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Racial Discourse in Mathematics and its Impact on Student Learning, Identity, and Participation

by

Niral Shah

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Committee in charge:

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Racial Discourse in Mathematics and its Impact on Student Learning, Identity, and Participation

Abstract

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Discussions of race in educational research have focused primarily on performance gaps and differential access to advanced coursework. Thus, very little is known about how race mediates the learning process, particularly with respect to classroom participation and student identity formation. This dissertation examines mathematics learning as a context for illuminating the racial dynamics of learning in everyday classroom activity.

Although mathematics and race may seem strange bedfellows, a poststructural analysis reveals specific linkages between them that suggest that their discourses are actually well aligned. To conceptualize this alignment, this dissertation introduces the theoretical frame of *racial-mathematical discourse*, which establishes the groundwork for the empirical investigation reported here. Observations took place in four mathematics classrooms at a racially diverse high school over the course of a school year. Interviews (n=35) were conducted with students from the focal classrooms. Data were analyzed to explore how students make sense of racial-mathematical discourse, and to gauge the discourse's impact on learning.

Findings indicate that racial-mathematical narratives were central to students' sense making. All students reported awareness of the "Asians are good at math" narrative, as part of a web of racial ideology. Importantly, students linked it to narratives about other groups' mathematical inferiority (e.g., "Blacks are *bad* at math"). They also connected racial-mathematical narratives to broader racialized discourses outside mathematics (e.g., perceptions of intelligence). Students observed the presence of these narratives in locations outside the school setting, such as media imagery and international comparisons.

Data further suggest that racial-mathematical discourse is not a static belief system. Rather, it emerges and is reified as students engage in typical classroom practices, such as noting which classmates get asked for help. This is consequential for learning, in that the deployment of racial narratives in social interaction frames students' opportunities to build identities as capable learners. This dissertation develops a framework leveraging insights from sociocultural and poststructural theory to trace the impact of racialized classroom episodes on students' identity formation. It highlights critical issues that need to be taken into account in the design of equitable learning environments, especially for students of color from persistently marginalized backgrounds.

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Acknowledgments

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Chapter 1: Introduction

Derrick is a tall, confident, high-achieving African American boy enrolled in ninth-grade accelerated Geometry. He has always loved math and aspires to a career as a chemical engineer. During an interview about his experiences learning mathematics in school, Derrick recalled an interaction he had in math class with a fellow African American classmate. The teacher was passing back the results of a recent exam and, as usual, Derrick had done well. Surprised at the good grade, Derrick's classmate turned to him and said, "Oh, you're really smart! You must have some Asian in you."

Discussions of race in educational research have tended to focus on either racial performance gaps or racial disparities in students' material opportunities to learn, such as the opportunity to enroll in advanced courses. Although such research has been instrumental in identifying structural forces that perpetuate educational inequity, especially for students of color from persistently marginalized backgrounds, much less is known about how issues of race mediate the learning process itself. This dissertation examines mathematics learning as a context for illuminating the racial dynamics of learning in everyday classroom activity.

Mathematics is an interesting domain within which to study this topic. On the one hand, mathematics is typically considered the most "culture-free" of the subjects taught in schools. On the other hand, it is also one of the only subjects in the United States for which a narrative exists linking race and domain ability (i.e., "Asians are good at math"). What should be made of this tension? It may be that perceptions of mathematics as "neutral" have, to date, preempted extensive research into the ways in which mathematics learning can become a racialized endeavor for students like Derrick. How might the interaction with his classmate have affected Derrick's identity as a learner in mathematics? What impact might it have had on his subsequent engagement in the learning process? Considering questions of this kind requires new theoretical ideas and analytical tools that can situate learning in a racial context.

As a way of conceptualizing the relationship between race and learning in mathematics, this dissertation offers the notion of racial-mathematical discourse, which refers to the language, symbols, and practices that facilitate individual reasoning and inter-personal dialogue about race in the context of mathematics learning. The dissertation is organized around two broad strands of inquiry related to racial-mathematical discourse: 1) analyzing the content, structure, and sources of the discourse; and 2) investigating its impact on learning, specifically with respect to students' participation in classroom practices and identity formation.

The first strand of inquiry begins in Chapter 2 with a theoretical examination of the conceptual underpinnings of racial-mathematical discourse. The following research question drives this part of the inquiry: On what basis have notions of race and mathematical ability come to converge in the United States context? Using methods of discourse analysis (Foucault, 1972; Goldberg, 1993), I demonstrate that, in spite of their superficial dissimilarity, both the dominant discourse of race and the dominant discourse of mathematics learning in the U.S. are predicated on the same three fundamental concepts: hierarchy, intelligence, and innateness. I argue that this discursive alignment illuminates the specific link between race and mathematics, in particular.

This theoretical work sets the stage for an empirical investigation. After detailing in Chapter 3 the methodology used to collect and analyze the data, Chapter 4 engages the following empirical question: How do high school students make sense of issues of race in terms of their learning of mathematics? Analysis of interview data reveals that students' sense making of racial-mathematical discourse revolved around racial narratives like "Asians are good at math," which

can be understood as elements of racial discourses. However, while this particular narrative was highly salient to students, data indicate that it was but one node among a tapestry of racial narratives deemed relevant by students to mathematics learning.

Not only did students tend to link the "Asians are good at math" narrative to other racial-mathematical narratives that position other groups as mathematically inferior (e.g., "Blacks are bad at math"), but they also connected racial-mathematical narratives to broader racialized discourses beyond mathematics, such as those related to perceptions of intelligence and cultural practices like parenting styles. This is significant because it shows how racial-mathematical discourse implicates learners of all racial backgrounds, and is structured in a way that fixes them in hierarchical relation to each other (cf. Ernest, 1991; Martin, 2009). These empirical findings corroborate and extend the theoretical ideas proposed in Chapter 2.

Whereas Chapter 4 focuses on the content and structure of racial-mathematical discourse, Chapter 5 explores its sources. That is, where do students perceive racial-mathematical discourse surfacing in the world around them? The data show that although students noticed elements of the discourse emerging at school, both in and out of math class, racial-mathematical discourse is also distributed across multiple sites that extend beyond the school setting, such as students' local communities, media imagery, and national comparisons. Documenting this pervasiveness is important because it bounds the scope of the problem to be dealt with, an issue I take up in the concluding chapter of the dissertation.

After unpacking the nuances of racial-mathematical discourse in the first part of the dissertation (Chapters 2 through 5), the second part shifts to the question of its impact on the learning process. Using a sociocultural perspective, I conceptualize learning as contingent on students' participation in classroom practices and as reflected in micro-moments of identity formation. Chapter 6 taps both observational and interview data to illustrate some concrete ways in which mathematics classrooms become racialized spaces. Analysis points to a subset of apparently race-neutral classroom practices that students nonetheless understand in racial terms. These findings are significant because they suggest that rather than an abstract set of static beliefs, racial-mathematical narratives can have a material effect on regular classroom activity.

Chapter 7 complements this empirical investigation by presenting a framework that conceptualizes the effects of racial-mathematical episodes on student identity formation. Specifically, it offers a way of imagining how various deployments of racial-mathematical narratives can position students as being more or less capable of learning and succeeding in mathematics, thereby affecting their access to productive subject positions as mathematics learners. The framework leverages ideas from both sociocultural and poststructural theory, the latter of which has received little attention to date in either mathematics education research or the learning sciences.

Chapter 8 provides an opportunity to reflect on the theoretical ideas and empirical findings presented in the dissertation in terms of their implications for how they expand our understanding of the learning process—both in general and specifically in mathematics. I conclude by delineating new avenues for future research, and by discussing various pedagogical interventions that may prevent racial hierarchies in mathematics learning contexts from forming. To begin, though, the rest of this chapter is devoted to considering extant treatments of race in the mathematics education literature.

Race-related Research in Mathematics Education

Historically, issues of race in mathematics education research have received little attention (Diversity in Mathematics Education, 2007; Lubienski & Bowen, 2000; Parks & Schmeichel, 2012). Nevertheless, in this section I reflect on four lines of research in mathematics education that have in some way taken up issues of race: (a) gap-focused studies; (b) research on the cultural practices and epistemologies of historically marginalized students of color; (c) interview studies with African American mathematics learners; and (d) research that has centered race while considering mathematics learning. I do not attempt a comprehensive review of these bodies of literature. Instead, I highlight the array of theoretical perspectives and methodological approaches they use to study race in order to situate and motivate this dissertation.

Gap-focused research

A driving factor in the development of the Curriculum and Evaluation Standards for School Mathematics (1989) issued by the National Council of Teachers of Mathematics was the belief that mathematics should be equally accessible to all students. Central to the reform movement was the explicit recognition of racial disparities in mathematics education, or the fact that Black, Latina/o, and Native American students lagged behind White and Asian students on standardized tests and advanced mathematics course-taking (Oakes, Ormseth, Bell, & Camp, 1990; Reyes & Stanic, 1988). Such gaps were viewed as evidence of a need for change in the field. Thus, not only did the Standards present a radically new vision of what it meant to do, learn, and teach mathematics, but they also were significant in that they tied the reform movement directly to the goals of racial equity and social justice.

In the decades since the inception of that reform movement, conversations around equity have become virtually inseparable from discussions about racial achievement gaps. Bolstered by data from national and international studies such as NAEP and TIMMS, much has been written about the continued persistence of such gaps in spite of well-intentioned efforts at reform (Riegle-Crumb, 2006; Schoenfeld, 2002; Secada, 1992; Tate, 1997). But while most would agree that achievement gap studies have been useful in calling attention to systemic inequities with respect to race, class, and gender (Lubienski, 2008), some researchers have criticized the focus on the achievement gap as excessive and grounded in narrow definitions of equity (R. Gutierrez, 2008; Martin, 2003). These scholars do not question whether the gaps exist. Rather, their concerns have to do with the question of utility: What is the incremental benefit to marginalized students of continuing to frame their education in terms of achievement gaps?

In challenging what she has labeled a "gap gazing fetish" in mathematics education, Gutierrez (2008) has specified several aspects of gap-focused research that render it problematic. First, Gutierrez argues that gap research privileges between-group comparisons at the expense of within-group variation. In other words, the "gap" is commonly framed as one between racial groups, which both obscures the diversity of mathematics experiences within a particular racial group, and also ignores the substantial overlap in performance across racial groups. A second issue Gutierrez problematizes is an assumption embedded in gap-focused research that implies the necessity of a comparison group—usually White learners—to analyze and understand the mathematics learning experiences of non-White students. In this sense, she claims that gap-focused research implicitly affirms Whiteness, an ideology that centers Whites as the standard that other racial groups should aspire toward (Frankenberg, 1997; Leonardo, 2002, 2009).

Gutierrez also points out that comparisons between racial groups tend to be highly purposeful and selective. For example, racial disparities almost always emphasize gaps between

White or Asian students and Black or Latina/o students, while gaps between White and Asian students are rarely scrutinized, except when they are mentioned in terms of international comparisons (R. Gutierrez, 2008; Martin, 2009). Lastly, by operationalizing race primarily as a demographic variable, Gutierrez contends that gap research tends to reduce the multiple identities students embody to static, one-dimensional constructs, and that gap perspectives ignore students' agency for defying adverse circumstances to secure and leverage learning opportunities.

Overall, Gutierrez's critique reveals the limitations of treating race as purely a demographic variable. Of course, that is not to say that gap-focused research can never be useful. Indeed, there are documented examples of researchers and practitioners using gap analyses to create programs that benefit historically marginalized learners in mathematics. Appalled by racial disparities in pass rates across the introductory calculus classes at the University of California at Berkeley, Treisman (1992) used ethnographic methods to study African American students' weekly study habits. They found that while these students worked just as hard as their peers, unlike their classmates African American students tended to work in isolation. These findings precipitated the creation of a successful program called the "Mathematics Workshop Program" (MWP), which was specially designed to increase instructional time and implement structures to encourage collaboration among historically marginalized freshmen of color taking introductory mathematics (Fullilove & Treisman, 1990).

And yet, while the work of Treisman and his colleagues is admirable, most gap-focused research does not become a platform for designing interventions. Rather, the analysis becomes an end unto itself. And in any case, by not conceptualizing race as a sociohistorical construction with very real (and historically oppressive) consequences for people of color (Omi & Winant, 1994), gap-focused research cannot shed light on the ways in which race and racism operate at the level of everyday lived experience. So while gap-based approaches are not necessarily obsolete (Lubienski, 2008), they can only scratch the surface in understanding the racialized quality of the mathematics learning process (Martin, 2006).

Valuing cultural practices and non-dominant epistemologies

Gap-focused studies illustrate one way in which race has been operationalized in the mathematics education literature. And in a sense, they represent the predominant way in which historically marginalized students of color more broadly have entered the mathematics education discourse. Another body of literature that has addressed these students is research on the relationship between culture and mathematics learning (T. Carraher, D. Carraher, & Schliemann, 1985; Civil, 2002; Cole, Gay, Glick, & Sharp, 1971; Lave, 1988; Nasir, Hand, & Taylor, 2008; Saxe, 1988, 1999, 2012).

Although they are often conflated, studying "culture" is not the same as studying "race," even if the research involves students of color. Whereas "culture" refers to the material and non-material artifacts that organize human activity (Cole, 1996), "race" refers to a fluid framework for organizing human beings based on phenotype—usually skin color—that was invented and is continually deployed for the purpose of systematically advantaging some groups of people over others (cf. Omi & Winant, 1994). As will be shown throughout this dissertation, race and culture frequently become intertwined. However, this does not mean that one is a synonym for the other. Still, as I will discuss, to the extent that research on culture in mathematics education emphasizes the productive cognitive resources and epistemologies that students of color bring with them to the classroom, it can be understood as an anti-racist project aimed at countering deficit

discourses that position certain racial minorities as mathematically inferior (de Abreu, 1995; Powell, 2002).

Situated theories of cognition have been pivotal in shifting conceptualizations of learning from purely an individual, mental phenomenon to a set of processes rooted in the everyday practices of the social world (Lave & Wenger, 1991; Rogoff, 1990, 2003), specifically in the context of "communities of practice" (Wenger, 1998). Further, sociocultural perspectives on learning, which emphasize the role of tools and signs in mediating human thought and activity, have been central to studying how individuals construct knowledge through engagement in social practices (Vygotsky, 1978; Wertsch, 1991, 1998). In mathematics, the coupling of these theoretical perspectives sparked decades of research on the cognitive underpinnings of a variety of out-of-school, everyday practices involving mathematical problem solving, such as candy selling (Saxe, 1988) and farming (de Abreu, 1995).

In her work with African American children, Nasir (2002) studied the mathematical problem solving involved in the playing of dominoes and basketball. Not only did the research show that the children in her study were carrying out complex acts of mathematical problem solving, but Nasir also found that when mathematical tasks were framed in the context of calculating basketball statistics, students performed better than when the same mathematical content was situated within standard textbook problems. Paralleling Nasir's study, Taylor's (2009) examination of the purchasing practices of African American boys and girls in a low-income neighborhood demonstrated that, again, children employ and juggle a variety of mathematical strategies in the process of accomplishing tasks in everyday life.

Scholarship in this area has also pursued the goal of utilizing children's native problem solving strategies in the design of curriculum and pedagogy that better leverages their prior knowledge. For example, Civil (2002) developed an elementary mathematics curriculum around the mathematics of gardening, a practice that was identified through ethnographic research conducted by teachers on their Latina/o students' home lives. The garden, then, provided students a familiar context for problem solving, and also leveraged the expertise of parents and fellow community members. Civil's work is part of a larger body of work predicated on the idea of "funds of knowledge," which refers to the wealth of mathematical knowledge embedded in students' out-of-school cultural practices that can provide a foundation for mathematics education in more formal settings (Civil & Andrade, 2002; González, Andrade, Civil, & Moll, 2001). Overall, the "funds of knowledge" approach seeks to valorize the kinds of knowledge that historically marginalized learners rarely have the opportunity to display in school.

Research on students' out-of-school practices represents one effort to counter prevailing deficit thinking about students of color as inherently lacking the capacity to succeed in mathematics, but it is not the only one. Grounded in psychological research that posits fundamental cognitive, interactional, and epistemological differences between racial groups (e.g., Hale-Benson, 1996; Shade, 1992; Willis, 1992), a second line of research has investigated how cultural orientations shape students' mathematical problem solving (Malloy & Jones, 1998; Stiff & Harvey, 1988). In particular, researchers have focused on differences in the "learning styles" preferred by Blacks or African Americans compared with Whites or European Americans.[1] The following excerpt from Stiff and Harvey (1988) captures the thrust of this work:

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[1] These terms tend to be used interchangeably in this literature.

[2] Instead of "stereotype," which implies an individual, cognitive phenomenon (i.e., a mental representation or

Black students are characterized as "field-dependent" learners. They view the world as a unified environment with inherent order for which relationships are the focus. Blacks are more likely to approach problems holistically, to defer analytical investigations, and to limit syntactical representations of the world. Instead, Blacks prefer to use descriptive modes and views the world in relative terms (in context). Benefit to the group is valued and, consequently, cooperation among all parties is acceptable and desirable behavior. (p. 197)

The characterization of Black learners as "field-dependent" and "holistic" problem solvers is juxtaposed with "field-independent" Whites that "…value analytical thinking and systematic approaches to problematic situations" (Stiff & Harvey, 1988, p. 196). Other scholars (e.g., Malloy & Jones, 1998) have attempted to substantiate this theoretical claim through empirical studies involving clinical interviews, which they argue reveal clear differences in mathematical thinking across racial lines.

In contrast with research on students' out-of-school mathematical practices, the literature on "cultural learning styles" is an example of research in mathematics education that focuses on culture but addresses race head-on. However, this kind of scholarship can be problematic because of its tendency to essentialize and overgeneralize (K. D. Gutierrez & Rogoff, 2003). Forging causal links between cognitive functioning and racial background implies that how people think and interact is a deterministic byproduct of their racial affiliation, rather than an effect of cultural and historical processes. Further, claiming that Black learners are "holistic" thinkers and White learners are "analytical" thinkers implies that all (or even most) members of a particular group think and act in the same way. Not only does this kind of assertion homogenize racial groups in ways that masks within-group variation, but it also assumes that cleanly demarcating racial groups is even possible. In not troubling the idea of "race" itself, the "cultural learning styles" literature, then, does not differ substantially from the aforementioned gap-focused studies that understand race as a set of fixed categories into which people are born.

Research on students' out-of-school mathematical practices have by and large avoided the knotty conclusions of the cultural styles research. Despite sometimes investigating practices commonly associated with particular racial groups (e.g., African American children playing dominoes or basketball), scholars in this area have not argued that racial affiliation determines the ways in which people engage on a cognitive level with certain cultural practices. From their perspective, any correlations are coincidental by-products of histories of participation in particular cultural practices (K. D. Gutierrez & Rogoff, 2003).

Still, the research on "cultural learning styles" should not be dismissed outright; it is, in fact, well-intentioned scholarship. At a time when culture and cognition were seen as largely unrelated, the cultural styles literature offered a response to deficit models that devalued non-normative cultural differences (see also Ginsburg & Russell, 1981). Thus, both literatures can be said to share an interest in recasting students of color as intellectually sophisticated and cognitively capable. In fact, the basic methodological move of studying the lives of children typically left out of academic spaces sends the message that these students' prior knowledge "counts."

A third body of work that shares this aim is research on "ethnomathematics," which engages the notion of culture in a more overtly political way (see Barton, 1996 or Presmeg, 2007 for full reviews of this literature). According to D'Ambrosio (2001), one of the progenitors of this area of scholarship, ethnomathematics is most centrally concerned with "the recuperation of

the cultural dignity of human beings" (p. 9). From his perspective, the "cultural dignity" of a people is fundamentally associated with perceptions of their cognitive status, and because mathematics serves as a marker of cognitive status, questions of whose mathematics "counts" become especially relevant.

Central to ethnomathematics is the goal of displacing the commonplace view of mathematics as "culture-free" (Bishop, 1988; de Abreu & Cline, 2003), thereby opening the possibility of reframing the mathematics learning experiences of students of color. Bringing culture into the mathematics education discussion can be interpreted as a critique of what some have called "epistemological ethnocentrism," or an over-privileging of "Western" ways of knowing and a belief in Europe as the historical origin of all scientific knowledge (Mudimbe, 1988). Echoing this view, Powell (2002) has noted that ethnomathematics "departs from a binary mode of thought and a universal conception of mathematical knowledge that privileges European, male, heterosexual, racist, and capitalistic interests and values" (p. 3).

One way in which ethnomathematics scholars have sought to de-center Western mathematics is by calling attention to the mathematical traditions of non-Western cultures (Presmeg, 2007). From Selin's (2000) edited volume, which documents the global roots of mathematics across a diverse array of cultures and geographies, to Joseph's (2000) controversial book, The Crest of the Peacock, the telling of non-Western mathematical histories has sought to reclaim cognitive status for colonized and marginalized cultures. The charge of "epistemological ethnocentrism" in mathematics education has also inspired some to question whether it is even possible for non-European children to excel in a traditional, Western mathematics classroom (Corey & Bower, 2005). Drawing on the Afrocentric philosophy of Carter G. Woodson, Tate (1995) has called for culturally relevant mathematics curricula that address the specific needs of African American children, which in his estimation would involve more open-ended problems related to pressing social issues in the real world.

To summarize, several lines of research in mathematics education have problematized the relationship between "culture" and mathematics learning. Compared with gap-oriented research, they represent a shift toward examining the actual learning experiences of students of color engaged in mathematical problem solving. And through their commitment to countering deficit discourses, these bodies of literature have been instrumental in reconceptualizing what it means to be a student of color learning school mathematics.

However, in spite of this, they do not generally explore issues of race and racial identity. Discussions of race that do take place are not informed by a theory of race or how it operates. "Race" in the context of this research is subsumed by "culture." Again, this is partially a function of historical context, since much of this research was being conducted when even culture was just becoming normalized in mainstream academic discourse. In light of this, it is unsurprising that a more controversial topic like race was not yet the subject of research.

African American learners' experiences in mathematics
Thus far, I have argued that race in mathematics education research has either been conceptualized as a demographic variable or considered through the lens of cultural differences. A third strand of research, which focuses on African American mathematics learners, has investigated the intersection between one's racial identity and one's identity and experiences as a mathematics learner (Berry, 2005; Martin, 2000, 2006; Moody, 2004; Stinson, 2008). That is, how does simply being African American—while situated in a historically racist context (i.e., the schools and the United States)—affect one's opportunities to learn mathematics?

Some of the earliest work in this area was Danny Martin's (2000) research, which in terms of theoretical perspective and modes of analysis departed from the extant mathematics education literature in several significant ways. The primary theoretical construct in Martin's study was the notion of "mathematics identity," which "allowed consideration of the participants' definitions of what it means to be African-American in the context of mathematics learning" (p. 20). In framing his work around questions of identity, Martin argued that it was imperative to situate African American students' mathematics learning experiences within the appropriate layers of context. For Martin this meant analysis of the individual learner, school-level factors, perspectives of parents and other community members, and sociohistorical factors that include "the historically based discriminatory policies and practices that have prevented African Americans from becoming equal participants in mathematics and other areas in society" (Martin, 2000, p. 29).

One part of Martin's study consisted of interviews where he asked African American parents to reflect on their personal experiences learning mathematics as children. These were adults who had decided to reinvest in their mathematics education later in life by enrolling at a community college in Northern California. Using his multi-level contextual framework to interpret his interview data, Martin found that participants could not separate their mathematics learning experiences from their racial identities as African Americans. Many parents recalled specific moments in their mathematics education histories and interpreted them through a racial lens. Consider the case of Amber, a thirty-two year old African American mother who spoke of being tracked out of the most advanced mathematics courses at her high school:

> Now in private school I already had Algebra I. I should be going onto Trig, and then Algebra II and Statistics, leaving out of there. They told me that trig was full, Algebra II was filled and Statistics was filled. All the kids, the people that was in there was Asian and White. So they gave us 2 PE (Physical Education) classes. Why the hell you need 2 PE? I had 2 PE, a dance and an insurance class. That was most of my day. And all the people who were in insurance were Black and Hispanics. Why do I need insurance?…But I didn't plan on being a small business person in that kind of business. It was orientated for someone who was in small business. Everybody else who wanted to be doctors and lawyers who were the Asians and Whites, got all the science classes, all the Algebra, Algebra II, Statistics, Trigonometry. (Martin, 2006, p. 215)

According to Martin, anecdotes such as this provide insight into how some African American parents socialize their children into school and pass on particular beliefs about the instrumental value of mathematics, as well as perceptions of the racialized institutional barriers involved with learning mathematics in the United States. And although race-based tracking has been thoroughly documented in the literature (Oakes et al., 1990), what is important here is that evidence of the phenomenon is substantiated by the voices of those that experience it firsthand. In this way, Martin's work illustrates the importance of connecting an individual student's identity to the broader forces at play within a school, between students and parents, and in society over time (Cobb, Gresalfi, & Hodge, 2009).

Martin's research has since inspired a host of interview studies of African American mathematics learners. Moody (2004) produced case studies based on interviews with two African American women completing mathematics-related degrees. Moody's findings corroborate the

work of her colleagues in that her participants' mathematics identities were also closely intertwined with their racial identities. One of the women she interviewed remembered feeling victimized by racism from her algebra teacher, an experience that caused her to count learning algebra as "one of the many [racialized] battles I would fight in my life" (p. 140). The other woman in Moody's study also reported dealing with racism in her mathematics education, but she described feeling well-equipped to manage it because of the way her mother, who had a Masters degree in mathematics, socialized her to think about learning mathematics.

Similarly, in his case studies of two successful African American middle school boys, Berry (2005) found evidence of students reporting racism in the context of tracking in their algebra classes. Using critical race theory (CRT), a branch of critical studies that views race and racism as permanent fixtures in the organizing structures of society (Bell, 1992), Berry argued that the local racism experienced by the boys he interviewed was an instance of broader structural racism that remains pervasive in the United States. Other scholars in this area have leveraged CRT in a similar way (e.g., Martin, 2006; Stinson, 2008).

In fact, the literature on African Americans in mathematics education aligns well with CRT also in that it privileges the experiential knowledge of marginalized people of color. Critical race theorists argue that those in the best position to articulate the material consequences of racial oppression are those that experience it on a daily basis (Ladson-Billings, 1998). This tenet has influenced how critical race theorists choose to present their data and findings. One of the most prevalent forms of presenting data in CRT is the "counterstory," which Yosso (2006) describes in the following way:

> Likewise, counterstories do not focus on trying to convince people that racism exists. Instead, counterstories seek to document the persistence of racism from the perspectives of those injured and victimized by its legacy. Furthermore, counterstories bring attention to those who courageously resist racism and struggle toward a more socially and racially just society. So while counterstories challenge mainstream society's denial of the ongoing significance of race and racism, they do so by offering a critical reflection on the lived experiences and histories of People of Color. In its multiple forms, counterstorytelling can strengthen traditions of social, political, and cultural survival and resistance. (p. 10)

Although not every researcher investigating the mathematics learning experiences of African American students has explicitly cited CRT in their work, the ways in which these scholars have chosen to present their data is consistent with the counterstory methodology. Indeed, the use of interviews has been particularly effective in shedding light on this type of experiential knowledge.

A final point worth noting about this body of research is that nearly all of the studies belong to what has been called the "discourse of achievement" (Stinson, 2006). Unlike gap studies that usually highlight the academic failures of African American students, research in this category has intentionally given voice to African American students who have achieved success in mathematics. The choice to focus on successful students represents a deliberate rebuttal to portrayals of African American students as failures and as lacking in agency. In that sense, this literature continues the anti-deficit project of the aforementioned research on students' cultural-mathematical practices.

Overall, research on African American mathematics learners has moved the field forward in a number of ways. First, it has highlighted the importance of racial identity in shaping students' perceptions of their capacity to succeed in mathematics, as well as the goals that fuel their desire to persist in learning mathematics. In bringing issues of race more directly into conceptualizations of learning, this body of work has broadened our understanding of how students' multiple, intersecting identities relate to their participation in mathematics education. Second, consistent with a core theme in the ethnomathematics movement, this research has put a spotlight on both race and racism, which the African American participants in these studies usually experienced through discriminatory tracking practices. In effect, this finding represents a qualitative complement to studies that have documented inequities in course taking using quantitative methods (Oakes, 2005). Finally, from a methodological standpoint, this literature has demonstrated the power of interviews to illuminate people's histories of lived experiences learning math.

And yet, these advances notwithstanding, I argue that this literature does not quite qualify as a racial analysis. By this I mean that—although they overlap—there is a difference between research on the experiences of people of color and research on race. Researchers in this tradition sought to better understand the mathematics learning experiences of a particular racial group (i.e., African Americans), and in the context of that investigation, issues of race and racism emerged through data analysis as key themes. However, studying race itself was not the original intent of this research (see Martin, 2000). As a result, perhaps, few studies in this area theorize "race" as a theoretical construct in its own right.

