for him, for his enthusiasm, for his dedication to what made him happy despite his surroundings.

Interpreting experience through social identities

As I wrote in Chapter Three, I have been influenced by the work of Danny Martin who conceptualized mathematics as a racialized experience (2009). In this work, he insisted on how doing mathematics only feels abstract and objective and colorblind to whites. For participants who are black, the historical dominance of whiteness in mathematics is palpable, shaping experience. In Chapter Four, describing the figured worlds of this classroom, I explored how different social identities were mapped onto different figured worlds. In this section, I describe how kids narrated their experience in figured worlds that are always marked by social identities. First, how the space of the classroom was kept separate from Spanish, race, ability, and other kinds of difference. Second, how understandings of gender equity intersected with voices about "state examish" and "critical thinkingish" mathematics. Last, I will explore the way in which one kid felt physically marked as "not a school person."

In Chapter Four, Desi described how she felt that there was a difference between "being serious in some subject" and "our Dominican selves"(Second Interview). Desi communicated collectivity in her conception of what it means to be Dominican. Yet this classroom daily, incessantly, separated the kids into individuals (even when this is painful, think of Lorena and Sade) and ranked and sorted them into categories. Why did mathematics not seem like a community endeavor? And how might the emotional life of kids in this classroom have differed if it did? Because Spanish was seen as outside the classroom, English dominated. Carmen echoed this separation:

Carmen
This is like a let's say Hispanic school like most people know English,

people have their own culture,
culture,
so like and like they like mostly in this school they wanna talk Spanish,
when they do something playing and the teachers know Spanish and we say Spanish words but low,
or like if we were doing something in math,
like *ocho,*
mas diez,
eighty

Rachel
Do you ever talk in Spanish when you are doing your math?

Carmen
NO
because this is an English class that's why.
(Carmen, First Interview)

Spanish was for when you are "playing" so you had to do it "low." Carmen made it very clear that although most of the kids and teachers speak Spanish, this was still "an English class." And this was, to be clear, not an English class, but a math class. But for Carmen, a class in which they speak English was just that: math class was an English class. To Carmen, Spanish was not just a different way to be speaking, it was a separate kid language because "they have their own culture," distinct from the official school culture. This split between Spanish and mathematics was pronounced, and kids felt it. It mattered that they thought math should not be done in Spanish, the language spoken most often at home. The split that Desi narrated, between being "serious in some subject" and "our Dominican selves" creates a split between being good at school and being herself.

Desi also described the public narratives about ethnicity, race and mathematics. I asked her if ethnicity mattered for mathematics, and she said,

Desi
Sometimes yeah.
And like I believe like in every culture,
there is a different kind of math learning.

Like in
Japan, they are pretty advanced
and some of them know what they are doing,
and all of them, they are all just like,
yeah, I am on to this,
and even if you are not the greatest over there,
you are still good,
so I am like, *Whoa!*

Rachel
What about in the Dominican Republic in terms of math?

Desi
In my country it is not really like that.
If you,
if you
fail you have to pay for school and school is really hard and you only go to an amount of years in school and some people don't go to college at all.
It is like rare, if you go to college in my family.
Like, my mom she didn't go to college
(Desi, Second Interview)

Desi thought that there were differences between cultures in mathematics: "in every culture, there is a different kind of math learning." She immediately turned to the public narrative of Asian mathematical prowess. I think it matters that she turned to that narrative first, not beginning with what was different about the DR, but drawing first on a very widespread narrative of Asian mathematics. The Japan narrative was focused on being "good," a narrative of ability. Desi follows this story with one about the DR, which stresses material conditions that affect educational opportunity, not ability. She talked about how much school costs, how difficult it was to go. For this reason, her mother did not go to college.

Desi had taken in a public narrative about people in Japan being "good" at math. And she knew through her extended family experience that it was difficult to be able to go to school in the DR. Does this mean that Desi thinks that people from the DR are "bad" at math? There is no evidence of that. The two narratives, perhaps, sit side by side in her view of the world, two understandings which do not necessarily have to make sense together, do not have to relate to each other, other than being placed there in juxtaposition.

Other social aspects beside language and ethnicity are kept separate from what Desi called "being serious in some subject"(Second Interview). Although I have written about the kids' interest in issues around disability studies, and how Luis repeatedly used metaphors around social conflict in solving problems, these social issues were never part of the public script of their mathematics class. As with Spanish, there was disconnect, separation. Ms. Marquez, in our final interview, maintained that Desi and Luis would benefit from a "conceptual" class, one that connected mathematics to "social justice." These are the connections that Luis seems to make all the time, but are under the radar, not given status as mathematical.

Kids talked about gender as mattering in math class. Carmen said that boys think they are better:

Carmen
People say guys are better than girls,
no not really because

Rachel
Who said that?

Carmen
Guys say that,
guys are better than girls,
and we say girls are better than guys,

but no not really because you could do a,
like what girls do guys can do,
what guys do girls can do,

but like if you know how to do math a way,
someone else could do it some other way,

so like ,

in math and in every other no ones better than no one.

Rachel
Do people ever try to make people feel like some people are better?

Carmen
YES
it will be like everyone because sometimes I feel like cause some people like they say that they are smart and
I do the work how they do cause they finish the work fast and they get it right then it takes me like a while to get it right,
so I kind of feel bad but at the same time everyone learns at their own pace.
(Carmen, Second Interview)

Carmen began with a moral statement about guys and girls in math class. Although guys may say they are "better" than girls, Carmen knew that "what girls do guys can do" and "what guys do girls can do." She then made a general statement about equity and many ways in mathematics: different ways do not make some people better than others. This was a strong statement about equity and disability in math class, one that other kids (particularly Luis and Ruby) echoed. It was a voice, a repertoire, about ability in mathematics that is associated with the "critical thinkingish" mathematics. It provided a way for Carmen, and other kids, to answer back the demands of another prominent voice about ability in mathematics, which Carmen immediately moves towards.

This second voice was organized around the binary of get it fast or struggle slow. Carmen described how others "say they are smart." Smartness was connected immediately to "they finish the work fast and they get it right." Carmen's experience was different—she takes "time" (echoes of "time and a half"). She reported her negative feelings in this situation, "I kind of feel bad," and then contrasted that with the public narrative of "everyone learns at their own pace." This narrative exemplifies how multiple discourses about math dialogically interact: Carmen used discourses about gender equity, the binary of get it fast or struggle slow, and the script of everyone learns at their own pace. And it also speaks to the messiness of trying to write about only gender, or only race, or only ability. Carmen began with her critique of boys, but she ended by narrating the experience of watching others (not necessarily boys) get it right faster than Carmen.

Carmen communicated the feeling of not being fast in math class. Bobby, in his interview, communicated the feeling of being gazed upon and judged because of his physical self. Bobby was a very committed student, carrying around a dictionary so that he could always look up a work if necessary. When I narrated him that way, he seemed pleased, but let me know that not all people *see* that in him:

> **Rachel**
> You want to know what I notice when I have watched you work?
> You love to be right.
> You love multiplication.
> You work hard in school and in class.
>
> **Bobby**
> [big smile] I don't look like the type of,
> like,
> characteristics.
> many people have told me that I'm not,
> that they look at me [gestures to himself]
> just by looking at me,
> like by the way that I am,
> that I am not kind of like a school person.
> and that's true.
> I like school sometimes,
> and sometimes I don't.
> because when it comes to the HARD HARD HARD things,
> I like it
> (Bobby, Second Interview)

What “characteristics” might make Bobby not look like “a school person”? It was located in his body, as he gestured to himself. Is it the way that he dressed? That he spoke Spanish? That he was the most dark-skinned boy in the class? Bobby may have been making the point that he was judged by the color of his skin, that his blackness made him appear to not be a “school person.” He may have meant a hip-hop like way of dressing and acting that many boys in the class adopted at times to show off, make jokes, and have fun, identity markers that are associated with blackness. Kenny, however, rarely participated in those activities, neither rapping nor snapping, neither did his dress or accessories point to that kind of identity claim. I cannot be sure about exactly what Bobby is referring to, but it is clear that Bobby believed that there was something about his BODY that makes him “not a school person.” This is troubling, and must be considered as I work to understand what “a math person” is and is not. Bobby understood that he was addressed in particular ways because of his physical self. In Chapter Seven, I claim that Bobby was developing increased identification with mathematics throughout the year. Yet how could Bobby feel like a “math person” if he saw himself positioned as “not a school person?”

Conclusion

As Paul Lockhart (2009) wrote, the last people that we ask about math class are actual kids, who know. They would tell us how math class feels: boring and hard (Lockhart, 2009). In this chapter, kids narrated not that class was boring, but that it was stressful. They told us that attention from the teacher meant respect, and that attention from the teacher confused and frustrated them. They told us that helping and being helped was a critical part of their experience in math class. They told us that math class was separate from their language, from their critique of social issues, and thus from themselves (from “our Dominican selves”(Desi, Second Interview). And what can we do with this information? Can an appreciation of the experience of math class for kids lead to better experiences? What about how ability groups and intense intervention felt for kids? In the final data analysis chapter, I turn my attention to the focal kids individually, tracing the ways in which they narrated themselves in the world of mathematics, looking for ways in which these felt experiences are transformed into self understandings.

Chapter Seven:

Authoring Mathematical Selves

> “Forming an identity on intimate landscapes takes time, certainly months, often years. It takes (and makes) personal experience to organize a self around discourses and practices, with the aid of cultural resources and the behavioral prompting and verbal feedback of others. It takes the heuristic developments of dispositions and savoir-faire to imagine the world and to identify with the figured world. Conceiving oneself as an agent whose acts count in, and account for, the world cannot happen overnight.”(Holland et al., 1998, p. 285)

In this work I focus on understanding change over time. In mathematics or science education, very few studies have taken a longitudinal view of children doing identity work in the figured worlds of school (Barton, Kang, Tan, O’Neill, Bautista-Guerra, & Brecklin, 2012). Through this work, I am able to better describe the long-term process of identification with mathematics in school, what Holland et al. describe as “conceiving oneself as an agent whose acts count in, and account for the world.” Using this concept allows me to look at each kid over time, hoping to describe how each forms her/his relationship to mathematics.

As described by Holland et al. (1998), identification codevelops with salience and expertise. To illuminate this co development, they drew on a sequential stage theory of developing expertise developed by Dreyfus (1984). In Dreyfus’s theory, one must begin to feel strongly about a realm into order to develop expertise. You have to want to be good at it, in order to get really good at it. The role of emotion in Dreyfus’s theory illustrates this point well, but the stage-based theory proves less than useful. However, I will still use some of these tools to build theory that connects processes of identification with mathematical knowing. If we understand theories like Dreyfus as one possible way to understand this process, rather than ways to label individuals at certain parts of the process, then we can use them without categorizing children.

I use *authoring the self* to describe both long-term development and the moment-to-moment activity of being addressed by the world and answering. I use *identification* to describe the process in the longer term in relationship to a particular realm: mathematics. So how did kids author themselves over time in mathematics? First, we have established that their classroom was a complex site, a place in which multiple figured worlds intersected and conflicted. Recalling Bakhtin (1981), each individual is addressed by the world in multiple ways, and must answer. Answerability is the constant process of our lives. It is a process of borrowing and appropriating voices, using the voices of others to construct your response to how the world positions you.

Fossilization was originally a term used by Vygotsky (1978) describing the process of learning, in which a new routine first takes a long time, heavily mediated by language or other mediators, and is gradually compressed to become automatic. In a similar process, individuals are always in a state of being addressed and having to address the world, being named and having to name the self. They cannot do this fresh each time; certain ways of authoring the self become more or less automatic. How do kids become automatic in one or another of their understandings of self as math learner? Do they? In what ways? Over time, I could see change, from certain ways of understanding the self becoming increasingly prominent (fossilization), or a breaking apart of previous self-understandings and thus being forced to work to understand the self. Even when I found fossilization of certain self-understandings, these were never monoglossic.

As I analyzed the narratives over time, I could see kids authoring their selves through various voices. And I saw this change over time as related to changes in the classroom, or conflict with other increasingly important voices. I also saw the process of fossilization occurring, a process of compression of categories and narratives over time. Desi increasingly saw herself as a "slow" learner(Desi, Second Interview). Even as one aspect of Desi's identification with mathematics was fossilizing, other aspects of her relationship to mathematics became more contentious, more open, through her developing critique of labeling. Fossilization was one process I saw across the kids, but this process did not finish, always still in process.

The most dominant pattern across the interviews was how kids came to increasingly understand themselves through a fast/slow binary, what Arturo helped me name as *get it fast* or *struggle slow* (Arturo, First Interview). I saw evidence of this understanding in all of the kid's interviews, but with quite different degrees of appropriation. This understanding was linked to the dominance of "state examish" mathematics, in which kids had to solve many small problems as quickly as possible, using memorization. Only Luis and Ruby resisted the binary of get it fast or struggle slow, using instead the voices of "critical thinkingish" mathematics. For all the other kids, this process— learning to see themselves and each other through fixed, "state examish" categories (get it/struggle and fast/slow)— resulted in the fossilization of these categories. For some kids, that construction worked, for others, it was unstable.

I have arranged the focus kids into four groups, based on patterns in how they authored themselves in relation to mathematics over time. The first group (Federico, Bobby, Carmen) took up the fast/slow binary of mathematics to understand their own competence in mathematics. The second group (Luis and Ruby) took up an alternative voice about mathematical competence, developed through the "critical thinkingish" activity in the class, the talking kind of math learner. These kids understood their own competence through their creative use of strategies, and how they talked about mathematics in class. Both of these groups had kids that seemed to consistently identify with mathematics. Both groups had kids in them that saw themselves as agents in these two mathematical worlds: fast/slow and talking mathematics.

The last two groups of kids were more concerned with de-identifying with mathematics over time, either by highlighting other activities that they *did* identify with, or by naming themselves as "struggling" and "slow." The third group of kids (Rita and Ana) had been successful in math classes, but no longer "liked" it. I document the process through which they have begun to de-identify with mathematics.

The last group of kids increasingly named themselves as "struggling" and/or "slow" (Clementine and Desi). Both of these kids also had very powerful critiques of the way in which they were taught mathematics. Clementine critiqued the intervention of adults in her learning. Desi critiqued how labeling and ability groups have positioned her. Their critiques teach me how to understand resistance to the figured worlds of mathematics that they are given.

Kids Authoring Themselves Getting It Fast or Struggling Slow

In the final interview, I asked each kid, "If there are different types of math learners what kind are you?" This question was designed to elicit their understanding of their positioning as a math learner (see Chapter Three for my critique of this question). A few kids used *visual* and *not visual* as a way to understand themselves (Ruby, Rita, and Carmen), and one kid (Bobby) told me that he was a multiplication type. But everyone but Luis, in at least one of their answers, placed themselves as a kid who either knows it right away, or a kid who had to go through an arduous process to learn mathematics. The dominant heuristic in this classroom was whether you get it fast or you struggle slow.

Bobby. Bobby was a round thirteen-year-old, darker in skin than the other kids in the class, naming himself as Dominican and American (see Chapter Three). He had no IEP. Bobby believed in the power of the right answer, and the power of his dictionary. In class, Bobby worked hard to get it fast in mathematics. That affinity served him well as the class transitioned into exclusively “state examish” mathematics: Bobby was placed in the highest level group. As I wrote in Chapter Three, in his interviews, Bobby demonstrates awareness of class and racial identities that shaped both his own understanding of himself, and how others saw him. Bobby brought multiple narratives of his family into his interviews.

Bobby in math class. Bobby was not in Ms. Emerson and Mr. Pierce’s class in sixth grade. The first time I noticed Bobby, he was reading out of his dictionary to answer a question during Math Slang. Later in the year, when I saw him using the dictionary again, he told me that the dictionary was his “Bible.” Bobby certainly had faith in the right answer. My second experience with Bobby was watching him be the kid monitor of a small group reviewing their multiplication facts. Bobby took this job very seriously. He took on the role of a particular kind of teacher: his four kids were not allowed to use their notebook to solve any of the problems. Bobby scolded the other kids, taking on the voice of a strict teacher. On 10/12/10, he said to Lea: “I know you know this because you were in the sixth grade.” Here, Bobby echoed the connection kids made between grade levels and particular kinds of mathematical knowledge.

Because of how he schooled kids, I had a negative reaction to Bobby during the fall. I did not like the way that he treated Lea and Federico, schooling them for not knowing something right away. However, I did not see Bobby do this again, after October. As the year progressed, I developed a fondness for Bobby. Bobby did not misbehave or joke in class. He worked hard to solve anything he was given, and he cared deeply about his work. I felt that he wanted to be part of the chistosos, but although he was included at times, at others he was not. He seemed to be most comfortable with Federico, often playing tag in the hallways before class.

Bobby was able to use his dictionary and his memory for procedures and facts to help him gain status as a procedural mathematician. Bobby and Pedro, arguing as they raced to finish a worksheet, called each other “stupid,” linking “stupid” to being slow to finish worksheets (field notes, 1/24/11). Bobby was deeply engaged in establishing himself as not “stupid” in math class.

Despite this bid for status, Ms. Marquez never mentioned Bobby when she spoke about “top” kids. During my final interview with the teachers, Ms. Marquez said only of Bobby that, “He can do it”(Seventh Grade Teacher Interview). Yet she put him in the highest level (Independent) group during the spring. Bobby was not on the honor roll in the fall, but was in the spring, when the class was more focused on procedural work.

Authoring the self. When I asked Bobby to write about his history as a math learner in the fall, he didn’t hesitate about which story to tell. The critical story, from his point of view, was how he learned his multiplication facts in the DR from his uncle. This story was important because of the teacher, who later became his uncle, and important because he learned something valuable, multiplication. Bobby, like other kids in his class, saw mathematics as a set of topics to be mastered, preferably ahead, and as fast as possible. He retold the same story for me at the end of the year;

> **Bobby**
> Multiplying
> I learned actually in my country,
> Dominican Republic,
> my uncle,
> which is now,
> well,
> he was a teacher before he met my aunt and before they got married,
> so now he is my uncle and he taught that in 1st grade so when I entered 2nd grade I would be ready like not ahead ahead
> but at least I have a head start of what we are gonna start
>
> and multiplication seems easy to me because if you tell me what is 12 times 12
> I am gonna say 144,
> like I know
> like sometimes your brain has to search for it,
> and my brain doesn't really have to search for it because I know where it is just by hearing it.

(Bobby, Second Interview)

Compared to his first telling, now Bobby emphasized the idea that he was taught ahead of time. He also brought his "brain" into the narrative. He narrated memorization as your brain searching, or better yet, just knowing. In the figured world of "state examish" mathematics, brains had agency as they do the hard work of looking for the answers. When Ms. Marquez gave him the role of a monitor, Bobby was able to reenact this important scene in which his teacher/uncle taught him his facts.

Bobby was sensitive to the feelings of his friends, for example when he was sensitive to Ortiz when describing the ability groups (Chapter Four). When he was schooling the kids, particularly during multiplication, he may have felt that that was through love. Or, in another narrative he told, like the love his mom showed him by buying him multiplication flash cards.