It is true that many scholars in this area have used critical race theory. But while CRT may be useful as a theoretical backdrop for understanding how and why racism permeates the U.S. context, it does not, by itself, facilitate an unpacking of "race" itself. An analysis of race would involve questions of the following type: Why are the racial categories we have in the U.S. those categories and not others? How and for what purpose have those categories evolved over time? How is race constructed and reproduced in everyday interaction, and by what means is it deployed to constitute individuals as racialized subjects? There are theories that engage such questions (e.g., Goldberg's (1993) treatment of racial discourse; Omi & Winant's (1994) theory of racial formation), but they have not been the focus in much of the literature on African American mathematics learners. In the next section, I review scholarship in mathematics education that signals movement in this direction.

Centering race

Race-focused research in mathematics education remains rare, but there are a few examples that center race itself as a unit of analysis. One approach has been to critically analyze the racialized discourses used to talk about students of color in mathematics. In their analyses of mathematics education policy documents (e.g., NCTM's Principles and Standards) and of teachers' reflections on their students of color, Martin (2003) and Spencer (2009), respectively, both found a discomfort with talking about race. Instead, they found a preference for the language of color-blindness, a way of seeing the world that minimizes the significance of racism while assuming a meritocratic society (Bonilla-Silva, 2003). In a critique of policy rhetoric, Martin (2003) has argued that the phrase, "for all," becomes a color-blind proxy for talking about racism and historically marginalized racial groups, and teachers might employ color-blind ideology so as to avoid "seeing" race in their classrooms altogether (Reed & Oppong, 2005; J. A. Spencer, 2009).

Of course, as I elaborate in the next chapter, discourses are about more than language. Discourses also depend on the societal narratives that shape human thought and activity. In the case of racial discourse, narratives can be thought of as widely held beliefs about the intrinsic traits and practices of a particular group. For example, race scholars in and out of mathematics education have noted a variety of racial narratives that position Black people and Black learners as "academically unpromising," "unmotivated," "prone to criminality," and "intellectually inferior" (Ferguson, 2000; Nasir & Shah, 2011; Stinson, 2008; Wortham, 2006). Not only do such narratives circulate throughout U.S. society, but by extension they also permeate schools and can become salient in the learning process (Nasir, Snyder, Shah, & ross, 2012).

Psychological research on "stereotype threat" is one body of work that illustrates how racial narratives can affect learning. It has been shown that under certain conditions, making participants aware—either explicitly or implicitly—of prevailing racial narratives[2] that position them as less competent can depress test performance across a variety of domains (Steele, 1997; Steele & Aronson, 1995; S. J. Spencer, Steele, & Quinn, 1999). These findings are striking because the participants exhibiting reduced performance are pre-selected to be high performers and tend to be "domain-identified." This suggests that the stereotype threat effect is not the result of a latent self-doubt suddenly triggered by the activation of the negative narrative. Rather, Steele (1997) and others argue that stereotype threat induces anxiety[3] that stems from the fear of being seen as confirming the societal narrative about their group.

Nearly all of the stereotype threat research examining mathematical performance focuses on gender narratives. However, in a study of the impact of racial narratives about mathematical ability, Aronson and his colleagues (1999) found that when White males were told in advance that Asian students score higher on standardized tests than White students, their performance suffered. One reason this finding is important is that it speaks to the cultural significance of the "Asians are good at math" narrative in the U.S. context. And yet, little is known outside the controlled, experimental setting about how this narrative might contribute to the racialization of the learning process in mathematics.

What is also interesting about this particular study is that White males are not a negatively stereotyped in mathematics. If being compared to Asians adversely affected their performance, what impact might the "Asians are good at math" narrative have on learners from historically marginalized racial backgrounds for whom pejorative narratives do exist? Recalling the anecdote at the start of this chapter, what role did it play in the interaction between Derrick and his fellow African American classmate? What might be learned from an empirical study of how racial-mathematical narratives operate in the unstructured realm of everyday classroom interactions?

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[2] Instead of "stereotype," which implies an individual, cognitive phenomenon (i.e., a mental representation or schema), in my research I prefer the term "narrative" for two reasons. First, "narrative" alludes to the storytelling dimension of societal beliefs, which implies that, rather than being the property of an individual, narratives are fundamentally about social interaction. This conceptualization is more in line with the dynamic quality of racial discourse. Second, "narrative" connotes a historical weight that honors how societal beliefs only become robust and widespread after a long process of social construction and modification.

[3] Recent research in neuroscience has sought to identify the underlying mechanisms by which stereotype threat-induced anxiety affects access to cognitive resources, such as working memory (see Krendl, Richeson, Kelley, & Heatherton, 2008).

Situating the Dissertation

To summarize, mathematics education research has conceptualized race in three ways: in terms of performance and opportunity-to-learn gaps; in terms of differences in cultural-mathematical practices; and in terms of identity. In doing so, the literature has illuminated some of the ways in which racism can produce inequities, which affect students' sense of themselves as capable doers of mathematics. Overall, the existing research corpus underscores how critical it is to never separate the learning process from a student's lived experiences as a racialized subject in the United States, a historically racialized context.

In spite of this progress, though, questions remain regarding the relationship between race and mathematics and its implications for learning. This dissertation builds on and extends the literature in three ways. First, considerable attention has been paid thus far to structural levers like tracking that tend to perpetuate racial disparities. However, less is known about the racial dynamics of everyday social activity in math classrooms. At a basic level, this was a primary motivation of the dissertation: to understand how and why race becomes embedded in the fabric of the learning process in mathematics.

The pivot to analyzing race at the level of social interaction also requires methodological approaches suited for such a study. So whereas prior research has relied primarily on interviews, here I also employ participant observation to capture race in "real-time." This component of the data collection was inspired by an approach used by Nasir and her colleagues (2009), who used observation to document explicitly and implicitly racialized moments between students in regular classroom activity. I elaborate on the affordances and challenges of their approach in Chapter 3.

Second, from a theoretical standpoint, rather than treating race as a set of fixed, natural categories or even mainly as an "identity," I conceptualize race as a discourse. The discursive lens is appropriate and useful for a study of how race operates in everyday activity because it privileges the construction of racial meanings through the deployment of language, symbols, and social practices (Goldberg, 1993). Further, the focus on racial discourse opens a key unit of analysis: racial narratives. Prior research has shown that racial narratives figure prominently in people's sense making about racialized phenomena, such as the causal factors behind racial performance gaps (Shah, 2009). This is also important for a study of race specifically in mathematics, since as was mentioned previously, mathematics is one of the few academic subjects for which an explicit racial narrative exists: "Asians are good at math."

Third, rather than concentrating on the experiences of a particular racial group, this dissertation employs a broader lens. Besides African Americans, little is known thus far about how mathematics learning becomes racialized for students of other racial backgrounds. Further, as I argue throughout this dissertation, analyzing race from the standpoint of a single group obscures the relational nature of racial discourse. That is, a racial analysis must account for the ways in which race functions to create hierarchies—to position groups in relation to each other (Bonilla-Silva, 2003). Another way of thinking about this is to realize that, for example, as a racial category "White" becomes meaningful only because there are "Blacks" and "Asians" (and vice versa). In the case of mathematics education, Martin (2009) has proposed the existence of a taken-for-granted "racial hierarchy of mathematical ability," where some racial groups are assumed to hold greater mathematical talent than other groups. This study represents an effort to understand how racial-mathematical discourse constructs and underwrites that hierarchy.

From behaviorism to cognitive science to situated and sociocultural theory, our understanding of the learning process has evolved and expanded over time. This study

contributes to that conversation by shedding light on the racialized quality of learning. It is my hope that this dissertation research will inform the design of learning environments that disrupt racially inequitable discourses and safeguard all students' opportunities to learn.

Chapter 2: Theorizing the Convergence of Racial-Mathematical Discourse

"The sum of the square roots of any two sides of an isosceles triangle is equal to the root of the remaining side. Oh joy! Rapture! I got a brain!"

—*Scarecrow,* <u>The Wizard of Oz</u> (1939)

The Negroes of Africa have by nature no feeling that rises above the trifling. Mr. Hume challenges anyone to cite a single example in which a Negro has shown talents, and asserts that among the hundreds of thousands of blacks who are transported elsewhere from their countries, although many of them have even been set free, still not a single one was ever found who presented anything great in art or science or any other praiseworthy quality, even though among whites some continually rise aloft from the lowest rabble, and through superior gifts earn respect in the world. So fundamental is the difference between these two races of man, and it appears to be as great in regard to mental capacities as in colour.

—*Immanuel Kant, <u>Observations on the Feeling of the Beautiful and the Sublime</u> (1764*)

At first glance, mathematics and race seem strange bedfellows. Indeed, a supposedly neutral, "culture-free" body of knowledge, and a centuries-old social construct deployed for the purpose of segregation and oppression, would appear to have little to do with each other. And yet, mathematics is one of the few academic subjects in the United States for which a narrative exists explicitly linking race to disciplinary aptitude (i.e., "Asians are good at math"). So to borrow from Gloria Ladson-Billings (1998), I ask: What's race doing in a nice field like mathematics education? The purpose of this chapter is to explore the conceptual underpinnings of racial-mathematical discourse, thereby laying the groundwork for the empirical inquiry to come.

I begin by briefly describing the methods used in this theoretical chapter, which involve conceptualizing mathematics learning and race as discourses. This approach, which is consistent with the methodological principles outlined in the work of Michel Foucault, is useful because it provides a way of unpacking the economy of terms, practices, and beliefs that come to be associated with a given topic. In other words, discourse analysis illuminates what we talk about when we talk about something like "race" or "mathematics learning." Of course, as I explain, the meanings a society constructs around a particular idea are both multiple and context-dependent. What is meant by "race" has changed over time and varies by geography; what is meant by "learning mathematics" does not mean the same thing to everyone. Thus, for the purpose of this discussion I focus primarily on dominant discourses of mathematics learning and race situated in the contemporary United States context.

After discussing the methodological approach, the rest of the chapter proceeds as follows. First, I analyze the dominant discourse of mathematics learning. I argue that, for a variety of reasons, mathematics has accrued the reputation of a "high-status knowledge" accessible only to an elite few born with the intellect to grasp the subject (Ernest, 1991). Next, I analyze the dominant discourse of race, which has functioned to construct hierarchies that order groups of

human beings according to perceived differences on a variety of supposedly innate characteristics, including intellectual capacity (Goldberg, 1993; Mills, 1997).

Core to my argument is the idea that both discourses share three foundational concepts: hierarchy, intelligence, and innateness. In my view, these concepts constitute a nexus between the dominant discourses of mathematics learning and race that begins to shed light on their convergence in a racial-mathematical discourse. Thus, in spite of superficial differences, it may be that these "strange bedfellows" are actually quite compatible. The theoretical work in this chapter is an important first step toward my larger project. For as will become clear in subsequent empirical chapters, students themselves take hierarchy, intelligence, and innateness as central to their experiences in perceiving mathematics learning as a racialized endeavor.

Methodological Notes on Discourse Analysis

The notion of "discourse" has been conceptualized in a variety of ways across academic fields, and this diversity, in turn, has engendered multiple forms of "discourse analysis." Some define discourse in terms of written and oral language, which manifest in the form of "texts" like written manuscripts and speech acts (Fairclough, 2003; van Dijk, 1988). Textual analysis comprises a significant strand of research in linguistics, where researchers have, for example, parsed discourses of climate change by analyzing language on the topic used in speeches and letters written by Czech president Václav Klaus (see Reisigl & Wodak, 2009). Linguists have also employed computer software to explore statistical patterns in the frequency of certain words or word combinations in everyday texts, such as occurrences of "elderly" and "unemployed" in a 60-million word collection of newspaper articles (Mautner, 2007, 2009). In general, this type of discourse analysis examines language use at the level of grammar and syntax in order to uncover latent meanings in text.

Beyond oral and written texts, scholars have also theorized "discourse" in ways that transcend language to include a broader range of semiotic systems, such as social practices and physical artifacts (Foucault, 1975; Gee, 2011; Jäger & Maier, 2009; Weedon, 1997). Although these modes of discourse do not constitute language in the traditional sense, they function in a "language-like" way that allows them to be analyzed as "texts." In his seminal analysis of the French prison system, Foucault (1975) focused on the ways in which institutional practices (e.g., solitary confinement) and material objects (e.g., the architectural layout of the prison itself) reflected and reified discourses of criminality, punishment, and rehabilitation. In doing so, Foucault developed a methodological approach that blurred the line between traditional texts and non-linguistic artifacts in discourse analysis.[4]

Apart from the idea that discursive elements can assume a variety of forms, a key point is that discourses represent what is generally accepted as "true" about a given topic. Another way of saying this is that a discourse produces knowledge (i.e., a system of meanings) about a thing, and that this knowledge is then taken up as self-evident or "common sense" (Jäger & Maier, 2009; Weedon, 1997). But by staking a claim to "truth," a discourse centers itself while marginalizing other discourses: if one discourse is "true," then others must be less true or altogether false. It is in this sense that Foucault (1980) and others argue that discourses exercise power, because they normalize certain ways of thinking and acting while regulating what is considered valid and invalid.

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[4] There is much more to say about "discourse" than I say here. An extended discussion of how discourses can be multi-modal, as well as how individuals come to be constituted as "subjects" through discourse, is left to Chapter 7 where I theorize the impact of racial-mathematical discourse on student identity formation.

Take the example of discourses of patriotism. In the United States, "patriotism" is often signified by particular practices, such as: serving in the military, unconditional support of national policy, wearing a flag pin, and proclaiming phrases like "the United States is the greatest nation on Earth." But one can imagine an entirely different discourse of patriotism that defines a "patriot" as someone who vocalizes dissent, engages in non-violent protest at home, and serves in local government. Both discourses involve distinct sets of terminology, material objects, practices, and beliefs. And within a broader discursive field, these discourses co-exist as "…competing ways of giving meaning to the world and of organizing social institutions and processes" (Weedon, 1997, p. 34). One component of Foucauldian discourse analysis involves identifying these various discursive elements (i.e., the content of discourse), and mapping the economy of meanings that arise from the relationships between those elements (i.e., the structure of discourse).

It is also noteworthy that certain statements considered legitimate in one discourse might be deemed impermissible in another. Consider the case of Daniel Ellsberg, the government analyst who released the top-secret Pentagon Papers during the Vietnam War. The latter of the two discourses described in the previous example would likely consider him a "hero" or a "patriot," but such a label for Ellsberg would likely be unacceptable in the first discourse. How do discourses set the boundaries[5] that distinguish "true" from "false"? By what mechanism does a discourse determine what is "in" and what is "out"?

Discourse theorists posit that every discourse is predicated on a foundational array of themes or concepts[6] that makes possible the enunciation of the expressions in that discourse (Foucault 1972; Hall, 1996). To clarify the point, imagine a discourse as a tree. If the branches and leaves of the tree represent all of the discourse's various elements: vocabulary, institutional practices, physical artifacts, and so on, the soil from which the tree originally emerged would represent the discourse's foundational concepts. Further, it follows that new expressions would gain traction only if the soil's particular composition provided the conditions for them to flower.

Returning to the previous example, let us suppose that the concept of "blind loyalty" was foundational to the first discourse of patriotism. If so, this would explain why the statement, "Daniel Ellsberg is a patriot" would never be considered valid within that knowledge system, since the release of the Pentagon Papers would be interpreted as a breach of confidentiality. In other words, that discourse's soil would never permit the formation of that particular expression within that discourse. Thus, in order to understand why the content of a discourse is the way it is, one must unpack the foundational concepts on which the discourse was constructed. In his early work Foucault (1972) referred to this method as archaeology, and this is the method I employ in this chapter.

To summarize, then, the "archaeological" approach is a conceptual examination that involves detailing the content and structure of a discourse, as well as identifying its generative foundational concepts. Using this approach, I begin by analyzing the dominant discourse of mathematics learning in the United States.

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[5] That is not to suggest, of course, that discursive boundaries are somehow "real" or clearly defined. As Reisigl and Wodak (2009) note, those borders are artificially imposed for the purpose of analysis.
[6] This idea has been given many names in the literature, including "rules of formation" (Foucault, 1972), "discursive formation" (Hall, 1996), and "preconceptual primitives" (Goldberg, 1993).

Mathematics Learning as Discourse

What it means to do and learn mathematics is not given. Rather, like any discourse, the meanings we associate with mathematics learning are socially constructed; they are effects of political struggles and cultural practices like schooling. For decades, mathematics education in the United States has been governed by two competing versions of mathematics teaching and learning: "traditional" and "reform" (cf. Boaler, 2008; Schoenfeld, 2004).

As with most labels that purport to describe entire fields or movements, what these terms are invoked to signify are often monolithic caricatures of actual mathematics instruction. In reality, although they may lean in one direction or the other, most math classrooms fall somewhere in between. Still, the distinction between "traditional" and reform" is useful because they represent discourses of mathematics learning that are pervasive in the field, even if they are gross oversimplifications. Both perspectives embody particular definitions of mathematics learning, which are informed by certain pedagogical practices, beliefs about student capabilities, theories of how people learn, and epistemologies of mathematics.

"Traditional" instruction typically conjures the image of a teacher standing at the front of the room lecturing while students sit in rows and jot notes in silence. Classroom interactions tend to be limited to the occasional initiate-response-evaluate (IRE) sequence, where teachers ask for one-word answers and students provide them. At the end of the lecture, students may be given a worksheet of problems isomorphic to those demonstrated by the teacher. After a few weeks of this routine students may be asked to show what they have learned on a summative exam, after which they move on to the next topic in their textbooks and repeat the process.

Alternatively, "reform" instruction is typically perceived to involve students working in groups on complex, open-ended tasks that may have multiple solutions. Some of these tasks may require students to apply their knowledge to fields outside mathematics, or to consider how mathematics can be used as a tool to analyze issues of social justice in their local communities. The teacher acts as a facilitator, supporting students in a sense making process that unfolds over time, where they are encouraged to formulate hypotheses, explicate their reasoning, and ask questions. In addition to written exams, students may also present their work in front of their class or create a portfolio of their work, which offer multiple ways in which students can display competence in mathematics.

Again, these characterizations are exaggerations. But of these contrasting discourses, most classrooms in the U.S. lean toward "traditional" pedagogy (Schoenfeld, 1988; Stigler & Hiebert, 1999), which therefore represents the dominant discourse of mathematics learning in the United States. In this section, I use discourse analysis to unpack this dominant conception of mathematics learning. The analysis will reveal three concepts foundational to this discourse: hierarchy, intelligence, and innateness. For the sake of clarity, I discuss each concept in a sequential fashion. However, given that they are closely interrelated, many of the examples I use to support my argument may reveal overlap between them.

Hierarchy in mathematics education

The notion of "hierarchy" manifests in mathematics education in several ways. On a basic level, hierarchy is embedded in the traditional mathematics course sequence. With its emphasis on mastery and prerequisite knowledge, the standard K-12 sequence reifies perceptions of mathematics as a linear, logically organized body of knowledge (Ruthven, 1987). A common belief among educators (and the public) is that mathematics learning must occur in a carefully structured progression: one cannot understand concept #7 without a complete mastery of

concepts #1 through #6. Or as some teachers are wont to say: "how can my kids learn algebra when they can't add fractions?" Learning and knowledge in other subjects, such as English or even science, are not understood in such hierarchical terms.

Similarly, hierarchies are reinforced and perpetuated in the way that schools are structured. For example, the existence of different tracks (e.g., "honors" vs. "regular," 9th grade Geometry vs. 9th grade Algebra 1) is normal in most K-12 schools in the U.S. (see Oakes, 2005). These tracks signify hierarchy on a structural level, and students are keenly aware that course enrollment becomes a status marker. Beyond institutional practices, Parks (2010) found that hierarchy is even reproduced in the everyday metaphors embedded in the language of mathematics education. For instance, the pre-service mathematics teachers in her study often used words like "behind," "advanced," and "gaps" to describe their students; Parks identified similar language in major policy documents.

Beyond the usual ways in which math is taught and its curriculum structured, there is also the question of who has had the opportunity to learn mathematics. Historically speaking, mathematics has functioned as a gatekeeper, and access to mathematics has been limited to elite segments of society (Schoenfeld, 2004; Stanic & Kilpatrick, 1992). For years, calculus was a subject taught exclusively at the college level, and efforts to make it available at the high school level are a relatively recent phenomenon. Deconstructing these hierarchies has continued with attempts to democratize access to algebra, as reformers attempt to make algebra available to more students and offer it earlier in the K-12 course sequence (Moses & Cobb, 2001).

The prestige that mathematics has accrued over time is also a function of its perceived role as a critical driver of the modern economy. Apple (2004) points out that schools and society treat technical disciplines like mathematics as forms of "high status knowledge," because they fuel economic prosperity in today's technology-oriented, information-based global marketplace.[7] Non-technical knowledges (e.g., art, music, social sciences) receive less attention because their contribution to GDP is less apparent. Further, Apple argues that like any commodity, the scarcity of STEM expertise in the United States only intensifies demand for it and elevates its status. From this perspective, then, the "high status" conferred on mathematics is partially a function of its perceived utility.

Of course, the irony about the utility of mathematics is that it cuts both ways. That is, students tend to view mathematics as the least useful of the subjects they learn in school. Whereas reading and writing are endemic parts of everyday life, most feel that they can get through the day just fine without having to factor a polynomial or solve for 'x.' Math teachers know that half of their job is preparing rich curricula and designing effective pedagogical structures, and the other half of their job is answering the question: "When are we ever going to use this?" The effect of this predicament is that even the lack of perceived utility facilitates an impression of mathematics as removed from the everyday, and therefore more the province of elite intellectuals.

In fact, this idea that mathematics is useless (i.e., cannot be applied) is not limited to schoolchildren. Mathematicians themselves have argued as much and even embraced it:

> I have never done anything 'useful'. No discovery of mine has made, or is likely to make, directly or indirectly, for good or ill, the least difference to the amenity of

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[7] Besides economics, national interest in STEM education has also risen during times of political unrest, such as the mid-20th century space race, which served as a proxy for the ideological conflict between the United States and Russia (see Schoenfeld, 2004).

the world. I have helped to train other mathematicians, but mathematicians of the same kind as myself, and their work has been, so far at any rate as I have helped them to it, as useless as my own. Judged by all practical standards, the value of my mathematical life is nil; and outside mathematics it is trivial anyhow. I have just one chance of escaping a verdict to have created something worth creating. And that I have created something is undeniable: the question is about its value. (Hardy, 1940, p. 90)

For the famous British mathematician, G.H. Hardy, doing mathematics for its own sake was a worthwhile enterprise. Rather than considering it an insult, he saw the charge of "uselessness" as a point of pride. For the average person, though, the more "useless" and "foreign" mathematics seems, the more it appears that "mathematics holds a privileged status in our society as an elite activity for the smartest of citizens. That assumption supports a view of math as out of the reach of the 'common' man and thus disconnected from and inaccessible through everyday experiences" (Nasir, Hand, & Taylor, 2008, p. 226). Such perceptions only exacerbate the theme of hierarchy as central to discourses of mathematics learning.

Mathematical performance and intelligence

Besides hierarchy, a second foundational concept that undergirds the dominant discourse of mathematics learning is "intelligence." Just as the Scarecrow in The Wizard of Oz rattles off a string of mathematical gibberish to verify the existence of his newly implanted brain, in the United States mathematical performance has come to signify intelligence: if you do well in math, it shows that you are "smart" overall (Martin, 2009; Nasir, Hand, & Taylor, 2008).

More than most subjects, mathematics is considered the realm of geniuses and prodigies. In a study of students' perceptions of mathematicians, Picker and Berry (2000) found that middle school students in the United States and Europe frequently cited Albert Einstein when asked to describe a mathematician, even though Einstein is never mentioned in the context of grade school mathematics. It may be that students associate mathematicians with high intellect, and they think of Einstein because, as a cultural icon, he embodies the pinnacle of human intelligence. Indeed, pop culture fosters this idea, when in films and on television natural geniuses assume the form of mathematicians.

In part, mathematics has earned this reputation based on people's perceptions of the discipline itself. Whereas the humanities are associated with free-floating creativity and exploration, mathematics is considered synonymous with dispassionate logic. Certainly, the term "genius" has been used in other fields (e.g., the artistic genius of Picasso, the literary genius of Shakespeare, and the athletic genius of Michael Jordan). The difference, though, is that these forms of genius are thought to spring from intuition rather than cognitive faculty. Alternatively, mathematics and the sciences are more closely associated with the mental variety of innate talent.

But even among the sciences, which are also considered logic-driven domains, mathematics stands out. For while the sciences focus on "real world" phenomena, "mathematical objects, starting with numbers, are not objects that can be directly perceived or observed with instruments" (Duval, 2006, p. 106). As a consequence, unlike chemistry, physics, or biology, mathematics is seen as a discipline of the mind—a pure, self-contained, internally consistent system in which everything was borne of the basic axioms and everything can be traced back to the basic axioms. As the only fundamental body of knowledge constructed by human beings that,

supposedly, exists independent from physical and cultural reality (Presmeg, 2007), mathematics represents a triumph of rationality, a monument to the power of human cognition and capacity for abstract thought.

Along these lines, its distance from the "real world" lends mathematics an aura of objectivity and authority. Because it supposedly transcends culture—after all, 2+2 = 4 as much in China as in Brazil—mathematics has a universal truth-value that most subjects are not permitted to claim. To the average person, the discipline has an air of certainty; math problems are thought to have one solution, and a proof is either right or wrong. Distinct from other fields, mathematics is considered a matter of fact, not opinion. There is also the matter of a "self-perpetuating linguistic barrier" (Boulding, 1955), in that because it runs on a unique, symbol-based grammar, mathematics can seem inaccessible. Strangely, the same thing that makes math a "universal" language also makes it a foreign language, or a code for which only a select few are able to learn the cipher.

This "absolutist" view of mathematics (Ernest, 1991) is reinforced by impressions of what it means to be a mathematician. The stereotypical image is that of a solitary genius— usually an old, White male—sitting in an empty room with only his mind and a piece of paper to keep him company. Day after day, year after year, the mathematician is lost in thought, until a sudden flash of intellectual insight produces a solution in a strictly deductive fashion. Whether this gels with how mathematicians actually solve problems is beside the point (see Lakatos, 1964 for a different perspective); what matters is mathematical practice is perceived to depend entirely on raw intelligence.

The conflation of mathematical performance and intellectual capacity is further perpetuated through certain classroom practices. For example, dominant mathematics pedagogy tends to perpetuate the idea that math problems have either right or wrong answers. Instead of problem solving and understanding, a premium is placed on speed and correctness (Boaler, 2008; Esmonde, 2009a; Horn, 2007; Schoenfeld, 1988). The "smart" kids are the ones that can execute calculations in their heads and do it quickly. Needing scratch paper is viewed as an admission that one lacks high mental capacity. Further, many in the United States view mathematics as the most challenging subject in school. In 1992, for example, the Mattel Corporation released a talking Barbie Doll programmed to repeat over two hundred phrases. Controversy ensued when it was discovered that among phrases like "I love shopping!" some of the Barbie Dolls were programmed to say, "Math class is tough!" To be among the select few to succeed in the "hardest" subject suggests a unique cognitive capacity that sets one apart from the masses.

Innateness and mathematical ability

In addition to hierarchy and intelligence, a third concept that underpins the dominant discourse of mathematics learning is the notion of "innateness." Ernest (1991) describes how these three foundational themes are closely intertwined:

> According to [the humanist] view, mathematical talent and genius are inherited, and mathematical ability can be identified with pure intelligence. There is a hierarchical distribution of mathematical ability, from the mathematical genius at the top, to the mathematically incapable, at the bottom. Teaching merely helps students to realize their inherited potential, and the 'mathematical mind' will shine through. (p. 178)

The "hierarchy of mathematical ability" described by Ernest (1991, p. 247) implies that innate mathematical potential is unequally distributed among students. Despite research that shows that all human beings share a capacity for learning mathematics, people continue to believe in the existence of a "math gene" that some have and others do not (Devlin, 2000). This belief is consequential because it implies a binary view of mathematical ability, in which a select few are born with mathematical aptitude while others are not.

Ironically, this belief runs contrary to the oft-voiced ethos in the United States that success depends solely on persistence and hard work. And yet, Stevenson and Stigler (1994) found that most children and parents in the United States believed that mathematics achievement depended mainly on a child's innate capacity for learning the subject. Japanese children and parents, in contrast, tended to espouse the view that success in mathematics is a function of effort. It is beyond the scope of this chapter to unpack the complex reasons for this cultural difference. Nevertheless, there is little reason to think that this investment in the notion of innate mathematical ability in the U.S. has changed over time.

Of course, innateness is not necessarily unique to mathematics. Just as some individuals are considered "math people," others are just as readily considered "English people." Although everyone is assumed to have the capacity to learn how to read, only true "English people" are considered capable of writing a compelling essay or composing an affecting poem. Similarly, the dichotomy between "book smarts" and "street smarts" is typically framed in genetic terms— some people are thought to naturally excel in school, while others were born with the gift of "common sense."

The point here, though, is not whether this foundational theme only applies to math. What matters is how innateness interacts with the previously mentioned generative concepts of hierarchy and intelligence. Hypothetically, one can imagine a world where although some people are thought to be smarter than other people (i.e., a hierarchy of intelligence), it is still possible for people to become smarter over time. In other words, a person's location on the intellectual hierarchy is not fixed. However, when innateness is added to this mix, what happens is that the possibility for intellectual growth (i.e., learning) becomes severely constrained or eliminated altogether. This is consequential for mathematics instruction, since if a person's mathematical destiny were more or less determined at birth, even the best instruction in the world would, presumably, only make a marginal impact. If that is the case, some might reason, why bother trying to teach certain students high-level mathematics when they are doomed from the start?

Summary

In this section I argued that the dominant discourse of mathematics learning in the United States is predicated on three foundational concepts: hierarchy, intelligence, and innateness. These concepts are reified and reproduced through a variety of discursive channels, including how mathematics is traditionally taught, the typical structure of the mathematics curriculum, and common perceptions of mathematics itself. The effect of this discourse has been to frame mathematics in the United States as the exclusive province of the intellectual elite born with the ability to understand the subject.

To reiterate, though, this is only one way of defining "mathematics learning." Even the most hegemonic of discourses within a discursive field leave gaps for alternate discourses to emerge. For example, the structural reform movements to bring calculus into the high schools and to promote "algebra for all" represented attempts to democratize access to mathematics. The NSF- and NCTM-supported curriculum reform movements of the 1990s represented attempts to

enrich opportunities to learn and make them more accessible on a cognitive and social level. Finally, reforms like "complex instruction" have sought to create teaching practices that deconstruct the intellectual cachet associated with mathematics, making "smartness" more widely available to all students (Boaler, 2008; Cohen & Lotan, 1995). Altogether, these reform efforts are built on a different set of practices, terminology, and beliefs about what it means to do mathematics, students' capabilities in math, and how people learn. In short, they constitute a competing discourse.

And yet, the type of mathematics instruction most students experience throughout their academic careers more closely aligns with the dominant discourse of mathematics learning. For that reason, I argue, hierarchy, intelligence, and innateness have become interwoven into the fabric of how most people in the U.S. understand what it means to do and learn mathematics. Next, I conduct a similar archaeological analysis of racial discourse.

Race as Discourse

What is "race" and why does it exist? What purpose do racial categories serve? Just as "mathematics learning" can be examined as a social construction, it is also possible to analyze race as a discourse in order to unpack the meanings it has become infused with, as well as to understand its functions. Overall, I argue that like mathematics learning, racial discourse is predicated on the same three foundational concepts: hierarchy, intelligence, and innateness.

Racial hierarchy

According to Goldberg (1993), a key element of racial discourse is the notion of classification, which he defines as "the scientific extension of the epistemological drive to place phenomena under categories" (p. 49). Classification produces racial categories by identifying patterns of traits across human populations. As Goldberg notes, there is nothing inherently discriminatory or oppressive about grouping people. One might argue that racial categories merely reflect behavioral and phenotypical trends in the world: some groups tend to do this, and some groups tend to do that; some people look like this, and other people look like that. By itself, classification can be seen as nothing more than a neutral method of describing difference.

But racial categories have never been neutral. The act of classification has always been coextensive with the acts of evaluation and judgment. The qualities used to identify differences and construct racial categories become imbued with value. It is not enough that some people talk one way and other people talk another way—it is that one way of talking is deemed better or more desirable than the other. In effect, classification becomes a way of ordering human beings, and racial categories become the building blocks of racial hierarchy (Goldberg, 1993).

Hierarchy is the beating heart of racial discourse. It is the foundational concept from which all racial discourses emerge, and it is their primary reason for existing. Historically, racial hierarchy has been predicated on the White-Other dialectic, in which Whites are considered normal and ascendant while non-Whites (i.e., "Others) are branded as deviant and inferior (Mills, 1997; Said, 1979). Akin to moons orbiting a planet or planets orbiting a common sun, hierarchies would fall apart without an anchor; in this arrangement Whites represent the gravitational center of racial hierarchy (Leonardo, 2009). The notion of relationality is critical because race would neither make sense nor "work" with only one racial group. Race depends on a dynamic of unequal status between multiple racial groups. And by pitting racial groups against each other, hierarchy opens the door for exclusion and even domination. In this sense, like gender and other social markers, race has often functioned as "…a way to naturalize arrangements of power in

order to depict them as unchangeable when, in fact, these arrangements of power are actually socially constructed and thus historically mutable" (Bederman, 1995, p. 246).

Of course, hierarchies do not exist in the abstract. Claims about the racial superiority or inferiority of a people are always based on a variety of specific qualities or practices, such as aesthetics or moral virtue. Given the previous discussion about the close link between mathematical ability and intelligence, in the next section I focus on racial hierarchies constructed around the perceived capacity for rational thought (Eze, 2001; Mills, 1997).

Race, intelligence, and personhood

The notion of "intelligence" has a long history in racial discourse. However, to appreciate the full significance of the race-intelligence connection, we must situate its history within the context of a fundamental philosophical question: What does it mean to be a human being? During the medieval period in Europe, human beings were classified into two groups: "barbarians" and "civilized" peoples. The criteria used to draw this distinction were largely religious in nature, as Christianity divided the world between "barbaric" heathens and "civilized" believers. However, this changed during the Renaissance, at which time a "scientific and secular paradigm" emerged (Eze, 2001). In this critical turn rationality supplanted theology as the primary determinant of personhood.

It was also around this time that race first emerged as a social construct. Certainly, previous hierarchies of difference like the barbarian/civilized dichotomy involved prejudice and exclusion. But as Frederickson (2002) argues, because "barbarians" were thought to be capable of conversion, their lack of "civilization" was not considered an immutable trait. If the "barbarians" accepted Christ and adopted "civilized" cultural practices, they could become "civilized." For that reason, those ways of categorizing the world can be described as coming closer to ethnocentrism or xenophobia than racism, whereas the idea of "race" presupposes a fixed essence that cannot be changed (Frederickson, 2002).

By the onset of the Enlightenment, the relationship between cognitive capacity and one's humanity had become a central concern for philosophers. This is perhaps best exemplified in Descartes's famous cogito statement, "I think therefore I am." In essence, intellect acquired the status of an ontological property. That is, what it meant to be human—at least from the Western European perspective—became intertwined with the capacity for rational thought. At the same time, the explosion of colonialism around the globe was bringing Europeans into contact with an unprecedented array of difference (e.g., phenotype, language, spiritual beliefs). In order to make sense of this difference, the same "capacity to think" frame was used to determine the humanity (or lack thereof) of these new groups of people.

Take, for example, the views of two preeminent philosophers of the Enlightenment: Immanuel Kant and David Hume. Today in the United States, the Enlightenment is credited with providing the philosophical foundation for a democratic, egalitarian society, in which all people have an equal opportunity to exercise their natural rights and pursue happiness through reason and individual effort. The caveat, of course, was that only human beings considered "people" (i.e., those perceived as capable of reason) were afforded this opportunity (Mills, 1997). In his essay, "Of National Character" (1754), David Hume explicated a racial hierarchy indexed by intellectual disparities between Whites and non-Whites:

> I am apt to suspect the negroes and in general all other species of men (for there
> are four or five different kinds) to be naturally inferior to the whites. There never

was a civilized nation of any other complexion than white, nor even any individual eminent either in action or speculation. No ingenious manufacturers amongst them, no arts, no sciences. On the other hand, the most rude and barbarous of the whites, such as the ancient GERMANS, the present TARTARS, have still something eminent about them, in their valour, form of government, or some other particular. Such a uniform and constant difference could not happen, in so many countries and ages, if nature had not made an original distinction betwixt these breeds of men. Not to mention our colonies, there are NEGROE slaves dispersed all over EUROPE, of which none ever discovered any symptoms of ingenuity; tho' low people, without education, will start up amongst us, and distinguish themselves in every profession. In JAMAICA, indeed, they talk of one negroe as a man of parts and learning; but 'tis likely he is admired for very slender accomplishments, like a parrot, who speaks a few words plainly.

In his bigotry Hume offers a multi-layered racial analysis. First, he asserts that all non-Whites—and "negroes" in particular—are fundamentally inferior to White people. Hume makes this claim based on his perception that non-Whites have shown a lack of "eminence" and "ingenuity," the latter of which can serve as a proxy for intelligence. In contrast, even the "most rude and barbarous" of White people, despite having no formal education, have managed to make something of themselves. Citing this lower-class group of Whites is especially useful to Hume's hierarchy because it rules out confounding factors (e.g., formal education) and isolates race as the sole explanatory variable. Even when a learned Black person is found in Jamaica, Hume denies him genuine cognitive capacity by likening him to a "parrot." According to Hume, no matter how much he tries, this "negroe" will never attain a White level of rationality because intelligence, like race, is innate and unchangeable.

Hume was not alone in his views. Similar sentiments appear in the writings of the famed philosopher, Immanuel Kant, who in his infamous and ironically titled essay, "Observations on the Feeling of the Beautiful and the Sublime" (1764), suggested that because a man had black skin, it was "…a clear proof that what he said was stupid." In the same essay Kant also asserted, "So fundamental is the difference between these two races of man [Whites and Blacks], and it appears to be as great in regard to mental capacities as in colour." Thus, both Kant and Hume were invested in the idea of a "racial-rational hierarchy" (Eze, 1995), where the capacity for rational thought is tied to race and unequally distributed across the human population. As Mills (1997) argues, the net effect of this ideology is that "knowledge, science, and the ability to apprehend the world intellectually are thus restricted to Europe, which emerges as the global locus of rationality, at least for the European cognitive agent, who will be the one to validate local knowledge claims" (p. 45, emphasis in original).

The confluence of race and intelligence continued into the modern era, as the study of racial-rational hierarchy shifted from philosophy to science. During the 19th century, a pseudo-science emerged called phrenology, which examined the physical structure of skulls in order to draw inferences about mental functioning. Phrenological studies were used to support racist claims about the under-evolution of people of color. In 1874 Ransom Dexter, a professor of zoology and physiology at the Old University of Chicago, published an article where he argued that "facial angle" could be used to order different races along an evolutionary continuum of cognitive sophistication. In the excerpt below, Dexter elaborates on the three left-most portraits from a diagram included in his paper (see Figure 1):

The other three profile views represent the savage, the half-civilized, and the cultivated races of man. The first of the three, the one next to the view of the idiot, is a drawing from a correct engraving of the celebrated North American Indian chief Black Hawk, and corresponds in brain capacity, facial angle, and mental powers, very nearly to the other savage races, viz., the Malayan and Ethiopian. The next that is represented in the cut is the half-civilized Mongolian race, illustrating very nicely the ratio of the two factors, physical and mental. The last is a representation of the highly-cultivated Caucasian race, and is a correct profile view of one of the most illustrious statesmen that this or any other nation ever possessed—that of Daniel Webster [a U.S. senator]. (p. 591)

Figure 1. A perspective on the evolution of man from animal based on phrenological research (Dexter, 1874). From left to right: Caucasian, Mongolian, American Indian, idiot, monkey, dog, bird, and reptile.

The racial-rational hierarchy articulated here resembles the statements of Kant and Hume, except that in this case the ideology pretends credibility under the veneer of "science." Phrenology was eventually debunked, but racist discourses about intelligence did not die with it. Racial-rational discourse continued into the early 20th century with the development of IQ testing. In an address to the American Educational Research Association, Gloria Ladson-Billings (2012) recalled the work of Lewis Terman, the Stanford professor, eugenicist, and creator of the Stanford-Binet Intelligence test, who said:

High-grade or border-line deficiency…is very, very common among Spanish-Indian and Mexican families of the Southwest and also among negroes. Their dullness seems to be racial, or at least inherent in the family stocks from which they come…Children of this group should be segregated into separate classes…They cannot master abstractions but they can often be made into

efficient workers…from a eugenic point of view they constitute a grave problem because of their unusually prolific breeding." (Terman, 1916, p. 91-92, cited in Ladson-Billings, 2012, p. 116)

Terman articulates the central theme of racial-rational discourse: certain racial groups "cannot master abstractions" because of a hereditary deficiency "inherent in the family stocks from which they come." However, in spite of this cognitive handicap, he contends that they can be made into "efficient workers," presumably in manual labor jobs where intelligence is actually an impediment. By contrasting the capacity for abstract thought with the facility for labor, this statement can be read as a message about personhood. Whereas Homo habilis was able to use stone tools, what distinguished Homo sapiens was the ability to think (i.e., intelligence). If it is determined that some people cannot think, the implication is that they are under-evolved.

Some contemporary proponents of IQ testing perpetuate Terman's perspective. In particular, two findings have received considerable attention: 1) a roughly one standard deviation difference in average IQ scores between Blacks and Whites in the United States (Herrnstein & Murray, 1994; Rushton & Jenson, 2005); and 2) people from certain Asian countries exhibit higher IQ scores than people from Europe (Lynn, 2008). Together, these findings clearly imply a racial hierarchy of intellectual capacity. Although a comprehensive discussion of the research and debates about IQ testing is beyond the scope of this chapter, suffice it to say that these findings have been criticized on multiple grounds (see Gould, 1996), including inappropriate sampling methods, narrow conceptions of human "intelligence," test bias, and the finding that despite purporting to measure a supposedly fixed quantity, scores on IQ tests have actually increased steadily since the 1930s (Flynn, 1987).

Overall, scientific endeavors like phrenology and IQ testing feed racial discourses about intelligence. And while it is tempting to think of racial-rational discourse as a historical relic, recent research suggests otherwise. Survey research conducted at the turn of the 21st century indicates that negative stereotypes associating people of color—and Blacks, in particular—with low intelligence remain prevalent, even as people are increasingly likely to reject their validity when asked (Bobo, 2001; Devine & Elliot, 1995; Plous & Williams, 1995). In a recent study measuring people's implicit knowledge of racial associations, Goff, Eberhardt, Williams, and Jackson (2008) found that participants exhibited a strong, bi-directional association between Blacks and apes, regardless of the level of their personal racial biases or their explicit knowledge of the long-standing Black-ape connection.

Beyond the research world, racial-rational ideology has also materialized in somewhat unexpected sectors of everyday life. On August 11, 2010, The New York Times ran an article titled, "Baseball's praised diversity is stranded at first base." The piece highlighted a glaring disparity between the proportion of racial minorities hired to coach first base and third base. Although people of color made up 67% of all first-base coaches, only 23% of third-base coaches were members of a racial minority. Typically, third-base coaches are charged with interpreting and relaying intricate signs from the dugout to players on base that determine play-by-play strategy; they also must make rapid decisions about whether to risk sending a runner home. First-base coaches, on the other hand, are responsible for reminding runners at first base about the number of outs and advising them on when to attempt a stolen base. One explanation for the gap put forth by some managers of color was that baseball teams were less willing to hire people of color to coach third base because the job is more intellectually demanding compared with coaching first base. Regardless of whether this is actually the reason for the disparity, the fact

that it was even floated as a hypothesis underscores the persistence of racial-rational discourse in modern culture.

Innateness: Race is what you are born with

Although I have not yet addressed it directly, the concept of "innateness" is implicit in the basic idea of racial hierarchy and of racialized perceptions of intelligence. In the United States, common wisdom holds that every person is born into one of a handful of racial categories (i.e., White, Black, Latina/o, Asian, and Native American), and that these "races" are signified by phenotypical characteristics—primarily skin color—that render groups of people distinct from each other. These racial categories come to correspond to particular behaviors or personality types, and a collective knowledge forms about how people act and how people think. This knowledge becomes part of a society's "common sense": everyone *knows* how Black people talk, everyone *knows* the clothes White people wear, everyone *knows* what Asian people do for a living, and so on. In this formulation, "race" is a permanent essence hardwired into our genetic makeup that reflects the natural order of things.

To be sure, this perspective on race suffers from multiple flaws of logic. First, geneticists and anthropologists have shown that "race" lacks a biological basis (Long, 2004). That is, actual patterns in human genetic variation overlap in ways that render clean demarcations of racial groups impossible. Second, if race were biological or some kind of abstract essence—as opposed to a social construction—racial categories would be stable over time, but the history of race in the United States does not support this contention. The original U.S. census in 1790 contained three categories related to race: "free Whites (males/females)," "all other free persons," and "slaves" (see Table 1). This scheme remained in place until 1850 when it was replaced with three other categories: "Whites," "Blacks," and "Mulattos." The number of racial categories listed on subsequent census reports, in 40-year intervals, is as follows: 8 (1890), 10 (1930), 9 (1970), and 19 (2010).[8] Further still, the categories themselves have undergone dramatic shifts (e.g., "octoroon" and "Hindu" were considered races in 1890 and 1930, respectively).

This variation across time points to the instability of race as a social concept. Indeed, inconsistencies also exist across geographies. For example, in contrast with the U.S., race in modern South Africa consists of just four categories: Black African, White, Coloured, and Indian or Asian. And racial categories in Brazil are defined by such fluid amalgamations of physical and social markers that members of the same family might affiliate with different racial groups. The larger point is that race cannot be pinned down, neither at the level of our genes nor at the level of society. As much as it seems that it can be defined once and for all, race is a slippery, malleable concept that remains in a constant state of flux. In short, race has been, and will continue to be, whatever we decide it is.

Table 1.
U.S. Census Categories Related to Race or Ethnicity (1790-2010, in 40-year Intervals)

Year	U.S. Census Questions Related to Race or Ethnicity
2010	**What is the person's race?** White, Black or African Am. or Negro, American Indian or Alaska Native (print name of enrolled or principal tribe), Asian Indian, Chinese, Filipino, Other Asian

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[8] These counts include the "Other" category. Four of the 19 categories in the 2010 census came from a separate question about "Hispanic, Latino, or Spanish" heritage.

	(print race, for example, Hmong, Laotian, Thai, Pakistani, Cambodian), Japanese, Korean, Vietnamese, Native Hawaiian, Guamanian or Chamorro, Samoan, Other Pacific Islander (print race, for example, Fijian, Tongan), Some other race (print race) **Is the person of Hispanic, Latino, or Spanish origin?** If yes: Mexican, Mexican-Amer., Chicano; Puerto Rican; Cuban; Other (e.g., Argentinean, Colombian, Dominican, Nicaraguan, Salvadoran, Spaniard)
1970	**Race**: White, Negro, Indian (Amer.), Japanese, Chinese, Filipino, Hawaiian, Korean, Other (fill in the blank)
1930	**Color or race**: White, Black, Mexican, American Indian, Chinese, Japanese, Filipino, Hindu, Korean, Other (fill in the blank)
1890	**Race**: White, Black, Mulatto, Quadroon, Octoroon, Chinese, Japanese, Indian
1850	**Color:** Whites, Blacks, Mulattos
1790 - 1840	Free Whites (males/females), All other free persons, Slaves (males/females)

Note. The 1930 census was pivotal in several ways: 1) "Mulatto" was eliminated, and all people of mixed Black/White heritage were instructed to identify as "Black"; 2) a similar "one-drop rule" went into effect for American Indians, although some exceptions were made where individuals of mixed heritage could identify as White; and 3) "Mexican" was introduced as a racial category.

Omi and Winant (1994) capture this idea in their theory of "racial formation," which they define as a "sociohistorical process by which racial categories are created, inhibited, transformed, and destroyed" (p. 55). The racial formation perspective is useful because it frames racial categories not as static labels, but instead as dynamic byproducts of specific sociopolitical forces or "projects" (Omi & Winant, 1994, p. 56). Racial projects can be implemented both at the macro-level of social structure (e.g., in the form of anti-miscegenation laws) and at the micro-level of everyday practices (e.g., lynching).

For example, consider the emergence during the early 20th century in the United States of the "one-drop rule," which asserted that all mixed-race individuals with even partial non-White ancestry be identified as "fully" non-White. As an attempt to simplify and eliminate the complex notion of "mixed race," the "one-drop rule" sought to erect definitive boundaries between racial categories for the purpose of producing certain social arrangements (e.g., segregation) and

guaranteeing certain economic interests. In general, though, the "one-drop rule" illustrates the theme of "innateness," which is central to how race is commonly understood as something that, quite inescapably, lives in the blood.

Summary

Using discourse analysis, in this section I highlighted three concepts foundational to the idea of race: hierarchy, innateness, and intelligence. Race is not a static, neutral framework for categorizing variation in the human population. Instead, race is a flexible, socially constructed system that relies on a gestalt of phenotypical traits and cultural behaviors to understand and organize human beings. The racial categories that comprise this system are context-dependent and subject to political contestation, which explains their instability over time and space. Race involves first dividing people into racial groups based on supposedly genetic traits and practices, and then ordering those groups in hierarchies that foster relations of exclusion and domination. So although race is not "real" in the biological sense, its effects have a material impact on people's everyday lives because it is treated as if it were real.

Of the various racial hierarchies rampant in the United States, here I emphasized hierarchies predicated on the racialization of intelligence (i.e., racial-rational hierarchies). This particular discourse is especially important, I argue, because the capacity for rational thought has become a primary measure of what it means to be a human being (Bederman, 1995; Goldberg, 1993; Mills, 1997). From the racist point of view, the ability to cognize abstract ideas has not been considered an automatic birthright of all human beings. Therefore, not all human beings were afforded full personhood because not all human beings were granted an equal capacity for rational thought. In the next section, I complete this theoretical inquiry by explaining why the link between race and intelligence is especially consequential for mathematics learning.

Discursive Alignment

Martin (2006) has claimed that mathematics learning and participation constitute "racialized forms of experience." And yet, as Leonardo (2009) argues, the same can be said of schooling writ large: "…as a racial state apparatus (RSA), school is a material institution where race takes place, where racial identity is bureaucratized/modernized, where people are hailed as racialized subjects of the state…It is one important place where race takes on an empirical form: from tracking practices, to resource disparities, to different rates of achievement" (p. 42). In other words, then, maybe there is nothing special about mathematics. Perhaps mathematics learning can be considered racialized because schooling itself constitutes a racialized form of experience. Still, if that is the case, what should be made of the "Asians are good at math" narrative, a statement that explicitly links race to mathematics? If mathematics truly is culture-free (and race-free), then how can the existence of such narratives be explained? In short, what does race have to do with math?

In this chapter, I employed discourse analysis to explore the race-math connection and provide a preliminary answer to this question. Theoretical inquiry revealed that despite their superficial differences, mathematics learning and race are actually quite compatible, and that they converge on a fundamental level. Specifically, I identified three generative concepts that lie at the root of both discourses: hierarchy, intelligence, and innateness (see Table 2). With respect to mathematics learning, people in the United States tend to believe that some individuals are born with mathematical ability while others are not, and that success in mathematics signifies high intellect. Equally pervasive in racial discourse is the long-standing view that we are born

into one of a handful of racial categories, and that some racial groups are cognitively superior to others.

In light of this discursive alignment, I argue that although they seem strange bedfellows, mathematics learning and race are actually well suited to each other. That is, the core themes of hierarchy, intelligence, and innateness comprise a nexus, or a common conceptual soil from which the dominant versions of both discourses have flowered. Thus, it is not at all surprising that a racial-mathematical narrative like "Asians are good at math" would emerge and gain traction in the public domain.

Table 2.
Discursive Alignment of Race and of Mathematics Learning in the United States

Dominant Discourse of Race	Foundational Concepts	Dominant Discourse of Mathematics Learning
Some racial groups are superior to others.	Hierarchy	Some people do better at math than other people.
Race provides an indicator of intellectual capacity.	Intelligence	Being good at math shows that you are smart.
Race is a genetic trait that people are born with.	Innateness	Math ability is something you are born with.

Of course, this is not to say that these themes are necessarily exclusive to discourses of mathematics learning and race. For example, schools in general tend to foster hierarchies of academic ability and discourses of "smartness" (Hatt, 2007; Leonardo & Broderick, 2011), leading students to believe that if they do not succeed then it means that they are somehow innately dumber than their classmates. And STEM subjects (science, technology, engineering, mathematics) in general can be thought of as "high status knowledges" often associated with intellectual status (Apple, 2004), which may explain the existence of other racial narratives touting Asian superiority in science and technology alongside mathematics. Similarly, intellectual hierarchies are not limited to racial discourse, as there is a long history of men being positioned as "smarter" than women (Bederman, 1995; Walkerdine, 1998).

To be clear, then, I am not claiming that the relationship between race and mathematics learning is unique; rather, I am making a claim about its specificity. In other words, mathematics learning is not racialized in the same way that other academic subjects might be racialized. What makes mathematics learning in the United States a particular type of racialized experience depends on the way in which mathematical competence has come to signify cognitive capacity par excellence (Shah, 2010). Again, this is not because mathematical competence actually requires an especially high intellect compared with other skills or disciplines, but rather because as a cultural construction mathematics has been imbued with this connotation over time.

I believe this may have profound implications for how we understand students' mathematics learning experiences. For many students, learning math is about solving equations and graphing parabolas—it is just another course requirement. However, for students from persistently marginalized racial backgrounds, the stakes are much higher. Certainly, mathematics can act as a material gatekeeper, obstructing access to future economic opportunities and full civic participation (Moses & Cobb, 2001). But learning mathematics can also be about identity and personhood. Living in a world where intelligence has become a primary marker of personhood, and where for five hundred years certain racial groups have been considered under-

evolved and intellectually deficient, mathematics can represent an opportunity for a student to reclaim cognitive status by showing that she or he is "smart" and can think complex thoughts. Mathematics offers a chance to show the social world that you are a full human being.

      Moving forward, the theoretical work undertaken in this chapter is but a first step that sets the stage for a complimentary empirical investigation. Do students understand racial-mathematical discourse in these ways? Do they perceive mathematical ability as intersecting with racial hierarchy and emblematic of an innate intellectual capacity? These are some of the questions I consider in the rest of this dissertation. In the next chapter, I elaborate the methods used to conduct the empirical part of the project.

Chapter 3: Methods

Recall from Chapter 1 that this research was organized around two majors strands of inquiry. The first strand of inquiry sought to unpack the content, structure, and sources of racial-mathematical discourse. Whereas the previous chapter began this inquiry using theoretical methods, Chapters 4 and 5 take up this part of the investigation from an empirical standpoint. Because I was interested in students' perspectives on racial-mathematical discourse, interview methods were especially well suited to exploring the research questions in this part of the study.

The second strand of inquiry concerned the impact of racial-mathematical discourse on learning in regular classroom settings. One way to get at how issues of race manifest in classroom activity is to ask students to reflect in the interview setting on moments when, from their perspective, race arose in the context of mathematics learning. As I explain below, this technique proved fruitful for surfacing instances of racial-mathematical discourse in everyday learning situations. However, another approach to investigating this issue is to collect data about it more directly through classroom observation. Despite its challenges this method has tremendous upside, in that it can illuminate how race interacts with the learning process in "real-time." Thus, a combination of interviews and longitudinal participant observation in mathematics classrooms was used to conduct this second strand of inquiry.

Overall, the methods used in this study were consistent with the ethnographic approach, which privileges social context and subjective experience in trying to understand the dynamics of human activity (Eisenhart, 1988). Further, in contrast with prior research (e.g., research on African Americans in mathematics) that has focused on a particular group of students, I purposefully sought a racially diverse school site and interview sample. This design decision was informed in part by the theoretical discussion in Chapter 2, which suggested that studying racial discourse means analyzing how it functions by positioning students from different racial backgrounds in relation to each other.

In this chapter, I elaborate on the methodology used to investigate students' perspectives on racial-mathematical discourse and how it mediates mathematics learning, identity, and participation. I begin by describing the research setting and focal classrooms. Next, I detail the instruments and procedures used in data collection, as well as discuss issues related to researcher positionality. Last, I provide a brief overview of the approaches used in analyzing the empirical data presented in subsequent chapters.

Research Setting and Participants

Setting

Research was conducted during the 2010-2011 school year at Eastwood[9] High, a comprehensive high school located in a working-class area of Northern California. In 1960, the city of Eastwood was 98.5% White. Over the next three decades, though, Eastwood experienced a dramatic demographic shift. Mexican farm workers had been coming since the 1940s for seasonal work in agricultural industries based in the city, and eventually these workers and their families established permanent residency. At the same time, White families were increasingly moving to outlying suburbs as new groups of immigrants from various parts of Asia and Latin

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[9] All names used in this dissertation, including those of the school, teachers, and students, are pseudonyms. Some details have been changed in order to protect the identities of the participants.

America arrived. In 2010 Eastwood had a Latina/o plurality and was one of the most diverse cities in California with respect to race, ethnicity, and language.

Eastwood High was one of three high schools in the school district. Overall, the school reflected the diversity and socioeconomic status[10] of the broader Eastwood community (see Table 3 below). Following other researchers who have studied racial discourse in schools (e.g., Park, 2011; van Ausdale & Feagin, 2001), I intentionally sought a racially diverse setting under the assumption that racial talk and racial sense making might be more explicitly prevalent in a place where students are constantly confronted by various forms of difference. This was the motivation behind selecting Eastwood High School as a research site.

Table 3.
Racial and Ethnic Demographics at Eastwood High and in Focal Classrooms

	Asian (includes Filipina/o)	Black or African American	Latina/o	Polynesian	White	Mixed or Other
Eastwood High School (n = 1700)	**8%**	**25%**	**48%**	**3%**	**14%**	**2%**
Geometry (n = 29)	10%	20%	48%	14%	7%	-
Algebra 2 (n = 26)	8%	15%	42%	4%	31%	-
Precalculus (n = 27)	18%	15%	41%	15%	11%	-
AP Calculus (n = 18)	17%	22%	61%	-	-	-

Note. Data based on school records, n = number of students.