Over the scope of the two interviews, I saw Bobby identifying more with mathematics, authoring himself as a person with agency in mathematics. Bobby began his final interview by telling me, "Did you know that math is one of my favorite subjects?"(Second Interview). Perhaps this was because his particular way of learning math became gradually more valued in the class. He also talks more specifically about enjoying "struggle" in mathematics, perhaps expanding his idea of what mathematics could be. Bobby brought his family into his understanding of self as a math learner. Bobby identified as someone whose family pushed for him to have a "head start," as he recounts how his mother bought him multiplication fact cards when he was 6. By the end of the year, he was on the Honor Roll and in the "most understands" group (Bobby, First Interview). But for Bobby, I would argue that it was not only about the figured world of the classroom. Bobby, again and again in interviews, brought his family into this story. His success in class justified the care his family has given him in mathematics.

Federico. I have been interested in Federico since the day I met him in his sixth grade class, and he told me in an aside, quite seriously, that I was making his teacher nervous. Federico was a light-skinned boy who was fiercely protective of himself. He described himself as "Hispanic American," with a family from the "Dominican Republic and somehow I have a small Portuguese." Federico was serious in class, working hard and participating in discussion. He had a label of a learning disability and also received speech services. His family spoke Spanish and English. He was fiercely protective he was of his teacher, and as I got to know him better, I think that fierce did describe Federico. More than any other kid in the class, Federico was involved in fiercely defending himself and others. Federico constructed an identity for himself as a serious math learner that got picked at, by other kids, and sometimes by teachers. He defended himself through serious class participation, hard work learning new methods, and by authoring a mathematical self that can be "fast" and "slow" simultaneously.

Federico in math class. Federico fiercely defended himself in class. When Bobby refused to let Federico use paper to work out the multiplication facts, Federico defended himself using the voice of Ms. Emerson: "I'm slow writing and [gestures to his head, like for thinking] but I know them all. Just pressure"(field notes, 9/29/10). During the winter, I saw Federico being teased by Tony, including accusations that he smelled. Federico gave Tony a fierce glance, and then raised his hand to continue his participation in class.

As I wrote in Chapter One, Federico's disabilities were extremely visible to his sixth grade teachers, who saw both "fine motor" and "processing" difficulties (Sixth Grade Teacher Interview). Ms. Emerson said, "His inability shines out on me all the time," referring to his difficulties writing legibly. In Ms. Marquez's classroom, Federico was initially disciplined for disorganization, with Ms. Marquez calling him out publicly when he cannot find materials in his backpack, saying that he was "disorganized" and "needs help"(field notes, 9/14/10).

This was the only time that I heard such public disciplining of Federico by an adult in seventh grade, as he quickly adapted to both the "state examish" and "critical thinkingish" practices of the classroom. Federico was able to debate points beautifully, to discuss different aspects of mathematics, as I documented in Chapter Five in a discussion about integers. Federico participated actively in small group learning, almost always finishing worksheets correctly. Federico became even more confident in the spring, which his teachers attributed to his relationship with a tutor at his after school tutoring program. This tutor taught Federico procedures in such a way that Federico successfully remembered them in class, and Federico grew more confident.

Federico was sometimes on the periphery of the social world, so much so that Elisa says she doesn't know what kind of boy he is. He set himself apart. I think he set a great deal of pride in his schoolwork. He adopted such a serious posture and voice when speaking in class. At times, Federico was very separate from the chistosos, and at other times I saw him standing easily with them before they enter the class. He said that he did hang around with them, to help them know how to "balance" being serious and having fun in class (First Interview). Federico hung out with Bobby before class often, and in class worked closely with Elisa.

Authoring the self. According to Ms. Alton, the ratio on Federico's IEP means that he was automatically in Ms. Alton's group in the spring. The groups, from his point of view, were not based on ability, but on HOW kids learn (Chapter Five). His group was the "kids who learn differently" group (Ms. Alton's group). His understanding of the groups is that Ms. Alton devises these "easy straight methods" for kids who "learn differently." Federico took up the voice of his teacher, Ms. Alton, who told me that her group was for those who "need different methods"(Seventh Grade Teacher Interview). I asked him how Ms. Alton's group worked for him,

> **Federico**
> Worked pretty well for me.
> I've learned most of the work with Ms. Alton,
> I kind of understood more than what I did with Ms. Marquez
> cause her easier methods made it easier for me to remember [*finger up to ear, swirling motion*] it and learn it.
> (Federico, Second Interview)

Again, as in the moment with Bobby in class, Federico referred to his brain when talking about remembering. As for Bobby, the brain was part of the narrative.

In his second interview, when I asked him what kind of learner he was, he replied,

> **Federico**
> I'm one whose
> I'm between my own learning I am half to self-taught and also learn more,
> I use my former knowledge from other things combining with newer knowledge and I somehow learn new methods or new ways of doing things
> (Federico, Second Interview)

Notice the mathematical language, the quantification of self here: "one," "between," "half." He was working to be precise about who he was. I understand his way of speaking as highly formalized. Federico tended to choose the most sophisticated word possible, often combining different voices. At times, that made it hard for me to understand, as multiple voices seemed to collide. He uses authoritative discourses, such as mathematical language, evoking in one utterance "Pi," "perfect squares," "rational and irrational when you times out." Federico authored himself in a steady state, always in control, always already knowing.

Later in the second interview, I asked him what kind of math learner most people think he is, and he said that he was both a "quick learner but also a slow learner." When asked how his peers see him, Federico responded, "Some see me slow, but some see me as I rush right through things, I rush right past them." Again, both fast and slow. I asked Federico about the moment with Bobby and multiplication, in which Bobby scolds Federico for not memorizing the multiplication facts, and Federico defends himself (Chapter Four):

> **Federico**
> [*Nodding as I read his quote*]
> I can be pressured because I know the multiplication tables forth,
> from both sides like all up,
> it is just like,
> when I am being rushed,
> it slows down my brain just slows it down my mind[*gestures up and down*]
> my brain,
> ten million thoughts go all at once,
> and my body just takes time to like put it all down,
> and then to actually write it down or anything.
> (Federico, Second Interview)

Again, Federico defended his knowing. Not only does he know his multiplication tables, but he knows them, "forth, from both sides like all up." What disables him was "being rushed," which prompted a physiological reaction that he narrated. Federico re-narrates his speech and language processing difficulties, something that Ms. Emerson alluded to in her description of Federico. His disability rests in his body and how his body processes information. Knowing was one thing, getting it out was another. The two are separated for Federico in how he understands himself and his disability.

At the end of his second interview, I asked Federico if he has an IEP. He said yes, and then told me it was for:

> **Federico**
> To tell teachers what we are like,
> or what's our learning speed,
> and what teachers say that is best for us for our learning,
> for how we learn
> for more time on the state tests.
> Explaining to teachers that I can learn fast but I can also learn but not too fast but a little slower.
> (Federico, Second Interview)

Federico narrated himself not as fast or slow (except in response to my question about what type of learner you are), but narrated the process itself as either slow or fast. Disability was expressed here as speed: the IEP told the teachers "what's our learning speed." I wonder how that conception of disability was related to "more time on the state tests."

Federico was able to narrate aspects of his disability, particularly to defend himself from the positioning of others. In the fall, he saw himself as a kid who was "okay, but I ask a lot of questions"(field note, 1/4/11). At this point he named himself in both mathematical figured worlds: both "okay" in state-examish mathematics and one who asks "questions" in "critical thinkingish" mathematics. When his class shifted to only "state examish" mathematics, Federico authored himself as both "fast" and "slow" in mathematics, or, more often, as learning "fast" and learning "slow." Federico was engaged as always in defending himself, perhaps from the idea that he might not be "fast" and "ahead" in mathematics. He used discourses of processing to explain this paradox, how he can learn both slow and fast. He knows just as fast as anyone else, he just takes longer to organize his output. Federico seems to see himself as an agent in his math classroom, both in his hard work and how he authored himself, fiercely defending himself against being addressed only as disabled, only as slow.

Carmen. Carmen was a tall, strong and fit girl with straight dark bangs across her face, and flashing eyes. She was often very funny, making jokes about my camera or her boyfriends, but also serious about getting her work done well. She described herself as a "girl" and told me, "My family is from the Dominican Republic." She had a label of a learning disability, and was currently categorized as an English Language Learner. Her family spoke Spanish at home. Carmen was overtly aware of the camera and my attention. During her interview, she flipped her hair, talking about the camera being on her as she has difficulty solving a problem in the interview: "we need to finish multiplying, the camera is looking at me"(First Interview) She would fix her makeup and then ask me to put the camera back on her. Carmen spoke frequently and often about her feelings in math class, reporting both loving and hating mathematics. Carmen preferred "state examish" mathematics, wanting a single way to solve problems, yet this same kind of mathematics tended to make her feel wonderful when right, defeated when wrong.

Carmen in math class. Carmen was not a focus of my fieldwork in sixth grade. The few glimpses were of her engagement and enthusiasm: such as when she loudly exclaimed, "Oh yeah, I smart, yeah, yeah" after correctly evaluating an expression with exponents (Field notes, 3/23/10). I saw her accurately use a ratio table to solve a fractions problem, and then patiently help Federico to use a ratio table, even when his strategy is different (field notes, 6/9/10). Like a teacher, she carefully and kindly led Federico through the method, telling Federico that "you did it different" but you got the "right answer."

Carmen was a strong presence in the hallways before class, loud, funny, always in the middle of a group. During whole group discussion, Carmen was much more quiet, rarely volunteering. Carmen worked hard during class, often closely with Rita. Carmen told me several times that "I take the rule better"(field notes, 10/19/10). She would get frustrated if there was not a specific mathematical rule to follow. I often saw Carmen confused as she was learning rules, but once she learned it, she was able to replicated it when asked.

As the year progressed, I saw less focus from Carmen, and more overt sadness. In the early spring before the test, Carmen appeared to be very sad, crying silently during class, withdrawn. Even as she successfully completed procedural work, she was no longer commenting on her greatness. By the end of the year, after the test, she returned to her exuberant, joyful behavior. In this way, Carmen was the canary in the coalmine for this class. She reflected more openly the mood of the class, which became sad in the depths of test preparation.

Authoring the self. When I asked Carmen what kind of math learner she was, she at first did not answer, but when pressed, defined herself as a "leader" because she is "always there to help" even if it "may take hours to explain." Carmen told me that when she helped others in math class, "I feel like a goddess." Carmen made a connection between helping and leadership. This sentiment is echoed through out the interviews with other kids. Twice in this narrative, Carmen brought up the issue of time, demonstrating her leadership by persisting in helping, no matter how long it takes.

Carmen understood mathematics as doing what "you're supposed to," telling me "I take the rule better" and "I just do it." Her mathematics was memorization and replication of procedures. Carmen preferred learning clear procedures to solve problems. Because she sees mathematics as learning and applying rules, she was happy when she knew the rules, and unhappy when she did not. Struggle was not a feeling that she seemed to enjoy, at least not in mathematics.

More than other kids, Carmen talked out loud during class about her feelings. More than other kids, she allowed me to see how she was authoring the self while actually solving problems. Sometimes that was so positive:

> "Oh yeah, I smart, yeah, yeah."(field notes, 3/23/10)
> "I'm so great, I'm the great one."(field notes, 10/5/10)
> "I got addition(of integers)." (field notes, 10/19/10)
> "I love math."(field notes, 10/26/10)
> "Now I am getting this."(field notes, 2/1/11)

And other times, so negative.

> "I hate math . . . because I suck at it."(field notes, 10/12/10)
> "I didn't solve it."(field notes, 10/19/10)
> "Augghhh, Dios" and "I don't get it."(field notes, 10/19/10)
> "I don't know this, I'm not smart like you."(field notes, 10/19/10)

"I am bad at algebra, so I am lost, super lost in the world."(field notes, 1/4/11)
" I am lost like a little child."(field notes, 1/4/11)
"The letters confuse me." (field notes, 1/4/11)
“I don’t care.”(field notes, 3/9/11)
“I’m lost.”(field notes, 3/16/11)

Reading over the list of Carmen’s quotes, I am struck with the strongly dualistic way in which she thought about her own competence in mathematics. She was either great or terrible, she “loves math” or she “hates math”, was either “lost in the world” like “a child”, or was a “smart girl.” I see this opposition as interrelated to her conception of mathematics, and how she engaged in mathematical learning.

In her struggle with the student teacher that day, she told him that she couldn’t do it; “I am not smart like you”(field notes, 10/19/10). Her conception of smart was closely tied to knowing it, knowing it fast. When that failed, Carmen felt like a failure. She told me about this feeling on the state test, when she took too long to figure out a problem:

Rachel
Ohh, took you a while to figure out the pattern

Carmen
Yeah,
but I like when I found out that I felt so . . .
like not smart because

Rachel
But why - you figured it out

Carmen
Because I spent half an hour when I should have knowed it,
that's why
(Carmen, Second Interview)

There was anger in her voice in that last utterance, when I questioned how she felt. She should have known it. For a learner who prided herself so much on “getting it quick,” struggling felt like failure. Even though she eventually figured out the algebraic pattern, she felt “not smart.”

In her first interview, Carmen did not discuss negative feelings about her math class, or math learning. But in June, in her final individual interview, Carmen told me what it felt like to be wrong. I asked her about her feelings in math class:

Rachel
For example,
from you I have learned that we haven't talked about here,
is that you FEEL a lot about math,
I think.
because somewhere I wrote down

Carmen
I hate math sometimes

Rachel
Sometimes you say,
I hate math.
and the next day,
turn around and you will be like *I love math*.

Carmen
Cause I used to get it

Rachel
Turn around the next day,
you'll be like mad at what you are doing.

and the next day you will be like,
I'm the smart one I'm the smart one,
like dancing.

Carmen
Oh,
because like I know I am like that kind of called bipolar,
not really.

It is cause like when I struggle when I don't do the right question,
when I don't get it right,
I feel very mad because another person does it like I don't think its fair,
I want to do it too.

Rachel
You want to get it right too

Carmen
Yeah

Rachel
But then when you do get a problem right,
it seems like you feel quite happy

Carmen
I do,
so like,
I think that makes me very proud of myself.
(Carmen, June interview, 2011)

Carmen made it plain why she felt so much: because getting it fight felt so good, “proud,” while when “I struggle” she was pointedly aware of the other kids, who did do it. That felt unfair to her, and “I want to do it too.” Getting it right had serious emotional consequences for Carmen, and other kids, but Carmen narrated exactly how this feels.

Carmen described herself as “bipolar,” placing markers of uncertainty around this, saying, “like that kind” and “not really.” That kind— which kind? Carmen knew that she was read as emotional in this classroom, more so than other kids. Bipolar is quite different than the language of disability evoked, for example, by Desi, when she named herself as ADHD (later in this chapter). While that also is a medical label, it does not have the level of stigma as “bipolar.” While Desi’s label named her as having difficulties learning, it did not name her emotionally. Bipolar is an illness of unregulated emotions. At another point in the interview, she described herself as “very ordinary,” “very crazy in the head,” and “very fun,” all in a row. This emotional difference was again medicalized (crazy). Her bi-polar feelings are constructed by her deep involvement in mathematical activity that was always either right or wrong.

Kids Authoring Themselves as “the Talking Kind”

A few kids in the class emphasized the problem solving side of mathematics, the “critical thinkingish” mathematics of the fall. As Luis said in his first interview, “I like problems that give me problems." These kids used discourses about multiple strategies, emphasizing the creativity in mathematics. These kids resisted the hegemony of memorization that dominated the classroom in the spring.

Luis. Luis, with his curly mop of hair, quick laugh, and wide smile, was a mathematical iconoclast in both his sixth and seventh grade years. He described himself as an "intelligent man," and also named himself as "Latino," "Hispanic," and "Spanish." His family was from the Dominican Republic, and "my great great grandpa is from Spain." He had a label of a learning disability.His family spoke English. Luis brought into the seventh grade classroom an idiosyncratic way of being a math learner, not caring about being wrong, only about solving problems. In both years, Luis served as a focal point for disagreement about ability and disability for his teachers. His sixth grade teachers could not decide where to place him: whether as a mathematical genius (Ms. Emerson) or as one who was not good at taking tests (Mr. Pierce). While Ms. Marquez initially ranked him highly based on his conceptual skills, later in the fall, she discovered that "he can't do rote"(field notes, 11/16/10). He was placed in Ms. Alton's group who saw him as a "behavior." In the final interview with the seventh grade teachers, Ms. Marquez seemed to regret her emphasis on procedural learning in the spring, and wanted to create a class for Luis that stressed conceptual learning. Ms. Alton disagreed, saying that such a class would not give Luis what he "needs." Luis preserved his way of being a "critical thinkingish" learner, even as he was defined as a "behavior" and demoted from a high-status critical-thinkingish learner to a low-status state-examish learner. When I talked to him at the end of seventh grade, he still loved math.

Luis in his math class. In both years, Luis was a socially powerful figure in his classroom. Ms. Marquez called him "the king" and said that she spent the year dethroning him. Federico referred to the chistosos as “Luis and his lackeys”(Federico, First Interview). Luis loved to socialize and make jokes; but when solving problems in math class he became mostly serious. He liked to work alone or with a teacher on what he called “my math”(field notes, 10/19/10). Working hard on math was important to Luis, something that he preferred to do alone, and in a different way than everyone else.

Ms. Marquez consistently ranked Luis as one of her “conceptual” thinkers at the beginning of the year. She paid close attention to what Luis says during class, and she would call on him even when a discussion was ended. Luis would ask many questions, sometimes the same one repeatedly. She was patient with this, and usually answered him. She used the word “challenging” to describe him (field notes, 4/13/11), and at the moment, I was not sure whether she thought his presence in the classroom was challenging, or that he loved to be challenged. Ms. Marquez kept a close eye on Luis, calling him out for misbehavior fairly often. He never responded defensively to Ms. Marquez, often making one more joke with a twinkle in his eye, and then getting back to work. I sensed that Ms. Marquez and Luis enjoyed each other, and their battle in the classroom was light-hearted.

During class in the fall, I saw many instances of the Luis that Ms. Emerson described. He ended the discussion of the hot dogs problem with a generalization about “infinity” (field notes, 9/22/10). He hid problems under his worksheets to finish them. He participated quite frequently in math discussions.

In the spring Luis was placed in the lowest status group, Ms. Alton’s group, although he moved from group to group, again demonstrating how challenging he was for adults to categorize. Ms. Alton understood Luis as a “behavior,” perhaps referring to the special education designation of Behavioral Disorder. When the figured world of the classroom shifted to value different mathematics, Luis's status dramatically changed.

Authoring the self. Considering all these different ways he was positioned, how did Luis author himself? In his first interview, Luis spoke about himself as a math learner, "I usually have a lot of questions about, about math." In his second interview, in June, when I asked him what type of math learner he was, he said, "the talking kind," which he defined as:

> **Luis**
> It means the one that always has something to say about math,
> like questions a lot about math,
> or he wants to debate about things,
> so like if someone says *the answer is 54* and I think it is 12 I am going to keep on . . .
> I'm gonna . . .
> like let's say even if I end up being the one that has the wrong answer and the answer really is 54,
> then I will go around it and say, *like,*
> *oh it is 54,*
> *but the way you did it is harder because I just changed it by multiplying like this and I am trying to find the easier ways*,
> so I look like,
> yeah.
> (Luis, Second Interview)

Luis defined the talking kind with reported speech, animating this as a discussion between kids. In his scenario, Luis was wrong, yet demonstrating the qualities Luis values: "keeping on"(persistence) and sharing different strategies. When I asked him if anyone else was also the talking kind, he differentiated himself from other kids who simply talk a lot. He is different because,

> **Luis**
> I guess.
> cause like if they get a wrong answer then they are like
> *Oh*,
> and then they will be quiet about it but me I know that I will keep on going.
>
> **Rachel**
> um,

so okay.
So how does it feel to be that kind of a learner in your math class this year,
is it a good fit or not,
or sometimes it is and sometimes it isn’t?