Focal classrooms

Two teachers in the mathematics department, Ms. Patterson and Ms. Zielinski, agreed to make their classrooms available for the study. Both teachers identified as White and female. Data collection took place in Ms. Patterson's Algebra 2 and Precalculus classes, and in Ms. Zielinski's lower-track Geometry and AP Calculus classes. Instruction across these four classes was similar: students began the period with a warm-up, which was typically followed by lecture, guided practice, and individual practice. Occasionally students were organized into groups to work together on homework or collaborate on longer-term projects. Curricula were based primarily on traditional textbooks aimed at supporting procedural fluency.

Similar to many large high schools, Eastwood High had two separate tracks in mathematics for entering 9th grade students. The majority of freshmen were enrolled in two periods of math: Algebra 1 and a mandatory support class designed to review the basics of arithmetic and pre-algebra. A smaller group of freshmen had been selected to take Geometry based on test scores and teacher recommendations from 8th grade. These students were on track to take AP Calculus in 12th grade. Besides this sorting at 9th grade, no other formal distinction was made to separate students in mathematics (e.g., "honors" Algebra 2 vs. "regular" Algebra 2).

Prior research has shown that the existence of tracking structures tends to correlate with racial disparities in course-taking patterns, and in mathematics this has often meant an over-representation of White and Asian students in advanced courses like AP Calculus (Oakes, 2005).

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[10] According to www.cde.ca.gov, 67% of students at Eastwood High were labeled "socioeconomically disadvantaged."

However, this was not the case in the four classrooms that were the focus of this study. As shown in Table 3 above, the racial and ethnic demographics of the focal classrooms matched, by and large, the demographics of Eastwood High. While the precise reasons for this pattern are unclear, it should be noted that the mathematics department at Eastwood neither actively documented such trends, nor did they have an explicit equity agenda. But the fact that the racial makeup of the focal classrooms was not skewed is an important piece of context for considering the empirical data to come.

Data Collection

Participant observation

During a nine-month period between August 2010 and May 2011, I conducted approximately 130 hours of participant observation at Eastwood High. Due to scheduling constraints, the majority of observations took place in two of the four focal classrooms: Ms. Patterson's Precalculus class and Ms. Zielinski's Geometry class. Primarily, my time in the classroom was spent sitting in the back and recording field notes. Occasionally, though, I would also serve as a classroom tutor, helping students only when they had raised their hand or specifically asked for my assistance.

The decision to play a more active role in the classroom beyond observation was based on several factors. First, I felt obligated to the teachers participating in the study to reciprocate their generosity. Given my background as a former high school math teacher, helping their students was one small way to contribute. Second, from a research standpoint, participant observation gave me a chance to get to know the students and for them to know me on an informal level. The mutual trust built over time proved useful in recruiting students later in the school year for interviews. Third, prior research on race in educational contexts (e.g., van Ausdale & Feagin, 2001) suggested that racialized episodes were more likely to occur during informal classroom interactions when teachers are not present. Participant observation gave me greater access to these parts of classroom life.

Still, the challenges of observing race in "real-time" were considerable. My primary goal was to capture moments involving explicit racial talk (i.e., interactions where interlocutors used racial labels, such as "White" or "Mexican"), as these would be most obviously related to race. But in an era defined by colorblindness and the suppression of racial talk, research has shown that race can also operate in subtle and implicit ways (Pollock, 2004; Schaffer & Skinner, 2009). For example, in a yearlong observational study of high school mathematics classes, Nasir et al. (2009) found that explicit race talk was hard to come by. However, they also employed a broader lens that captured instances of historically racialized behavior (e.g., rapping, use of African American Vernacular English), which lent insight into more subtle manifestations of race. In my observations I adopted a similarly liberal view of classroom activity. And further, in an effort to capture non-verbal phenomena, I also attempted to document students' movements in the classroom, which might have revealed, for instance, racialized patterns regarding which students were positioned as highly competent when their classmates needed help. Such patterns might illuminate some of the implicit ways in which racial-mathematical discourse influences learning.

Semi-structured interviews

All students from the focal classrooms were invited to participate in individual interviews. Of those that gave consent, 35 students (19 boys, 16 girls) were chosen from across

each of the four focal classes. The participant pool was assembled using maximum variation sampling (see Glesne, 1999, cited in Park, 2011), with the goal of securing representation across the various racial and ethnic groups at Eastwood High, rather than trying to exactly match the school's overall demographics (see Table 4). Interviews were conducted during the second half of the school year once the bulk of classroom observations had been completed. This was a purposeful design decision intended to mitigate potential bias on the observational data caused by students knowing that race was a major focus of the interviews.[11]

Table 4.
Racial and Ethnic Demographics for Interview Pool

	Asian (includes Filipina/o)	Black or African American	Latina/o	Polynesian	White	Mixed or Other
Eastwood High School (n = 1700)	**8%**	**25%**	**48%**	**3%**	**14%**	**2%**
Interview Pool (*N* = 35)	23% (*n* = 8)	14% (*n* = 5)	14% (*n* = 5)	14% (*n* = 8)	29% (*n* = 10)	6% (*n* = 2)

Note. Data based on students' self-reports, *N* = total number of students interviewed.

Interviews followed a semi-structured protocol (see Appendix A), which was implemented in a fluid, conversational style. Each interview was audiotaped and lasted approximately 30 minutes, with some extending for over an hour. The stated purpose of the interviews was framed in a general way, as I told students that I was interested in learning more about their experiences learning math in school over the years. The first half of the interview focused on students' beliefs about mathematics, as well as their perceptions of themselves as mathematics learners. The second half of the interview probed students' reasoning about racial-mathematical discourse. To prompt this part of the conversation, students were asked: "Have you heard people say that some groups are better than others at math?"

Several points deserve elaboration regarding this component of the interview protocol. First, extensive piloting suggested that this particular question—while latently race-neutral—would be likely to trigger racial thinking without having to explicitly cue students. Second, because the interviews were designed to gauge students' perceptions and awareness of racial-mathematical discourse, as opposed to their endorsement, the question—and most questions during the second half of the interview—was intentionally framed in a "de-centered" way (i.e., "what people say" rather than what the student herself/himself believes). Last, pilot data revealed a tendency for students to respond to this question by citing the "Asians are good at math" narrative. For this reason, much of the interview protocol included prompts about the mathematical, academic, and racial positionality of Asians in the United States (and globally), which then became a segue for discussions about the experiences of other racial groups in

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[11] In fact, my original intent was to also ask students about particular racialized moments recorded in the field notes, thereby using the interview data to triangulate the observational data. However, for a variety of reasons—not least of which being the paucity of explicitly racialized episodes related to mathematics in the observational data— triangulation became a moot point.

mathematics. In the few cases where students did not bring up race spontaneously, they were asked directly to comment on the "Asians are good at math" narrative.

Interviews can be effective contexts for surfacing people's everyday experiences with race (Bonilla-Silva, 2003; Essed, 1991; Martin, 2000). However, asking people about race can also cause discomfort. Given that the interview was framed in a broad way, the turn toward talking about race caught some off-guard, even though most students were willing and open to discuss their views and experiences. In many cases the questions themselves posed genuine conundrums. For example, although nearly every participant readily mentioned that Asians are generally perceived to be superior in math, they had a much harder time trying to explain why that perception exists. Understandably so, the interview was the first time many of the students had explicitly tried to make sense of the issues I asked them about. Students were also keenly aware of how their comments were coming across, as they would often begin a statement with the disclaimer, "I don't mean to sound racist…" So while my research goal was to probe student thinking as deeply as possible, I saw my first priority as respecting students' feelings and boundaries. Managing this tension was a constant challenge during data collection.

Researcher positionality

Research in general, and ethnographic methods in particular, are not neutral or "objective" endeavors. How a researcher's positionality affects study design, data collection, and data analysis requires critical reflection (Fine, 1994; Foote & Bartell, 2011; Villenas, 1996). Certainly, this dissertation was influenced by my position—both in terms of how I self-identify and how others might identify me—with respect to multiple social markers, including gender, class, age, sexual orientation, language, and education level. Presumably, though, of most immediate consequence to the present study was my positionality as a racial subject.

I was born and raised in the Midwestern United States. I am the son of Indian parents who immigrated in the 1970s. I have light-brown skin, black hair, and a South Asian first and last name. Prior to graduate school I had been a high school math teacher, and the irony of a "mathematically capable Asian" studying something like racial-mathematical discourse was not lost on me. In fact, on the first day of data collection, both of the participating teachers introduced me to their classes as a "smart guy earning a Ph.D. in mathematics education from UC Berkeley." This image was undoubtedly reinforced by my dual role as a classroom tutor. Some students were also interested in my racial and ethnic origins, sometimes calling me "Indian" and other times identifying me as "Arab."

But is there evidence that my positionality influenced the data I collected? With respect to the observational data, one might hypothesize that the presence of a mathematically capable Asian-identified person may implicitly cue race in students' minds, thereby precipitating racialized episodes that otherwise would not have taken place. While this is plausible, given that I recorded so few explicitly racialized episodes during my observations, it is not obvious that my presence skewed the data in this way. Further, several Asian students were already enrolled in each of the focal classes, so my presence may only have been marginally impactful.

My race had a more noticeable effect during the interviews. As I mentioned before, students tended to cite societal narratives that framed Asians as mathematically gifted. One possibility to consider is that students were complementary toward Asians because they identified me as a person of Asian descent (i.e., they were telling me what they thought I wanted to hear). For example, in one interview a female student mentioned the "Asians are good at math," and it became clear as she talked that from her perspective the term "Asian" referred to

people from East and Southeast Asia. However, mid-sentence she did a double take and looked at me with a half-smile as she noted enthusiastically that, "Indians are smart too." While this was the most obvious example in the data of my positionality influencing students' sense making, it is plausible that there were other less explicit instances of this sort.

But again, the impact on the data was probably limited. First, even if my positionality caused students to think of Asian math learners, the fact that they elaborated extensively on the topic, and even cited multiple examples of the "Asians are good at math" narrative in their prior schooling experiences and in the media, suggests that it was already quite salient to them. Second, students' knowledge and perceptions of racial-mathematical discourse went well beyond Asian students, as they shared racialized episodes involving non-Asian math learners. If anything, it could be that being identified as Asian actually offered me a "middle" position of sorts. That is, students might have felt comfortable discussing racialized narratives pertaining to Asians with me because—superficially, at least—those narratives seem complementary toward Asians. And while being a person of color may have encouraged the students of color I interviewed to share their stories of marginalization, not belonging to a group that has been pervasively marginalized in the United States may have made it easier for White students to be candid with me as well. In short, some students may have been less open to talk about racial-mathematical discourse with, for instance, a White, Black, or Latina/o interviewer.

Overview of Analytic Methods

In this section I briefly outline the analytic methods used in each chapter. A primary goal of this dissertation was to better understand students' perspectives on the content and structure of racial-mathematical discourse. To explore this topic I turned to the student interviews, all 35 of which were audiotaped and subsequently transcribed in full. Using an analytic approach developed in a previous study that treated racial narratives as units of analysis (Shah, 2009), I began by identifying the various racial narratives mentioned by each of the participants and entered them into a database using Filemaker Pro software. Each narrative was then tagged in two ways: a) by the racial group to which the narrative pertained; and b) by theme (e.g., math-related, intelligence-related). The catalog of themes was developed through an iterative process of open coding (Glaser & Strauss, 1967).

This initial pass facilitated three sets of analyses. First, I queried the database for all mentions of the "Asians are good at math" narrative, since it was the only narrative mentioned or acknowledged by every student in the interview pool. Focusing on these excerpts of transcript, I then sought to unpack the nuanced ways in which students made sense of this narrative. Second, I queried the database for all math-related narratives about any racial group. This illuminated some of the constitutive elements of racial-mathematical discourse (i.e., its content), as well as how they related to each other (i.e., the internal structure of racial-mathematical discourse). Finally, I queried the database for all instances of racial narratives not explicitly related to mathematics (e.g., "Polynesian parents don't care about school," "Blacks are good athletes," "Asian kids are smart"). Examining how and when these non-mathematical narratives emerged in student thinking provided a fuller picture of how racial-mathematical discourse related to racial discourses outside mathematics (i.e., its external structure). Altogether, these analyses yielded the findings in Chapter 4.

In addition to characterizing its content and structure, in Chapter 5 I present findings from a related inquiry aimed at gauging the pervasiveness of racial-mathematical discourse in society writ large. This analysis focused on a question posed in the interview regarding why

racial-mathematical discourse exists (i.e., why people say that some groups are better than others at math). Similar to the approach used in Chapter 4, students' responses to this question were coded in an iterative fashion until patterns emerged. These themes serve as the basis for the findings presented in Chapter 5.

The third and final empirical strand, which is presented in Chapter 6, relied on both observational and interview data to investigate how racial-mathematical discourse manifested in everyday classroom activity. Field notes were scanned for racialized moments, from which a subset of math-related episodes was identified. These episodes were pooled with retrospective racial-mathematical episodes shared by students during interviews. This collection of episodes was then analyzed along two dimensions. First, I tabulated the number of racial-mathematical episodes shared per student interviewed. Second, I coded all of the episodes according to the specific classroom practice or situation in which that episode took place. More detail on the entire process of identifying racialized episodes and coding them is elaborated in Chapter 6.

Chapter 4: The Content and Structure of Racial-Mathematical Discourse

"Well, I think everybody had the list in their head: 'Oh it's Asians, and then it's White people, and then…Blacks and Mexicans are tied' (laughs)."

—*Rachel,* 12th grade, Algebra 2, White

Chapter 2 employed discourse analysis to reveal the conceptual underpinnings of racial-mathematical discourse. Building on that theoretical work, in this chapter I use student interview data to conduct two lines of empirical inquiry: the first explores the content of racial-mathematical discourse, while the second probes its structure. With respect to the discourse's content, I will demonstrate that students' knowledge of and perspectives on racial-mathematical discourse include but transcend the notion that "Asians are good at math." Instead, the data show that the "Asians are good at math" narrative is but one element of a complex economy of racial narratives about a range of issues, including academic ability, intelligence, and parenting practices (see Table 5 below).

In the second line of inquiry, I consider how these narratives are organized, both within and across racialized discourses. Specifically, I identify two types of relationships in the data that characterize the structure of racial-mathematical discourse: external and internal relationality. External relationality refers to the way racial narratives about the same topic implicitly connect across racial groups (e.g., "Asians are good at math" in dialectic with "Polynesians are not good at math"). This kind of relation, I argue, fosters the hierarchical structure endemic to all racial discourses. Internal relationality refers to links between narratives about a variety of topics internal to a single racial group (e.g., "Latina/os are not intelligent," "Latina/os work hard at manual labor," "Latina/os are not academically oriented"). This kind of relation describes the ways in which racial-mathematical discourse operates in concert with other racial discourses beyond mathematics (e.g., perceptions of intellectual capacity or quality of parenting) to position learners as more or less capable of learning mathematics.

Together, these strands of analysis build toward the general schematic in Figure 5, which outlines the content and structure of racial-mathematical discourse. To be clear, the goal of this chapter was only to document the existence of certain societal discourses relevant to students' understanding of the relationship between race and mathematics learning. But the findings here also hold serious implications for how learners of all racial backgrounds get positioned within a "racial hierarchy of mathematical ability" (Martin, 2009). In that sense, this empirical analysis both dovetails with the theoretical work in Chapter 2, and also lays the groundwork for subsequent analyses of the impact of racial-mathematical discourse on students' participation and identity formation in everyday classroom activity (see Chapters 6 and 7).

Before delving into the data, several caveats are in order. First, it is worth reiterating a point made in the Methods chapter: the purpose of the interviews was to gauge students' awareness of racial discourse, not their endorsement. The data to come should be understood as a window into what students hear in society and at their school, rather than as a reflection of their personal beliefs. Fortunately, documenting awareness is sufficient for the project of mapping the content and structure of racial-mathematical discourse. Second, students tended to be extremely candid in the interviews, and at times this led to them vocalizing potentially problematic ideas

about race and society. The goal is not to demonize or ridicule individual students, who were often ambivalent in their beliefs. Indeed, individualizing racism in this way would trivialize how race operates as a hegemonic system embedded in social structures and everyday practices (Essed, 2002; Omi & Winant, 1994). Last, in many cases students were not asked directly about the themes that ended up emerging most prominently in the data. It is plausible that the findings in this chapter represent a lower bound on the narratives that students are actually aware of and consider salient.

An Economy of Racial Narratives

Conventional wisdom suggests that if race matters at all in mathematics education, then racial discourse in mathematics begins and ends with the "Asians are good at math" narrative. Student interviews, however, revealed a substantially more complex picture. Indeed, as students sought to make sense of the relationship between race and mathematics learning, they drew on an intricate tapestry of racial narratives that went well beyond Asians and well beyond mathematics.

Table 5 summarizes the most common types of racial narratives[12] identified in the interview data. For now I highlight several top-level trends. First, the vast majority of narratives mentioned concerned Asian learners and Asians in general. In part, this finding is an indicator of what students found relevant in their experience, but it is also an effect of the interview protocol, which anticipated that most students would initially gravitate toward the "Asians are good at math" narrative, and therefore included several follow-up questions specifically related to Asian learners. Second, in spite of this emphasis on Asians, students cited an array of narratives related to non-Asian racial and ethnic groups. Indeed, 30 of 35 students mentioned at least one narrative about a non-Asian group. Further, while nearly all of the Asian-focused narratives were positive (e.g., "Asians are smart," "Asians are disciplined about school"), nearly all of the narratives about non-Asian students of color—with the exception of those about athletic ability—were negative (e.g., "Black people don't care about school," "Latina/os are dumb," "Polynesians are bad at math").[13]

Table 5.
Most Common Types of Racial Narratives Mentioned in Student Interviews (N = 35)

| Topic of Racial Narrative | Number of Students Mentioning a Narrative about a Particular Topic Related to that Racial/Ethnic Group | | | | | |
	Asians	Blacks	Latina/os	Polynesians	Whites	Other
Math or STEM Ability	35	7	4	3	5	2
Academic Ability	16	5	4	3	3	-
Intelligence	22	6	5	4	5	1
Parenting	22	1	-	1	-	1
Athletic Ability	2	8	2	3	2	-
English Skills	2	-	-	-	5	-

Note. In addition to the six topics listed here, students mentioned 45 racial narratives related to other

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[12] My analytic approach in this chapter privileges racial narratives as units of analysis. Detail on how I conceptualize and operationalize "racial narrative" was included in previous chapters.

[13] Students showed more ambivalence with respect to where they positioned Whites within these racial orders. I return to this issue later in the chapter.

topics, such as the perceived personality styles or physical traits of a given group. Since only one or two students mentioned each of these narratives, for the sake of brevity they are not included here, but some of them factor in the ensuing analysis and are mentioned accordingly.

A third trend in the data was that the racial narratives spanned a variety of topics beyond mathematics, including perceptions of academic ability, intelligence, and quality of parenting. Given that students were, in general, not asked directly about any of these issues, it is significant that so many students spontaneously brought up these non-mathematical topics in the context of a conversation about mathematics learning.[14] If they had been asked more direct questions (e.g., "What are all the stereotypes you hear about different groups of students at your school?), it is likely that the interviews would have yielded even more instances of racial narratives, particularly those related to non-Asians. Thus, the findings represented in Table 5 probably represent a lower bound on what students find salient in this area.

Overall, the content of racial-mathematical discourse—as characterized by the kinds of racial narratives mentioned by the students I interviewed—was rich and diverse. Students tapped into a range of racialized discourses that pertained to people from multiple racial and ethnic groups while situating mathematics learning in a racial context. The rest of this chapter is devoted to analyzing how these manifold narratives connected to each other (i.e., the structure of racial-mathematical discourse). However, given that it was the most frequently cited narrative in the data corpus, a more thorough analysis of how students made sense of "Asians are good at math" is warranted.

Unpacking the nuances of "Asians are good at math"
Recall that the interview protocol consisted of two parts. The first part explored students' orientation to mathematics, including self-assessments of their proficiency in math, their perspectives on what it takes to succeed in mathematics, and also their epistemological beliefs about mathematics as a discipline. The second part of the interview focused on issues of race, with an emphasis on how students made sense of race in terms of mathematics learning. In order to pivot to this second part, students were asked the following question: "Have you heard people say that some groups are better than others at math?" The question was intentionally designed to open a conversation about race without doing so in an excessively leading way.

As expected the majority of participants (25 of 35) interpreted the pivot question in racial terms, specifically citing the "Asians are good at math" narrative. Another four students were not asked this prompt because they brought up race (and the "Asians are good at math" narrative) spontaneously at an earlier point in the interview. The remaining six students expressed awareness of the narrative when asked directly whether they had heard it. Ultimately, all 35 students in the study reported being aware of (but did not necessarily endorse) the "Asians are good at math" narrative. Despite its superficial simplicity, though, students' sense making about this narrative was far from straightforward.

While a comprehensive examination of the "Asians are good at math" narrative is beyond the scope of this chapter, here I briefly discuss two themes that emerged in the data: innateness and universality. The first theme concerns the notion of innateness, or the implicit assumption that Asians are genetically good at math. In Chapter 2 I argued that, from a conceptual standpoint, "innateness" functions as one point of convergence between the dominant discourse

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[14] The only exception to this was a follow-up question that students were asked about whether Asian learners were thought to excel in math specifically or in school in general (see interview protocol in Appendix A).

of race and the dominant discourse of mathematics learning in the United States. That is, race and mathematical ability have both been considered genetic traits. On first pass, though, the empirical data do not appear to support this theoretical assertion.

During the first part of the interview, where students were asked about their beliefs regarding mathematical ability, nearly every participant (29 of 35) insisted that mathematical ability was not a genetic trait that some are born with and others are not. Indeed, student after student was adamant that mathematical ability was malleable, that one could improve in mathematics through effort and persistence. However, there are at least two reasons to be skeptical of this finding.

First, it conflicts with findings from national surveys that have shown the opposite view to be pervasive in the United States (Stevenson & Stigler, 1994). Although this research is now nearly two decades old, it is unlikely that views could have shifted so dramatically given that— efforts at reform notwithstanding—the national context for mathematics education has remained largely static over that time. And while research has shown that certain types of instruction can foster malleable views of mathematical ability (see Boaler, 2000, 2008), the mathematics instruction at Eastwood High generally relied on direct instruction, so it is unlikely that the students I interviewed were idiosyncratic relative to the average mathematics learner in the United States.

But there is also another reason to be skeptical about students' stated beliefs regarding mathematical ability, and it has to do with how these same students talked about the "Asians are good at math" narrative. Altogether, 20 of 35 students suggested in some way that people believe that Asians are genetically good at math. In a few instances, students like Mark, an 11th grade Algebra 2 student who identified as White, raised the issue explicitly:

> They say that Asians are better at math, but no--they just were…I mean (it) could
> be a genetic thing, like you know how something develops some skills from that
> and they probably worked on their skills prior to that, but no, any race can learn
> anything…they just have to put their mind to it, you know? And…it really doesn't
> have anything to do with race at all. I'm pretty…I'm, I'm for sure on that one,
> yeah.

Here Mark considers the possibility that Asians' proficiency in mathematics may be a "genetic thing," although he rejects the notion that a person's race constrains her or his potential. Another student named Samantha, a 10th grade Geometry student who identified as White, noted that just as she considered herself "naturally good at English," it may be true that Asians were "naturally good at math." In both cases, students were ambivalent and seemed to be positing conjectures rather than making definitive claims.

Whereas some students were explicit in using the notion of innateness to link race and mathematical ability, it was more typical for this theme to surface in subtle ways. That is, students' underlying beliefs were revealed through the rhetorical moves they used to refute the "Asians are good at math" narrative. Specifically, students argued in favor of cultural factors (e.g., parenting practices, study habits) in lieu of biological factors to explain the phenomenon of high mathematics performance among Asians. For example, consider the lines of reasoning put forth by Tim, an 11th grade, White student in Algebra 2, and by Crystal, a 9th grade, Filipina student also in Algebra 2, as they evaluated the validity of the "Asians are good at math" narrative:

Tim: I'd have to disagree with it. Sure they're good at math, but that's
                because they're being told to do well in math. You know, because if
                they didn't want to do math or if they didn't have no parents at
                home, they wouldn't be good in math.

Crystal: Yes, I…yes, I've heard that a lot of times (laughs). But I think
                Asians are more disciplined, and those who are disciplined have
                the ability to learn more and like try to learn and get help when
                they need it. And those who aren't (disciplined), who don't try,
                that's why they don't learn the content.

Although neither student explicitly states the particular aspect of the "Asians are good at math" narrative they disagreed with, it can be inferred from the substance of their counter-arguments. Tim argues that Asian success in mathematics depends on parenting and personal desire, while Crystal argues that, "Asians are more disciplined." In both cases, the students deploy a "nurture" argument to counter the unspoken notion that Asians are naturally good at math. However,

Beyond innateness, a second theme in students' sense making about "Asians are good at math" was universality, or the implication that all Asians excel in math. This theme was also typical in the interview data, as 21 of 35 participants made some reference to it. Again, students tended to employ subtle rhetorical moves while refuting the narrative that revealed its unstated implications. A common strategy, for example, was to point out Asian classmates that were struggling in mathematics. Sarah, an 11th grader in Algebra 2 who identified as White, expresses this point:

I don't know, I think…well, I know there's the Asian scenario where all Asians are
good at math, but I know plenty of Asian people that just aren't good at math. So I
know Black people that are good at math too…it doesn't matter what race you are
or anything. Or like if your stereotype is that you are good at math.

By mentioning that she knows "plenty of Asian people that just aren't good at math," Sarah implicitly challenges the narrative's universality[15], which in a broader sense is a characteristic that defines all stereotypes. When someone asserts that a group of people acts a certain way, the implication is that the entire group acts that way. One reason this is problematic is that it obscures the reality of within-group variation (R. Gutierrez, 2008). And yet, racial narratives can persist in spite of people's awareness of this variation, an issue that will resurface in the next chapter.

Who counts as "Asian"

In addition to the conceptual nuances of the "Asians are good at math" narrative, there was also the issue of who was thought to count as "Asian." That is, when students mentioned

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[15] Here I only note without further discussion that Sarah also mentions "Black people that are good at math." Later in this chapter I argue that this kind of rhetorical move reveals an implicit link between positive racial-mathematical narratives about Asians and negative racial-mathematical narratives about other students of color, a power dynamic that I call "external relationality."

hearing people say "Asians are good at math," which Asians did they think people were talking about? Given the racial and ethnic diversity at Eastwood High, students were accustomed to interacting with classmates from a variety of Asian backgrounds. Did they mean all Asians or only certain Asian sub-groups (e.g., Korean, Filipina/o)?

Of the 35 students interviewed, 7 stated that they could not say for sure. Of the remaining 28 students, 14 claimed that most people could not tell Asian people apart, and that the narrative referred to anyone who "looks Asian." The statement below from Rey, a 12th grade Precalculus student who identified as Samoan, exemplifies this sentiment:

Shah: So one thing I'm wondering about is when people say that Asians are good at math, which Asians are they talking about?

Rey: I mean you can–the Asians… The Asians as in, well what would you call them… Chinese… Chinese? Japanese? What do they fall under?

Shah: Like, I guess, I don't know.

Rey: Chink-eyed? (laughs) Nah, I'm playing. Yeah those Asians, as well as the Indian Asians too. I mean, dang, I forgot about them–the Indian Asians they're good. They're smarter in a lot of things, yeah. I don't think I've seen one Indian that's not on top of their stuff, yeah.

Like Rey, for most students the word "Asian" signified people of East and Southeast Asian descent. Several other students also used the derogatory term "chink-eyed" (usually in jest) as a catchall phrase to describe classmates of these backgrounds. Rey also calls out "Indian Asians." Roughly one-fourth of the students (9 of 35) specifically cited "Indians" as being good at math, but in general South Asians were an afterthought, if they were mentioned at all. In fact, students across the interview sample were unsure about where to situate South Asians within the racial order, and whether people of Indian or Pakistani descent should be considered Asian.

Their uncertainty reflects the fluidity and instability of racial categories in general, but also the prevailing racial logic about South Asians in the United States, particularly post-9/11 when a discourse emerged that racialized South Asians as "Arabs" and, consequently, as "terrorists" (Bonilla-Silva, 2003). Some students also articulated hierarchies of mathematical ability among Asian ethnic groups (e.g., "light-skinned" Asians versus "dark-skinned" Asians, Koreans and Japanese learners versus Filipina/o learners), an issue I take up in greater detail when reflecting on the dissertation's findings in Chapter 8.

The general racial positionality of Asians in the United States
Although an extended discussion is beyond the scope of this dissertation, it should be noted that the "Asians are good at math" narrative is closely related to broader racial discourses that function to constitute Asians as racial subjects. The predominant racial frame in the U.S. context through which Asians are understood today is the "model minority" idea. As Kim (1999) explains, "journalists, politicians, and scholars alike have constructed Asian Americans as a model minority whose cultural values of diligence, family values, respect for education, and self-

sufficiency have propelled it to notable success" (p. 118). In short, Asians in the U.S. are considered to be a racial group that has "made it."

The normalization of the "model minority" thesis can make it seem as if Asians have always been positioned in this way. In fact, this frame is a relatively recent invention that emerged in the mid-1960s. One of the earliest articulations of the "model minority" narrative in popular culture can be found in a 1966 article entitled, "Success Story, Japanese-American Style," which was published in The New York Times Magazine by William Peterson, a sociologist at the University of California, Berkeley. Peterson argued that like many White immigrant groups before them—and unlike many racial minorities—Japanese immigrants had overcome racism and exclusionary policies in a relatively short amount of time following Japanese internment to find educational, economic, and political success:

> Each new nationality that arrived from Europe was typically met with such hostility as, for example, the anti-German riots in the Middle West a century ago, the American Protective Association to fight the Irish, the national quota laws to keep out Italians, Poles and Jews. Yet, in one generation or two, each white minority took advantage of the public schools, the free labor market and America's political democracy; it climbed out of the slums, took on better-paying occupations and acquired social respect and dignity. This is not true of such "nonwhites" as Negroes, Indians, Mexicans, Chinese and Filipinos. The reason given for the difference is that color prejudice is so great in this country that a person who carries this visible stigma has little or no possibility of rising. There is obviously a good deal of truth in the theory, and the Japanese case is of general interest precisely because it constitutes the outstanding exception. (p. 40)

During the same period similar articles appeared in publications like U.S. News and World Report touting Chinese Americans as "disciplined" and committed to advancement through education. Over time media accounts traded targeted praise of particular Asian immigrant communities for more blanket statements about Asians as a "model" racial group writ large. For example, a Time magazine cover story in 1987 entitled, "The New Whiz Kids," showed six children of apparently East or Southeast Asian descent in a classroom gripping textbooks and sitting in front of a computer.[16] According to the article, "No matter what their route, young Asian Americans, largely those with Chinese, Korean and Indochinese backgrounds, are setting the educational pace for the rest of America and cutting a dazzling figure at the country's finest schools."

Part of its appeal is that the "model minority" discourse seems harmless and complimentary. As a result, most people do not think to resist it or challenge it because, after all, what could be wrong with a compliment? Further, it appears to be backed by scientific evidence (Wu, 2002), such as higher IQ scores (see Lynn, 1982) or higher test scores in subject like math among certain Asian American ethnic groups. However, as many scholars have noted, the "model minority" mythology is false and problematic for a number of reasons, of which here I discuss just a few.

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[16] To be fair, one of the children in the back can be seen holding a basketball, and the article does cite a statistic from a 1984 Department of Education study that found almost one-third of Asian Americans participate in varsity athletics. Still, these images and data were framed in a way that did not debunk the central thesis of the article that Asians in the U.S. are primarily focused on academics.

One reason it is problematic for Asians is that it oversimplifies their historical racial positionality in the U.S. At the same time that the "model minority" discourse distances Asians from non-model racial minorities, thereby making them more acceptable to Whites, a parallel discourse exists that has long-since framed them as "forever foreign" and unable to ever truly become "real" Americans (Tuan, 1999). To be sure, from their earliest immigration Asians have been considered worthy of suspicion—at various times an economic and military threat (i.e., "yellow peril"). Not only, then, does the "model minority" discourse dismiss Asians' ongoing experiences with racism (Chou & Feagin, 2008), but in actuality the racial position of Asians in the U.S. is far less clear or settled than it would suggest. Rather, as Kim (1999) argues, it is through a process of "racial triangulation" that Asians are located within the U.S. racial system.

The "model minority" myth also oversimplifies reality by inappropriately homogenizing a pan-Asian American identity and experience (Lee, 1996). Of course, this is very much in line with the purpose of racialization, in that the act of constructing a racial group goes hand in hand with sweeping claims about the traits and experiences of that group. In fact, each Asian American subgroup (e.g., Chinese, Vietnamese, Mien, Korean) has a distinct immigration history that has partially determined their current positions and opportunity structures. With respect to the notion that all Asians Americans are excelling in education, a recent large-scale study of middle school students' performance in math and reading found considerable variation across nine Asian American subgroups (V. Pang, Han, J. Pang, 2011). This heterogeneity, not to mention the multiplicity of experiences even within those subgroups, contradicts the perception of Asian Americans as a monolithic group.

Apart from its costs to Asian Americans, another reason the "model minority" myth is problematic has to do with its implications for non-Asian racial minorities. A generally accepted assertion among race scholars is that the "model minority" discourse emerged as an implicit (and sometimes explicit) rebuke of Blacks, Latina/os, and Native Americans, in particular (Chou & Feagin, 2008; Kim, 1999; Wu, 2002). Importantly, the "model minority" image crystallized in popular culture during the Civil Rights movement, at a time when "unruly" minorities were protesting and advocating for equality and social justice. Asians as constructed through the "model minority" myth provided a convenient contrast: a racial minority group that apparently found success by working hard, keeping their heads down, and not causing political unrest. If other racial minorities simply stopped complaining and followed this model, they too could achieve the American dream.

So just as W. E. B. Du Bois famously asked of Blacks over a hundred years ago how it feels to "be a problem," it is in this sense that Prashad (2000) asks of Asians how it feels to "be a solution." In effect, Asians became a buffer in the U.S. racial order between Whites and non-Asian racial minorities. Whereas before Whites may have been the primary targets of scorn, some of that resentment was redirected toward Asians as they were elevated as a new racial standard for minority groups. This is not to say that this dynamic was the result of a premeditated plot perpetrated by White people. Nevertheless, an effect of the "model minority" discourse has been to allow Whites (and others, in some cases) to quell charges of persistent racism and minimize claims of racial injustice (Chou & Feagin, 2008).

There is certainly more that can be said about the general racial positionality of Asians in the U.S., but this brief discussion is useful in contextualizing the analysis presented thus far of the "Asians are good at math" narrative. There are many commonalities between the "model minority" discourse and the racial-mathematical discourse about Asians. On the surface, both discourses seem to be nothing more than positive statements about a particular racial group.

Further, both discourses homogenize variation by making universal claims that all Asians behave in certain ways. Last, there is the implication in both discourses that these behaviors are somehow innate. Although the "model minority" idea is predicated in part on the perception of certain cultural practices (e.g., strict Asian parenting that promotes academic discipline), in the absence of a plausible rationale for why racial patterns in those practices exist, the practices can be talked about as if they were genetic (i.e., Asians are innately stricter parents). I return to this issue later in the chapter.

Given this overlap, the "Asians are good at math" narrative can be thought of as an instance of the broader "model minority" discourse. And to the extent that this is the case, theoretically speaking, we should expect a similar tension between the "Asians are good at math" narrative and pejorative racial-mathematical narratives about other groups (e.g., "Blacks are bad at math"), as well as linkages between racial-mathematical narratives and racial narratives about other topics (e.g., intelligence, cultural practices). As I demonstrate below, this supposition was confirmed by the empirical data.

Students did not make sense of the "Asians are good at math" narrative in a vacuum, but instead treated it as one narrative among an economy of racial narratives they perceived as relevant to racial-mathematical discourse. As Table 5 shows, many of the racial narratives students cited were about Asians, but many were about other racial groups as well. And while some of the narratives pertained to mathematics, many others did not. The key point regarding the content of racial-mathematical discourse is that "Asians are good at math" is only the tip of the iceberg. What are these other narratives and how do they relate to each other? The rest of this chapter is devoted to answering these questions as I begin to explore the structure of racial-mathematical discourse.

External Relationality

Students forged a variety of connections between racial narratives that, I argue, reveal the structure of racial-mathematical discourse. In order to parse this structure, over the next two sections I propose two types of discursive relations between these narratives: external and internal relationality. I begin by analyzing "external relationality," which refers to how narratives about one racial group (e.g., Asians) become linked with narratives external to that racial group (i.e., narratives about other racial groups).

A key theoretical point made in Chapter 2 concerned the hierarchical nature of racial discourse (Goldberg, 1993). That is, race does not mark difference in a neutral way; it attaches value to certain differences in ways that construct racial hierarchies. Applying this idea to racial narratives, which constitute a type of discursive element, we can ask how racial narratives facilitate racial hierarchies. Consider the "Asians are good at math" narrative: if Asians are deemed "good" in math, does not the narrative imply that there is at least one non-Asian group that is "bad" at math, or at best that non-Asians may not be as good as Asians at math? Theoretically speaking, the linguistic structure of the narrative—and this is probably true of all stereotypes—is inherently hierarchical. But the empirical question remains: Do students understand racial-mathematical narratives like "Asians are good at math" as non-relational statements, or are students attuned to the ability hierarchies they would seem to imply?

It turns out that the data support the latter hypothesis. Students did not comment on the mathematical aptitude of a given racial group out of context. Approximately 70% of participants (25 of 35) talked about a positive racial-mathematical narrative about one racial group in terms of a negative racial-mathematical narrative about another group (i.e., external relationality).

Consider the following comment from Troi, a 12th grader in Precalculus who identified as Polynesian (Samoan):

So there's a lot of jokes that say "Where the Asians at?" cause, you know, Asians are supposed to be the good ones at math…or like, you know, the Indians like Sanjay [a classmate of his in Precalculus] are supposed to be good at math, and uh Tariq [another classmate] is supposed to be good at math, but I don't think they'll notice me like, "Oh Troi…big Troi, Samoan Troi is good at math" [laughs].

In noting that, "Asians are supposed to be the good ones at math," Troi mentions several of his Asian classmates as examples of students that are expected to succeed in mathematics. But he does not stop there. Instead, he connects this narrative to societal beliefs about his own ethnic group (i.e., "Samoans are not good at math).

When making such linkages, it was not common for students to explicitly state the negative racial narrative. One possible reason for this is that students feared being perceived as racist, even if they disavowed the validity of a particular stereotype. Instead, students drew connections between narratives in subtle ways that implied the existence of explicitly pejorative racial narratives. A typical approach was for students to challenge the validity of the "Asians are good at math" by citing examples of mathematically successful non-Asians as exceptions to the narrative. For example, Monet, a 12th grader in Algebra 2 who identified as Black, described her stance on the "Asians are good at math" narrative by highlighting herself as a counterexample:

I don't… I don't agree (with the stereotype) because I feel like it doesn't really make a difference what race you are. Like I'm Black, but I'm good at math. So are you not going to ask me for help because I'm not Asian? So I don't really agree with the stereotype.

Notice that Monet does not actually vocalize a "Blacks (or non-Asians) are bad at math" narrative. Instead, she subtly alludes to its existence by suggesting that classmates may not ask her for help because non-Asians—and perhaps specifically Black learners—are not considered to be as mathematically capable.

Embedded in both Troi's and Monet's reasoning is the idea that the discourse suggests mathematical proficiency is the exclusive property of Asian learners. This is problematic because if only Asians can be good at math, then other racial groups cannot be good at math. In essence, narratives about the mathematical inferiority of Blacks, Polynesians, and other groups become the unspoken halves of the "Asians are good at math" narrative. The external relationality between positive and negative racial-mathematical narratives renders them two sides of the same coin. Thus, for students like Monet, citing examples of mathematically successful non-Asian students becomes a useful rhetorical tactic that undermines what Martin (2009) has called the "racial hierarchy of mathematical ability," where some racial groups are expected to excel in mathematics at the expense of others that languish at the bottom.

It is worth noting that these mathematical "exceptions" were almost always classmates of color from historically marginalized communities, especially Black and Latina/o students. Rarely did students mention successful White classmates as exceptions to the "Asians are good at math" narrative. In fact, the data indicated ambivalence regarding White students' mathematical ability. Only five students even mentioned racial-mathematical narratives about White students, with two saying that people think Whites are good at math and the other three saying that Whites are

considered bad at math. The quotation at the beginning of this chapter from Rachel, a 12th grade Algebra 2 student who identified as White, exemplifies this ambivalence: "Well, I think everybody had the list in their head: 'Oh it's Asians, and then it's White people, and then…Blacks and Mexicans are tied' (laughs)."

On the one hand, that so few students mentioned narratives related to White students may reflect the fact that as the predominant racial ideology in the United States, one of the goals of "whiteness" is to render Whites invisible and absent in conversations of race (Leonardo, 2009). That is, when people think of "race" they do not think of White people, since they are perceived to be color-free and tend to adopt a stance of color-blindness (Bonilla-Silva, 2003). On the other hand, perhaps the unsettled position of Whites in the racial-mathematical order renders stereotypes about them less potent and thus less pervasive. For as Rachel tells it, the top and bottom of the hierarchy are fixed, but where Whites fall is undetermined: not as gifted as Asians, but apparently not as deficient as other students of color.

This echoes a similar issue that came up before in the discussion of Asians' general racial positionality in the U.S. context. In the broader racial dynamic Whites reign supreme, but as Kim (1999) argues, Asian Americans are "triangulated" into an ambiguous space between Whites and Blacks. That is, their status as a "model minority" positions them closer to Whites, but their status as "foreigners" simultaneously marginalizes them as "Other." In mathematics, though, the situation for Asians and Whites is inverted.

Within racial-mathematical discourse, Asian positionality is no longer ambiguous: they are definitively at the top of the racial hierarchy of mathematical ability. Instead, it is Whites that now occupy the undefined middle space. But whereas in the broader culture Asians may function as a "buffer" between Whites and non-Asian racial minorities, it is not at all clear that Whites in mathematics are playing the same role. That is, judging by how students in this dissertation research perceived Asians in mathematics, it does not appear that Whites are deflecting the attention, jealousy, ridicule, and scorn often directed at Asian learners. A thorough exploration of Whites' location in the racial-mathematical order, as well as the ideological and material functions that location serves, is beyond what is possible in this chapter. However, future research should return to these issues because they may help further illuminate how the racialization of non-Whites in mathematics relates to the construction of their racial position in the U.S. writ large.

In sum, as a defining quality of the structure of racial-mathematical discourse, the notion of external relationality is important because it expands the scope of the discourse's impact. Conceptualizing racial-mathematical discourse as being solely about the "Asians are good at math" narrative suggests that its impact on learning and learners is limited to Asian students. That is, either the discourse might serve to motivate Asian students to succeed in mathematics, or the discourse becomes a source of extreme pressure as Asian students struggle to live up to the expectations it sets (see Figure 2). In essence, this structure implies that the effect of racial-mathematical discourse on learning is essentially reflexive (i.e., pertaining to Asians alone).

Figure 2. Prevailing conception of racial-mathematical discourse.

The findings presented thus far, however, point to a more a complex, hierarchical structure that implicates mathematics learners of all racial backgrounds (see Figure 3). A narrative like "Asians are good at math" exists in dialectic with other racial-mathematical narratives. These narratives mutually constitute, reinforce, and entrench students' racial and mathematical positionality on a racial-mathematical order. A situation is created where one could not exist without the other: the superiority of one group depends on the inferiority of another group and vice versa. Asians become "good" at math because they can be compared to Latina/os; Polynesians become "bad" at math because we can compare them to Whites or Asians.[17] This kind of hierarchy is only possible because of the way in which the narratives are connected to each other within the broader structure of racial-mathematical discourse.
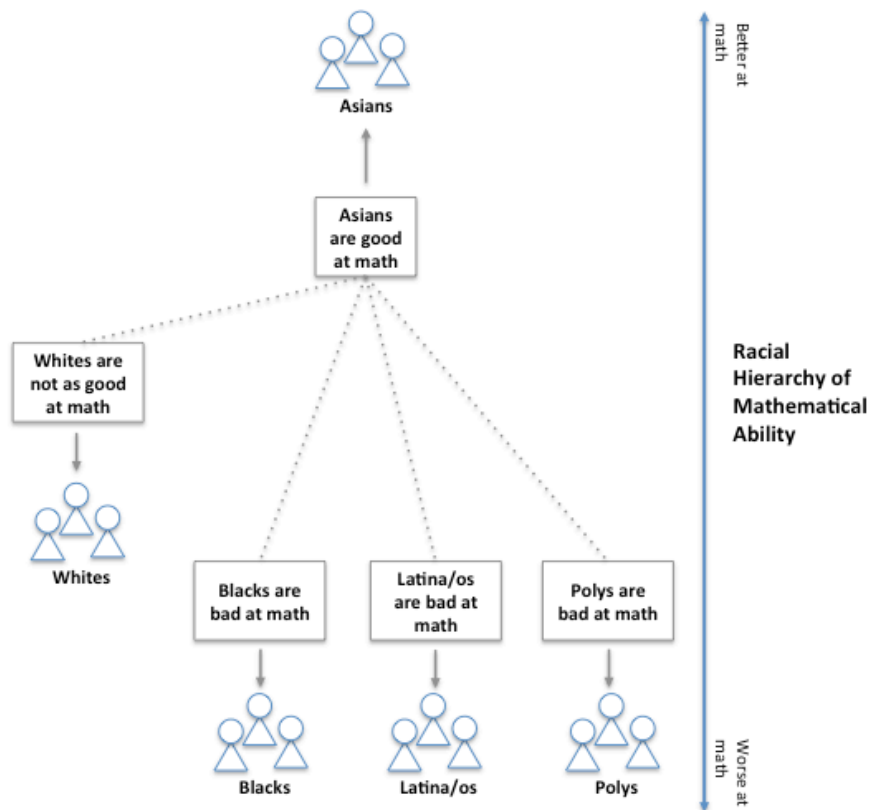
Figure 3. External relationality between racial-mathematical narratives.

Internal Relationality

In this section I continue detailing the structure of racial-mathematical discourse by calling attention to a key aspect of that structure: how racial-mathematical discourse links to racialized discourses beyond mathematics. Whereas external relationality refers to connections between narratives about the same topic (e.g., mathematics) that cut across racial groups, internal relationality refers to connections between narratives about different topics internal to a

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[17] Here I have focused on racial narratives related to mathematics, but one can imagine how the concept of "external relationality" applies to any topic (e.g., personality traits, intelligence) for which narratives exist that cut across racial groups. This will become evident in data presented later in the chapter.

particular racial group. I begin by highlighting the three most significant non-mathematical racialized discourses that emerged in the data. Then, I conduct an in-depth analysis of how narratives from these various discourses coalesce to racialize mathematics learners. Focusing on the case of Polynesian males, I demonstrate how webs of racial narratives work in concert to construct Samoan and Tongan boys as mathematically deficient.

Connections to non-mathematical racialized discourses

Besides those related to mathematics, the most frequently mentioned racial narratives concerned perceptions of overall academic ability, general intellectual capacity, and parenting practices (see Table 5). Racial narratives about academic ability often emerged in the context of students' linking Asians' mathematical prowess to the belief that Asians excel in school overall, regardless of subject area. Rey, a 12th grade Precalculus student who identified as Samoan, expresses this perspective:

Shah: Have you heard people say that some groups are better than others at math?

Rey: (3 second pause) Like the Asians? (Laughs) The group…Asians? Yeah I guess, yeah I heard that. Well Asians are good at a lot of things, yeah, I guess, yeah.

Shah: So what do people say?

Rey: Well, Asians–Asians are good at everything…and then, you're talking like stereotypes? Asians are good in everything… I don't know, sometimes when you see a Black person doing stuff, they're probably like… They probably seem amazed or something like that. Yeah because at this school, Black people are like… And once you see them actually like doing good, (other students) are like amazed for some reason I guess.

Although the initial interview question related to math, it prompts Rey to think about how Asian students are "good at everything." While Rey does not specify what he means by "everything," based on similar comments from other students it can be inferred that it refers to academic pursuits, as opposed to extracurricular activities such as sports. Notice also that Rey alludes to a prevailing narrative that Blacks are not as academically inclined, which in his view engenders a kind of "racial surprise" when Black classmates do well. The external relationality between these racial-academic narratives mirrors the same kind of relationship between racial-mathematical narratives discussed in the previous section.

Altogether, over half of participants (20 of 35) cited a racial-academic narrative, most of which (n = 16) pertained to Asian learners. Here Rachel echoes Rey's comment and describes the relationship between narratives about Asians in school and in mathematics:

I think it's just Asians are good at school (laughs) and then, it's like--that's a really broad one, like how all Asians are supposed to bring home straight A's, and if there's a B, you're going to get beat! That's a big one last year, I remember that.

But I think that's the whole one, but then inside of that, they're supposed to be really good at math. That's their thing. And I don't know if it's just because our parents told it to us, and that's just how it was or…we get so many of our products from China so…"Oh! You must be good at math because math is involved in everything [emphasis her own], and you must manufacture all these things."

Rachel describes a nested structure for these discourses. She acknowledges that Asians are considered excellent at school in general (i.e., racial-academic discourse), but she notes that "inside of that" Asians are considered good at math (i.e., racial-mathematical discourse). Further, Rachel attempts to explain why Asians are considered good at math, hypothesizing that it might be related to a Chinese expertise in manufacturing made possible by an excellence in mathematics. How students built and leveraged folk theories to explain racial-mathematical discourse is explored further in the next chapter.

Besides tapping into a racial-academic discourse, roughly two-thirds of students (24 of 35) brought up racialized perceptions of intelligence. Several students recalled hearing that Black students at Eastwood had been referred to as "gorillas" or "monkeys," animals that connote under-evolution and diminished rational capacity relative to humans. A White, 12th grade student in Algebra 2 named Rachel described being teased because she would dye red her naturally blonde hair: "I get a lot of jokes about being a redhead…they make a lot of the fact that the dye will never cover up the blonde. Because I say a lot of stupid things." Omnipresent in the United States, the stereotype of the "dumb blonde" is racially (and gender-) specific in its reference to a segment of the White population.

Overall, though, nearly all of the intelligence-based racial narratives mentioned pertained to Asians, positioning them as "smarter" than other racial groups. Consider the following explication from Troi, a 12th grader in Precalculus who identified as Polynesian (Samoan):

Because I would say society has based, like, where each ethnicity should belong…like um, smart kids are Indian and Asians, of course, and the mediocre kids are like some Whites, some Blacks…and like the lower kids are like, you know, some of the Blacks again, some Whites, or like Latinos--Latinos are like the lower, you know, educational kids and Blacks. And like Polynesians now because Polynesians are populating California and in the United States.

As was discussed in Chapter 2, the notion that "smartness" (i.e., the capacity for rational thought) is unequally distributed across racial groups has a long history in social discourse, particularly in Europe and in the United States (Shah, 2010). The intellectual order Troi describes syncs with the concept of a "racial-rational hierarchy" (Eze, 1995; Mills, 1997), albeit with one exception. Whereas in Mills's formulation Whites have been historically positioned as most intelligent, Troi identifies Indians and Asians as the "smart kids"; Whites (along with non-Asian students of color) occupy the middle and lower rungs of this ladder. Notably, Troi's articulation of a racial-rational hierarchy mimics the racial hierarchy of mathematical ability articulated earlier by Rachel (see Figure 3). Again, reiterating a key point from Chapter 2, I do not believe that this alignment between perceptions of intelligence and perceptions of mathematical ability is coincidental. Indeed, the empirical data presented here support the theoretical premise about the centrality of "intelligence" in racial-mathematical discourse proposed in Chapter 2.

In addition to academic ability and intelligence, a third frequently cited discourse had to do with parenting practices. Second only to the "Asians are good at math" narrative in popularity, nearly two-thirds of participants (22 of 35) claimed that Asian parents were more academically oriented, sometimes even at the expense of their own non-Asian parents. Isaac, a 12th grade Algebra 2 student who identified as Polynesian (Tongan), had this to say about how Asian parents go about reinforcing high academic expectations with their children:

> If I were Asian, you know, my parents would have been more stricter. They would have taken things away from me, you know: having fun. That's what I think. That's how I look at them. If you're doing good in school they give you more freedom. Like being Tongan, my dad gave me freedom, but not too much freedom. But like I could go to my cousin's house…I think if I were Asian, I wouldn't be able to go out as much as I did. Like when I would go to my cousin's house, my dad would let me sleepover. But how I'm thinking is that an Asian family wouldn't let him…they'd make him come right back home to do your homework. When my dad is too tired, he wouldn't tell me to do my homework-- he'll expect me to do it…

To be clear, Isaac does not seem to believe that his father—or Polynesian parents in general—are "bad" parents. But Isaac draws a contrast between his Tongan father, who gave him "more freedom," and Asian parents, who in his view are "stricter." The prevalence in the data of the "Asian parents are strict about academics" narrative was remarkable because at no point were students asked directly about parenting practices. It is plausible that if students had been asked directly about stereotypes related to parenting, awareness would have been nearly ubiquitous. Similar to rhetorical strategies highlighted earlier, students would often bring up racial narratives about parenting to counter other racial narratives. This move is noticeable in the following remark from Jessica, a 9th grader in Algebra 2 who identified as "mixed" race:

Shah: Have you heard people say that some groups are better than others at math?

Jessica: Mmm…yeah. Asians. Well they're always…that's like a stereotype that Asians are smart, and not really…I guess I see them, but they are smart--it's just not Asians. I think its cause of like if you go back its how their parents raised them.

Shah: And so like, what will students say about it?

Jessica: Like…uh…my friends joke around like, "My parents are going to, like, whup me because I have a B." And I'm all like, "What are you talking about?" They're like, "I'm Asian!" And I'm like, "Oh my god, okay! Whatever, be quiet, I have a C in that class" (laughs).

In this case, Jessica brings up Asian parenting to counter the "Asians are smart" narrative. On a deeper level, though, she is rejecting the implication of innateness (i.e., that Asians are genetically smart). This continues the earlier discussion about "nature" versus "nurture." From

her perspective, the Asians she knows are in fact smart, but she does not believe they could have been born that way. Instead, she contends that parenting practices served to nurture that intelligence over time.

But like so many students who made a similar argument, Jessica fails to address an important question: assuming her reasoning is correct, why should it be that Asian parents are better than other parents at motivating their children in school? This was not a formal component of the interview protocol, but few students who were asked could offer a clear explanation. Reminiscent of Ogbu's (1978) argument about voluntary minorities, some argued that as immigrants Asians in the U.S. tend to work hard and value education as a means of advancement. However, no students applied this logic to Latina/o immigrant parents and children, for instance.

I do not doubt that the students I interviewed had some Asian friends with strict parents. But it is also plausible that their perceptions were influenced by the ideology and mythology about Asian parenting that has become entrenched in the U.S. cultural imagination. For example, Amy Chua's (2011) infamous book, Battle Hymn of the Tiger Mother, has most recently been taken up as evidence of the superiority of Chinese—and, by extension, Asian—parenting practices. What is ironic about cultural explanations for racial phenomena is that, in the absence of a clear reason for why one group of parents would be more effective than another at encouraging academics, the basis for the (perceived) cultural disparity becomes implicitly genetic. In other words: why are Asian parents good at pushing their kids in school? Because they just are. It is in this sense that deploying a racial-cultural narrative like "Asian parents are stricter" to counter the "Asians are good at math" narrative can be just as problematic as claiming that Asians are innately better at math. Ultimately, both mathematical ability and parenting ability get framed as genetic traits.

How discourses converge to racialize math learners

By themselves, racial-mathematical narratives like "Latina/os are bad at math" are powerful messages about who can and who cannot succeed in mathematics. Further, external relationality linking narratives about mathematical ability across racial groups bolsters their impact. But as the findings from the previous section show, non-mathematical discourses of race—especially those related to academic ability, intelligence, and parenting—also factor in students' attempts to situate mathematics learning in a racial context. In this section I explore how internal relationality between narratives from discourses about a single racial group (e.g., narratives about Polynesian academic ability, Polynesian intelligence, Polynesian physical traits) facilitates the production of particular kinds of mathematics learners and solidifies their location on a racial hierarchy of mathematical ability. To illustrate the point, I consider the case of Polynesian males at Eastwood High.

Polynesians—especially Polynesian males—were commonly described by students at Eastwood High as "big and mean" and "good at sports." Indeed, many of them played on the football team and organized a regular game of rugby during lunchtime. Some of the faculty perceived them as "troublemakers" and found them difficult to manage. All of these perceptions held consequences for how they were positioned as learners. The statements below from three Polynesian boys describe these discourses and explain their consequences:

> And so people come into class and they just see me as big, mean…and here [at Eastwood High], the Poly kids are seen as like we're big, that we do whatever we

want. That's what they think. That's what a lot of people think about us. Like we're not very intellectual, and like we're not smart, basically. But once they meet me they'll know that I'm actually very intelligent, and I can do math, I know how to do English, I can do science…all that kind of stuff. I think when I come in they just see me as someone who's going to hurt them or beat them up or someone who freaking wants to kill. They're not going to take time out to sit and talk with me, and actually greet me and actually get to know me. So that's the whole point of the judging, that's how I see it.

Troi (12th Grade, Precalculus, Samoan)

They think, like, just because [Polys] so big that we don't know how to do math. They think we're dumb. But some students--I'm not going to lie--some students take that image and prove it to them that they are. Me? Me and my brother and a couple of other students like Rey…we try to prove them wrong. Not that we're only big and good at sports, but we're also trying to tell them that we're also smart. That we're scholar-athletes. That's what we try to prove. That's why I switched my whole image around sophomore year so I can be a scholar-athlete.

Isaac (12th Grade, Algebra 2, Tongan)

What do people say about Samoans? Just…don't mess with them (laughs). And they're good in sports. To be exact, contact sports like football, rugby, yeah. Nothing to do with school. So if they were to see them play sports, they would be like, "Oh damn, he was raw in this, he was good in this." But I don't think…I never heard anyone say, "Oh you Samoan, you must be good at math or you must be good in English."

Rey (12th Grade, Precalculus, Samoan)

Given that Troi, Isaac, and Rey were all enrolled in advanced math classes and all participated in team sports at Eastwood High, it is perhaps not surprising that they all independently tell a similar story of how Polynesians get positioned as mathematically and academically unpromising. Further, as Table 6 shows, their stories revolve around a similar set of racial narratives.