Luis
um,
I think it is always good because,
I have nothing to lose when it comes to math.
if I get a wrong answer and I always go for the right answers,
so I don't think I have anything to lose.
(Luis, Second Interview)

Luis’s vision of himself as singular, as a particular kind of math learner, seemed to be focused on exactly the opposite of the *get it fast* personae: Luis had “nothing to lose when it comes to math.” He does not base his understanding of self as a math learner in terms of right and wrong, or fast and slow, instead preferring to think of doing mathematics as repeatedly engaging in “how to do it.” According to Luis, his teachers and peers saw him as “the guy who likes to argue a lot.” Even now, after a spring full of test preparation, Luis did not base his understanding of himself as a math learner on the dominant paradigm of the class (get it fast/struggle slow).

While kids in his classroom, including his close friend Arturo, did not feel comfortable when they are wrong, Luis enjoyed that feeling. He told me about when he got a 110 on a test on integers:

Luis
It was easy to me,
so when things are easy to me I feel good about it,
and also when things are hard I feel good about it too,
because if something is hard and I end up getting,
If I at least get the right answer,
I feel good,
I feel real good about it because I got the right answer,
and this is kind of hard,
and also,
even if I was just to get an answer,
I would feel good about it,
because I know it at least has to be kind of close to it,

cause,
I when I usually do work,
I do a lot of work with it,
I show it a lot like there,
and I usually go over it at least one more time.
(Luis, First Interview)

Again, it was the process, and not the outcome that dominated his understanding. He "feels good" both when math was hard and when math was easy. This was a rarity in his classroom. Also unusual was how he never talked about "fast" or "slow" in interviews or in class. Speed had no place in his classification system, nor did any reference to memory or memorization. He referenced effort: "I do a lot of work with it."

In his first interview Luis did not believe that there was a difference between different learners in his math class, rather "everybody" stands out in his math class, because:

Luis
like I said before 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)

This was the only time in this first interview that Luis used the term, "smarter," and he does so based not on static characteristics, but based on particulars, "smarter at that." This is the narrative of "many ways, none is better." Carmen used it to understand gender relationships in the classroom, but did not take it up to understand herself. Luis used it at the beginning of the year to place all of the kids in the class on an even playing field.

Luis shifted this conception of smart by the final interview. I asked him about the groups:

Rachel
I never really understood what the groups were,
or why you were the only kid that moved from group to group

Luis
Well,

some,
to me,
the way that I saw the groups were was like smarter than others,
though teachers won't say that like that,
so that's the way I thought of it,
then they kept on moving me because I got asked to move because I felt that things were . . .
it was harder in the . . .
unsmartest

Rachel
Harder how

Luis
Like,
it was harder for me to work in the unsmartest group,
because in the unsmartest group people won't understand but I would feel like I understood
and then everybody would be all confused and stuff and then . . .

in the middle group,
where people are so so,
they would understand and they wouldn't understand so I felt a little comfortable there,
but like in the . . .
everybody understood everybody could help each other,

but in the first group,
where people didn't really understand things at all,
there was no body to get help from but the teacher

Rachel
There was no body to get help from but the teacher

Luis
But in the really smart group,
everybody could help everybody,
so if you thought this and then you would end up finishing the work too at the same time,
I understood it enough and had enough time to talk,
because everybody could help everybody and . . .
yeah.
I felt more comfortable there.
(Luis, Second Interview)

Luis recognized that the teachers were hiding something about the groups, and he identified it as "the groups were like smarter than others." Here, Luis was using the term smartest without qualifying it. Perhaps because he saw if as the central organizing principle of the groups, it became a term that should not be qualified, or resisted. This is a change from the "many ways, none is better" narrative.

Luis spoke of these groups as set entities, in mostly third-person language. He began the description of each group with a statement about the understanding of the people in the group. In the "unsmartest group" "people won't understand," in the "middle group" "people are so so, " and in the (notice how he does not name this group), last group "everybody understood." This echoed the way in which others characterized the groups based on levels of understanding (Chapter Four). Luis continued to explain how that difference affected his experience in the different groups; the more the kids knew in the group, the more they were able to help each other. When he was not able to get help from friends, "it was harder for me to work." Notice again how critical "helping" was.

Luis left the teachers out of this narrative, yet the teachers controlled (or tried to) the way in which kids interacted in each group. In her group, Ms. Alton would not call on Luis every time he raised his hand, thus shutting down his ability to be "the talking kind" of math learner. She structured the group so that they would complete the worksheets together, all at the same time. But his analysis highlighted the importance of being able to talk to peers, and answer their questions, as a part of "being good" at math.

In this passage, Luis was talking about working on worksheets, not on problems that give you problems. Not critical thinking mathematics, but "state examish" mathematics. Luis was the guy who talks a lot, who asked a lot of questions, who was not focused on right or wrong. There was no place for Luis in these groups, because there was no place for his kind of mathematics.

This narrative, of the "really smart" and the "unsmartest" has played out structurally in front of Luis. These groups have made the fast and slow binary a material reality (materialized in the groups), which accounts for how hard it was for people to explain the middle group. But while Luis has taken in this voice of "smart" in mathematics, he has not completely extinguished his earlier belief in that there is no smarter in math, just kids having different ways. After this turn of talk, I talked for far too long a time about my own confusion about the groups. Luis responded by clarifying his point of view about the unsmartest group. I see here a return to his narrative about equality, possibly inspired by my long turn of talk, as Luis may have had a chance to think about what his statements would sound like to me:

> **Luis**
> Yeah,
> it was,
> like I am not saying they were dumb or anything,
> cause they understood some things some days,
> other things other days,
> so it was hard for them.
> (Luis, Second Interview)

While we can see a shift in Luis's thinking that seems related to how the ability groups constructed mathematical ability in the classroom, Luis reminds us that while these kids were in the "unsmartest" group, they were not "dumb." Luis resists this ability narrative, insisting that everybody can be good at math.

Ruby. Ruby had medium brown skin and hair, always pulled back into a ponytail. Ruby had a playful personality, loves games and laughing. She was also an engaged math kid, one who made comments about the strategies of others, and asked questions when she was confused. She had braces, and was often smiling broadly during class and interviews. She describes herself as "female" and "Latin," and told me that "I come from the Dominican Republic, but I was born here." Ruby does not have an IEP. Her authoring dilemma was rejecting what she saw as a dichotomy between being smart and funny in math class.

Ruby in math class. I first noticed Ruby making a joke in her sixth grade classroom. In the field note in the beginning of Chapter One, as Ms. Emerson directed the kids to talk to each other about their work, I heard Ruby say, "What I got for the problem is blah, blah, blah"(field note, 3/1/10). This moment is a good introduction to Ruby because it makes two points. One, Ruby had mastered the language of the classroom around mathematics. Her joke was predicated on her ability to speak about mathematics the way that her teachers want her to. And second, Ruby enjoyed having fun. All kids do, of course, but Ruby frequently talked about having fun, made jokes, and generally tried to enjoy herself in school.

In her sixth grade math classroom, Ruby participated a great deal. Her teachers saw her as "good" at both procedural and conceptual mathematics (Sixth Grade Teacher Interview). She was similarly positioned in her seventh grade year. In the fall, Ruby participated more than another other kid in the classroom (defined by turns of talk during whole group discussion). I have several examples of her deep engagement in whole class "critical thinkingish" discussion during the fall. On 10/19/10, the class was "discovering" the rules for subtraction. As Ruby began to speak, she turned to face the class rather than the kid teacher. Using air quotes for "discovered," Ruby said,

> **Ruby**
> I discovered what I think it is you start with the first number,
> negative you go left . . .
> think of it . . .
> start at 2 . . .
> when you were little they told you,
> you can't subtract 14 from 2,
> too little."
> (Transcript, 10/19/10).

Ruby referred to the common refrain of elementary school teachers teaching the subtraction algorithm, “so can you take away 9 from 2?” [Kids are supposed to say no], “so then you have to borrow.” This was a voice of math teaching in the past. Ruby performed this voice, then critiqued it, showing that you *can* actually take 14 away from 2. Ruby ended her comments with “it’s just the number line.” Later that same day, Ritchie and Ruby were in a heated debate during a small group about directionality on the number line. Ms. Marquez brought this up after class, noting that the two kids were developing their “voices.” This was what Ms. Marquez most wanted from her kids, the ultimate goal of “critical thinkingish” math, and Ruby was able to do it. Ms. Marquez lists Ruby as one of the “top kids, if you want to call them that,” along with Jack, Ritchie and Luis (field notes, 9/28/10).

Ruby was placed in the independent group during the spring. She spoke less in the spring. Ruby seemed to have little difficulty learning the procedures, but she was not engaged in discussion or creative problem solving as she was in the fall. By the end of the year, however, Ms. Marquez remained convinced of Ruby’s “critical thinkingish” skills in mathematics. She told me twice during an interview that she was amazed that Ruby could “question and wonder about math after so many years of schooling”(field notes, 6/7/11).

Authoring the self. Ruby got excited in her interview when talking about games. She brought up games in both interviews, and also in class. When I asked Ruby why she liked games so much, she said**, “**Because like no one wants to be like learning so dull and without no life (Ruby, Second Interview). Ruby challenged her teacher (and myself as a math educator) to consider how it felt to be in the position of a learner of mathematics: Why must mathematics feel stale?

Ruby felt proud of her own strategies, understanding them as distinctive and original. She narrated her own process learning the multiplication facts. She explained how to solve four times four by using a fact she had memorized, like four times five, then subtracting four. I asked her what she thinks about this way,

> **Ruby**
> I think it is easier,
>
> I mean it might not be
> um
> as good as the people who already knew it memoried down [*gesture, hand coming down, hitting other hand*]
>
> but at least I know my way around it
> so it is kind of like a cheat sheet for me so that I don't have to memorize it and think too much about it
>
> cause in 3rd grade they used to tell us,
> *oh you have to memorize your multiplication tables*
> and I know all the kids used to memorize it and I didn't,
> and like
> uh,
>
> what I would do is that I would use the ones around it ,
>
> and when they would tell me,
> they would say,
> *Oh you know your multiplication tables*,
> but I didn't really know them [*fist gesture*]packed memorized I just used that and
> they would really think that I knew all of them in memory
> but I really didn't
> I just remembered most of them and used that as to get the other ones.
> (Ruby, Second Interview)

Ruby recognized that “it might not be as good as the people who already knew it memorized down” but she thinks her way around was “a good way.” This was a story about multiple ways, being valued, if not by teachers, at least by herself. You can hear the voices of teachers, quite clearly telling her, “You have to memorize your multiplication tables.” Ruby circumvented their narrative of how she would come to learn multiplication, coming up with her own way. Her teachers praised her for knowing them all, and she kept it secret that she instead has another way. I notice how even in this narrative, Ruby gave additional status to learning that was "memorized down"— words that are accompanied by a fist coming down into her other hand. She did this gesture twice, both when discussing memory. Working with integers, Ruby used her fingers for addition and subtraction. She recognized that this was not the way the teachers wanted her to do it, but she smiled as she showed me how, clearly pleased with her own ingenuity.

Echoing Desi's concerns about attention, Ruby also liked to get called on by the teacher, saying "I liked getting called" and "I want to get called"(Ruby, First Interview). her final interview, Ruby returned to this discussion about why she wants to be "called on," having to do with broader notions of who she was as a person.

> **Rachel**
> Another thing I noticed about you when you are in class is that you participate a lot,
> in class discussion,
> why do you do that?
>
> **Ruby**
> I guess sometimes I want to show how smart I am so if like I just keep it to myself,
> then no body knows that I know the answers,
> so I'll just raise my hand and I will say it cause then it shows that I know it
>
> **Rachel**
> Who are you showing when you do that?
>
> **Ruby**
> Everyone
>
> **Rachel**
> Not just the teacher and not just kids,
> not just certain kids?
>
> **Ruby**
> Everyone,
> [nods] cause like some people think like
> *Oh,*

> *people can't be like smart and joking around* so like I'm like,
> *that doesn't make sense to me*
> so I raise my hand sometimes,
> when I feel like I know the answer for sure for sure or I just want to share what I have.
> (Ruby, Second Interview)

Can one be smart *and* joking around in math class? This was Ruby's real game. She wanted to prove that mathematical ability was compatible with other senses of self, here, a sense of humor. Using reported speech of unidentified naysayers, Ruby put forward the contention that being funny and being smart were incompatible. Instead of rejecting one or the other, Ruby fought to be both.

Ruby brought up Luis three times during two interviews. Once, it was as an example of someone who was the kind of math learner who does things mentally. Another time it was when Luis kept asking questions, but ended up learning at the end. The third time was when he kept asking too many questions, and she suspected he was not paying attention. Luis seemed to be a critical kid for Ruby, perhaps because they both talked so much in class, perhaps because there was some level of competition for critical-thinkingish competence. Ruby was a rare kid who had both conceptual and procedural status in the class, and was willing to show confusion. Perhaps she kept Luis in mind because he represented the limit to which she could go.

Along with Ritchie, whom I did not interview, these two kids had the highest conceptual status in the classroom, based on Ms. Marquez's comments. They also spoke vividly of enjoying mathematics. Ruby smiled while explaining how she outsmarted her teachers by avoiding memorizing every multiplication facts. Luis bent over his work with strong interest, hiding problems under worksheets. Their developing identification with this kind of mathematics was powerful, and particularly robust. While Ruby and Luis were both impacted by the move to procedural mathematics in the spring, they retained their sense of themselves as agents. They can do things in the world of mathematics that that no one else can do. It was this kind of creativity in mathematics that gave them pleasure, and allowed them to keep their strong identifications with this kind of mathematics.

Kids Authoring Themselves as "I Don't Like It"

Ruby was a high achieving girl who wanted to prove that she could be both "smart" and "funny." The work of Boaler & Greeno (2000) demonstrated how some high achieving kids rejected mathematics because it seemed incompatible with being a verbal or a creative person. Of the nine girls and five boys who rejected mathematics in their study, all spoke of wanting to pursue subjects that offered creativity and expression. In this study, unfortunately, I have also found kids, all girls in this case, who told me that they no longer "liked" mathematics. This section explores their self-authoring.

Rita. Rita wore eyeglasses, stylish black frames, with long, straight, dark hair. Over the winter break in seventh grade she got a perm, turning her hair super curly. She described herself as "I am just like Latin." She had a label of a learning disability and was categorized as an English Language Learner. Her family spoke Spanish. Rita was generally quiet and serious in class, often working closely with Carmen. Rita was not a kid that others talked about during interviews, but I saw them turn to her during class to ask questions. She received high grades in math class, ending the year with an average above 100%. She initially told the story of her history as a math learner with some confidence: she has always liked mathematics and been good at it. This story changed over time, as Rita began to shift from, "I am good at it,"(field notes, 11/9/10) to "I don't like it"(First Interview) and "It got harder"(Second Interview). This narrative shift occurred slowly, over time, through experience in the shifting figured worlds of this classroom, and through her relationships with friends and family.

Rita in her math class. I first wrote about Rita in her sixth grade literacy class. Rita was serious throughout the discussion, except for moments of play, when she smiled or engaged in little conversations with her friends. During math class, I noticed her as one of the serious people. She was not involved in the shenanigans of the chistosos or disengaged in any overt way. So when I interviewed the sixth grade teachers at the end of that year, their stories about Rita surprised me. Mr. Pierce. said she "has the raw materials" (notice that ability is a possession), "very smart but not a lot of basic skills." Ms. Emerson described Rita's entry into sixth grade;

> **Ms. Emerson**
> [Rita] came in as like,
> hmmm, [*rolling her eyes*]
> for a lack of another way of putting it,
> the uber special ed kid,
> cried on her way to school,
> really was always upset,
> very,
> seemingly struggled a lot.
> (Sixth Grade Teacher Interview)

Rita was named as the "uber special ed kid." The evidence was emotional: "cried on her way to school." The sixth grade teachers painted a portrait of Rita that I could not understand: "crying," "struggling," "not a lot of basic skills." This highly negative portrayal of a kid, however, cannot be understood in isolation, because both teachers used this to emphasize Rita's transformation as the narrative continued. Her transformation was understood as relational, based on her relationship with Shaundra. Mr. Pierce narrated it as,

> **Mr. Pierce**
> Like you said in your ELA class,
> she took on the persona almost of Shaundra,
> people just grouped them together [*hands come* together],
> *oh there is Shaundra and Rita they are both smart*,
> and Rita kind of grew into being,
> a pretty good kid,
> when at the beginning of the year she seemed not so good.
> (Sixth Grade Teacher Interview)

Ms. Emerson narrates it similarly:

> **Ms. Emerson**
> And now all of the sudden,
> she is like this [*Ms. Emerson pulls her body up straight, perfect posture*]
> if no one knows the answer,
> Rita knows the answer,
>
> she just like took on that,
> personae in our classroom,
> which is really cool,
> because it definitely shows how important,
> the friendships can be in,
> the class,
> because they have definitely become like,
> one.
> (Sixth Grade Teacher Interview)

This performance of Rita I could understand, having seen her comportment and behavior myself. Notice how embodied being a good kid was; there was a set of postures, movements, and activities that must be taken up.

Rita's engagement was consistent in the fall of her seventh grade year. More than once, Rita was the only one who did extra work when she finished. She was the only one in a group to solve difficult integer word problems. Rita was able to tackle conceptual problems as well as learning procedures. Her grades were high throughout the year, ending up with over a one hundred average in the spring. Rita also participated frequently in class discussion, sharing her own strategies for solving problems.

In the spring, however, as state-examish activity dominated, and the three groups are created, Rita seemed less happy in the classroom. Rita was in the "middle" group. She seemed to be somewhat disgruntled (for her) during the spring, as she communicated strong dislike of fractions, "I hate fractions,"(field notes, 3/9/11) and gets annoyed at a procedure Ms. Alton asked her to do, saying "multiply this and this and this" in a frustrated voice (field notes, 3/9/11). Most importantly, Rita got upset when Ms. Marquez told the kids to forget about the variable when combining like terms on 1/4/11. Rita got up on her knees to loudly protest this move, but was not acknowledged. On 3/23/11, Rita shared her strategy for finding a missing angle in a rhombus, Ms. Marquez represented her strategy, but then signaled that this strategy was not the one called for on the test.

I was surprised when Rita only answered 60% of the problems correctly in the final class exam. In our seventh grade teacher interview, Ms. Marquez said that Rita, "fell through the cracks." Rita's behavior was puzzling from my perspective. I saw Rita again and again getting the mathematics correct during class; perhaps the only crack she fell through was testing itself. Her interviews deepened this puzzle for me, as Rita rewrote her identification with mathematics over the course of this year.