Table 6.
Racial Narratives Vocalized or Implied by Three Polynesian Boys

Troi	Isaac	Rey
"Polys are big"	"Polys are big"	"Samoans are bullies"
"Polys are not smart"	"Polys can't do math"	"Samoans are good at sports"
"Polys can't do math"	"Polys are dumb"	"Samoans are not good at math"
"Polys can't do science"	"Polys are good at sports"	"Samoans are not good at English"
"Polys can't do English"	"Polys are bad at school"	"Samoans are bad at school"
"Polys are violent bullies"		

All of the narratives mentioned by the three boys were Polynesian-focused (i.e., internal to their particular racial group), and the narratives also spanned a variety of racial discourses. The point I emphasize here, though, is how students connected the narratives in loose logic chains. For example, Troi draws a direct link between his classmates' perceptions of his academic potential in math, science, and English and their perceptions of his intelligence. But in Troi's model, the "Polys are not smart" narrative is also connected to the perception that "Polys are big." Similarly, both Isaac and Rey articulate the image of the "dumb jock," where size and athletic ability are conceptualized as dichotomous with intellectual capacity. The imposition of the "dumb jock" identity, in turn, means that neither Troi, nor Isaac, nor Rey are perceived (at least from their perspective) as capable in school or in mathematics. Rather than operating in isolation, the narratives form an interrelated and mutually reinforcing web (see Figure 4):
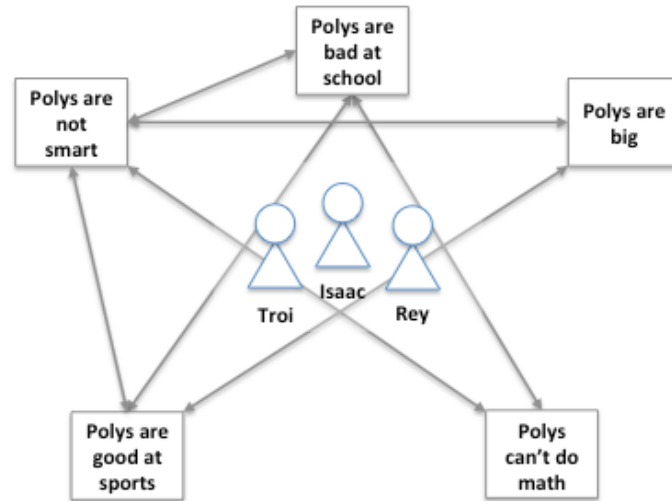
Figure 4. Internal relationality in the case of three Polynesian male students.

In sum, no one narrative alone fully defines a learner. A Polynesian boy at Eastwood High is not considered mathematically deficient just because Polynesians are big, or just because Polynesians are thought to excel at sports, or just because Polynesians are seen as bullies. Instead, narratives from multiple discourses are brought to bear on the question of a given student's positionality as a math learner and as a racial subject. And these narratives, in turn, become intertwined through their relationality, as they complement and inflect each other. The structure of racial-mathematical discourse, then, depends not only on the external relationality between racial groups, but it also hinges on the relations between narratives internal to a given racial group. That is, external and internal relationality mutually reinforce each other in racializing learners.

External and internal relationality as concurrent forces

In this chapter I have proposed two types of relations that define the structure of racial-mathematical discourse: external relationality between narratives across racial groups, and internal relationality between narratives within a particular racial group. With the general

schematic in Figure 5, I conclude by bringing together the main ideas in this chapter and discuss how these forces function in tandem.

Each racial group[18] in Figure 5 has its own set of narratives pertaining to that racial group (i.e., A_1, A_2…A_n; B_1, B_2…B_n; C_1, C_2…C_n). Each narrative, in turn, may derive from racial discourses about a variety of topics (e.g., mathematical ability, parenting, personality traits, intelligence, physical traits). Altogether, the economy of narratives is governed by external and internal relationalities. That is, narrative A_1 interacts with narratives A_2…A_n (i.e., internal relationality), but narrative A_1 also interacts with narrative B_1 (i.e., external relationality), which is an element of the same category of racial discourse but pertaining to a different racial group.
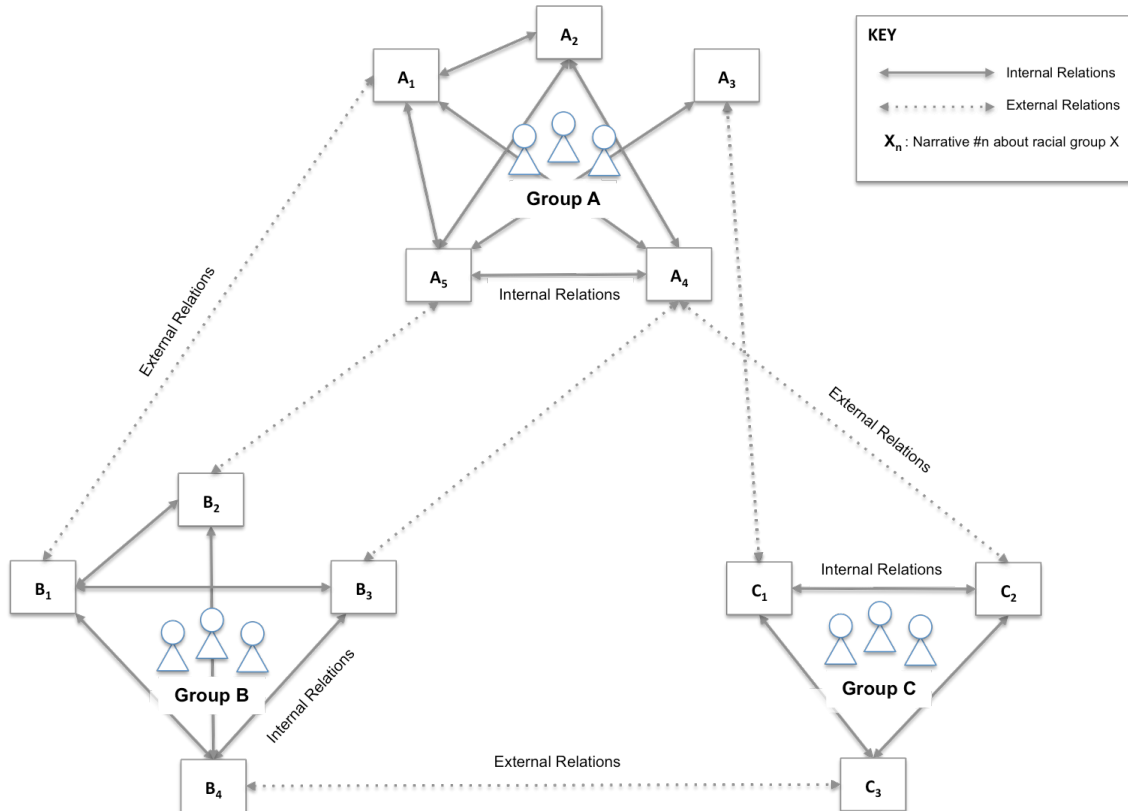
Figure 5. A general schematic of the content and structure of racial-mathematical discourse.

To illustrate, let us suppose that Asians, Blacks, and Whites are represented by Groups A, B, and C, respectively. Based on the interview data in this study, there are numerous narratives about Asians internal to Group 'A.' Consider, for example, the oft-mentioned notion that "Asians are good at school," a societal belief that directly positions Asians as academically capable. This narrative gets linked to complementary narratives that strengthen this positionality, such as the belief that Asians have a special ability to "focus," or that Asians have more time to focus on school because they are shy and "less social" than other students. Another example is the "Asians are good at math" narrative. The combination of being "smart" and being "good at school"

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[18] The choice to represent only three racial groups in Figure 5 is a simplification intended for illustrative purposes. The full economy of racial groups and racial discourses would be infeasible to represent in a diagram. Figure 5 is only meant to highlight structural features central to this larger economy.

allows Asians to excel in the one subject considered to be the most difficult of all subjects: mathematics.

So the internal relationality between narratives facilitates the construction of members of a particular racial group as certain types of learners. But each of these internal narratives is further bolstered by connections to counterpart narratives about other racial groups. For example, while the "Asians are good at math" narrative is supported by the "Asians are good at school" and "Asians are smart" narratives, it is also reinforced by the existence of a "Blacks are bad at math" narrative. To be an Asian person that is good at math is to simultaneously not be a Black person that is bad at math.

Similarly, the existence of a "Whites are good at English" narrative provides further validation by drawing clear lines between the "creative" disciplines (which become the property of Whites) and the supposedly less expressive, "technical" disciplines (which become the property of Asians). These dialectical tensions can be especially potent because racial narratives, I argue, are fundamentally hierarchical, so every narrative in Figure 5 has a mutually reinforcing flipside. In this sense, external relationality echoes Hall's (1996) notion of a "constitutive outside," in that people become defined both by who they are taken to be and by who they are taken not to be. In other words, the "outside" (i.e., what you are not) plays a consequential role in one's positionality. This idea is elaborated further in Chapter 7.

Of course, the schematic in Figure 5 is far from comprehensive. What does it leave out? First, I have yet to say much about student agency. While it is true that in most cases multiple discourses converge to position most learners as mathematically incapable, students continually find ways to reposition themselves in academically productive ways. One way this can happen is through the introduction and appropriation of counter-narratives (Nasir & Shah, 2011; Yosso, 2006). A student might, for example, counter the idea that "Latina/os are dumb" by proposing the counter-narrative that "Latina/os are smart" into the discourse about Latina/os.

Another way students can exert agency is to trouble the internal relationality between historically linked narratives. This was evident in comments from the Polynesian male students presented earlier, where one boy in particular, Troi, sought to decouple the idea that being physically large—a trait considered intrinsic to Polynesian boys—necessarily signifies low intelligence and thus low math ability. Instead, he aimed to prove that being Samoan, big, good at sports, and being good at math are not incompatible qualities. Students also have a say over how they choose to respond to negative narratives about their group. For some, a negative narrative can become a source of motivation to excel in mathematics to disprove the narrative.

Besides agency, I also have yet to say much about the dynamic nature of racial-mathematical discourse. The data presented thus far have framed the discourse in more or less static terms, as students shared the narratives they heard in the world around them. But while this approach proved useful for analyzing the discourse's content and structure, only documenting the existence and organization of racial narratives does not shed light on how racial narratives take up life in everyday activity. Also, it does not help us understand how their deployment in social interaction becomes consequential for issues of positioning and identity formation. Both of these issues are taken up in Chapters 6 and 7, respectively.

Summary

The purpose of this chapter was to use student interview data to map the content and structure of racial-mathematical discourse in the United States context. Conventional wisdom suggests that the connection between race and math begins and ends with the "Asians are good at

math" narrative. The findings here do not support this idea. To be sure, all of the Eastwood High students I interviewed found the "Asians are good at math" narrative to be salient. However, the data show that parsing the relationship between race and mathematics learning spurred students to draw from a variety of racial discourses that extended beyond Asians and beyond mathematics. Indeed, the preponderance of complementary narratives suggests that "Asians are good at math" is but one node within a complex economy of intersecting racial narratives.

The second part of this chapter was devoted to understanding how these narratives were organized in relation to racial-mathematical discourse. I proposed two types of relations—external and internal relationality—as core to the discourse's structure. I argued that these relations comprise a structure in which multiple racial narratives converge to position most non-Asian students of color as being mathematically incapable. Further, it is also noteworthy that the empirical data corroborated the significance of the three main theoretical concepts—hierarchy, innateness, and intelligence—that I presented in Chapter 2 as foundational to racial-mathematical discourse.

Having established a basic frame for racial-mathematical discourse and also analyzed much of its substance, I now turn to the question of its pervasiveness. In the next chapter I explore the various contexts—both in and out of school—where racial-mathematical discourse emerges.

Chapter 5: Sources of Racial-Mathematical Discourse

"Asians" + "good" + "math" (2,480,000 results)
>   Link 1: *Asians are Good at Math: What an Awful Stereotype*
>   Link 2: *Are White People as good as Asians at Math?*
>   Link 3: *Aren't You Asians All Good at Math? – Don't We Look Alike?*
>   Link 4: *Why does everybody think only Asians are better at math?*

"Blacks" + "good" + "math" (5,820,000 results)
>   Link 1: *How come black people aren't very good at math? – Yahoo! Answers*
>   Link 2: *Why Aren't More Blacks Pursuing Math and Science Careers…*
>   Link 3: *Declining numbers of blacks seen in math, science*
>   Link 4: *Blacks in Math and Science: Let's Get Those Numbers Up People…*

—Google Search, February 18, 2013

In the previous chapter, I analyzed interview data in order to map the content and structure of racial-mathematical discourse. This chapter extends those findings by detailing the sources of that discourse. In other words, where do students perceive racial-mathematical discourse surfacing in the world around them? Overall, the data suggest that racial-mathematical discourse is pervasive in the United States, and that it originates in (and propagates through) both local and society-level sectors of everyday life. As expected, one place where the discourse emerges is at school, both in and out of math class. But analysis also revealed that racial-mathematical discourse is distributed across multiple sites that extend beyond the school setting, such as students' local communities, media imagery, and international comparisons (e.g., Asian countries vs. the United States).

To be clear, in contrast with the previous chapter, the findings presented here should not be taken up as making claims about representativeness across the interview data. That is, in highlighting the role of particular phenomena in students' sense making about racial-mathematical discourse, I do not claim that these phenomena were salient to all or even most of the students I interviewed. To be sure, in some cases only a handful of students explicitly mentioned a certain source of racial-mathematical discourse. Nevertheless, given that students were not asked directly about any specific topic (e.g., course enrollment), frequency (or infrequency) should not be interpreted as an indicator of significance. Instead, the findings documented in this chapter should be understood as pointers to an initial set of phenomena students find relevant to racial-mathematical discourse.

School-related Phenomena

The most common source of racial-mathematical discourse—mentioned by 20 of 35 students—were racialized patterns they noticed at Eastwood High, or phenomena that were related to academic achievement more generally. One pattern salient to students pertained to mathematical performance (i.e., grades) or course enrollment. This comment from Samantha, a 10th grader in Geometry who identified as White, was representative of the data:

Oh yeah. Like Asian people [are considered better at math]… Five people popped into my head–they're Asian and they got A's, know what I mean? But, um…(3 second pause)… African-American students do less…or, you know, not as well, but I think that's definitely a stereotypical thing to say but it's like, look at where we're at, do you know what I mean? I think you hear more like Asian people are good at math. I would say that. (Laughs) This one girl–she's in calculus and she's my grade. That's ridiculous. How are you even in calculus…like, like…(laughs)? That just blows me away.

Samantha begins by noting that "five [Asian] people popped into my head and they got A's." As I noted in Chapter 4, it was common for students to make general statements about classmates whose performance (in their view) either confirmed or rejected certain racial-mathematical narratives. But Samantha goes on to cite a specific classmate: a 10th grade Asian female enrolled in AP Calculus. What is remarkable here is that including Samantha, a total of five students spontaneously mentioned this exact student. Another 3 interviewees mentioned a second Asian girl at Eastwood High named Aki who had taken Calculus as a 10th grader the year before. Altogether, for nearly 25% of the interview pool (8 of 35), these two students represented especially conspicuous instances of the "Asians are good at math" narrative.

Of course, race alone may not explain why these students in particular stood out. Three of the 18 students in the Calculus class at Eastwood High that year identified as "Asian," but Megan was the only one mentioned in the interviews. And presumably, Aki was not the only Asian student enrolled in Calculus the year before. What caused these two girls to receive special attention? While it may that be that Megan and Aki were simply more popular or well known at school and therefore more memorable than other Asians in Calculus, it seems plausible that a major factor in establishing their legendary status was their age.

Like most schools, the norm at Eastwood High was for Calculus to be filled with 12th graders. And while a few of the more advanced 10th graders were taking Algebra 2, most 10th graders were taking Geometry. Thus, at Eastwood High at least, Megan and Aki would be considered between two and three years above grade level. And combined with their enrollment in the most challenging math class offered at Eastwood High, it is not surprising that the girls might be deemed "mathematical prodigies" even independent of being Asian. At the very least, bringing race into the mix would only seem to solidify people's impressions of their mathematical competence, and simultaneously turn Megan and Aki into paradigmatic exemplars that further reify the "Asians are good at math" narrative.

And yet, there is evidence to suggest that how students identified these "exemplar" classmates in the first place was mediated by racial-mathematical discourse. For Megan was not the only above-grade level "prodigy" in Calculus. With one of the few A's in the class, Megan was certainly a high-performer in Calculus, but the student with the highest grade was a Latino boy in the 11th grade named Mario. While not as much of an outlier as Megan, being an 11th grader in Calculus still qualified Mario for "prodigy" status. In fact, Megan told me that everyone in the Calculus class wanted to be in Mario's group for collaborative projects, and that she herself was especially "jealous" of Mario's mathematical ability.

Given the high status attributed to Mario by his peers in Calculus, one might predict that Mario might stand out to students in the same way that Megan did as an example of someone who excels at math. And from a racial standpoint, one might predict that, like Megan, Mario may be cited in order to substantiate a positive racial-mathematical narrative about his racial group

(i.e., Latina/os). But it turned out that only 1 of 35 students—Akshay, an 11th grade student in Precalculus who identified as Indian—mentioned Mario. Further, despite describing Mario as "brilliant," and as one of the few students he knew at Eastwood High capable of excelling in both mathematics and English, this did not lead Akshay to espouse a "Latina/os are good at math" narrative. To the contrary, in the excerpt below Akshay explains that he actually believes "Mexicans" to be the worst at math:

> Alright…racially…who's not good at math? One of my best friends is White, and he's good at math. My other best friend [Mario] is too, but he's like the only good one in math who's like Mexican. Alright, Indians…they are straight up gangsters…straight from India. Who else is there? Megan in Calculus…every Asian guy I can think of is in Calculus. And they're sophomore and juniors, which is like crazy (laughs). I say Mexicans [are the worst], to be honest. Okay let's think about it. Who sits around me (in Precalculus)? Lucia--she's struggling with it…Beatriz? She thinks she did alright on the test. Then Silvia, she always asks me for help, but that's cool, I don't mind. Rico…I asked him if he raped the test or if he got raped by the test, and he got raped by the test. That's why I say Mexican.

Akshay recruits multiple classmates into his attempt to make sense of purported racial disparities in mathematical ability. Like Samantha, he takes notice of Megan and makes the broader claim that, "every Asian guy I can think of is in Calculus." Earlier in the interview Akshay also cited three Indian boys in Precalculus (himself included) that he considered to be the "best" students in the class (i.e., "gangsters"). Altogether, these classmates constitute his evidence that "Asians" and "Indians" really are the best at math. But notice that Akshay only mentions classmates that are doing well in math, in spite of the fact that at least two of his other Asian classmates (not mentioned by Akshay) were struggling in the Precalculus class.

There is a marked difference in how Akshay recruits specific students into his argument when talking about Mexicans in mathematics. Although he initially cites an example of a mathematically successful Mexican student (i.e., Mario), Akshay then rattles off three classmates he considers weak in mathematics. Neither Mario nor Beatriz—the student he admits did "alright" on the recent Precalculus exam—is apparently enough to prevent him from reassessing the "Mexicans are bad at math" narrative. In what seems to be a classic case of "confirmation bias," Akshay conveniently appropriates or ignores those examples that fit the pre-existing narratives he endorses. He cites students that fit the dominant discourse, such as Megan (i.e., an Asian that is good at math) and three of his Latina/o classmates (i.e., Latina/os that are not good at math), while dismissing students like Mario that contradict it. So although both Mario and Megan can be considered "mathematical prodigies," Mario is seen as an exception to the rule, while Megan is seen as proving the rule. Asian students like Megan become part of the racial-mathematical mythology and historically marginalized students like Mario do not.

Thus, the main point is that some students were attuned to course enrollment patterns at their school and the mathematical performance of their classmates, and that these phenomena influenced their awareness and understanding of racial-mathematical discourse. To be sure, this does not mean that students' knowledge of these patterns was necessarily based on actual data. Recall that unlike most U.S. schools, where Asians and Whites dominate the advanced math courses (Oakes, 2005), the demographics of the Calculus class at Eastwood High during the 2010-2011 school year actually came close to the matching the demographics of the school (see

Chapter 3). Only 3 of the 18 students identified as Asian and none identified as White; the remaining students were all either Black or Latina/o. Given these demographics, alongside the fact that even attempting calculus in high school is generally considered an impressive accomplishment, it would have been reasonable for an Eastwood student to argue that "Blacks are good at math" or that "Latina/os" are good at math because so many Blacks and Latina/os at Eastwood High were in AP Calculus. But no student I interviewed drew such an inference, nor did any student even seem aware of the actual demographics in Calculus.

The takeaway here is not that students are actively racist or fundamentally irrational. Indeed, the biases and inconsistency embedded in their reasoning reflect what we have long known about how people think and draw conclusions (Tversky & Kahneman, 1974). What this finding does reveal, however, is the ideological power of racial-mathematical discourse. Ultimately, the actual composition of the math classes at Eastwood High—both advanced and remedial—mattered less to some students than their perceived composition. In other words, the diversity in mathematical performance within racial groups mattered less than finding exemplars that synched with the dominant discourse.

Still, beyond students' perceptions, it is quite possible that students' awareness of actual racial achievement gap statistics can have an impact. Consider the following portion of my interview with James, a 12th grade student in Precalculus who identified as African American:

James: I heard that Asians, specifically, are like probably like on the top, but…I don't know, I think it's just…because I think Asians are good at everything really, so I don't think it's just math or science or nothing like that. But I heard that a lot, I heard about that a lot. Talking about that, me and Robin (his classmate in Precalculus): we the only, you know, African Americans in the, um, class so it seems like that, the numbers show that, but I don't think that that's necessarily the truth.

Shah: So why do you think people say that?

James: Um, I think people say that because…just the statistics it shows how many, like, cuz even in the school it shows, like if you go on the website it shows a little circle graph where it's like, it shows the percentage of people who graduate and stuff. Because my mom made me look at that before I wanted to come to this school, and then it was like the percentage of Asians that come to this school, it was like 90% from that group of people graduated. So…and for African Americans it was like 50-something. So it was kind of--it was kind of disturbing, but you try and…you use that as fuel so you can get into that good 50%. You know, you don't want to fall behind and help out the stereotype or anything like that, you just try and fight against that, yeah. That's how my mom taught me.

Similar to other students, James begins by noting an enrollment pattern: the dearth of African Americans in his Precalculus class. However, he goes on to connect what he sees in the classroom to school-level statistics found on the district website. Although his mother hoped to

frame the racial achievement data as motivation for her son to "get into that good 50%," the gesture has an unintended consequence: James pits the higher graduation rate among Asians against the relative struggles of his own racial group. In essence, the racial achievement gap data come to embody the narratives, and as a result the statistics themselves become elements of the dominant discourse. So by "reading" the achievement gap data as he does, James inadvertently perpetuates the racial-academic hierarchy implicit in the narratives.

In the Media and in Students' Communities

Another source of racial-mathematical discourse for some students (5 of 35) were representations of mathematics learners in the media. In particular, students mentioned movies and television shows where mathematics learners were depicted as "nerds" or "geeks," and how these characters had few lines, were almost always Asian, and tended to be sidekicks of the main character (e.g., "the smart Asian friend").

One piece of media that held particular salience for two students came from a popular, satirical cartoon in the U.S. called Family Guy. Both students spontaneously mentioned the same 10-second clip from an episode of this show. In the clip, students are seated in a row of desks preparing to take the SAT. As the camera pans from left to right, each student pulls a calculator from her/his pocket and places it on the desk. Eventually, the camera stops on the show's main character, Peter, who pulls an East Asian-looking boy from his pocket and puts him on his desk (see Figure 6). He then pokes the boy with a pencil and exhorts him to "Do math!" Troi, a 12th grader in Precalculus who identified as Samoan, describes how this clip influenced him:

| Troi:	But usually I say…I play around too. Like if I don't know a problem in math, I'll say, "Where my pocket Asian at?" [Laughs] Cause like the Asians--like the Asians are supposed to be the ones who are super smart and all that kind of junk, but then that's how I see the groups, like who are smart in math.
Shah:	What's the "pocket Asian"? Where do you get that?
Troi:	Yeah, Family Guy…a funny show. Like there was this one episode where Peter went back to third grade, and there was like a math test, and then like he was sitting there and he reached in his pocket and pulled like an Asian kid out and he was like, "Do it! Do it! Do all the math!" It was just crazy…it was funny.
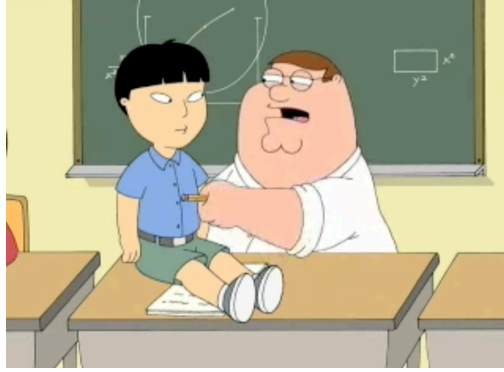
Figure 6. Screenshot from *Family Guy*, a popular television show in the U.S.

It is remarkable that students would remember a 10-second clip from an episode that originally aired five years prior, and also reference it without prompting in an interview about mathematics learning. If others had been asked directly about this particular episode, given the popularity of the show it is likely that more students would have reported awareness.[19]

Generally speaking, the "Asians are good at math" narrative has become a staple of comedy in the United States directed at Asians. Consider the following bits from two prominent comedians, Bill Maher and Conan O'Brien:

> In New York they found an Asian that can play basketball! (Audience laughs)
> Have you seen this guy, Jeremy Lin? Oh my god, this guy is blowing up…The
> whole country is affected: Black kids in South Central are pulling up their pants
> and studying Calculus! I mean, it's insane…But hey, the proof is in the stats: this
> guy has scored more points in his first five starts than any player in NBA history.
> Typical, isn't it? One high-scoring Asian ruins the curve for the rest of us!
> (Audience laughs, claps)
>
> Bill Maher (On *Real Time with Bill Maher*, 2/17/12)

> My kids have that Asian flu where their throats hurt and their math scores are up.
>
> Conan O'Brien (Posted on Twitter, 2/6/13)

In both jokes racial-mathematical narratives are inserted into contexts seemingly unrelated to academics (i.e., basketball and the flu). However, they do not feel out of place because "Asian" in pop culture has become basically synonymous with "mathematical ability." And not only do the narratives seem familiar, but it is noteworthy that the only reason the "Asians are good at math" is considered acceptable to reference is that it has the veneer of a compliment. Of course, as was discussed in Chapter 4, "positive" stereotypes are problematic as well. Notably, here Maher takes his joke a step further by connecting "Asians are good at math" to an implicit reference of the "Blacks are bad at math" narrative (i.e., external relationality). To

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[19] Several students in pilot interviews conducted at the same school the year before also spontaneously mentioned this same clip from *Family Guy*.

the extent that "Calculus" functions as a proxy for intelligence, he may also have been hinting at the "Blacks are not smart" narrative.

But the media imagery cited surrounding Asians was not limited to mathematics. Later in my interview with Troi he elaborated on how both Asian students and parents get positioned as academically oriented in the media:

> Troi: Well, I think society portrays it as Asians and Indians are good at school in general. Sometimes [incomprehensible] it will be like some Asian kid took calculus at two years old, stuff like that. Or he already graduated at the age of five, stuff like that.
>
> Shah: You'll see that?
>
> Troi: We'll see that. We'll see like, on TV, for example, there will be a family--like the dad is pressuring the son to be a doctor or a lawyer, and the son is basically studying his life away to become what his father wants him to become. Because, you know, they keep…they have high, like, expectations…so they'll do whatever it takes to get there. Basically they'll do school all their life or something.

Although Troi does not specify the television shows he has in mind, the images he describes are common in the media. Asian kids who "took calculus at two years old" or who "graduated at the age of five" constitute the popular notion of the "Asian prodigy." This trope is perennially bolstered by print and visual media coverage of events like the Scripps National Spelling Bee and the Intel Science Talent Search, both of which frequently count numerous students of Asian heritage among their lists of finalists. Reflecting on the discussion in the previous section, one can speculate how the media-perpetuated image of the "Asian prodigy" might have compelled students at Eastwood High to single out classmates like Megan, the 10th grade Asian student enrolled in Calculus.

In addition to commenting on the positionality of Asian students in the media, Troi also mentions that Asian parents are portrayed as "pressuring the son to be a doctor or lawyer." In the fall of 2011, roughly six months after our interview, the Fox television network aired an episode of Glee, a popular comedy show, entitled "Asian F." Nearly identical to the scenario outlined by Troi, the plot involved an Asian father exhorting his son to quit the glee club and focus on schoolwork after the boy earns an "Asian F" (i.e., an A-) in chemistry.