Authoring the self. In the beginning of the seventh grade year, knowing that she was named as a former "struggling" kid by her sixth grade teachers, I asked Rita if she was enjoying math more this year. She gave me a suspicious eye, and told me that she had "always been good in math" (field notes, 11/9/10). However, in our first interview (December), Rita told me that while she had "always been good at math," she no longer "liked it"(First Interview).

Over the year, this narrative has shifted. Here is how she narrated it in the first interview (a paired interview with Carmen):

Rita
For me,
I always been good in math

Rachel
When you first remember doing that

Carmen
Second grade

Rita
Yeah,
it's true,
I don't know,
I think I got it from my mom,
because my mom is good in math,
so I got it from her,
but now I am just,
I don't know,
I just stopped liking math

Rachel
when did that happen?

Rita
this year

Rachel
well what do you think happened?
What is going on for you?

Rita
I find it,
like I don't know,
I find it harder now just like,
oh last year,
was like kind of easy
(Rita and Carmen, First Interview)

This first telling of the story can be reduced to these elements:

> I always been good at math
> I got it from my mom
> I don't know
> I just stopped liking math
> I don't know
> I find it harder, it got harder

I will go through this narrative line by line.

I always been good at math. The story began in certainty—Rita understood herself as "always good at math." She was confident about this, strongly stating this both in interviews and in impromptu moments during class. She placed herself at one pole of an important dualism in how kids make sense of math: being good or bad at it.[6] I cannot say whether she was thinking of critical thinking mathematics or "state examish" mathematics, or whether this term depended on such categories. I do know that Rita attended the same progressive elementary school as Luis, one that gave them both (as well as Ritchie and Elisa) years of exposure to constructivist mathematics.

I got it from my mom. But Rita did not attribute her skills at math to her school, but, she "got it from my mom." Although those who taught Rita this phrase may have meant it as an assumption about genetics, Rita did not. Rita said that "she helps me sometimes" and "that is how I became really good in math"(Second Interview). Rita's internal conflict about her mathematical identifications centered around her mom, which I explore in the next section.

I don't know. Rita's stories about this shift were filled with uncertainty, repeating the sentence, "I don't know." This refrain formed a contrast with the certainty that opened the story. It is critical when analyzing the development of narrative to pay attention to "I don't know." These phrases mark disjunction, confusion, and meaning making.

I just stopped liking math. Rita narrated the same reason each time she tells this story, shifting slightly. First, in her first interview, "I just stopped liking math." Not that she found out she was bad at it, not that she did poorly on a test, nothing from outside herself. This statement, in the first person, was filled with her agency.

I find it harder. Rita continued to be the active agent: "I find it harder." What got harder? How? Combing through her interviews for this word "harder," I found it again and again. There are several ways in which she uses it. First, Rita saw math as inevitably "getting harder" at each

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[6] And yet one that was rarely used by my participants. Rita and Federico both used it. Other kids used other ways of understanding themselves than "good" versus "bad" at math.

grade level. Throughout this paper thus far, I have documented how the children saw mathematics through a lens of grade-levels, each year progressively more difficult.

In our second interview, at the end of the year, Rita retold a similar, yet subtlety different narrative. This retelling was full of voices, full of unresolved conflict, and spoke to the unfinished nature of identities. The question of whether or not Rita liked math was critical at home and at school. Rita provides an example of how her understanding of self as a mathematics learner was refracted through her relationships with others.

Rachel
What about your family,
what kind of a math learner do they think of you?

Rita
They think I'm good [*nods*].
I got it from my mom.

Rachel
You told me that before.
Your mom enjoys doing math?

Rita
She's really good at math,
and I'm just like,

she helps me sometimes,
like
so that's how I became really good in math,
because of my mom,

and I used to love math,
and now I tell her that *I hate it*,
and she is like,
Why
She gets upset.

Rachel
What does she do when you say that?
She gets upset?

Rita

Yeah she does,
like
I'm really good at it, and you just don't like it?
She's like *What happened to you*
I'm like
I don't like it.
(Rita, Second Interview)

This story was squarely focused on processes of identification, on emotionally charged choices about mathematics: "hate," "love," and "upset." Immediately after Rita named her mother as "she's really good at math," Rita left the next sentence unfinished: "and I'm just like." What might she have said after that? These gaps in the narrative are important, because like Rita's refrain of "I don't know," they communicate that this act of meaning-making was in process. This narrative has lost the "I don't know" from her first telling of this story.

There was tension in this narrative between binaries that we have discussed: loving and hating math, being good at math, and the here unnamed opposite. I notice also that the strongest words—"I hate it"— are reserved for interaction with her mother. My own history as a teenager enters into my analysis in this moment, as I remember saying "I hate math" to my own mother, something I would have never said to another adult, certainly never to my teacher. For me, and I suspect for Rita, this dialogue with her mother was a critical site of identity development around mathematics. How did a girl go from understanding herself as "good at math" to "I just stopped liking math"? The answer is critically important, to me, to feminist, equity-minded math scholars, to Rita's mother, and to Rita herself.

After she told that story, I pressed Rita to explain this shift further. Rita again emphasized that "I don't know how to explain it," but then found this small moment in her class to narrate for me.

Rita
It's just getting harder,

> like I could take it,
> but then sometimes I am just *oh God*,
> like Ms. Marquez. heard me saying to Luis that he was getting a panic attack about it,
>
> Sometimes I'm like *oh my god what is she talking about*
> especially when it is like a whole big line the integers thing,
> from here to here,
> it is like really long,
> I'm just like [*shocked face*]
> like I forget the rules or I don't use them so I'm like freaked out
> (Rita, Second Interview)

Rita shifted from saying "I find it harder" (which she used in December), to "It's getting harder," moving the statement from her opinion to a fact. That seventh grade math class was harder was now assumed. Rita assured me that "I could take it"; she can endure what must be endured, not enjoyed. What interfered with her ability to "take it" were moments that make her (and her peers) panic: like "a whole big line the integers thing from here to here." Rita made several points here about "harder." One, she felt this intensely. It is not as if Rita had no feelings any more about math, she had strong negative feelings: "panic," and "freaked out." This is not a narrative about math being boring, which implies a lack of feeling, instead intensely felt.

The meaning of harder was closely connected, here and at other points, with remembering rules and difficult procedures. Rita's experience, of seeing the long line of integers on the board, evoked in her a rush of thinking about which rules that she might have to use, and whether or not she was going to be able to remember them. Panic and forgetting were again closely related in the experience of the kids. Rita explained how difficult it was to recall the rules for operating with integers.

Rita shifted her ideas of "good" in mathematics. In her second interview, she understood the groups as based on methods, not any other understanding of ability or disability (like Federico and Ms. Alton). However, in that same interview, when I asked her what her teachers thought of her as a math learner, she replied, “medium.” Later in the interview, when I asked Rita “most people think of you as what kind of math learner?” she responded, again, “medium.” Following up on this answer, I asked Rita what kind of learner Ms. Marquez thinks of her as. Rita replied, “in between.”

Rita categorizes herself (from the teacher perspective) using terms (medium, in between) very similar to the name of her group—the “middle” group. Rita, a young women with a grade of A + in mathematics, no longer will call herself “good” in math. The same girl who, at the beginning of seventh grade, proudly told me that she was “always good in math,” now never named herself that way in a twenty-five minute interview about math. Other people “think” that about her (her family and friends). She did not. Or did not know what to think. Along with her felt experience of panic during state examist mathematics, her placement in the “middle” group affected how she named herself as a math learner.

In Rita’s second narrative, her mom wanted to know why Rita no longer liked math, as do I. Rita answered: it is how math class feels. For her, the absolute worst moment, the line of integers and the resultant panic was absolutely related to the performance of memory that she must do to continue to be a viable math learner. This moment felt terrifying. The turn from “critical thinkingish” to state-examish meant not only a turn from one kind of thinking to another kind of thinking, all done alone in the mind of an individual kid, it meant a turn from collaborative and creative meaning-making to individualist memory performances. In the narratives she presented, Rita was not turning off to math because of a perception about girls and math, or Latinas and math, in fact her own mother is a role model for positive identification with mathematics. Rita turned off to math because of how it was now done in her classroom—individualistic memory performances.

Ana. Ana had medium brown skin, brown eyes and hair, and a very assured manner. She was always sitting up straight in class, facing the front, taking notes. During many points in her sixth grade and seventh grade years, I saw Ana nodding as the teacher spoke, establishing that she was listening. Ana described herself as “female,” and told me, “I speak Spanish, but also English.” When I asked her where her family is from, she told me “Dominican Republic” and “Dad is also Ecuadorian.” She had a label of a learning disability, and was formerly categorized as an English Language Learner. Her family spoke Spanish at home. Like Rita, Ana was an excellent student in so many ways, performing the required procedures that her teachers asked for. Also like Rita, Ana had high grades in math. And also like Rita, Ana reported that she no longer likes math at the end of her seventh grade year. Ana understood herself as a hard worker, as opposed to smart. I can see the roots of this conception in the figured worlds of her classroom.

Ana in math class. Ana impressed me each time I worked with her. Ana seemed more self-possessed than other kids in her class. In her sixth grade class, I noticed how carefully she worked with her friends on 6/9/10 to help them understand the sandbag model of integers. Mr. Pierce told me that Ana “struggled” a little when she came into the class, but now was doing well, describing her as “really has so much potential, and maybe wasn’t always viewed that way”(Sixth Grade Teacher Interview). He also told me that Ana frequently told him that math was her favorite subject.

In the beginning of seventh grade, I again saw Ana as this excellent kid, until the end of October. I began to notice Ana looking unhappy in class, ignoring what Ms. Marquez would do on the board. She stopped nodding her head. Her grade for the first marking period was a 75.

During the fall, when Ms. Marquez valued “critical thinkingish” competence most, she described Ana as good at that part (the “state examish”) but not at the other part (“critical thinkingish”).

By January, when the class shifted to “state examish” activity, Ana started nodding again, and at the same time, when I asked Ms. Marquez about it, she told me that Ana was doing much better. Ana was on the honor roll with an average of 90%, Ms. Marquez told me that “Ana worked her butt off to get an A-. It didn’t come easy” (field notes, 3/9/11). That same day, in class, Ms. Marquez had given out donuts for the kids who made honor roll. As she did so, Ms. Marquez told the class that getting good grades was not about being “smart,” but about working hard. Ms. Marquez continually stressed this message of personal responsibility. Ana took in this message, telling me in the second interview that she got into the honor roll because she did extra credit.

By the end of the year, when discussing placement for next year, Ms. Marquez showed a great deal of faith in Ana. She wanted Ana in the most advanced class, and was angry that Ana would be excluded. Ana, however, told me that she wanted to be in the “low” class (field notes, 6/8/11).

Authoring the self. Throughout her interviews, Ana communicated how important relationships are for her in school. As discussed in Chapter Six, Ana said that she prefers being taught by other kids, who will give you a “shortcut,” as opposed to teachers, “cause teachers like, is right there, and you know, like, do this, do that”(Second Interview). She talked a great deal about Ms. Marquez in the second interview, stressing her positive relationship with her. At first, Ana thought that Ms. Marquez was going to be strict, and she was very nervous about it. Ana insisted that she would not be able to learn from a strict teacher, that she “can’t learn” because she would be “shy”(Second Interview).

When I asked Ana what kind of a math learner she was, she did not categorize herself, rather naming the process she goes through to learn.

Ana
[pause]
I don't know.

I just,
when my teacher comes up with this new thing,
whatever,
like a lesson,
a new lesson,
I just learn whatever she is saying,
everything,
I just like,
like I learn everything from like whatever,
the lesson she is teaching I learn everything from there,

and when she changes it again,
I get a little bit confused,
cause,
like,
I have been learning this new thing,
and then she is gonna change it like again.
(Ana, Second Interview)

At first, topics were new, overwhelming. Then she "learns whatever she is saying." Ana got confused because the teacher "changed it again." In this passage, learning is memorization. This kind of learning, the way Ana experienced it, the way that she narrates it, required sameness, replication rather than appropriation. Ana not only tells us what kind of learner she is, but what kind of learning stands out to her in the classroom. Unlike Luis, who talks about solving problems, Ana was talking very specifically about memorizing procedures.

In her first interview, Ana told two narratives, one for when she felt successful and one when she felt unsuccessful in class. These were analyzed in Chapter Six, but I return to them again briefly to show how this kind of learning felt for Ana. I present them side-by-side to highlight their symmetry:

Rachel What about a time you felt successful? **Ana** Um, well, I feel, when I know something, like when somebody doesn't know I try to help them, and that makes me feel like a teacher and stuff and I like that, because sometimes when he doesn't know something, I'll be like, *oh,* *I know this,* *so let me just explain*	**Rachel researcher** alright, so what about unsuccessful **Ana** when I don't know something, when I feel frustrated like um, When I don't know something I get so frustrated, I don't like that feeling. Ms. Marquez she be like, *why you stressing out for,* *Relax* (Ana, Second Interview)

Each narrative began with feeling, " I feel," and then moved outwards, to dialogue with others. The emotions were inside, but they played out in interaction. In the successful moment, in knowing, Ana called up a peer who asked her a question. She explains, narrating herself," Oh, I know this." The unsuccessful moment ends with Ana interacting with her teacher, who wants her to "relax." Both are about the feelings, but emphasize not just the feeling felt alone, but how the feeling was experienced in dialogue with others. Knowing felt empowering (connected to her friends), and not knowing brings out panic and stress (connected to her teacher).

When in the second interview I asked her to tell me about the year, she remembered, "tests. Lots of tests." She said that she felt "pressure" from the tests,

> **Ana**
> Cause next year they are going to separate the kids,
> like into a high,
> a high class where smarties and them,
> and just a regular class.
> (Ana, Second Interview)

Ms. Marquez was asked to place kids in ability groups for their eighth grade year (see Chapter Four and Chapter Eight). When speaking to the class about it, Ms. Marquez used the language "advanced class" and "regular class"(field notes, 6/9/11). In this narrative, Ana also used "regular," but described the other class as the "high class" where the "smarties and them" will be. I asked her where she wanted to go,

> **Ana**
> The regular class,
> cause,
> if I go to [longer pause]
>
> people that get into honor roll,
>
> I have been on honor roll,
> but those people have like,
> you know,
> more than me,
> and it's kinda hard.
> (Ana, Second Interview)

Ana began with "if I go to" and stops for a long pause, as if she was not sure how to name what she previously called the "high class." She replaced that with "people that get into honor roll," but immediately ran into trouble. Ana herself was on the honor roll. She tried again, and this time differentiating herself from "those people" by what those people "have," "you know, more than me." More what? I can only guess. More smartness?

When Ana talked about herself as a learner, she frequently stopped, paused, especially at critical moments, as when she was about to name herself. Ana described herself as not a "smartie," not "those people who get on honor roll," "not a monster," and "not a nerd"(Second Interview). Through these negative statements, we know so much about what Ana thought she was not, but little about what exactly she was. What kind of math learner was she? Ana was the only kid who so fully avoided my question. Ana seems to have taken in the idea that some kids just work hard, and assumed that these kids are not “smart.” While her family thought she was good at math because of her grades, Ana saw her grades as the result of getting “extra credit” and working hard, same as Ms. Marquez’s explanation(Second Interview). Without extra credit, Ana believed that she would fail. Ana seems to see “smart” as “knowing things quick” and “already knowing what to do”(Second Interview). Not learning, precisely, but always already knowing. Memorizing quickly. Not forgetting.

I wonder if Ana even wanted to be seen as “smart.” During her second interview, she set herself apart from smart, and also from being a “nerd”(Second Interview). I told her that I saw her as a serious person in class, and she responded:

Ana
I'm not all serious,
you know,
not like a MONSTER
(Ana, Second Interview)

Ana avoided naming herself in these discussions, even as she differentiated herself from “smart.” At the very beginning of her second interview, Ana narrated her current relationship with mathematics:

Ana
Well, I don't really like math,
so I'm not really like,
like a . . .
you know.

I'm not crazy about math.
yeah,
cause its kinda hard,
sometimes,
cause there are so many numbers and you are trying to figure out how to solve it,

but it is
just,
it’s kinda tricky
(Ana, Second Interview)

Instead of naming herself as not smart, she talked about her preference: “I don’t like math.” Like Rita, who said that she no longer likes math because it is harder, with too many numbers, Ana states her feelings towards math: “I don’t really like it” and gives her reason as “cause it is kinda hard.” Both girls move back and forth between recognition of their own positioning in mathematics, and their agency.

Both of these girls had learning disabilities. Both are hardworking in class, and both earned a grade of an A in this class during the spring. But both rejected the kind of math they were doing. The narrative that emerged for both girls was the story of losing interest in mathematics, or perhaps a story of losing agency in their mathematical work. This narrative was difficult for Rita and Ana, both of whom enjoyed math previously, but now seem to see it as inevitable that they no longer like it. Rita provided the image of the “whole big line the integers thing, from here to here, it is like really long,” just as Ana said “there are so many numbers.” Rita talks about “forget the rules” as Ana talks about “you are trying to figure out how to solve it.” For both kids, a specific image of complex computational problems was called up, and the emotion that that these long problems evoked: panic, trickiness. Also tricky was understanding their positioning in a complex figured worlds of their classroom. Instead of labeling themselves with the multiple positionings they experienced, Ana and Rita take an active stance: I don’t like it.

Kids authoring struggle and resistance

Desi and Clementine told stories of ongoing struggle with mathematics: tales of fear, anxiety, and troublesome relationships with adults. These stories are canonical — the girls are recounting classic tales of how terrible it can be to do math in school, widely circulating storylines from the figured worlds of their classrooms. Similar to Ana and Rita, there are strong connections to relationships in math class, and to emotions, particularly the stress and panic that they feel in math class. Desi and Clementine also provide a pointed critique of adult practices in schooling.

Clementine. Clementine was a seventh grade girl, with dark skin and a ready smile. I met her in her seventh grade year, as she was not in the CTT class in sixth grade. Clementine did not have an Individual Education Plan. Her family spoke Spanish at home. Clementine seemed very confident in the different kinds of activity that Ms. Marquez designed, both procedural work and conceptual discussion. I noticed her asking difficult questions and presenting still emerging strategies. Like Rita and Ana, Clementine was successful in math class, yet did not author herself that way. Clementine returned repeatedly to a storyline of her "struggle" in math class (transcript, 10/26/10).

Clementine in math class. Clementine impressed me in the fall with her engagement in class. I saw her arguing passionately about whether or not they can cut up hot dogs in the hot dog problem. She shared during "critical thinkingish" class discussions: placing integers on a number line and attempting to generalize a rule. Clementine made connections between math and life, independently connecting probability to gambling. She cleverly solved the missing subtrahend integer problem with a guess and check method using the ones place. On that day, she asked Ms. Marquez if she could represent the strategy herself. As she walked up to the front of the class to write out her own solution, I noticed that on her face were two stickers, one of which said "Good Job!" She struck me in this moment as a very engaged mathematical thinker who was also still allowing herself to be a child, wearing stickers on her face. In the spring, Clementine was placed in the highest status independent group.

As I learned in the interviews, however, Clementine did not see her experience in math class as I did. In Chapter Six, which gives an overview of how kids' described the experience of doing mathematics, Clementine returned again and again to several themes. First, interactions with adults around mathematics were stressful for her. She told narratives of being yelled at, of being ignored, of adults being angry with her as they tried to teach her a mathematical concept. She also explained how much she enjoyed working with friends in math class. Clementine's critique of adult intervention in her learning pervades this section.

Authoring the self. In October, I sat down with a small group of kids to brainstorm their Mathematical Autobiographies. As I wrote in Chapter Three, these were an attempt to gather narratives from the kids about their histories as math learners. After giving kids a few minutes to brainstorm, I turned on the video camera and asked if anyone would like to share what they were thinking about. In her small group, Clementine shared first, performing an arresting narrative of struggle:

Clementine
well,
in my autobiography,
I would put that
um
That
I . .
I . . .
It takes me
It takes me longer to understand math than others
in every class,
I do good in every other subject but math
it takes me longer to understand it because um . . .
I get stuck . . .
and sometimes I don't . . .

Like that's why me and my mom,
we
whenever I have math homework she fights with me
because um
in math I don't focus
well I do focus but it takes me hard to like understand it
she gets stressed out because like *didn't we just go over this*[*an adult voice, accompanied with gesture of both hands going down to the table, hands on their sides, exasperated voice*]

and um

So
So like when I was younger sometimes teachers would
um
They would keep me up from lunch and like *finish the work* [*she pounds the desk with her fist here twice*]
because I didn't understand it.
(transcript, 10/26/10)

Clementine began with trying to sum herself up, using my terms, "in my autobiography." Notice how she pauses repeatedly after this pronouncement, particularly perhaps because she was trying to do something impossible—sum herself up. She said, "I" twice, paused, and started again: "it takes me longer to understand math than others because I . . ." She stopped and tried to explain another way: "in every class, I do good in every other subject but math it takes me longer to understand it because um . . . I get stuck . . . and sometimes I don't." So she may get "stuck," but the opposite was also true.

I created a new stanza here because she moved to another topic: her math relationship with her mother, " . . . that's why me and my mom, we-." But she could not finish that sentence either. She tried explaining the experience of doing homework with her mom, perhaps repeating a phrase she heard from her mom: "Whenever I have math homework she fights with me because in math I don't focus well I do focus but it takes me hard to understand it." So far, "stuck" and "focus" are possible ways to understand herself as a math learner, but she did not allow either word to stand. She qualified both as soon as she says them.

Struggling with naming herself, and naming her relationship with her mom around math, Clementine turned to reenacting moments with adults. The first moment she reenacted was doing homework with her mom. Clementine performed this narrative, acting out the role of her mom in an adult voice, particularly as she said," didn't we just go over this," accompanied by a frustrated hand gesture. For Clementine, this ritual of remembering, part of doing mathematics homework, was fraught with emotion. Next, Clementine animated her previous teachers, performing them with the words “finish the work” said in an adult voice, and a strong fist down to the table. These performed narratives are a relational exploration of how she understands herself as a math learner.

Seen in the context of the situation, Clementine seemed to be actively trying to communicate this story to the kids around the table, and to me. She struggled to explain herself, then started using these performed moments to explain herself. The stories, performed so actively, perhaps made her feel as if she had communicated what needed to be communicated, instead of the words (“focus” and “stuck”) that so inadequately defined her experience in the first stanza. What proves more powerful for Clementine, are reenacting the relationships.

As she told her history as a math learner, a history that was of course not complete but always emerging, she told a narrative about how difficult math has been for her. Clementine had some difficulty arranging her response to this question, and rightly so, for I did done something very peculiar. I asked Clementine to write her mathematical autobiography. This assumes that such a thing exists. The stories that we author about ourselves are always called up ad-hoc to fit the demands of the situation; there is no such thing as a stable autobiography as a whole, or in relation to something like math (Linde, 1993; Damasio, 2012). I tell a very different story about myself as a math learner in different contexts. I did know this when I asked the question, knowing that I would not get a stable, known entity, I wanted to glimpse the construction of such a thing. Clementine was particularly interesting in terms of her self-authoring because, first, there was a disconnect between her engagement in class and her authoring of herself as a math learner. And second, she took this story, reenacting how difficult her relationships have been with adults around mathematics, and revisited it in different formats and situations across the year. What remained constant was the urgency with which Clementine narrated this story.

After Clementine told this story, I asked if anyone wanted to ask her a question. Tony raised his hand and asked, "So don't you ever get memories of time you struggled, in math? I thought this indicated that Tony wasn't listening very careful to Clementine, but she answered the question quite seriously:

> **Clementine**
> Well,
> I constantly struggle in math but like
> I think
> I think this year it is gonna be easier for me because I am actually understanding it a little bit more
> (transcript, 10/26/10)

Taking up Tony's word, Clementine named her experience as, "I constantly struggle in math." Following that was the most positive statement Clementine made all year about her own performance I class, still quite measured for a kid who was placed in the top group in the class: "I am actually understanding it a little bit more." And, again, it seemed very different from what I saw when I looked at the class, particularly during whole group discussion in which Clementine shined.

The next day I asked the kids to write down their mathematical autobiographies. As I wrote in Chapter Three, I was not able to use most of these autobiographies for analysis. Clementine's however, was interesting in that it was a retelling of the previous day's story. Clementine wrote:

> I have always had problems in math. Whether it be with fractions, division, subtraction or multiplication I always make a mistake and I get frustrated. There are times I do get answers right but before this year I have never gotten an 85% on any test or quiz. I try to concentrate & it always end up with a headache when I am done with math. It doesn't help when people yell at me because I get nervous and stressed. (Clementine, mathematical autobiography,10/27/10)

In both stories, Clementine began with a summary focusing the story on her problems. The oral narrative began with, "it takes me longer to understand math than others" and the written story began with, "I have always had problems in math." Both are abstracts to the stories, communicating that the overall situation was a problem. In this written story, Clementine discussed the many topics in which she "always" makes a mistake. "Always" and "never" are important words in this narrative; she writes, "I have always" had problems in math, "I always make a mistake," "I have never gotten an 85%" and "it always end up with a headache." Clementine was narrating what she saw as a constant state: her problems with math. Yet in her current classroom, she was doing well, as she only implicitly admitted, since she must have gotten higher than an 85 this year.

The two separate moments Clementine performed so strongly the day before (the moments when her mother said "we just went over this" and her teachers said "finish the work"(transcript, 10/26/10)) are now compressed into "when people yell at me." Here Clementine introduced another theme in her story: physical responses to these stressful interactions: "I try to concentrate & I always end up with a headache when I am done with math. It doesn't help when people yell at me because I get nervous and stressed."

A few months after these autobiographies, I interviewed Clementine with Ruby. In Chapter Six, I wrote about some critical insights from that conversation. Clementine and Ruby were in the independent group in class at that point, and Clementine believed that they had been placed in that group because they were "most trusted" by Ms. Marquez (First Interview). The two girls told me about how much they enjoyed this group, as they had less adult intervention in their learning. To illustrate how frustrating adults can be around mathematics, Clementine told a story about doing math with her mom, in which they both ended up "frustrated"(First Interview).

Yet in this interview, Clementine did not narrate herself as "struggling" in mathematics, but able to do the work as long as she was able to work closely with kids.

When I first asked Clementine, at the beginning of her final interview, what kind of math learner she was, she seemed unsure where to start:

> **Clementine**
> Uh,
> I don't,
> I don't really know,
> like,
> cause,
> I guess I would have to practice something over and over again,
>
> but,
> you can't yell at me,
> cause then,
> I won't listen to you.
>
> and, I,
> I guess you could say that, I,
> like,
> I don't really like math so,
>
> I guess you could say that I,
> like,
> I don't really focus.
> [*now looks right at me, gives me an intense glare*]
> (Interview, Clementine, June 2011)

She began with a description very similar to the one that Desi gave to the same question, answering this question by telling me about how long it took them to learn something. Clementine told me, "I guess I would have to practice something over and over again." Desi told me, I am the type that I would take a minimum at least the whole day to learn something"(Desi, Second Interview). Both limited themselves to procedural mathematics.

Clementine followed this description with one of her critical themes: the interactions between her as a learner and the adults who were teaching her. She talked to them (perhaps to me?), using the second person, “you can’t yell at me, cause then, I won’t listen to you.” Clementine, then, told me “I don’t really like math.” This was the first time I had heard her speak in such a sweeping statement about her relationship with math. This narrative ends with Clementine fixing me with an intense glare, telling me, “I don’t really focus.” These are the words that she attributed to her mother in her first narrative, and I read her intensity towards me in this moment as framing me as an adult. Her glare felt like rebellion, rejecting the way adults frustrate her with mathematics. I could not escape being an adult in this moment, being aligned with those forces that Clementine was angry with.

When I switched the audience from adults to kids, Clementine told a very different story, one of competence:

> **Rachel**
> So,
> what kind of a math learner do you think the people around you think you are?
>
> **Clementine**
> Uh,
> when it comes to math,
> they usually come to me for the answers.
> (Clementine, Second Interview)

In the eyes of other kids, Clementine casts herself as competent. I also notice that Clementine assumed that people meant kids. When I return to the realm of adults, Clementine becomes quiet again.

> **Rachel**
> They come to you for answers. Um, to your teacher what kind of a math learner are you?
>
> **Clementine**
> I don't know.
>
> **Rachel**
> You don't know?
>
> **Clementine**

I don't know [*very quiet*],
if it is for a teacher,
I am average.

Rachel
What does that mean?

Clementine
Like,
I do good,
but not,
I don't do amazing,
but I don't do terrible either.
(Clementine, Second Interview)

Clementine named herself using mathematical language, the language of sorting and ranking kids in school: "average." Yet earlier in the year, Clementine understood very clearly that she had been placed in the most advanced group. She also reluctantly admitted that she got "good grades" in her second interview. Why was she now feeling labeled as "average?"

Finally, I asked her about her family:

Rachel
And what about for your family?

Clementine
They SAY that I am really smart,
and that I get good grades,

Rachel
Uh huh

Clementine
But like,
when it comes to them,
I don't really,
like,
like, [*dismissive hand gesture*]
math,
I don't do my math homework around them.
I like,
I mostly draw around them.
(Clementine, Second Interview)

So, even if Clementine seemed unwilling to mention any success in mathematic, her family at least seemed to recognize Clementine's turnaround in math this year. Perhaps Clementine's success in math meant no more homework sessions with her mom, which probably relieved Clementine. But Clementine dismissed her family's ideas, particularly about her being "smart." She called into question their opinion by drawing out the word "SAY."

Near the end of the interview, I asked again about how she was currently feeling about math, shifting my questions to being about feelings, rather than a type of learner. Her answer incorporated some of the success she found in her seventh grade year, but also seems determined by her previous, negative history.

Rachel
So how are you feeling about math now?

Clementine
[*puts her head down*]
I like it better,
I still don't like it.

Rachel
You still don't like it but you like it better.
Explain to me what you mean.

Clementine
like [*Head back up, shrugs*],
math,
I'm serious,
I get like these huge migraines when it comes to math,

like,
if I am stuck on one problem,
I get stressed out [*looks me right in the eyes*],
I get upset,

but like [*looking down*],
I guess I like it better,
because,
I know,

if I ask for help,
that they'll help me and they won't yell at me. [*looks at camera, looks away quickly*]
(Clementine, Second Interview)

I find this narrative really powerful, because the way that Clementine interacted with me, and with the camera during it. I feel that she was conscious of her audience, and perhaps conflicted about how honest to be, and at the same time almost daring me to listen to her story. She looked right at me when she said, “Stressed out,” just as she looked right at me when she said, “I don’t focus” earlier in the interview. At the end, when she looked at the camera, I wonder if she was thinking that Ms. Marquez might see this video. She identified, again, how critical it was for her that Ms. Marquez did not yell at her when doing mathematics (see Chapter Six). While I, looking over her year, might tend to focus on how Clementine was placed in the highest status group, or how deeply she engaged in mathematical learning, for Clementine, those experiences were not important to retell. What mattered to Clementine was the way in which she was treated during mathematics. Was she “yelled at?” Clementine told stories over this year about being yelled at by her mom doing math homework (math autobiography), being yelled at by her teachers to stay up at recess (math autobiography), being yelled at by her second grade teacher when she kept asking questions about math (Second Interview), and when her sixth grade math teacher “gave up on us”(Second Interview). For Clementine, despite good grades and being positioned as an independent learner, these experiences dominate her feelings about mathematics.

Desi. Desi had medium brown hair and skin. She described herself as “ a girl” and “from the Dominican Republic.” She had the label of a learning disability. Her family spoke Spanish and English. She dressed simply, with less of the neon and sparkling adornments that her female friends added to the navy and khaki school uniform. In both her sixth and seventh grade classes, Desi was at the heart of the social group in this class, part of girl’s groups and the only female member of the chistosos. Before class, she was always deeply involved in conversation with others. Desi did not engage in certain kinds of social behavior in class. She ignored Ortiz and Tony when they are teasing Federico, actively moving her books and body away from Ortiz. During moments in Ms. Alton's group when talk about friends, music and cracking jokes predominated, Desi participated a bit, but usually not enough to get into trouble.

While she was often quiet in math class, Desi had strong opinions. From my perspective, Desi was amazingly mature and clear-eyed. She was a child who speaks with a moral voice about classroom "labeling" practices, who had the guts to publicly out herself as disabled during class in sixth grade. At the same time, she increasingly saw herself as a "slow" math learner, a self-understanding that fossilized over her seventh grade year. Also the school script of personal responsibility was becoming more internally persuasive. These developing understandings were in conflict with the cultural practices of ability grouping and labeling. Desi used all these voices, all these heuristic tools in the figured world of the classroom, in order to author her mathematical self. While some voices were becoming more internally persuasive, and conflict between narratives was escalating, Desi consistently placed herself at the center of this story: it was Desi who has the active voice in her understanding of her place in her math classroom.

Desi in her math class. Even though I had visited her sixth grade math class a few times, I first noticed Desi in her sixth English Language Arts (ELA) class. Reading aloud the novel, *Freak the Mighty*, which deals with disability and difference, I noticed that Desi read with considerable expression and flair. She expressed her strong opinion about the book, saying "Oh, I love it" and "I read it four times." Desi seemed alive and engaged in this class.

This did not seem true in her math class. In subsequent visits to her math class, I sought Desi out. I learned that she tended to describe herself as "confused"(two out of three conversations I had with her). Instead of engagement and excitement, I saw Desi acting disinterested. She would sit and wait for an adult to help her. And, in those interactions with adults, I found that she wanted to be told how to do it. Desi described herself as part of a group of boys who “zoom out”(field notes, 6/9/10). I wonder here about her focus on zooming, knowing that she identified in our second interview as a kid with ADHD, a disability based on attention (Attention Deficit Hyperactivity Disorder). Is this a way she developed to understand her own attention, or a voice that adults around her used to explain it to her?

My observations were similar to how her sixth grade teachers saw Desi. Mr. Pierce says of Desi,

> **Mr. Pierce**
> Desi seems very unsure about what to do,
> in my in our class,
> I would say helpless
>
> I don't think she is doing it on purpose,
> but it seems like she doesn't even know where to get started a lot of time,
> and she needs a lot,
> she is pretty needy in our class.
> (Sixth Grade Teacher Interview)

Mr. Pierce used emotional terms to understand Desi’s behavior in math class: “she needs a lot” and “she is pretty needy.” Ms. Emerson added that Desi generally either “needs” or “wants individual attention,” that Desi “knows how to sort of go through the motions”(Sixth Grade Teacher Interview). Ms. Emerson saw Desi’s work in class as, “apathy based because she is just disinterested” although there have been a few moments when Desi was “really into” her math work and “loves it when she knows.” Ms. Emerson believed that emotions and motivations are at the heart of Desi’s work in class— “apathy” versus “really into it.” Both teachers used psychological notions to explain and understand Desi. Both stressed her passivity in math class.

Desi brought these ways of being a math learner into her seventh grade classroom, but was met with different expectations. In September, Desi got in trouble for doing exactly what she did in her sixth grade math class—being confused, being passive, waiting for help. Ms. Marquez called her out very publicly (Chapter Four) for not following class procedures when she didn't understand: use a red cup. Ms. Marquez stressed that this was Desi's "responsibility." Ms. Marquez drew on public narratives of effort and personal responsibility. Rather than rejecting this message, Desi appropriated it. She was the only kid with low math status who used the cups to indicate when she has a question.

While Desi initially seemed to embrace this new way of being a math learner, she had clear peaks and valleys throughout the year. During a "critical thinkingish" problem, while Luis and Arturo clamored to show me their thinking, Desi sat with nothing on her paper and a blank expression on her face. Desi was visibly agitated during review of multiplication tables, telling me that she "loathes the 12s"(field notes, 9/29/10). The high point was in January; "As we moved into groups, Desi came up to me, beaming, which is an unusual expression for her: Ms. Lambert, I have to tell you, 'I adore algebra, I found something I understand"(field notes, 1/24/10). And then, after the important moment with algebra, came a time in the classroom when state exam preparation dominated, and both kids and teachers were on edge, bored, etc. When asked her opinion of a test prep packet in January, Desi says, "ughhhh"(field notes, 1/4/12). But she sat and patiently worked through it with Lorena, giving me the sense that she was bravely bearing through some distasteful medicine because it was good for her.

Authoring the self. Throughout her interviews, Desi took an active stance. She most often spoke about herself with an active "I" voice, taking control of her own story.

In her first interview in the fall of the seventh grade, Desi still saw herself as feeling “confused” in math class. She saw seventh grade math as new, different, weird, things she has never seen before. As I wrote in Chapter Six, Desi narrated both this experience of finding each new grade new and different, and how tricky that made doing mathematics:

Rachel
Can you think of a time that you felt unsuccessful in class?

Desi
Well
it was the first days
I was kind of confused
because we were like
it was a new type of problem
so I was really confused
and I was like
oh
I am never gonna get this.

Rachel
What do you mean
a new type of problem?

Desi
Like
since we are in a new grade
It’s harder
so
I was like
Oh
this is a new grade
um
we are doing something new
something that I don't know
that I never knew of.

Rachel
Uh huh

Desi
So it is
hard
because

it gets confusing
and like
I was like
oh
I'm still in my sixth grade mode
and I'm not really sure what to do here.
(Desi, First Interview)

Each of the three stanzas began with Desi describing her experience in her new math class, then voicing her own thoughts as inner speech, reflecting on the experience. So is this behavior "apathetic," or quite the opposite— full of feelings? In this narrative, Desi named herself multiple times as a math learner who gets "confused," who stays in the "sixth grade mode." The voices reflect an inner voice telling her that the work is different, and that "I am never going to get it." What teachers read as passive, as apathetic, is in fact her mind and heart racing, wondering what she should do, wondering, "I am never gonna get this."

Over her sixth grade year, and in the beginning of her seventh grade year, Desi seemed to consistently see herself as "confused" in her math class. Over this period of time, this self-understanding seemed fossilized, a compressed self-understanding built from repeated experience. I cannot know how long Desi had this idea about herself as "confused" in mathematics. I like the use of the word fossilization to describe this kind of fixed identity because it embeds the fixed notion in process. Even a feature as fixed as a mountain is understood as in process. Forming over long periods of time under intense pressure, fossils themselves break apart and are remade into new geologic features. Desi's self-understanding as confused also changes.