To be sure, the image of the academically demanding Asian parent has gained steam outside of fictional representations as well. For example, in a controversial book published that same year called Battle Hymn of the Tiger Mother, Yale Law School professor Amy Chua contrasted what she termed a "Chinese" approach to parenting, which emphasized academic excellence at all costs, with a "Western" approach to parenting that prioritized a child's self-esteem. Indeed, one of the students I interviewed, a White 12th grader in Precalculus named Sandra, mentioned that she had read this book as part of an Ethnic Studies class at Eastwood High. Here she shares her interpretation of the book's message and how parenting affects a child's relationship with school and math:

Yeah, like…cause we did a thing today [in class] where we learned about how this one Chinese lady raised her kids really strict, like they couldn't even watch TV, they couldn't use their phones, they couldn't do anything unless they did their homework. They couldn't even have play dates when they were little--they just did homework. And the one thing they were allowed to do that was fun was piano or violin lessons for 5 hours a day. So after school they would go do that. And I guess her kids are hella successful…and she's successful--she works at Yale and she writes her own book and she still goes home to her kids and her family and stuff. It's just kind of the way you were raised, if you see school positively or negatively. My dad was positive in math, and then my mom--she didn't really do that good in school--but she always talked about how much she hated math, and then my sister did too. But my dad would always try and help me in math, and after a while I just started not liking it…it may have been all that negativity from my mom and my sister.

Besides commenting on how strict Asian parents tend to be, Sandra also noted the types of professions they push their children towards. Echoing Troi's comment from earlier, Sandra states that Asian parents want their kids to become "doctors and all these smarter types of things," which in her view was why they pushed math instead of English. But whereas Sandra and other students suggested that the decision by Asians to pursue certain careers was autonomous, another view is that such choices are heavily influenced by larger opportunity structures that themselves are effects of racial discourses.

For example, Sue and Okazaki (1990) maintain that in an effort to find a path to upward mobility, any cultural group will gravitate to domains where opportunities are relatively more available—what they term "relative functionalism." When applied to Asians, their theory predicts that because opportunities for advancement may be limited in fields like sports or politics, Asians will respond by focusing on areas like education where their efforts will be rewarded. What curtails opportunities in certain fields in the first place is a complex question, but it may be that pre-existing racial narratives about who belongs in what domains influence people's expectations, which then become a self-fulfilling prophecy. For example, if the general consensus is that Asians are not good at basketball, then coaches may not give Asian players access to the same opportunities to improve. Realizing that certain fields are less open to them, Asians might then veer from these paths in favor of other more promising career trajectories.

Applying the idea of "relative functionalism" to mathematics, Sue and Okazaki propose that technical fields appeal more to Asians because they are less dependent on facility with the English language and social skills. Seen in this way, Asian success in math is neither due to innate talent nor solely a function of cultural desire. Rather, mathematics becomes a kind of refuge from other domains where Asians might not be seen as competent or might experience discrimination due to limited English proficiency. From this perspective, investing in mathematics—and perhaps STEM domains more generally—represents a rational attempt to make the best of things.

Although there may be some validity to this conjecture, it also has its limitations to its explanatory power. For instance, the "limited English" hypothesis may be applicable to newly arrived Asian immigrants, but it would not apply to Asians who were born in the U.S. or who were fluent in English despite having grown up in a non-English dominant country. Further, if mathematics really were a refuge for those seeking to avoid language-heavy domains, then one

might expect a similar dynamic playing out for many Latina/os in mathematics. Clearly, the issue of why some racial groups perform better than others in mathematics cannot be pinned to a single explanation. Nevertheless, concepts like "relative functionalism" are useful in adding context and complexity to issues that are typically treated in oversimplified ways.

Returning to the previous point, it should be noted that the image of Asians as successful professionals, such as doctors and small business owners, is certainly rampant in television and film, but such patterns can also emerge in students' local communities. Elise, a 10th grade, Tongan student in Algebra 2, explains how she determined that Indians, in particular, are good at math based on something she noticed at a grocery store in her community:

Shah: Right, so you haven't heard people say that some groups of people
            are better than other groups of people at math?

Elise: Oh, like stereotypes? (laughs) That's racist! (laughs)

Shah: What do people…

Elise: Oh, Indians! (points at interviewer while she says this) Because
            they can run businesses, and business needs a lot of math, yeah.

Shah: Right. And so are you thinking about people that you know?

Elise: Oh, well, the people at the local grocery store…[Indian people] run
            a market where Polynesian people go buy food and stuff. Yeah, and
            [the Indian people] speak Tongan and ask how we are, so it's hecka
            cool. We've seen Samoans that tried to run a market for Polynesian
            people, and they ended up closing a month after it opened (laughs).

Over the past two decades, the character of "Apu Nahasapeemapetilon," the Indian owner of the local convenience store on The Simpsons, a television show, has entrenched in U.S. culture the stereotype of the successful South Asian small business owner. Elise's story provides a real-world counterpart to this media image, as she "reads" a racial-mathematical narrative into a phenomenon in her immediate surroundings outside school. Further, consistent with the notion of "external relationality" offered in Chapter 4, her investment in the "Indians are good at math" narrative is bolstered by the apparent mathematical deficiency of her own group, as she notices that Samoans tried and failed to run the same business in the same location.

What is interesting about this example is that it is not explicitly racial. Another person might reasonably view a change in ownership as a regular part of the business cycle. That some people like Elise may interpret this kind of episode in racial terms raises questions about the aspects of everyday life that may double as sources of racial or racial-mathematical discourse. That is, a latently race-neutral interaction with a dentist or security guard or homeless person may actually turn out to be—whether conscious or not—a kind of racial interaction where inferences can be drawn about a race's intellectual capacity, academic ability, or even mathematical aptitude.

International Comparisons and Perceived Histories of Mathematical Achievement

The discussion thus far has centered on how students detect elements of racial-mathematical discourse in the everyday world around, both in their schools and in their communities. Media images in pop culture are also salient but basically echo the local patterns students perceive in their everyday lives (e.g., Black students playing basketball instead of enrolling in Calculus, Indian immigrants running convenience stores). In this section I demonstrate how students' sense making about racial-mathematical discourse was also influenced by phenomena that extended even beyond their local surroundings in the United States.

Several students (4 of 35), for example, drew comparisons between Asian countries and the rest of the world, specifically with respect to technological superiority. In the following excerpt Isabel, a 10th grade Geometry student who identified as Salvadorian, uses such a comparison to substantiate the "Asians are good at math" narrative:

Isabel: Not to be racist, but I know that a lot of Asians are really good at technology, and that has a lot to do with math. Um…I know that…I don't know. I don't like to judge people, but I know that…they're really good at technology, but that's about it.

Shah: Can you tell me where have you heard that before?

Isabel: Well you hear it all the time over there in China, over there in the Philippines…they're ten years more advanced in technology than we are, and it's probably true because they're really smart. It's the way that they focus and they way that they're parents have taught their child and how their child has taught their children…to be focused and to be well-trained and to not get distracted, versus other people who get distracted easily, and like…I don't know, just the way that they learn, that they're always focused, always determined, so…

While most participants referred to Asian classmates at their school, Isabel interprets the racial narratives as pertaining to Asians in Asia. Her endorsement of the "Asians are good at math" narrative is informed by her perception that China and the Philippines are "ten years more advanced in technology than we are," as opposed to racialized patterns in who is thought to enroll in AP Calculus. Offering a similar argument, another student named Rachel, a 12th grade Algebra 2 student who identified as White, suggested that some might perceive China's manufacturing prowess as signifying mathematical ability. Taking this a step further, though, she also speculates that the "Asians are good at math" narrative may derive from the Japanese bombing of Pearl Harbor during World War II:

Rachel: And I don't know if it's just because our parents told it to us, and that's just how it was or…We get so many of our products from China so…"Oh! You must be good at math because math is involved in EVERYTHING, and you must manufacture all these

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> things." I mean, it's one of those things…so, I mean, but I--I grew up with the stereotype that Asians are good at math.

Shah: Right. Where do you think (your) parents got it from?

Rachel: Um, their parents.

Shah: And…

Rachel: I think it just started in…I mean in my--for all we know it could have started during a war or something and they were like, "Oh, the Asians are good at math because they bombed us and they knew the right trajectory" or some crap like that. And then they were like, "Oh okay, the Asians are good at math!" And it's just traveled down and here we are. That could be how it happened.

Both Rachel's and Isabel's comments reflect longstanding discourses in the United States about globalization and economic competitiveness linked to math education. To be sure, calls for reform in math education have often followed international events that caused the United States to question its technological superiority, such as Sputnik in the 1950s and the rise of the Asian economies in the 1980s driven by high-tech manufacturing (Schoenfeld, 2004). Such global comparisons remain powerful components of today's national dialogue as well. Consider the following remarks from President Obama's 2011 State of the Union Address, which was delivered just weeks before my interview with Isabel:

> *In a single generation, revolutions in technology have transformed the way we live, work, and do business. Steel mills that once needed 1,000 workers can now do the same work with 100. Today, just about any company can set up shop, hire workers, and sell their products wherever there's an Internet connection. Meanwhile, nations like China and India realized that, with some changes of their own, they could compete in this new world, and so they started educating their children earlier and longer, with greater emphasis on math and science. They're investing in research and new technologies. Just recently, China became the home to the world's largest private solar research facility and the world's fastest computer…*
>
> *…Our infrastructure used to be the best, but our lead has slipped. South Korean homes now have greater Internet access than we do. Countries in Europe and Russia invest more in their roads and railways than we do. China is building faster trains and newer airports. Meanwhile, when our own engineers graded our Nation's infrastructure, they gave us a ''D.''*

One of the major themes in this speech was that the United States was being "out-innovated" by the rest of the world, particularly East and South Asian countries. This innovation gap was framed in a way that positioned Asian societies as the vanguard of cutting-edge technology, but also as leaders in STEM education. Ultimately, the factual accuracy of these

claims becomes irrelevant in the context of the purpose the discourse is serving. Most people hearing that China and India are "educating their children earlier and longer, with greater emphasis on math and science" will not stop to ask what proportion of these nations' populations have access to any sort of educational opportunities, or how such technologically advanced societies can simultaneously contain such rampant poverty. What matters is that such statements such get taken up as proof of an inherent mathematical superiority exclusive to certain geographies. It is in that sense that global comparisons can become a source of racial-mathematical discourse.

Besides present-day international comparisons, there were students (7 of 35) who emphasized historical differences in mathematical achievement across geographies. Specifically, these students' beliefs about which cultures were thought to have played a part in "inventing" mathematics fueled their perceptions of racial-mathematical discourse. In the excerpts below, two students describe how historical contributions to mathematics made by Asians help explain the "Asians are good at math" narrative:

> I know the Chinese were the first ones to come up with zero or whatever, so they just have this natural tendency to, um, revolve themselves around math, around numbers, around statistics…that kind of stuff. So I think it's just an underlying emphasis on math.

> Carlos (12th Grade, Precalculus, Mexican)

> I don't know, ancient, uh, ancient history. Like the first Asian that was ever born (laughs) probably he was like the smartest, so yeah…that's where I think it came from. It moved on to most other Asians after, like, the Philippines were found, some came to America and yeah…we discovered algebra and math and all that.

> Max (10th Grade, Geometry, Filipino)

Both Carlos and Max position East Asia as a historical locus of mathematical knowledge. In their view, who "came up with zero" and who "discovered algebra and math" are important because they explain present-day disparities in mathematical achievement. The historical information provides an anchor that helped them trace Asians' mathematical ability to its ancestral source. However, the citation of cultural histories was not limited to Asian math learners. Farah, a 10th grade Precalculus student who identified as half-Arab and half-Mexican, recalled being told that, "Arabs are good at math." When asked where she had heard that before, Farah offered the following anecdote:

> It was actually this year and learning about the Arabs in World History class and figuring out that the word "algebra" is actually an Arabic word and I already knew all of that so I just stayed very quiet, and um, my friend Setu [a Polynesian boy] came up to me and he was like, "Oh, Farah, you're Syrian! You guys are Arab! You guys made algebra! No wonder why you're hella smart in math!" And I just sat there and I'm like, "Yeah. I don't think that's the reason." And then he's like, "Oh no, that's the reason, that's the reason!" And I just stayed quiet.

Like Carlos and Max, Farah's friend Setu fixates on the question of which cultural group was responsible for inventing some piece of mathematics, and uses that historical fact to explain Farah's success in mathematics.[20] There were no instances in the data of students' referencing mathematical achievements made by historically marginalized racial groups. Certainly, it is possible that students were simply not aware of such achievements, given that contributions from these groups to the history of mathematics are rarely valued or acknowledged. Thematically, this would be consistent with a perspective central to the "ethnomathematics" movement, which aims to challenge the belief that mathematics is a monocultural[21] invention (Powell, 2002).

However, it is also possible that similar to the ways in which students tended to notice certain Asian peers in advanced math courses while selectively ignoring non-Asian classmates, students may have unintentionally cited the histories that fit the pre-existing racial-mathematical discourse (i.e., confirmation bias). Would Carlos, Max, or Setu have been as quick to argue that Latina/os are good at math because Mayans had a hand in developing the concept of "zero"? Would they have argued that Greek children excel in math because of the Pythagorean theorem? The answer to either question in the current U.S. context is no. Even if the past achievements of the Mayans and the Greeks were acknowledged, I argue that they would not be leveraged in explaining contemporary trends in mathematical performance because today's racial-mathematical discourse spotlights Asian math learners. However, if there came a day when Mexico or Greece suddenly became an economic or technological superpower, it is plausible that their histories of mathematical achievement would be resurrected and connected to the present.

Summary

The previous chapter unpacked the complexities of racial-mathematical discourse from the student perspective. The findings in this chapter demonstrate that students locate the discourse in a variety of sites—distributed within and beyond their everyday lives—where it is generated and perpetuated. A key source for students' sense making were the racialized patterns they perceived at their school and in their communities. Typically, students reported seeing Asian classmates have the top grades and more frequently enroll in Calculus.

However, racial-mathematical discourse was not confined to students' local surroundings. Not only were the patterns they perceived reflected back at them in the media (e.g., television shows), but students also situated racial-mathematical discourse within a global context. That is, although the participants in this study lived and learned in the United States, their reasoning about the link between race and mathematics learning depended, in part, on their perceptions of countries and cultures from around the world. Some students drew on international comparisons, such as modern differences in the technological expertise between the United States and countries in Asia. Other students drew on more historical information, such as which cultural groups they perceived as having made significant contributions to the discipline of mathematics. Again, in keeping with the current nature of racial-mathematical discourse in the United States, students tended to only highlight the achievements of Asian geographies.

One commonality across these disparate sources of racial-mathematical discourse is what might be called their "fuel-efficiency." Rather than a robust set of evidence, students' reasoning

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[20] There is much to analyze in this episode regarding how deployments of racial-mathematical discourse hold implications for students' identities. However, for the sake of rhetorical clarity, I refrain for the time being from conducting such an analysis and return to this episode in Chapter 7.

[21] Interestingly, scholars in the ethnomathematics tradition challenge the belief that mathematics was a *European* invention, while in this study students consistently cited *Asia* as the birthplace of mathematics.

gleaned considerable mileage from discrete factoids, images, and even particular classmates. Whether it was the Arabic origin of the word "algebra," a 10-second clip from a popular cartoon, or two Asian 10th graders enrolled in AP Calculus, students tended to draw strong conclusions from these small but potent bits of information. Further, consistent with the well-documented psychological tendency toward confirmation bias (Tversky & Kahneman, 1974), students seemed selectively attuned to phenomena that matched the dominant discourse of race in mathematics. For example, despite being aware of non-Asian students of color excelling in mathematics, students did not use these "exceptions" to substantiate counter-narratives, such as "Blacks are good at math" or "Latina/os are good at math."

I do not claim that the sources of racial-mathematical discourse identified in this chapter are exhaustive. Nevertheless, the findings in this chapter are important because they may provide educators concrete objects to target for intervention, as well as a sense of which sources of racial-mathematical discourse may be out of their control (e.g., media imagery). I return to these findings in Chapter 8, where I reflect on strategies for disrupting the discourse. In the next chapter, though, I pivot to an issue I have not yet discussed: the dynamics of racial-mathematical discourse in real-time interactions between students in learning settings.

Chapter 6: Racialized Episodes in Mathematics Learning Settings

"When I walked into the Precalculus class this year, like the first couple days or whatever, I was getting questions like, 'Oh you're *in this class? For real?' And I would say, 'Yeah…yes I am.' I mean I wouldn't really trip. I kind of looked it off like I don't even care…I showed them my schedule like before we even had that class, but they were like, 'You're in this class?' I was like, 'Yeah.'"*

—*James,* 12th grade, Precalculus, African American

In the empirical analysis thus far, I have documented the complex ways in which students make sense of racial discourse in mathematics. Chapter 4 mapped the content and structure of racial-mathematical discourse, while Chapter 5 identified the various social phenomena that fuel students' reasoning about race. A question I have yet to address, though, is how racial-mathematical discourse becomes embedded in students' everyday experiences in school. That is, does this discourse merely represent an abstract set of stereotypes that remain in students' heads, or does racial-mathematical discourse actually affect the dynamics of the learning setting?

In Chapter 1 I reviewed research on African American learners in mathematics education (Berry, 2005; Martin, 2000, 2006; Moody, 2004; Stinson, 2006). A main finding in this literature is that race and racism become relevant to African American students' educational experiences through their interactions with certain institutional structures, such as mechanisms of course enrollment that deny them access to advanced mathematics courses (cf. Oakes, 2005). In this chapter I aim to build on this literature by exploring other ways in which mathematics learning takes on racial meaning for students at the level of everyday classroom practice. Research has shown that people's beliefs in and about a given domain influence their behavior (Schoenfeld, 2011). Thus, it seems likely that the racial discourses analyzed in Chapters 4 and 5 would have a material impact on learning in everyday mathematics classroom activity.

I begin by examining observational data collected across four mathematics classrooms at Eastwood High School during the 2010-2011 school year. Consistent with prior observational studies of race (e.g., Nasir et al., 2009), analysis of the field notes revealed few episodes involving explicitly racial talk, and even fewer episodes bearing any obvious connection to mathematics learning. In isolation, the observational data seem to support the dominant view of mathematics learning as a neutral, "race-free" endeavor (i.e., race really doesn't matter in terms of the daily routines of learning and engagement in math class).

But there is reason to reject this perspective. Although explicitly racialized episodes were rare in classroom observations, student interviews yielded numerous episodes in which race was perceived as salient in mathematics learning settings. These racialized episodes were analyzed to determine the learning situations in which they arose. Specifically, I was able to identify four aspects of typical classroom activity that students viewed through a racial lens: a) testing and test performance; b) asking classmates for help; c) expectations about course enrollment; and d) participation in whole-class discussions. Overall, the findings in this chapter suggest that rather than being a static belief system, students actively deploy racial-mathematical discourse in ways that may influence their perceptions of classmates and how they interact with them, both of which are consequential for learning.

Race in Real-time: Classroom Observations

A primary goal of this dissertation was to understand how issues of race manifest in regular mathematics classroom activity. This was the motivation behind including an observational component to the study. During the 2010-2011 school year at Eastwood High, I conducted approximately 130 hours of participant observation across four mathematics classes. Most of each period was spent taking field notes in the back of the room, but occasionally I circulated throughout the room answering questions from students who asked for help.

The purpose of the observations was to document episodes of racial talk in both student-student and teacher-student interactions. I use the term "racial talk" to refer to oral speech involving the explicit use of racial categories (e.g., "African American," "White") or racial epithets. Episodes involving racial talk are a subset of the more general category of racialized episodes. In this type of episode, despite the absence of explicitly racial language, one or more of the participants involved may perceive an interaction as having to do with race. Such episodes occur frequently in everyday life. Consider, for example, situations where a Black person gets pulled over by a White police officer or a real estate agent steers a Latina/o client away from certain neighborhoods. In these cases neither the officer nor the real estate agent is likely to use racial language. Indeed, it may be that neither individual even intended racial discrimination. But the people affected by their actions may—accurately or not—read these episodes in racial terms, and it is in this sense that I apply the term "racialized."

One of the challenges in an empirical study of race hinges on this distinction between "racial" and "racialized." How does an ethnographer prove that a particular observation had to do with race? How can a researcher be certain that she or he is seeing what is "really" there—as if an objective "truth" even existed in such matters—rather than what confirms a pre-existing hypothesis? The classic response to this problem is triangulation: employ additional research instruments (e.g., interviews) to rule out rival interpretations of data. Certainly, this approach provides researchers stronger warrants, but what happens when participants are interviewed and they themselves do not perceive an episode as racialized? Should we conclude that the episode did not in fact have anything to do with race? Perhaps. But this assumes that individuals are always able to assess the impact of social phenomena. And as research on stereotype threat shows, race can have profound effects on people even when they are not aware of it (see Steele & Aronson, 1995).

Thus, identifying racialized episodes through observation is a non-trivial exercise. My approach to analyzing the observational data was to first flag all episodes involving explicitly racial talk; these are the focus of this section. Then, in subsequent passes through the data I earmarked potentially racialized episodes. While these episodes did not involve explicitly racial talk, they were tagged as potentially racialized because they intersected with racial-mathematical narratives documented in Chapter 4.

For instance, at several points during the school year I observed a South Asian boy helping with technology-related problems in the class. On one occasion he was asked by a fellow student to fix a broken mp3 player, and on another he volunteered to help his Precalculus teacher troubleshoot the malfunctioning classroom projector system. During these episodes, the boy's classmates frequently noted that he seemed to be an "expert" with technology, but racial language was never used. However, given that several of the students I interviewed reported hearing the narrative that "Asians are good at technology," can a case be made that these episodes were in fact racialized? While much of this chapter is devoted to analyzing explicitly

racial episodes, I conclude this chapter with a brief reflection on these more ambiguous types of episodes.

With respect to explicitly racial episodes, in roughly six months of classroom observation—from late August to early March—I recorded only 26 episodes involving racial talk, none of which bore a clear connection to mathematics learning. Typically, racial talk arose when students were "off-task" and socializing. In 9 of the episodes students used racial labels to identify people (e.g., "there were White girls at the party I was at over the weekend"). In fifteen of the 26 episodes (58%) students used racial labels to associate racial groups with certain cultural traits or practices. For example, in one incident a White student named Paul bragged that he would beat his White, female Precalculus teacher in a game of Ping-Pong because he "plays like an Asian girl."

Although in most cases racial talk seemed spontaneous, at times it was triggered by elements of the classroom milieu. For example, during a Geometry class in September, Ms. Zielinski put the following problem on the overhead projector as the daily warm-up:

Six students attended a class party and ate a variety of foods. Something caused them all to be ill. John ate pizza, hamburgers, and tacos and became ill. Homer ate hamburgers and tacos but not pizza. He became ill. Paula ate pizza but neither hamburgers nor tacos and felt fine. Kelly didn't eat anything and also felt fine. Lisa ate pizza and tacos but no hamburgers and became ill. Diana ate hamburgers and tacos but stayed away from the pizza. He also got sick.

Fill in the table below to help you determine what food probably caused everyone to get sick.

	Hamburgers	*Pizza*	*Tacos*	*Become Ill?*
John				
Homer				
Paula				
Kelly				
Lisa				
Diana				

Students are given an opportunity to work on the problem for a few minutes, after which the teacher opens a whole-class discussion:

Teacher: So what did you guys find? Which food made everyone sick?

Whole Class: (Choral response) Tacos!!

Student 1:   That's racist.

Student 2:   Does that mean the tacos at this school aren't good?

(Field Notes, 9/13/10)

What seemed an innocuous math problem about inductive reasoning became—at least for one student—a racialized episode. In the first place, the student may have drawn an ethnic connection between "tacos" and the student's Mexican heritage. Once it was determined that tacos were the culprit that made everyone sick (thereby painting Mexicans in a negative light), the student may have concluded that the problem was "racist." To be sure, the potential for classroom artifacts to trigger racial thinking is contextual. Would the student have said anything had the solution been "hamburgers" instead of "tacos"? Would this episode have been racialized for students in an all-White classroom? Histories of discrimination influence what students find salient and what they ignore in a particular circumstance. Certainly, while the teacher cannot be blamed for assigning this problem, this episode illustrates the subtle manner in which racial thinking can be cued.

A final point about explicitly racial episodes documented in the classroom observations is that although they were rare, several episodes involved overt racial prejudice. In the following series of field notes, a boy named Tariq directs several racist stereotypes at Joey, a Black classmate in Precalculus:

> This morning the desks in the room are arranged in clusters of four, as Ms. Patterson is having her students work in groups. Each group has been assigned a rational function to graph, with the goal of creating a poster of their solution by the end of the period. The bell rings and students continue to file in. Tariq and Joey are in a group with two other students, Alma and Carlos. I catch Joey and Tariq already in conversation as they find their seats:
>
> Tariq: All you do is eat, get AIDS, and die!
>
> Joey: (Smiles, but doesn't respond)
>
> Tariq: Stop wasting our food!
>
> For the next 45 minutes the group works together, struggling to figure out what the graph of their rational function looks like. With some help from Ms. Patterson and me, they finally have a solution. Alma offers to begin making the poster by drawing a set of axes:
>
> Alma: Hey – who took my marker?
>
> Tariq: Maybe it was Joey…he's Black. Once I went home and my bike was stolen. It's in his nature to steal something.
>
>   Five minutes later, the poster is still not complete and the bell is about to ring:
>
> Tariq: Who's going to make the graph? C'mon, Carlos, take one for the team. Just like Joey—he has AIDS. He took one for the team.
>
>   (Field Notes, 12/8/10)

Was Tariq joking or did he actually mean the things he said? What impact, if any, did Tariq's statements have on Joey's (and the other students') mathematics learning? Throughout the school year I observed Tariq teasing Joey about a variety of things, and usually Joey seemed to find Tariq's sarcastic humor amusing. At one point in this episode Joey smiles in response to Tariq's ongoing racial commentary: can we assume that Joey perceived the exchange as harmless banter, or are there more pernicious effects at play of which even Joey might not be aware?

Although the data in this instance do not support definitive answers to these questions, it can be said that Tariq's blatant invocation of racial stereotypes about Black people are not of his own creation. His statements echo long-standing racist discourses about Blacks in the United States. In this case, evidence of racial prejudice was explicit. At other times, though, racist deployments were more coded. For example, in the following episode that took place in a Geometry class, a Latina student named Carmen is caught in a verbal tussle with a Black classmate named Marcus, during which time she appears to make subtle reference to a racial narrative linking Black people to monkeys:

> Ms. Zielinski has finished her lecture, and has asked students to work with a partner on a worksheet. Students are seated in rows, and Ms. Zielinski pairs up students seated adjacent from each other. Because they both sit at the front of their respective rows, this means that Carmen and Marcus will be partners. During the first three months of the school year, these two students have consistently bickered with and needled each other. Once Carmen realizes that she has been paired with Marcus, the following exchange ensues:

> Carmen: Oh no!

> Rest of Class: (Laughter from multiple students, who are well aware of the history of contentious interaction between Marcus and Carmen)

> After Carmen lobbies the teacher for a different partner, Ms. Zielinski assigns Marcus to a Polynesian student named Myra. While Carmen and Marcus continue their back-and-forth, a second Black student named Akhirah gets involved:

> Carmen: I feel bad for you, Myra.

> Marcus: Fuck you, Carmen.

> Akhirah: Watch your language, Marcus.

> Marcus: Shut up, Akhirah, I'll beat your monkey ass.

> Carmen: (Turns to Marcus and says under her breath) You're one to talk.

> (Field Notes, 11/15/10)

Compared with the previous episode involving Tariq and David, neither Carmen nor Marcus ever uses an explicitly racial label (i.e., "Black"). The potentially racialized term in question is the word "monkey," which as I discussed in Chapter 2 has long-standing associations with racialized discourses positioning Black people as intellectually deficient. Interestingly, it is Marcus that uses the phrase "monkey ass" first when talking to another Black student, Akhirah. It is unclear from the data whether Marcus intended this as a racial slight. However, given that the phrase, "You're one to talk," is meant as an insult, it seems plausible that Carmen interpreted the word "monkey" in racial terms and then deployed it back against Marcus. For in general, the term "monkey" only becomes an insult because of its historically racist connotations.

To summarize, ethnographic methods yielded relatively few episodes of racial talk in the classrooms I observed. Moreover, the link to mathematics learning in these episodes was either unclear or non-existent. Superficially, at least, these findings would seem to support the view that although students may be aware of racial-mathematical discourse (as demonstrated in Chapters 4 and 5), issues of race may not actually have a material effect on their everyday classroom experiences learning mathematics. But real-time observations are not the only data source that can illuminate the issue. In the next section I return to the interview data, where students shared retrospective accounts of racialized episodes related to mathematics learning.

Overview of Racialized Episodes Cited in Interview Data

All students interviewed were asked if they could recall specific moments when racial-mathematical discourse emerged in either their current math class or in the past. Students' post-hoc accounts of racialized episodes compliment the real-time observational data in two ways.

First, whereas the majority of the explicitly racial observational data seemed unrelated to mathematics learning, nearly all of the retrospective episodes were math-specific. And second, students' post-hoc stories offered privileged access to moments of interaction that an ethnographer might have found inaccessible, or that an adult presence might have altered to the point of their never having occurred. For example, several episodes of racial-mathematical talk reported by students occurred in other classes (e.g., Chemistry class) and after school (e.g., while students worked on math homework). Since the ethnographic work for this study focused solely on mathematics classrooms, these important data would have gone undocumented.