Elsewhere in this interview, Desi described how she needed to find one way, and practice it, and then she could learn something. According to Desi, other kids seemed to complete this process, magically, mystically, somehow getting it right into their heads without the long drawn-out process that Desi needed. She mentioned Jack and Ruby, explaining how distinctive they were because they "know everything." I asked her how they know everything, and she responded:

> **Desi**
> I don't know!
> They pay attention [*gestures hands forward*].
> It is like they are a movie
> or a computer
> and they just suck it all in [*gestures with hands around her brain*]
> like a sponge
> until they absorb every little piece of it [gestures grabbing tiny pieces of something in front of her]"
> (Interview, Desi, Fall 2012)

Desi was mystified by how some kids just watch a lesson, and then know how to do something. Her gestures particularly communicate an idea that the kids are sucking in *things*— these little pieces that she grabs for stand in for knowledge as isolated bits and pieces. Her description was so animated that it drew me in as well and made me wonder— how *do* some kids do that? Desi reported that, for her, there is a great deal of effort involved in learning something new in math class. This was Desi's way of expressing the two kinds of learners that Arturo described: those who get it fast or struggle slow (Chapter Six).

At the very end of her seventh grade year, I asked Desi if there are different types of math learners, noting that she can disagree. She responded that there are different kinds, and quickly describes herself.

> **Desi**
> I am the type
> that I would take a minimum at least the WHOLE DAY[*stress on that phrase*]
> to learn something,
> like some sort of problem,
> if it is something new
> and I would have to keep on reviewing and reviewing until it is
> finally stuck in my head.

(Desi, Second Interview)

Here Desi narrated her process of learning something new, emphasizing in the construction and content of her narrative how long this takes. She used stress in the second line to emphasize time, the feeling of how long this takes to learn something new. And even then she was not done: “I would have to keep on reviewing and reviewing until it is finally stuck in my head.” She contrasted this with, “those types of math learners who I don’t know how, but they like know everything.” While Desi must review and review in order to get the math “stuck in her head,” these other math learners already know everything. Desi was referring back to the kind of math learner that mystified her in the first interview, the ones who “suck it all in,” and she contrasts these learners with herself.

Compared to her first interview, which focused on feeling “confused” and “panicked”(Desi’s “I don’t test well” narrative, described in Chapter Six). Desi in her second interview described her process of learning, not processes of panic. Her second interview only used the word “confused” once. She did learn the mathematics, it just takes a really long time. A few sentences later, she summed up this longer turn of talk: “I just like to take it very slow.” Later in her interview, Desi named herself multiple times as “slow.” Desi, like most of the focal kids by the end of their seventh grade year, used the binary, get it fast or struggle slow to understand themselves and others as math learners.

Desi used this understanding of herself as a math learner as “slow” to orient other stories about her math learning. When asked how others, and then specifically teachers, see her as a math learner, Desi replies “slow.” In the first interview, Desi hinted at this distinction by emphasizing those who were fast, but Desi never described herself or others as slow. In the second interview she was immediately ready to tell me what kind of a math learner she was: she had a way to explain herself through a description of the process as she saw it, which transitioned into the label of slow. I see this as a fossilization of her experience learning: this process, taking so long, feeling slower than others, now can be crystallized into one categorical phrase: slow.

Desi was not only explaining what type of learner that she is, but what kind of learning math was: “state examish.” Throughout this interview, Desi ignored “critical thinkingish” mathematics, and focused on “state examish” mathematics. I wonder quite a bit about this, because certainly one can find a “voice” in Desi, a young person who was able to participate in an interview with a great deal of agency and self-understanding. Yet, in mathematics, she preferred to follow a single method to find answers, and she rarely discussed any other kind of mathematical activity. In this story, and echoing through both interviews, Desi viewed learning mathematics as memorization. You pay attention, you review and review, until it is “finally stuck in your head.” The other kind of math learner was “like a sponge” who was able to “absorb every little piece of it.”

So how was she authoring herself as a math learner? In this second interview, she named herself as “slow,” “fighty,” “eh,” “fast,” “nerdy kid,” “rebellious,” and “lazy.” All within one interview. Over time, in her experience in this math classroom, while these other possibilities existed, Desi replaced “confused” with “slow.” Certainly this was not the only way that she described herself as a math learner, but it was one way that fossilized over time. It was part of a shift, from her “sixth grade mode” of “confused,” to an understanding of self as someone who will “take a minimum of a whole day to learn something,” someone who is “slow,” compared to those around her who are “sponges.”

These were not the only self-understandings that fossilize across these two interviews. By the end of seventh grade, Desi more deeply internalized the narrative of effort that Ms. Marquez scolded her with in the beginning of the year. She now talked like a teacher, making general statements in the second person about effort and schooling. In the second interview, I asked Desi about her motivation across the year,

> **Desi**
> There were some times,
> like
> a few weeks ago
> I felt like
> I wasn't really good and that,
> and I guess I should have given up,
>
> and then in the beginning of the school year,
> I was like
> really unto my work
> and really paying attention a lot
> and it was one of those,
> I call it like
> *a nerdy kid* [she shakes her head back and forth]
> because I did all my work,
> and I paid attention,
> and I wasn't the best
> but I did really good
>
> and then I started slacking off
> and then now I am still the same,
>
> but now
> I realize that I do not want to
> repeat seventh grade and I want to go on to another grade with
> my friends and stuff and
> I was just like,
> *this is something that I have to take serious,*
> and I realized that Ms. Marquez has been telling me that
> the whole entire year
> so I have to work hard for it no matter what.
> (Desi, Second Interview)

This was one of several powerful effort narratives in this interview, which made it very clear that at this point, Desi took personal responsibility seriously. Although she was very aware that effort mattered, there were times that she gave that effort, and times that she did not. When she did give the effort, she became “one of those”—“a nerdy kid.” She shifted her identity in class by taking in the voice of her teacher about effort. This is again a reminder of the importance of relationships in math class. Desi felt strongly about Ms. Marquez, and this may have impacted her shift to the narrative of effort, reflected here, in a passage from her second interview that sounds right out of the mouth of her teacher:

> **Desi**
> No matter how hard something is,
> you can always like make your goal
> and set it and be able to accomplish it
> if you put in effort
> because nothing should be impossible for you.
> (Desi, Second Interview).

She phrased it in the second person, “you.” Desi’s belief in effort as the driving force in her math learning has fossilized, become stronger over time.

In her final interview, Desi repeatedly discussed the importance of effort, and connected it, as here, to understandings of disability. Immediately after the previous quote, I asked Desi how she learned that.

> **Desi**
> Because
> many kids don't know that,
> it’s like they feel like
> *you have to be able to be this or that and even if you have a disability* like,
> cause
> I have ADHD or something,
> some people say
> that *they are amazed at the fact that I can actually learn*
> *and pay attention and try*
> *to pay attention when it is like*
> *hard for me*
> and then many people are always just like,
> *oh it has to do with this*
> *has to do with that.*
> But I [unclear]
>
> **Rachel**

Has to do with what this and what that?

Desi
has to do with abilities that you have and it has to do with the fact that
you have to be like
if you are not good at this you are not good at it,
and if you are not good at it at all then
you have to be like in special ed or something
and I am like
no
that's a lie
you can do it
it's just that you are not putting in the effort
(Interview, Desi, June 2011)

Notice the dominance of reported speech in this narrative. Desi told this story, the story of a clash of perspectives, by orchestrating an imaginary debate between multiple points of view. Desi used multiple voices in her narratives, here and at many other places in her interview. In this narrative, some of the voices seem to be anonymous critics (these voices, of course, might be directly lifted from people she knew). She differentiates between those who were simply amazed that "I can actually learn" and another set of voices that try to label her: "it has to do with this and that," with "abilities you have." Ability can be owned, found, perhaps quantified. To not have this ability, meant that you "have to be like in special ed or something." Both times that Desi used more medical, legal discourse in this narrative, she added, "or something." Desi rejects these two voices on disability. Desi rejects those who doubt her abilities, and she rejects those who label her "something."

Disability was a taboo topic in this classroom, and in much of this school. The only kid that I documented speaking in class, even obliquely, about the fact that they were in a CTT classroom was Desi (10/12/10). And here, she again was direct about the topic, using moral language—-it is a "lie"—that there are those who are "not good at it" and those kids "should be in special ed."

Instead, it is that you are “not putting in the effort.” Desi does not take up her earlier distinction, in the same interview, between slow versus fast learners.

Desi’s theory of the groups, as I wrote in Chapter Four, explicitly rejected the “labeling” of the groups (Second Interview). When kids talked to me about the groups, the most common way to explain it was based on perceived ability, which was closely related to speed and memorization. The highest group was “those who can do it like quick” and the lowest group “struggled” to do it, or “needed help.” When I asked Desi about her experience of the different groups, she said that although she likes working in groups, she “didn’t like the labels of the groups”(Second Interview). Desi did not name the groups in the same way that she began her interview: those who take it slow versus those who know everything. Desi shifted categories here; she did not want to label her group, as others were labeling them. Are they slow learners? Desi rejected that. Desi named the kids in her group: “rebellious” or “lazy.” These two ways of meaning making—that some kids were slower, and that effort mattered most—emerged strongly in this second interview, and there was no resolution of their conflict.

This conflict existed not only in Desi’s interview, but in the figured worlds interacting within Desi’s classrooms. Desi brought up a moment in which this conflict was aired publicly in sixth grade. During a class discussion in English Language Arts class, part of the disability studies unit which included *Freak the Mighty*, Desi got into an argument with her best friend, Luis:

Rachel
So,
in terms of that,
I heard you say that you feel like you have been given a label?

Desi
I remember
like last year,

I remember when we were talking about
like,
people who had problems and stuff,
um,
they would always tell me,
like I had a
I was like in a debate with Luis,
and he said that
people that have disabilities should be in a class,
in a different type of class,
and I was like *whoa, Luis*.
And everyone was astonished when I said it,
cause I was like,
well Luis, I have ADHD. And I am perfectly fine.
And then he is like,
oh yeah,
but like I don't mean
and me and him were best friends at that moment.
and he is like, *oh, yeah well I don't mean*
like
you, I mean,
and I'm like,
no Luis,
I know what you mean, but
it is like
you're,
your giving everyone a label and you are saying that just because they have something
doesn't mean that they can't,
doesn't just mean that
they can't learn
and I am like *that is really stereotypical*.
and then he is like *oh, I believe that people have to have um different learning disabilities*
and they have um, their way of learning things and they are really slow,
and I am like [*shaking her head*]
Oh my god
because he was never in that type of thing
and then you have to be able to know how it feels
and then
be able to speak about it that way.

yeah,
because after that he started acting different with me
and then he is like
he still tried to recover from it.
Like with his *oh no but I am like really*,
and then he tried to stay to what he is trying to say,

and then I am like,
make up your mind.
So then,
he was like [*shrugs*]
I think he still thinks the same thing.
so [*shrugs*]
(Desi, Second Interview)

This conflict was unresolved and painful. In this moment we see Desi as a strongly opinionated young women, that moral voice that shined at times in her interview, speaking against labeling, against stereotypical ideas about ability and learning. Luis was the anonymous voice of the earlier narrative, trying to label and limit kids with disabilities. And yet what Desi reports Luis as saying was exactly what she opened this interview with: “they have their way of learning things and they are really slow.” To Desi, Luis has no authority to say that, not knowing “how it feels.” Of course, Luis has the same label of learning disability as Desi, but neither of them knew that at this point. Desi believed that she had a label of ADHD, which was not on her IEP. Luis knew only that he had time and a half, extra time on tests.

Even as Desi seemed to have an increasingly fixed understanding of herself as a math learner (slow), and what mattered in learning math (effort, memorization), she rejected being fixed, being “labeled” by others. Underneath all of this “labeling” was a voice of static ability—some kids are just good at math and if you are not, “you should be in special ed.” This inherent ability narrative contradicted the school story that Desi has bought: effort alone matters. These multiple circulating discourses contain contradiction, an element of activity systems that produces change (Engstrom, 2001). Contradiction describes fundamentally incompatible goals within one activity system, or in the boundaries between two activity systems. If we can all get to the same place, some kids needing time to get there, then why are they “labeled” into different groups? If effort is all that matters, why I given a static label?

This last group of kids named themselves as “struggling” and/or “slow.” These kids (Clementine and Desi) narrate themselves this way, increasingly over time, despite other possibilities. Both of these kids also had very direct critique of the way in which they are taught mathematics. Clementine critiqued the intervention of adults in her learning. Desi critiqued how labeling and ability groups have positioned her. Their critiques teach me how to understand resistance to the figured worlds of mathematics that they are given.

Conclusion

Certain heuristic habits are developed over time in this classroom, through engagement in the various figured worlds intersecting in this classroom. In this classroom, kids began to take up the heuristics of “state examish” mathematics to understand themselves and others, primarily the binary: get it fast or struggle slow. This class was surely not their first exposure to this heuristic: we find it in the way the sixth grade teachers understood learners as well. I know from experience that this heuristic saturates most math classes from elementary school to college. In this classroom, this binary became more powerful with the advent of ability groups and the dominance of test preparation. What did it mean to map one’s self onto this heuristic?

In this section, I will discuss several answers to that question. Most often, these kids understood learning mathematics as the process of memorization, which meant that most of the kids authored themselves, to some degree, as taking a long time to memorize. Some kids compressed this experience into such self-understandings as “slow.” Other kids narrated this process with their brain as the primary agent, not themselves. What if you had significant difficulty memorizing procedures? Some kids authored themselves using alternative voices about competence in mathematics from “critical thinkingish” mathematics. Other kids used heuristics from special education, particularly discourses of processing, to author a mathematical self that was both slow and fast. For other kids, this process of memorization *felt* terrible, bringing on feelings of panic and anxiety. Some of those kids rejected mathematics, despite competence. Others rejected the negative relationships with adults that math seemed to produce.

One result was how kids narrated their process of learning. Again and again, I heard narratives of memorization. Sometimes these narratives focused on how easy it was (Bobby), but more often they told a story of a painful process. Bobby's brain just knew exactly where information was, and got it. Federico's brain got in his way. Desi described the people who sucked it all in, their brains operating flawlessly, while when she learned, her brain "blanks out," shut down (Desi, First Interview). In these stories, the brain was the active agent, not the kid.

Federico, with a disability named as "processing" that did not allow him to be fast at recall, had to reshape this script to allow himself to be successful. His brain was not working properly: he knew them all, but his brain froze. Federico, not Desi, used the scripts of special education to defend his own understanding. Federico used multiple voices, multiple discourses to author himself as a math learner. He was both fast and slow. He was both okay and he asks a lot of questions. He may or may not need different methods. Disability, with the multiple discourses it attracts, seemed to be the site of this multiplicity. When the brain doesn't know where to find the multiplication facts, multiple discourses proliferate, describing and defining deficit. Federico attempts to rewrite this script so that he can be both "fast" and "slow."

Some kids take up this heuristic of get it fast or struggle slow, but struggle to find their place in it. Rita, Ana and Clementine had high grades, but all questioned whether the grades made them "smart." For Rita and Ana, their high grades were because of effort, not the same as getting it fast. All describe that process as stressful. Clementine, Rita, Desi and Ana all critiqued the process of learning mathematics by revealing the emotions at its core. Yet they saw this as necessary, as the way it should be: math gets harder.

All of these girls were de identifying with mathematics, pulling away from mathematical engagement as they understood it. Their individual self-authoring reflected their past as math learners. Clementine, despite her success this year, continued to author herself as in “constant struggle” with adults around mathematics. Rita felt she needed to rewrite her story, from being “good at math” to “I don’t like it, it got harder.” Ana, positioned more and more strongly as a kid who “gets it” as the year progresses, works to differentiate herself from what that identification could bring- being a “nerd”, a “monster.” Ana was moving away from mathematics even as she was re-established as good at it. Desi’s powerful critiques were not of memorization, but of labeling kids.

Ruby and Luis used an alternative heuristic, that of “critical thinkingish”, to understand themselves. Luis felt that “he had nothing to lose when it came to math.” Ruby felt that her comments and questions in class made her “smart.” She felt that her strategies, which she saw as under the radar of adults, were creative. I agree with Ms. Marquez, who marvels at this willingness to think, after so many years of schooling. Because this heuristic was not underwritten by memorization, these kids did not rely on narratives of the brain. Neither Luis nor Ruby brought forward their brain as part of the process; they are the agents in their mathematical work, not their brains.

So how do Luis and Ruby do this? How do they hold off the dominant heuristic of the classroom? They take up alternative voices of “smart” and they stick to them. Luis has had years of experience doing the alternative kind of math. Ruby did not, but did play games every Friday. Perhaps Ruby provided the most radical critique of all of the kids, because she explicitly critiques the way math is taught: “dull and without no life in it.” What if Desi had taken on the voices and scripts of "critical thinkingish" mathematics? Would she have been able to narrate herself as successful? I think so, and for all the kids. Success in "state examish" mathematics was more narrowly defined than in "critical thinkingish" mathematics. The only way was to get it fast. What if engagement, questioning, and persistence through challenging problem solving had been the dominant heuristics of the classroom? Some might have felt more disabled, but more would have been enabled by such a move.

Processes of identification. In Chapter Two, I wrote about a colleague who gently challenged me about my dissertation, asking "So, processes of identification? What are you actually going to find?" I can discern several insights about *processes of identification* in this study. The first was that kids creatively made use of resources from multiple figured worlds to author themselves, including the multiple discourses of special education and the practices of schooling. The second was that some self-understandings became more fixed (fossilization), and others became less fixed. My third insight into processes of identification was that relationships and emotions significantly affected whether a kid was beginning to identify or de-identify with mathematics. Lastly, I was able to understand how salience and expertise codeveloped for these kids.

Kids creatively made use of discourses and practices from figured worlds to author themselves. If I had written only an analysis of the figured worlds of mathematics in this classroom, I might have written a more deterministic account of the kids, particularly kids whom special education labels or classroom practices positioned. Such a one-sided story was impossible, however, after interviewing the kids. Sitting and listening to the kids tell the story of their mathematical experiences, I was constantly struck with their individuality, ingenuity, and agency. Agency is not absolute— no kid had complete freedom with which to name themselves as math learners. They had to work with the scripts they were given: the discourses of the classroom, public narratives about mathematics ability, and the felt material of their own experiences.

These kids had access and experience in many figured worlds, including the multiple discourses associated with special education (disability studies in education, cognitive psychologies narratives of the brain, discourses of learning differences, etc.) Some kids took up critique of being "labeled" (Desi, Second Interview) from disability studies in education. Other kids took up the dominant categories of the classroom such as fast/slow, but transformed them. Federico insisted on being both fast and slow, incorporating discourses about disability into the rigid categories of "state examish" mathematics. Other kids used narratives of the brain to make sense of their own processes of learning mathematics. Kids also turned the practices of schooling into discursive resources. When the kids were placed into ability groups, they developed several theories of how the hierarchy was arranged. These theories became discursive resources for authoring. After being placed in the "middle" group, Rita named herself as a "medium" math learner. While much of disability studies in education focuses on multiple discourses framing kids (i.e. Reid & Valle, 1995), I have not seen a similar study describing how kids use these discourses to frame themselves.

Some self-understandings became more fixed, and others became less fixed, through processes of fossilization and transformation. Throughout this dissertation, I have built on the original work of Vygotksy and his colleagues that used fossilization to describe the process of learning through social interaction and the mediation of tools (1978). I found evidence of how certain self-understandings gradually became more fixed over time, and called it *fossilization*. But this was not the only process in play; I also found evidence of the opposite process, in which kids rejected previously “fixed” self-understandings, both slowly over time and sometimes based on particularly important events. However, fossilization never occurs in isolation; these processes must be understood within the heteroglossia of the mind that Bakhtin (1981), Holquist (1990) and Holland et al.(1998) propose as the space of authoring the self. It is the multiple voices, competing within this multiplicity, that provoke change.

Desi provided an important example. Desi came into her seventh grade math classroom with a seemingly fixed self-understanding of herself as confused. She used this word repeatedly in class to her teachers, to describe herself in interviews, and to me as I sat with her in class. However, no self-understanding is truly fixed. At the beginning of seventh grade, Ms. Marquez called Desi out for accepting being confused in mathematics (Chapter Four). After that moment, Desi took up Ms. Marquez’s discourses of individual responsibility and effort. While Desi still reported feeling confused at times, she authored this experience differently, trying to work hard so she could understand. In seventh grade, Desi described learning mathematics as a slow process. Because her self-authoring was situated within a figured world that divided kids into two categories: get it fast or struggle slow, Desi began to understand herself as “slow” in the way she learned mathematics. This self-understanding was becoming compressed, summed up in that single word: slow. Over Desi’s seventh grade year, one self-understanding that had been fossilized (confused) crumbled, and another began to slowly develop (slow).

While in some respects I hesitate to put labels on these internal processes, I think that fossilization as a process is much more useful than the fixed understandings of identity currently circulating. At a recent math education conference, a colleague told me that by the time they are in high school, kids cannot change how they think of themselves in mathematics. I have heard other educators make the same claim about kids in middle school. I hope that this dissertation challenges that view. I have documented change. I have also documented that kids have agency in how they author themselves, despite the limitations of the process.

Salience and expertise codevelop. As Holland and her colleagues proposed (1998), salience and expertise are closely interrelated and inextricably tied to processes of identification. The greater the salience of mathematics to a kid, the harder they would work to develop expertise. Luis hid problems so he could work on them further. Federico signed up for extra tutoring so that he could memorize procedures. Expertise also can jumpstart salience. Federico told me how much it mattered when he learned his multiplication tables, “I remember having confusion between math, but that was before I learned my multiplication tables completely”(First Interview). Learning his multiplication facts increased not only his expertise but his emotional commitment to mathematics.

Other kids narrated a connection between learning their multiplication facts and their overall identification with mathematics. Bobby was so deeply affected by learning his multiplication tables that he told me the story twice, and named himself a “multiplication kind” of math learner (Second Interview). When narrating Lorena’s turnaround as a math student in sixth grade, Ms. Emerson emphasized both her relationship with Sade and how Lorena memorized the multiplication tables (Sixth Grade Teacher Interview). In “state examish” mathematics, expertise was memorization. No wonder then that multiplication was the mathematical topic kids discussed second most often in interviews, the first being operations with integers.

But what about Ruby, who celebrated how she tricked her elementary school teachers into thinking she had memorized all of the multiplication facts? Her trick was to use facts that she knew to find others (see Chapter Seven). For Ruby, her expertise was double. Not only was she able to compute the facts quickly, thus demonstrating expertise in "state examish" mathematics, but she also developed creative strategies that developed her expertise in "critical thinkingish" mathematics.

How did salience and expertise codevelop in this study? Defined within the figured world of "state examish" mathematics, then expertise was getting it fast. This presented an insurmountable barrier for most of our focus kids, who described the process of "getting it" as "slow." Within "critical thinkingish" mathematics, expertise was finding clever strategies and asking questions. Ruby and Luis continued to understand their own competence at mathematics through this heuristic, even as they simultaneously participated in "state examish" mathematics. This alternative heuristic sustained their relationship with mathematics, allowing both kids to continue to conceptualize themselves as agents in mathematics, even if their agency was underground for the spring (Luis's secret "number line in his head"(transcript 4/13/11) and Ruby's secret use of her fingers).

Relationships and emotion mattered significantly to identification with mathematics. Both in fieldwork and interviews, kids and teachers were constantly pulling my attention to relationships. The sixth grade teachers, in their interview, talked about the social relationships of the kids as central to learning and identification. In particular, these teachers noticed how strong friendships led to academic transformations in the case of Lorena and Sade, and Rita and Shaundra. In interviews, kids told me again and again how critical helping was. Again and again, they talked about their relationship with different teachers, and how their families helped them in math. Kids experienced mathematics not in some objective way, but *through* their interactions and relationships with others. Think of the narratives of Ana about being successful and unsuccessful in mathematics (Chapter Six). She was successful when she knew how to do something in math, and then she helped others. She was unsuccessful when she didn't know, and then her teacher counseled her. Each time, she narrated the emotion she felt while successful and unsuccessful, then immediately situated those emotions in relationships.

In my dissertation proposal, I wrote about emotion only once, to critique the stereotype of the emotional adolescent. Yet emotion became critical in helping me understand both the classroom and the people in it. Emotions mattered tremendously for how and if kids learned mathematics. In the narrative of Ana that I referenced above, when she helped others, she felt "like a teacher." Kids felt strong positive emotions in class, but their more vivid descriptions were the emotions around forgetting: anxiety and panic. Clementine felt betrayed by adults teaching her mathematics in the past. Even a positive year with Ms. Marquez did not seem to mute the rawness of Clementine's feelings when she talked about teachers in the past. These interactions organized her narrative of struggle, one that she did not put aside for new narratives.

As I wrote in Chapter Six, Vygotsky and his colleagues were clear about the irreplaceable role of emotions and relationships in learning(1978; Roth & Radford, 2011). Learning occurs socially, in interaction with others. This interaction, narrated so vividly by Desi (who felt respected when her teacher came over to her) and Clementine (who felt the anger of teachers and parents when she didn't understand), is itself a mediator of learning. Privileging emotion and relationships is hard to do in mathematics education. In this work, I have hoped to demonstrate the interconnections between subjectivity and learning mathematics.

Chapter Eight:

Conclusions and Recommendations

In this research, I asked: how do kids come to know themselves as particular kinds of math learners? I learned that kids engage in multiple practices in math class, are positioned within these practices, and position themselves. They creatively resisted and rewrote certain practices. Kids participated in multiple figured worlds, and they used that multiplicity strategically. Through their engagement in intersecting figured worlds: procedural and conceptual mathematics, friendship[7], schooling and special education, the kids worked and reworked their relationships, identities and positionings. Throughout this work, kids were particularly concerned with relationships and positioning, as well as how mathematics class felt.

Figured worlds describe how groups of people make and remake meaning systems around particular parts of life. Multiple figured worlds circulated within the classroom. Figured worlds overlapped and interrelated, and they necessarily involved positioning through hierarchies, thus were raced, gendered, and classed in particular ways. One of the creative ways in which kids engaged in their schooling was orchestrating overlaps between figured worlds, bringing different worlds into the classroom.

The chistosos provided an important example of how the kids authored their worlds. These kids, a subset of the kids in the class, brought hip hop into the classroom and connected it to procedural mathematics. Some of these kids would rap as they finished math worksheets. Other kids composed raps about their mathematical competence. This group of boys also made frequent jokes in class, snapping on each other about sex, class, race and hygiene. These boys were proud of their friendships, one writing a poem in eighth grade describing the strength of

[7] Instead of using the phrase social figured worlds, I am trying here the figured world of friendships.

their group's friendships over time. These boys created their own hybrid culture, one that mixed the figured worlds of hip hop, snapping, and procedural competence in math, all with a particular gendered and raced quality. They took some of the official lessons of procedural mathematics and remixed them.

Not only the chistosos remixed the figured worlds of the classroom. "Serious" people took mathematical work seriously, as well as the figured world of schooling, but these kids participated in this work immersed in their friendships. In interviews, kids emphasized how important working with their friends was in mathematics, and separated this practices from doing mathematics with adults.

One particular kind of mathematics lent itself to additional agency for kids. While the procedural mathematics that was described as ""'state examish'"" by Ms. Marquez tended to limit the choices kids made in their work, ""'critical thinkingish'"" mathematics valued kids' creative abilities to develop their own strategies. Kids like Ruby and Luis invested themselves in this kind of mathematics, and used their own strategies to solve problems even when the class focused on a single procedure. When the class focused on using rules to solve addition and subtraction of integers, Ruby used her fingers and Luis used "the giant number line in my head." They remixed the figured worlds of ""'critical thinkingish'"" mathematics into the world of ""'state examish'"" mathematics, preserving their own agency in the face of more prescriptive mathematical practices.

Agency in all these cases was critical to kids' identifications with mathematics. Luis and Ruby maintained a strong identification to mathematics through their creative reworking of mathematical practices. Strong friendships allowed kids to develop the practices and discourses of schooling and mathematics, such as Lorena and Sade in sixth grade. Kids in the chistoso group generally identified with mathematics, demonstrated by their enthusiasm in class, but only if they were given the space to do the mathematics with their own creative style.

Not only do kids author their own world, but they also authored themselves as math learners. Again, the multiplicity of meanings that circulated in their classroom provided materials for agency. Kids identified as particular kinds of kids in school, as particular kinds of math learners, and particular kinds of abled and disabled learners. Situated within such multiplicity, identity was dynamic and fluid. Understanding identity as both how you position yourself and how others position you both within practices and discourse, I saw tension between those two perspectives for some kids. I understood the process of identification as how these identities are shaken up (processes of transformation) and built up (process of fossilization) over time, in relationship to particular figured worlds.

Desi claimed an identity as a slow learner, as a kid with ADHD who could do it if she tried, as a rebellious thinker, as a friend, as a student who worked hard, and sometimes didn't. Some of these were situated in the figured worlds of special education, others in schooling, and others in "“state examish”" mathematics. At the same time, she resisted how she was positioned, "labeled" by the grouping practices of the classroom as well as circulating discourses of special education. In some narratives, Desi identified as a slow learner of math, and in others she defined herself as rebellious in the face of positioning. She held contradictory self-understandings simultaneously. Identities transform and fossilize through dialectical conflict, which makes it critical to recognize the multiplicity of discourses and practices that kids engage in. This conflict echoes the irreducible core ontology in Bakhtin: self/other.

With mathematics in particular, kids were positioned differently in different kinds of mathematics, but increasingly, as memorization dominated the classroom, one binary was used:

get it fast or struggle slow. I saw agency in how some kids orchestrated the materials of multiple figured worlds to author themselves. Federico used discourses of special education, particularly that of processing and the brain, to author himself as someone who was simultaneously fast and slow at mathematics. Both in interviews and in class, he used different discourses to defend himself from the positioning of others. Again, Federico belied any simple understandings of how individuals take up positionings such as learning disabled. He took up some of the materials of his own positioning and remixed them to reposition himself as able in mathematics.

There was a codeveloping relationship between salience and expertise in mathematics, but not in all cases. Some kids, like Federico, became increasingly committed to mathematics as they developed expertise. However, there were also kids like Clementine, Rita and Artemis who were developing more expertise in math, but the salience of math was decreasing for them. These were kids who found little agency in the procedural mathematics that dominated the spring of their seventh grade. Kids who saw themselves as creative thinkers in math were able to hold on to that identity, and to persevere through mathematics that was not creative through creative strategies they kept underground (Chapter Five). Again, there was a close relationship between multiplicity and agency.

Authoring the self occurs in a thinking, feeling human, whose relationships and emotion generally take precedence. I could see this in both ethnographic and interview data, as the kids constantly pulled my attention to the importance of how math class felt, and how important relationships with teachers and friends were to their learning of mathematics. While some authors have emphasized the importance of emotions in math learning, such as the recent work of Radford and Roth (2011), such work has ignored the perspective of kids. Desi, who was seen as passive and apathetic by some of her teachers, narrated her own experience doing mathematics as being frozen with fear, not even knowing how to respond. If educational research is to enter the grounds of identities and emotion, it cannot be to dismiss the very aspects of experience they purport to explore.

The kids in this study were unique individuals, who are continually engaged in building themselves out of the materials of many figured worlds. Reacting against the Cartesian duality that has dominated theories of humanity for centuries, sociocultural theory has overemphasized the role of social forces, ignoring the uniqueness of individuals and their agency (Stetsenko, 2010). Mathematics education has put forth theories of identity in which a single culture determines the identity of the children in the classroom (Cobb et al., 2009). Theories like those of Radford and Roth (2011) provide only a researcher's eye to understand emotion, depriving kids of any agency in their own portraits. These are colonial approaches to educational research, privileging the outsider's perspective without respecting that of persons, looking for single answers where complex multiplicity exists. Understanding multiplicity was critical in understanding the agency of kids, both in the world, and in their own self-understandings.

Enacting understandings: making choices about mathematics classes

Kids enacted these complex self-understandings about mathematics through the choices that they made about eighth grade. As I wrote in Chapter Four, in my interview at the end of seventh grade with Ms. Marquez and Ms. Alton, the teachers told me about another conflict in the math department of Central Academy. The eighth grade math teachers were insisting on tracked math classes for the following year. Ms. Marquez and Ms. Alton were asked to create the class lists for the tracked eighth grade classrooms. Not only this, Ms. Marquez told me, growing increasingly angry, but "they will not let IEP kids in them" because there was "not enough support"(field notes, 6/7/11). Ms. Marquez said that she wanted to put Arturo and Ana in the top class. Ms. Alton disagreed with Ms. Marquez's analysis. To her, putting all the kids with IEPs together was not necessarily "bad" because those kids need "support," including Arturo and Ana. Ms. Alton made it clear that she sees the kids with IEPs (named by Ms. Marquez as the "IEP Kids") as a monolithic group who all need similar methods and supports. Ms. Marquez saw kids in terms of "“critical thinkingish”" and "“state examish”" mathematics.

That same day in class, while the kids were working on some multi-step algebraic problems with positive and negative numbers, Ms. Marquez called each kid up to her one by one, asking them which math class they wanted to be in: the "regular class" or the "advanced class." Ana, when talking about her choice with me, slipped in her language, telling me that she wanted to be in the "low class." As I walked around the class, I asked each kid which class they had selected. . Only Ana and Desi chose the "regular" class. Rita seemed to be ambivalent about the choice, but did tell Ms. Marquez that she wanted to be in the advanced class. In the first pilot study I did for this project, the last question in our protocol gave the kids this exact situation, but hypothetically. We found that kids almost always wanted to be in the advanced class. This situation replicated this question. This was an illusion of choice, however, as Ms. Marquez knew that she could not place 12 out of 24 kids (everyone with IEPs) in any class but the lowest one. However, it gives us a moment to see the kinds of choices kids might make about mathematics. The two kids who outright rejected advanced mathematics are kids who have narrated their perpetual struggle in mathematics (Desi) and increasing disinterest in mathematics (Ana).

I video-recorded some of the kids on this day as they told me which class they wanted to be in. Their responses echo so strongly their self-authoring from their interviews:

Desi
Advanced classes are so,
so,
like ON everything,

and everyone likes to work and everyone knows how to do the work fast,
and I like to go slow,
like I would rather just TAKE TIME to learn my things and,
you know,
go through life learning them SLOWLY,
other than the other people who just want to pass through them.
(Transcript, 6/7/11)

Desi rejected the advanced class because she likes to go “SLOWLY” and “TAKE TIME.” Her description stressed the binary between fast and slow, as does Carmen’s narrative:

Carmen
What did I pick?
I picked accelerated class,
because I thought that it was better for me,
and like I said I would become a better math student,
because,
I get to be at the same rate as everyone else in the class,
like I could push myself harder than I have,
and like,
I would like get something like easily,
like,
I am good at math because I am very visual person,
I could get the math whether it is hard or easy . . .
that is also good for me,
because I am learning things ahead of time,
and when I get into that grade,
I'm gonna know everything and its gonna be like if you say,
piece of cake [*air quotes*]
because it is gonna be very easy to do,
so I think it is very good for me,
so,
I would like to be in that class.
Can I see myself?
(transcript, 6/7/11)

Carmen uses all the binary relationships at the heart of “state examish” mathematics to place herself in this hypothetical math class: not only fast and slow, but ahead and behind, and easy and hard. Carmen, who identified with this kind of ““state examish”” mathematics throughout the year, wanted to continue in it, while Desi wanted to opt out of the race that mathematics had become. Rita seemed the most conflicted of the three, choosing the accelerated class perhaps because of who she used to be: "good at math."

Rita
I think I would like to be in the accelerated class,
because I think I would,
actually catch up with the class,
and do everything in the time we have to learn it,
and,
[*grimace*] another like,
I have always BEEN good at math,
too,
so I think I could,
and I want to get my,
my [8th grade algebra test] out of the way quick,
cause like I don't have to take it in ninth grade.
(transcript, 6/7/11)

She also reminded me here of how the figured worlds of mathematics in school are mandatory. Rita cannot opt out of mathematics and continue on the same track towards college.

In Chapter One, I made an argument that studying identification with mathematics matters both because kids need math, and because math needs these kids (Gutiérrez, 2002). These kids did need math. They need to complete certain math classes in order to apply to college. The filtering effect of mathematics, referenced by the National Research Council in 1989, operates both through the performance of kids on grades and tests, and through the choices they make. In order to be able to finish the math necessary to be admitted into a four-year college, kids should take algebra in eighth grade (Moses & Cobb, 2001). When I returned to visit the participants a year later, at the end of their eighth grade year, Ms. Marquez was again angry. She told me that, yes, all the kids with IEPs were placed in one class, despite what they requested. According to Ms. Marquez, the teacher of this class was particularly procedural. While the class was labeled an Algebra Class, not all the kids in the class took the statewide Algebra Exam. Those kids, she told me, would have to take Algebra again, taking them off track.

She was particularly upset that Luis did not take the test. She told me that certain kids are being "funneled" down certain paths, kids with IEPs especially (field notes, 6/12/12). And particularly Luis, who she said was again singled out for his "behavior" (field notes, 6/12/12). Ms. Marquez's face and body were angry as she told me this. Writing this conclusion, I feel my own anger. This is an instance of injustice, of oppression, in particular the kind of practices that attempt to label and control kids, particularly Latino and black boys, who defy authority. In this case, our budding mathematician, Luis, was denied opportunity, "funneled" into the lowest track of mathematics that the school offered.

During my interview with his sixth grade teachers, Ms. Emerson said of Luis: " I will say right now on this tape that if any student I have taught yet solves some unknown math problem, it will be Luis" (Sixth Grade Teacher Interview). Both Ms. Emerson and Ms. Marquez clearly identified special potential in Luis around mathematics, related to his creativity, passion, and diligence. The same child was named a "behavior" by his special education teacher (Ms. Alton) in seventh grade, and again by his math teacher in eighth grade (according to Ms. Marquez). As Luis moved along in school, opportunities to be a creative mathematician diminished rather than increased. If this trajectory continues for Luis, he may not ever have access to the kind of higher-level mathematics that emphasizes creativity (Boaler & Greeno, 2000). As Boaler and Greeno (2000) argue, too many kids with the necessary creativity to excel in graduate mathematics have left the field well before because they do not see school mathematics as creative. In this case, the overly creative Luis has been increasingly "funneled" out of mathematics. As Gutiérrez suggested, this is a tragedy not only for Luis, but also for mathematics itself, which needs the kinds of thinkers that Luis could be.

Recommendations

I did not set out to write a dissertation about educational policy, but the political context of education constantly mattered in my analysis. Larger policies, particularly accountability, standardized tests and the implementation of special education policies, irreversibly affected this classroom and the people in it. Ms. Marquez taught test preparation the entire spring because the test had real effects determined by policy (merit pay, teacher tenure, school rankings). This shift in pedagogy was ultimately negative for many of the focus kids, though not all. ““‘state examish’”’ pedagogy limited the options for naming oneself as a math learner, making the binaries of get it fast or struggle slow more powerful. Special education policy operated as a funnel, just as Ms. Marquez proposed, in conjunction with tracking. For these kids, their sixth grade and half of their seventh grade math classes had mixed groups, which did not explicitly rank kids into material groups. The coming of the state test, and the entrance of a special educator who believed that the kids with IEPs needed one kind of support, meant that kids were placed into static ability groups from January until May. I cannot disentangle test-taking, special education, and tracking here—they operate as a many-headed hydra. Each has the same rationale: help the kids. In this case, joined together, they produced gains on the standardized tests but increasing dissatisfaction and de-identification with mathematics. These policies and practices became part of how kids understood themselves as math learners, and the effects of these increasingly negative self-understandings around mathematics may be significant for Rita, Clementine, Ana, Desi and more.

Policy recommendations. This study provides evidence that policy makers must look beyond test scores. In this case, a group of Latino/as in special education increased their math test scores. However, the pedagogy used to affect test scores emphasized memorization of set procedures, and left no time for creative problem solving in mathematics. The use of ability groups and the prominent focus on memorization affected the kids’ identifications with mathematics, causing more kids to de-identify with mathematics than to develop stronger affinities for it. This study suggests that such focusing on a single assessment measure was counter productive in the long run. For mathematics education, critical long-term indicators could be the percentage of people from underrepresented groups choosing challenging mathematics and excelling in it. We need to value highly what we truly value. The policies of accountability should value longer-term goals in mathematics.

In this case, because of the high stakes of the state exam, the teacher shifted pedagogy, moving from pedagogy that emphasized critical thinking to “teaching to the test,” as she called it. The practices of “teaching to the test,” in this classroom, led to increased feelings of anxiety for kids around memorization. Of nine focus kids, five kids (all girls) described strong feelings of panic and anxiety when asked to memorize mathematical facts and procedures. This suggests that “teaching to the test” may additionally disable kids by increasing their anxiety around mathematics.

Current special education policy locates disability in the individual, creating an Individual Education Plan. This study established that different kinds of mathematical pedagogy disabled differently. The same child was seen as more or less disabled by teachers based on what kind of mathematics pedagogy dominated the classroom. This challenges an implicit focus on deficits in special education policy. In addition to the concerns listed above, this study questions whether or not this individualist focus further disables; would Lorena be as disabled if she could still work with Sade? If she could work with a calculator? If she was allowed to take assessments in some other form but alone with her memory?

At several points in this study, the fact that a child had an IEP led to decreased academic choices rather than increased opportunity. Teachers assumed more than once that if a child had an IEP they should be in the lowest track in tracked classrooms and schools. Since an IEP was designed to protect the rights of children , does current special education law address these concerns?

Educational policy ignores the emotions and relationships of children. Children in this study report how critical respect and collaboration are to their learning. Some of the narratives in this study, particularly those of Clementine, suggest that the pressure of the tests not only make kids anxious, but make adults frustrated and angry with children. Is the policy of high stakes testing producing more anger, frustration, and anxiety in our schools?

Educator recommendations. Kids notice how they are "labeled." Kids notice every kind of hierarchy we create, such as ability grouping. They develop their own theories to account for hierarchies in the classroom. And further, kids use these theories, as well as the language their teachers use, to understand themselves as learners. Some kids quietly critique this labeling, while others internalize their place in the hierarchy without critique. When we teach mathematics, we are teaching more than the subject matter, we are teaching children who they are and who they can be.

Different pedagogies offer kids different ways of understanding themselves. Mathematics work that was centered on discussion of multiple strategies offered kids the possibility of being "the talking kind," one who asks a lot of questions or has interesting strategies. This kind of pedagogy encouraged a theory that there are many ways to solve mathematics problems, and none are better than others. Pedagogy that focused on individual memorization and test taking, using memorized procedures, offered kids possibilities such as either fast or slow, either get it or struggling. These kinds of limited, dualistic possibilities left some kids believing that they were "slow" and "struggling." Different pedagogies offer different possibilities for ability and disability that kids use as part of how they make sense of themselves as learners. And, these self-understandings matter for how kids engage in mathematical work, as well as for the choices they make about which mathematics to take.

If different pedagogies offer different ways of understanding the self, we need to offer children the kinds of self-understandings that will benefit them in the long run. A mathematical pedagogy centered on problem solving, emphasizing perseverance and flexible thinking offers the best possibility that kids will develop both salience and expertise in mathematics. I found that the fast/slow and get it/struggling binaries are well established in public narratives about mathematical ability. Thus, to help kids create new possibilities for selves as mathematics learners, they need sustained immersion in curriculum that values thinking over memorization. The study shows that this is possible, as two out of nine focus kids are able to retain the view that mathematics is strategic problem-solving, rather than memorization.

Teachers would benefit from exploring this interrelationship between salience and expertise in mathematics. It is not enough to just like math. It is not enough to know a lot of math. One will not deeply know a lot of math unless you like math, and one will not like math unless you know a lot of it, or think you do. The key is identification, or developing a sense of oneself as having agency within that world. This is a much more nuanced understanding of the interrelationship between expertise and emotion than in oversimplified notions like self-esteem. A teacher needs to simultaneously build enthusiasm for mathematics in the classroom, while providing opportunities for kids to develop ever-deeper expertise.

In the specific case of teaching addition and subtraction with integers, I can strongly suggest that kids are encouraged to find a model and/or strategy that works for them, and that following rules is done carefully, without being valued as the highest status method. Ms.

Marquez began instruction of integers using models such as the number line, encouraging non-routine problems solving and noticing patterns. As the year progressed, this kind of activity disappeared and the mechanical use of the rules dominated. The use of the rule worked for some kids, to the extent that they were able to solve most computation problems at the end of the year. Few kids were able to solve two fairly simple problems in context because they had little experience in doing such problems. When a topic like integers, which demands flexible strategies and models that can work in a variety of situations, including algebra, was reduced to following limited and easily forgotten rules, kids made many mistakes. Integers were an important touchstone for kids throughout the year, standing in for the complexity of seventh grade mathematics. I worry that as the kids began to follow the rules without understanding what they were doing (evidenced by the fact that most kids could not solve subtraction of negative numbers in June) meant that when they forgot the rule, or misused it, they could not use their own sense of the numbers to find answers. This in turn may have convinced the kids that math will make increasingly less sense as they move ahead in school.

Many teachers understand the deep importance of emotions and relationships in learning. The teachers in this study describe their kids in terms of their feelings, their friendships, and their families. Yet our schooling practices ask teachers to routinely erase this knowledge, putting kids at desks alone to do tests (because you can only test an individual), positioning kids through grades and classroom posters (because kids will only work when motivated by grades), and arranging kids into groups based on perceived ability (assuming that this will not affect relationships and emotions). I hope that some of the findings of this study that make the taken-for-granted world of the classroom unfamiliar, can help educators challenge their own practices, especially those that conceive of kids as individual memory machines.

This study offers practical advice for math educators working with kids who are not meeting standards in mathematics, whether or not those kids are in special education. First, any kind of mathematics instruction must consider the child's long-term relationship with mathematics. Intervention should not focus on short-term memorization at the expense of a long-term relationship with mathematics. Second, successful intervention will be focused on what kids know, not what they don't know. Successful work in integers for these kids would necessarily build on the kid's previous experience with integers. Special education teachers and other interventionists must understand their children as having a long and varied experience with any mathematical topic they need intervention for. They are not blank slates. Ms. Alton, like other educators, talks about some kids as having "no number sense." This suggests that the educator sees the child as knowing absolutely nothing about how numbers work. I strongly reject this all too prevalent way of understanding children in mathematics. Assessment practices must focus on finding out what children know, not what they don't know. In addition, this study suggests that working with kids necessitates understanding how their understanding have been forged in positive and negative relationships with both people (teachers and family members) and even with mathematical tools (such as following rules or the number line).

This study, along with others in the disability studies tradition, establishes that disability is not a static condition in the brain of the individual, but shifts based on contexts. In this study, pedagogies had different ways of abling and disabling kids. Aspects of the participant structure of the classroom, particularly whether or not the kid had access to collaboration with other kids, also abled and disabled kids. To support kids in inclusive classrooms, we must seek out the contexts in which children are abled, and extend those contexts as far as possible. If Lorena works best with a close friend, then certainly her rights as a special education student should extend to that protection. If Luis believes he cannot work in the "unsmartest group" because he cannot get help from other kids there, then why was he placed there? For Luis, engagement in mathematical problem-solving and discussion enables him. His protections as a student in special education should extend to this support as well.

Kids with special education labels necessarily challenge the status quo in schools. Somewhere in their history, they did not act like other kids acted, or learn like other kids learned. Now they have special rights, and educators have special obligations to them. The way it plays out in schools, as this study testifies, is often the flip. The IEP becomes a way to "funnel" the challenging kid away from opportunity. What if, as educators, we flipped that? What if we rose to the challenge that these kids give us, supporting their strengths? Discussions that challenge Luis will challenge Ruby. Teaching that strongly respects children, providing affective equity will support Clementine as well as Desi. Rejecting the fetish of memory in mathematics will support all children.

Research Recommendations

I hope my work can add to the literature on equity in mathematics and disability studies in education, first, by creating conversation and connections between these two fields. I trust that this discussion is enlivened by my use of sociocultural theory, which brings an increased analysis on multiple interacting levels, emphasizing emotion, interaction, and the processes of learning who one is in complex sites like classrooms. Disability studies in education could benefit from my focus on classroom practices. Mathematics educators could take from my work a more dialectical rather than dualistic way of understanding mathematics classrooms.

Most work in special education and mathematics continues to document short-term processes, such as assessing different ways kids can memorize multiplication facts over six weeks. I want to challenge a traditional view of what mathematics is and can be for kids. What if we see learning mathematics as not just memorizing facts, but as building up a set of practices such as argumentation? If so, we need to reform how kids with disabilities are taught mathematics in this country. We need to take seriously the relationship that kids develop with mathematics. It pains me to think of kids who have spent year after year in our school system in a cycle of remembering and forgetting, dominated, as this classroom was in the spring, with forgetting. What kind of relationship can kids possibly form with mathematics through years and years of these experiences? I want to open up this conversation with the subfield of special education mathematics.

More than anything, I hope that researchers can learn from me what I learned from this process: to look for and respect the agency of children. This dissertation was made possible by the ideas and engagement of the kids in that classroom. They turn the notions of adults, in every academic field, on their heads. I have at points thought that instead of writing a dissertation, I should just submit Desi's second interview in its entirety. Her critique of mathematics reform, math testing, labeling, special education, and hypocrisy in all its forms was stunning. I truly hope that my effort at understanding both the ways in which the kids were addressed by the world, and how they answered, has been a productive conversation for the reader interested in how kids make sense of themselves in mathematical worlds.

Appendix A

Figures 1 - 3

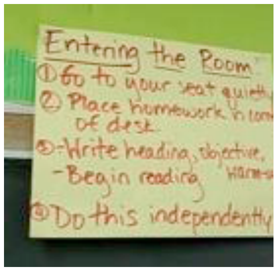

Figure 1. Classroom sign for entering the room. 1. Go to your seat quietly. 2. Place homework on corner of desk. 3. Write heading, objective, warm-up. 4. Do this independently.

Figure 2. Classroom sign for S.L.A.N.T.

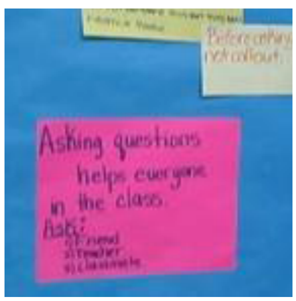

Figure 3. Classroom sign encouraging asking questions. Student writing says "Asking questions helps everyone in the class."

Appendix B

Figures 4 - 6

Figure 4. Classroom sign for Star Points. Lists the names of all the kids in the class.

Figure 5. Classroom sign for How many books have we read? Lists the names of all the kids in the class and has stars by some names.

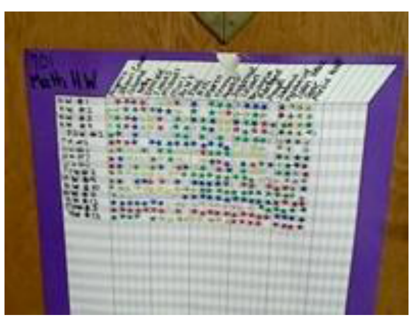

Figure 6. Classroom sign for Have we done our math homework. Lists the names of all the kids in the class and has stars by some names.

Appendix C

Protocol for First Narrative Interview

1. Pretend that I've never been to your math classroom.

    Can you describe it for me?

    How does class generally start?

    Then what happens?

    Sum up the routines at the end and get feedback.

2. Do certain young people stand out? Why? Do you?

3. Can you think of a time that you felt successful in your math class?

4. Can you think of time that you didn't feel successful?

5. Do you think that you are successful in this class? How do you know?

6. Do you like math? Why or why not?

Appendix D

Protocol for Second Narrative Interview

1. How has math class been going for you?

2. If there are certain kinds of math learners, and there may be or may not be such a thing, what kind are you?

3. What was the story of your year in math?

Bring up particular moments for analysis, different for each kid

4. This question was different for each kid, a particular question that I wanted to ask each kid based on preliminary analysis.

5. We will end with some quick questions. You can give me just one or a few words to answer.

To most people, I am what kind of math learner?

To my teacher, I am what kind of math learner?

To my friends, I am what kind of math learner?

To my family, I am what kind of math learner?

To myself, I am what kind of math learner?

6. Last question. People who read my paper will want to know some information about you. But I want you to pick how I describe you based on gender, ethnicity, race, etc. Pause to discuss terms.

What gender are you?

What race or ethnicity best describes you?

Do you have an IEP? (What is an IEP?)

Does that have anything to do with math? (Repeat for all their answers)

Appendix E

Addition and Subtraction of Integers Assessment

- 2 + 7 =	**3 – 9 =**	**5 + 6 =**	**8 – (- 2) =**
6 + 3 =	**- 7 + - 2 =**	**- 4 + - 6 =**	**- 7 – (- 2) =**
8 – 2 =	**- 7 – (- 8) =**	**7 + - 9 =**	**- 2 – 7 =**
- 5 – 8 =	**- 8 + 5 =**	**- 4 – (- 6) =**	**5 + - 9 =**

The back of the assessment had the following question:

What tools or methods do you use to solve integer problems? Be as detailed as possible.

Appendix F

Contextual Problem Assessment

Solve the problems. Show all work and please do not erase.

An architectural drawing of a building shows the elevation of the basement floor to be – 12 feet. The elevation of the roof is 32 feet. What is the total distance from the roof to the basement floor?

The temperature at noon on a winter day was 8° C. At midnight, the temperature had dropped 15°. What was the temperature at midnight?

Appendix G

Descriptions of Focus Kids and Adults

Focus Kids

Ana had medium brown skin, brown eyes and hair, and a very assured manner. She was always sitting up straight in class, facing the front, taking notes. During many points in her sixth grade and seventh grade years, I saw Ana nodding as the teacher spoke, establishing that she was listening. Ana described herself as "female," and told me, "I speak Spanish, but also English." When I asked her where her family is from, she told me "Dominican Republic" and "Dad is also Ecuadorian." She had a label of a learning disability, and was formerly categorized as an English Language Learner. Her family spoke Spanish at home.

Carmen was a tall, strong and fit girl with straight dark bangs across her face, and flashing eyes. She was often very funny, making jokes about my camera or her boyfriends, but also serious about getting her work done. She described herself as a "girl" and told me "my family is from the Dominican Republic." She had a label of a learning disability, and was currently categorized as an English Language Learner. Her family spoke Spanish at home.

Clementine had dark skin and a ready smile. I met her in her seventh grade year, as she was not in the CTT class in sixth grade. Clementine seemed very confident in the different kinds of mathematical work. Clementine did not have an Individual Education Plan. Her family spoke Spanish at home.

Desi had medium brown hair and skin. She described herself as "a girl" and "from the Dominican Republic." She dressed simply, with less of the neon and sparkling adornments that her female friends added to the navy and khaki school uniform. Desi was at the heart of the social group in this class, part of both girl's groups and the only female member of the chistosos. She had the label of a learning disability. Her family spoke Spanish and English.

Federico was a light-skinned boy who was dedicated to his schoolwork. He described himself as "Hispanic American," with a family from the "Dominican Republic and somehow I have a small Portuguese." Federico was serious in class, working hard and participating in discussion. He had a label of a learning disability and also received speech services. His family spoke Spanish and English.

Bobby was a round 13-year-old, darker in skin than the other kids in the class. He first described himself as "Hispanic and black" then changed it to "Hispanic and American." He also told me he was "medium class." Bobby was a serious student in class, carrying around a dictionary and using it. He did not have an I.E.P.

Luis, with his curly mop of hair, quick laugh, and wide smile, was a mathematical iconoclast in both his sixth and seventh grade years. He was also described as king of the chistosos. He described himself as an "intelligent man," and also named himself as "Latino" and "Hispanic" and part "Spanish." He had a label of a learning disability. His family spoke English.

Ruby had medium brown skin and hair, always pulled back into a ponytail. Ruby had a playful personality, loved games and laughing. She was also an engaged math student, one who made comments about the strategies of others, and asked questions when confused. She had braces, and was often smiling broadly during class and interviews. She describes herself as "female" and "Latin," and told me that "I come from the Dominican Republic, but I was born here." Ruby did not have an I.E.P.

Rita wore eyeglasses, stylish black frames, with long, straight, dark hair. Over the winter break in seventh grade she got a perm, turning her hair super curly. Rita was generally quiet and serious in class, often working closely with Bridgette. She described herself as "I am just like Latin." She had a label of a learning disability and was categorized as an English Language Learner. Her family spoke Spanish.

Adults

Mr. Pierce, who was one of the mathematics teachers for the sixth grade, was a white man in his early thirties. He had been teaching for three years when I was in his classroom.

Ms. Emerson, the special education teacher for the sixth grade, was white, with brown hair pulled up into a ponytail and a long, colorful skirt. She had also been teaching three years.

Ms. Marquez was the seventh grade mathematics teacher. She was Latina, (Dominican and Ecuadorian), in her early thirties, with long black hair pulled into a ponytail. She was in her ninth year of teaching when I observed in her classroom.

Ms. Alton was the seventh grade special educator. She was black, perhaps in her twenties. She was soft-spoken and calm, and was in her first year of teaching.

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