To be coded as a "racialized episode," a student's anecdote had to involve specific students and specific statements made by those students, as opposed to a general racialized observation. This distinction is illustrated in the side-by-side comparison of two anecdotes presented in Table 7. The anecdote on the left from Student A qualified as a racialized episode because Student A recounted concrete details of a specific interaction. On the other hand, although Student B's anecdote was clearly racialized, it was less an "episode" than a description of a general pattern. That is not to say that Student B's learning experiences were any less racialized than those of Student A. But for analytical purposes, this approach made it easier to calibrate racialized episodes in the interview data with episodes from participant observation.

Table 7.
Examples of Anecdotes Coded (and Not Coded) as Racialized Episodes

Interview Question:	
Can you remember times when these stereotypes came up in class?	
Student A's Anecdote	**Student B's Anecdote**

(Coded as a racialized episode)	(*Not* coded as a racialized episode)
Um…one of my friends—he just talks a lot—but he was talking about something, about the math, and he was like, "Oh, I'm going to bring this guy with me to the math section (of the SAT)," and the whole class started chuckling a little bit because the guy he was talking about is Asian and he's smart at math.	Yes. Not in class, but outside of class. I've heard people say (to Asian students), "Hey, you should be doing math! What are you doing here? You should be studying math." Or they'll say, "You should be studying…just studying instead of hanging out with friends. Wow, you have friends?" Stuff like that.

Figure 7 below provides an overview of the 42 racialized episodes that were identified in the interview data using these criteria. Several aspects of these findings are noteworthy. First, roughly two-thirds of the students interviewed (23 of 35) were able to recall a specific racial-mathematical episode. And second, half of those students (12 of 23) shared two or more episodes. This is remarkable considering that students were not told in advance that race would be one of the interview topics. Further, the relatively high analytic bar that episodes had to pass in order to qualify as a "racialized episode" suggests that the 42 episodes identified in the data are probably a floor on the actual racialized moments experienced by students. Last, students from all racial backgrounds shared (and did not share) specific episodes, which suggests that race in mathematics education is not just relevant to only certain racial groups (e.g., Asians).

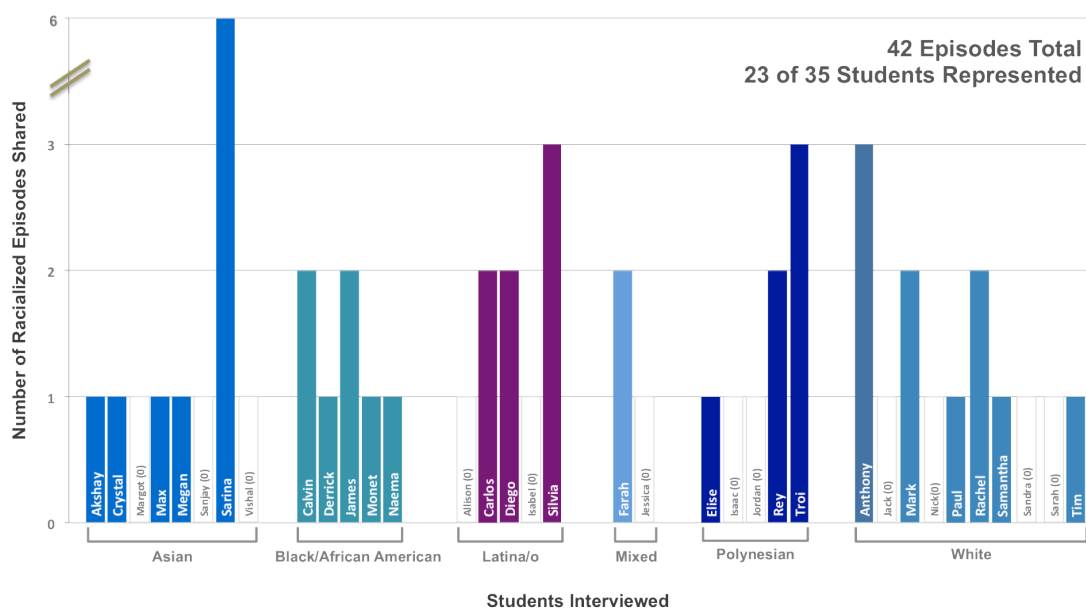*Figure 7.* Overview of racialized episodes identified in student interview data.

Racialized Aspects of Mathematics Classrooms

Having characterized some general patterns in the racialized episodes coded in the interview data, I now turn to elaborating the nature of those episodes. Specifically, I ask: what specific practices or situations were students engaged in when race became salient? In the

forthcoming analysis, I discuss four racialized aspects of mathematics learning environments (see Table 8). While not necessarily exhaustive, these findings serve as pointers for how racial-mathematical discourse becomes embedded in everyday teaching and learning settings.

Table 8.
Types of Racialized Practice/Situations Identified in Episodes Shared by Students

Racialized Practice or Situation	Number of Racialized Episodes
Testing and Test Performance	7
Asking Classmates for Help	20
Expectations about Course Enrollment	7
Participation in Whole-class Discussions	4
Other	4
Total	**42**

Note. The "Other" category comprises episodes involving perceived cultural traits, racist stereotypes, and perceptions of special treatment from teachers. These episodes were similar to those found in the observational data presented at the beginning of this chapter.

Testing and test performance

Research on "stereotype threat" has shown that under certain conditions, the practice of testing can become a highly racialized situation (Aronson et al., 1999; Steele, 1997; Steele & Aronson, 1995). As Claude Steele and his colleagues have argued, the cuing of stereotypes (e.g., racial narratives) fosters a fear of being perceived by others as intellectually inferior, which can result in a statistically significant drop in test performance. Thus, in part what makes the stereotype threat effect so striking is that it is directly observable and quantifiable. However, outside of the controlled conditions of the lab setting, analyzing testing as a racialized activity remains a thorny proposition. In this section I focus on two racialized episodes shared by students that shed some light on this issue.

As the data show, all of the students in this study considered race as somehow related to mathematics education, but few students perceived race and racism as more central to their personal experiences learning mathematics than Carlos, a high-performing 12th grade Precalculus student who identified as Mexican. In fact, well before I intended to broach the topic per the interview protocol, Carlos raised the issue of race almost immediately while recounting his earliest memories with mathematics in school:

Shah: And you said you like math--has it always been like that since you were young?

Carlos: Well when I was in 5th grade, I wasn't the best…I sucked at math, it was horrible. All these kids were better than me, so I made it my mission, my commitment to be the best I can be, to do the best. From the 5th grade on, I really started focusing on math and learned to enjoy it once I understood it. So from the 6th grade on, I started to be at the top of my class.

Shah: Why was that important to you?

Carlos: Well, I always went to church with kids who went to public school, and I saw how they struggled in math, how people viewed them. I'm going to bring race into this cause…I've been biased against because I'm Mexican. I didn't want people to say that about me, "Oh look, there's just another Mexican that doesn't know how to do math." So that was one of the main reasons I wanted to do the best, because I wanted to show people that, you know, Mexicans are smart, and that they don't just work and do gardens all the time.

More than academic achievement, Carlos framed his "mission" to succeed in mathematics as a response to racial narratives about Mexicans as unintelligent, lazy, and only capable of manual labor. When asked for a particular moment when this racism manifested, Carlos shared the following memory that occurred six years prior when he was in elementary school:

And then the way they um, you know, they used my [lack of] success in class as evidence for that. They'd be like, "Oh look at you—you got a C on a test. It shows that you're just a dumb Mexican." And sometimes they would go too far, and they wouldn't apologize for it.

Comparing test scores is something students frequently do, and not only in math class. They often do this to label and sort the "smart" kids from the "dumb" kids in a given subject. In this case, though, Carlos's classmates racialized his exam performance. As he put it, his low grade became "evidence" of his being "just a dumb Mexican." Carlos's experience mirrors data presented in Chapter 5, where one student interpreted racial gaps in high school graduation rates as evidence that Asians were more academically oriented than other groups.

Besides the racialization of performance outcomes, students reported race playing out in testing situations in more subtle ways as well. In the analysis of observational data earlier in this chapter, I focused exclusively on explicitly racialized episodes. The reason for this was to mitigate the possibility of researcher bias (i.e., coding episodes as racialized that, at least on the surface, seem to have little to do with race). And yet, based on the circumstances surrounding particular episodes, some of the classroom interactions I documented may indeed have been racialized for the students involved in spite of the absence of racial language. One such episode took place during an exam in a Precalculus class, as students were beginning to turn in their tests:

It is 8:45 am, and students have been working on today's chapter test on logarithms for the past thirty minutes. Suddenly, Akshay gets up from his seat, walks to the front of the room, and hands his exam to Ms. Patterson: he is the first student to turn in his test. Several students look up momentarily and then continue working. Five minutes later, Vishal turns in his test, followed a minute later by Sanjay. It is 8:51. There are still twenty minutes to go before the bell rings. Another seven minutes pass until the rest of the class begins to turn in their tests.

(Field Notes, 2/25/11)

Superficially, this episode is race-neutral. In the first place, there was no racial talk because the room was silent for the exam. Further, what could be racialized about students merely getting up to hand in their tests? As it happened, I was scheduled to interview Akshay, the first student who turned in his test, later that day after school. Like every other interviewee, Akshay noted the omnipresence of the "Asians are good at math" narrative. When asked for specific instances where he noticed such narratives arise, Akshay shared the following episode:

Akshay: I just thought of something: three Indian dudes come up [to the front to turn in their tests]. That was just my opinion, and I pointed it out and everyone was like, "Oh my god, they're Indian--they have to be geniuses in math!" And I was like, "Yeah, you're an idiot cause you were struggling [incomprehensible]." I find it to be that they were paying attention.

Shah: And so after class you pointed this out to other students and they said that?

Akshay: Oh no, no…just in general it's like…my friend Rico [a Latino classmate]–I told him, "Did you realize that the first three people in class that were done with the test were Indians?" He's like, "I know, huh?" And he's just babbling on about how like Indians are smart, and I was like, "Whatever dude."

This episode is significant for a number of reasons. First, it shows that although an interaction may seem race-neutral from the perspective of a third party, such as a teacher or a researcher, the episode might actually be racialized from the perspective of the students involved. And from a methodological standpoint, the fact that students are reading race into "race-free" situations suggests that observation alone may be insufficient for unpacking all of the subtle dynamics of race in the classroom.

This episode is also interesting for the types of racial inferences drawn by the students involved. It is unclear whether Rico was conscious of the racial pattern in this episode before Akshay pointed it out. Nevertheless, once it was brought to his attention, Rico readily connected the social phenomenon he observed to the broader racial-mathematical discourse. Just as in the previous episode where Carlos's classmates used a poor test score as proof that Carlos was "just a dumb Mexican," in this case Rico (and possibly other students) used the speed[22] with which his classmates finished a test as evidence that "Indians are smart" and "geniuses in math."

But what if instead of three Indian students, three Latina/o students had been the fastest to turn in their tests? Would this pattern have gone unnoticed (i.e., the episode may not have been perceived as racialized)? Echoing a point made in the previous chapter about confirmation bias, I argue that neither Rico nor Akshay would have construed such an event as proof that Latina/os are math geniuses because it contradicts the dominant discourse of race in mathematics. Important here is that Rico did not spontaneously invent these racial narratives about Indians

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[22] Apart from race, this episode is also indicative of students' beliefs about what it means to be "good" at math. As I discussed in Chapter 2, the notion that solving problems *quickly* signifies an individual's mathematical aptitude is very much central to the dominant discourse of mathematics learning in the United States.

based on what happened that day. The racial-mathematical discourse was in place long before he sat for his exam, which explains why Rico was able to follow Akshay in making the leap from a single episode to a broad set of narratives.

Of course, there are multiple reasons why a student might turn in a test quickly, all of which afford a variety of possible interpretations. Although in this case it signaled competence, turning in a test quickly can also signal apathy. That is, a low-performing or under-prepared student might not see a need to continue working on an exam. Alternatively, not turning in a test quickly can also be interpreted as competence. For example, during a test three months prior in this same Precalculus class, it turned out that Akshay was the last person to turn in his test. It is doubtful that this behavior would have been seen as evidence of Akshay's stupidity, whereas a non-Asian student in the same position might not receive the same benefit of the doubt. Again, the point is that racial-mathematical discourse functions as a kind of filter, mediating how students understand social interactions with their peers, as well as how they view their classmates as mathematics learners.

I began this section by citing research on stereotype threat, which has investigated the effects of racial stereotyping on test performance. Although the present study was not designed to explore causal claims related to quantitative student outcomes, the data do point to some of the nuanced ways in which the practice of testing—a routine classroom activity—can take on racial meaning from the student perspective.

Asking classmates for help

The most common type of racialized episode (20 of 42) in the interview data involved interactions where students were selecting classmates to ask for help. For instance, one can imagine a scenario where a group of students gets stuck while working on their algebra homework and loudly proclaim, "Let's ask the Asian kid for help!" Typically, though, the episodes students shared did not involve such explicit racial talk. Rather, students reported noticing patterns of classroom activity that they understood in racial terms. Here Allison, a 12th grade Precalculus student who identified as Mexican, describes how her classmates tended to gravitate toward the same three Indian males from the testing anecdote discussed in the previous section:

> Um, well I know in our class alone because, uh, everyone who has a question or if they don't understand something will either go to Akshay, Vishal, or Sanjay (laughs). Those are the three people in there who know what they're doing. And so people will always go to them for help. And I think at first, if they didn't know the person, it would be assumed because they were Indian. After they get to know 'em, I think they are smart anyway so…

According to Allison, Akshay, Vishal, and Sanjay were identified as "the three people in there who know what they're doing." But she takes this claim a step further, arguing that even before students got to know them, their mathematical ability would have been assumed because of their race. In Allison's view, this assumption then translated into a material effect on students' participation patterns.[23] While her general claim about these South Asian boys being positioned

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[23] Providing a lens on unfamiliar situations is a general function of all discourses. For example, one might imagine how racial discourses might influence who gets picked first for a basketball team or a soccer team, which is the athletic equivalent of "asking for help."

as highly competent is consistent with my observations, the data do not allow me to confirm or reject whether they were the only students granted such status. Further, more data would be needed to determine whether their classmates positioned them in this way before actually knowing them or knowing about their actual performance in Precalculus. Nevertheless, Allison's speculative comment is instructive because it shows how racial-mathematical discourse can influence students' perceptions of their classmates.

The effect of racial-mathematical discourse in this regard was not limited mathematics classrooms. In the following excerpt Rey, a 12th grade Sa'moan student in Precalculus, recalls a pattern of interaction from his AP Biology class:

Rey: Last year in AP biology class, one guy named Kwan–every time (other students) would come in there just asking for the homework assignment… and Kwan, he was one of the top people in that class, him being Asian too.

Shah: But was that just biology homework or was that math homework?

Rey: Oh no, no, we was in biology class and they would have the, um, calculus class after it…was he in calculus? Yeah, he would have the calculus class after, so we would have biology fifth (period) and they would have calculus after. And so the people in AP Biology would go to him for help. And so yeah it would be the math homework for the next period.

Shah: Would they actually say, "Hey, you're Asian. Help us"?

Rey: Oh no. It's because they're all in the same class, there's only one (AP Calculus) class. They knew that he was the highest person with the highest grade in the class, and they knew that he was doing well in the class, that he knew his stuff… From what I know he would always have his homework (done). People would ask him, "how do you do the homework?" He just says he just does it. Just like that…you know that he's not studying two or three hours a day trying to figure out the problems because he probably doesn't want to be doing that for the whole school year.

In these racialized episodes, both Rey and Allison are bystanders. Despite not being directly involved in asking (or being asked) for help, they both interpret these interactions as racialized. Of course, in the absence of clear supporting evidence, one might argue that classmates were targeting these particular Asian students not because of their race, but because they were widely known to have the highest grades in math. And yet, whether race was functioning as an "invisible hand" guiding students to their Asian classmates is immaterial. What actually matters is that other students—namely Rey and Allison—saw these interactions as evidence of racial-mathematical discourse in action.

In Chapter 4 I noted that much of students' reasoning about race in mathematics centered on Asian learners. I found the same to be true of the racialized episodes concerning who students

ask for help. However, this does not mean that such patterns of behavior were of no consequence to non-Asian students. For example, like many of the math classes at Eastwood High, the school's math club was racially diverse. At lunchtime the club would occasionally offer tutoring, during which Sarina—one of the club's self-identified Indian members—made the following observation:

> Sarina: Well, like…cause we do tutoring, and people will come up to us and they'll be like, "Let's go to the Asian and leave the other people." Because we have Latinos and we have one Black kid and a couple White people, so they'll go to the Asians rather than going to them, saying "Oh, you should know."
>
> Shah: And how do the non-Asians feel about that?
>
> Sarina: They don't care. They sit there and eat their lunch.

This episode echoes the notion of "relationality" proposed in Chapter 4. Just as the "Asians are good at math" narrative implies that other groups are not good at math, if some students are being disproportionately asked for help, then it stands to reason that other students are being passed over. What impact might this have on historically marginalized students? Sarina maintains that it did not bother the non-Asians in the math club, but it is difficult to say what they were actually feeling. Approaching a classmate for help is an act of status attribution; it is a message about who is "smart" and who is not. For certain groups of students to feel routinely excluded in this way because of their race cannot go unnoticed, particularly given that these data indicate that students are keenly aware of these patterns.

On the flip side, though, being constantly identified as the authority on all things mathematical can be problematic as well. Later in the interview, Sarina shared a time when a group of strangers accosted her while she was shopping at the mall:

> I was at the mall, and I was walking and these girls are like, "Oh! How many percentage is this? This (label) says that this (product) has this many carbs—what percentage is this? You're Asian, you should know." I was like, "Well, okay…" (laughs).

Sarina told me that she had often been a target of the "Asians are good at math" narrative in school, but this incident in a public place clearly caught her off-guard. The flipside of being perceived as mathematically incompetent is being positioned as merely a "human calculator," an image that has racialized connotations as documented in Chapter 5.

To summarize, nearly half of all of the racialized episodes mentioned by interviewees concerned students' perceptions of which classmates get asked most for help. Rather than instances of explicit racial talk, in most cases students were "reading" race into visual patterns of interaction. Students' racialized interpretations of these patterns were mediated by the racial-mathematical discourse elaborated in the previous two chapters. The practice of asking some students for help and not others is consequential because it means that certain students (or racial groups) become wellsprings of mathematical competence in the classroom, while other students are marginalized.

Expectations about course enrollment

A third type of racialized episode that emerged in the interview data pertained to expectations about course enrollment. One of the key findings in Chapter 5 was that students tend to notice enrollment patterns (i.e., which students are in which classes) and connect them to racial-mathematical narratives and their concomitant discourses. In this section, I flesh out that finding by presenting two concrete episodes recalled by students.

Earlier I discussed an incident involving three Indian American boys that took place in a Precalculus class while students were taking a test. Another student in that class was a boy named James, a 12th grader who identified as African American. In several ways, James was the definition of untapped potential. Throughout the school year he was late to class, rarely completed homework, and would often go entire class periods without putting pencil to paper. Based on that, the easy conclusion would have been that he was at best apathetic and at worst mathematically deficient. On occasion, though, James would show flashes of brilliance that belied this characterization, as he would correctly answer deep, conceptual questions posed by his teacher for which no one else in class seemed to have a response. During my interview with him, James told me that his mom had pushed him to excel in math from a young age, but that his interest in academics had waned in high school. Indeed, despite being one of a select group to be placed in Geometry as a freshman, he had failed several math classes along the way. Still, James had persevered enough to enroll in Precalculus as a senior.

Toward the end of our interview, we began to discuss how his being African American might have shaped his learning experiences in mathematics. In the following excerpt, James remembers the first time he walked into Precalculus class earlier that school year:

Shah: What if growing up you weren't African American, what if you were Asian? Do you feel like people would have treated you differently in some way, in terms of learning math?

James: Probably with the comments…maybe like if I got something wrong, someone would be like, "Oh you're not supposed to get that wrong, you're Asian" or something like that, maybe, maybe a couple comments like that. I don't think it would have affected me too much. I probably would have had a different first impression when I walked in that class, though…I know that.

Shah: What do you mean?

James: When I walked into the Precalculus class this year, like the first couple days or whatever, I was getting questions like, "Oh *you're* in this class? For real?" And I would say, "Yeah…yes I am." I mean I wouldn't really trip. I kind of looked it off like I don't even care. But yeah I think the first impression would have been different, for sure.

Shah: Who was telling you that when you walked in?

James: I think it was Troi and like somebody else…I don't remember. I showed them my schedule like before we even had that class, but they were like, "You're in this class?" I was like, "Yeah."

No one explicitly told James that he did not belong in Precalculus because "African Americans are bad at math," but from his perspective the episode was racialized. His classmate Troi, a Sa'moan student, was actually a close friend. It is likely that he meant his question as a joke, instead of as a racist insult. Nevertheless, James took it that way, which I argue is partly an effect of a history of racial discourses that have framed African Americans as inferior on multiple fronts. As a result, Troi did not have to say anything about race; James interpreted his friend's surprise as a racial surprise.

The notion of a "racial surprise" can also work in the opposite direction. Data in the previous chapter showed that many students had no problem believing that two tenth-grade Asian "prodigies" would be enrolled in AP Calculus. The same lack of surprise can apply to how some students explain a dearth of historically marginalized students in those same courses. Consider the following anecdote shared by Silvia, an 11th grader in Precalculus who identified as Mexican:

In Geometry [during 9th grade]…there were just a few Mexicans or Hispanics in the class, and some Black guy—there were more Blacks than Hispanics in Geometry—he said, "Oh, there are less Mexicans in this class because they are in the lower classes because they aren't as smart."

In order to explain the enrollment demographics of his math class, Silvia's classmate endorsed a racial hierarchy that positions Mexicans as less intelligent than Blacks. Thus, for him it seems that it was not at all surprising that there would be fewer Mexicans in an advanced mathematics course. Once again, broader racial discourses are brought to bear on students' reasoning about local patterns of social phenomena.

To the extent that race distorts students' expectations about course enrollment patterns, this finding may shed further light on why tracking is problematic. Certainly, the racial disparities typically caused by tracking mean that certain groups of students are denied access to the most challenging coursework available, which is essential for post-secondary academic and economic opportunities. However, tracking poses another danger: if students validate racial narratives based on who they see in their classes, and if certain racial minorities are relegated to more remedial courses, then tracking, in effect, reproduces the dominant racial-mathematical discourse. So not only is tracking consequential for students' material opportunities to learn, but its effects can also be consequential for how students are perceived and positioned.

Participation in whole-class discussions

The final racialized aspect of mathematics classroom activity students mentioned was participating in whole-class discussions. They often defined this in terms of which students they noticed volunteering answers when the teacher asked a question of the entire class. Rachel, a 12th grader who identified as White, shares an incident that occurred in her Algebra 2 class involving a 9th grade, Asian student named Michelle:

Um…I think in this class during the very first two weeks or something, Michelle said an answer for something and someone said, "She's Asian. Of course she knows it."

This seemingly straightforward episode is nonetheless revealing. First, as a 9th grader enrolled in Algebra 2, Michelle is two years ahead of the average mathematics student at Eastwood High School. Michelle's classmate, then, could have attributed her competence to being a "math genius." But given that it was early in the school year, it is unlikely that anyone knew what grade Michelle was actually in—after all, as a freshman she was new to the school. So in the absence of this information, her classmate fixated on the available visual data: Michelle's race. In this way, students deploy racial-mathematical discourse in the service of parsing social phenomena.

But as with much of the data, cases of explicit racialization were rare. Similar to how students read race into latently race-neutral interactions (e.g., asking classmates for help), data suggest that students did the same for participation in whole-class discussions. Consider this comment from Rey, a 12th grade Sa'moan student in Precalculus:

Yeah, I go to the Indian Asians for help, especially one of them in my group. He knows his stuff, as well as… I forgot the other guys name—I don't know if he's a sophomore or what, but he knows…I remember from the beginning he was naming the problems, he was naming the formulas, he knew what kind of quadratic or whatever, what kind of graph this is…he was answering (incomprehensible). It was like dang!

Rey grounds his admiration for his "Indian Asian" classmates in their public displays of mathematical competence. Just because he may not vocalize his racial reasoning in the moment, it may seem to an observer that these participation patterns go unnoticed by students, or that these episodes are to them race-free. Clearly, the interview data tell a different story.

At the very beginning of this chapter I highlighted the analytical challenge associated with observing race in real-time. The fact is that I documented many more episodes during the school year when the teacher posed a question to the class and, usually after a long silence, one of the three Indian boys were the only students to respond. Did other students notice these incidents? Did they trigger in their minds the "Asians are good at math" narrative? On another occasion I observed Rey, the same student who was amazed by his Indian classmates, ask Sanjay to help fix his broken IPod. Did Rey asking Sanjay for help amount to a deployment of the "Asians are good with technology" narrative? Should such episodes, which involve no explicit racial talk, be counted as racialized? The data in this chapter suggest that students are attuned to a variety of subtle classroom interactions, and that sometimes they read them in racialized ways. So while I do not attempt to settle this question here, it is clear that these episodes cannot be dismissed off-hand.

Summary

The original intent of this part of the dissertation was to understand if and how issues of race emerged in the course of everyday activity in mathematics classrooms. Is racial-mathematical discourse merely a static belief system, or does it actually have a material impact on the dynamics of a learning environment? Looking to build on Martin's (2006) claim of

mathematics learning as a "racialized form of experience," I sought to detail the particular aspects of the mathematics learning process that, from students' perspectives, tended to assume racial meaning.

As it turned out, extensive classroom observations yielded few episodes involving racial talk, and of those a limited number appeared directly related to mathematics learning. To an extent, this was to be expected. First, race is a taboo topic, and second, the classrooms I observed employed fairly traditional mathematics pedagogies, which afforded little opportunity for student talk or interaction. But while the dearth of observational data may be taken up as supporting a view of mathematics learning as "neutral" and "race-free," the interview data told a very different story.

As they reflected on their prior schooling experiences, many students were able to recall multiple racial-mathematical episodes. Given that students were not aware in advance that race would be a focus of the interviews, this finding is remarkable in and of itself. That so many of the participants spontaneously described episodes in vivid detail is a testament to the salience of race in their everyday mathematics learning experiences. In fact, if students had been asked to first reflect and then bring to the interview specific stories to share, it is likely that the pool of racialized episodes would have been even larger.

By analyzing this pool of episodes, I was able to identify four aspects of classroom activity racialized by students, three of which—testing, asking classmates for help, and participation in whole-class discussions—represent core classroom practices typical of many mathematics classrooms. To be clear, the reliance on post-hoc interview data does not allow me to make claims about the frequency of these practices and situations in everyday classroom practice. However, having now identified a working set of key phenomena, a follow-up study that uses a combination of ethnography and video analysis could more directly measure their impact on classroom activity. For example, data from this type of study could be analyzed to uncover subtle racialized patterns in which classmates get asked most often for help.

Overall, the findings presented in this chapter are consequential because they shed light on how racial-mathematical discourse can affect student learning on an everyday level. Sociocultural theorists posit that the learning process hinges on students' engagement in an array of social practices (Lave & Wenger, 1991; Nasir, 2002; Wenger, 1998). My data suggest that as mathematics learners engage in certain classroom practices, they actively deploy racial-mathematical discourse in ways that color how they perceive and interact with their classmates. This is a particularly important consideration for educators in reform-oriented classrooms, which depend on students viewing each other as equally capable participants in mathematical inquiry (Boaler, 2008). In the next chapter I continue the inquiry into the relationship between racial-mathematical discourse and learning, shifting from its impact on classroom participation patterns to its implications for students' identities as mathematics learners.

Chapter 7: Impact on Student Identity Formation

"It ain't what they call you, it's what you answer to."

—W.C. Fields

       The three previous empirical chapters analyzed various features of racial-mathematical discourse. Chapter 4 unpacked the content and structure of the discourse, Chapter 5 shed light on the array of phenomena—both in and out of school—that fuel students' reasoning about race in mathematics, and Chapter 6 analyzed how racial-mathematical discourse plays out in everyday learning situations. This chapter continues exploring the connection to learning by theorizing the impact of racial-mathematical discourse on student identity formation. In doing so, I present a general framework for analyzing identity formation that synthesizes insights from both the sociocultural and poststructural paradigms.

       Sociocultural theory, which has guided many analyses of identity formation in educational research, focuses on the identity-related artifacts or "resources" made available for people to appropriate while engaged in social practices (Leander, 2002; Nasir, 2011). In order to illustrate the utility of this approach, as well as to test its limits, I revisit a racial-mathematical episode discussed in the previous chapter, except that here I analyze it with respect to the moment-to-moment dynamics of positioning and identity. Besides showcasing the strengths of the sociocultural approach, the analysis will also reveal some of its blind spots, such as its tendency to emphasize the dynamics of local activity settings (e.g., classrooms) over the broader, sociohistorical contexts (e.g., racialized discourses) within which those local spaces are situated.

       In my view, poststructural perspectives on identity and subjectivity, which have received little attention in educational research on learning and identity, may offer a way forward. Central to poststructural thought is a concern for the ways in which discourses function to constitute individuals as subjects (i.e., "identity formation"). Leveraging the work of Michel Foucault and Stuart Hall, in particular, I demonstrate how the poststructural perspective can illuminate the connection between global forces and local practices. In this way, I argue that poststructural theory can complement and augment the analytical power of the sociocultural approach.

       Overall, the framework I propose here makes two contributions: 1) it provides a way of conceptualizing how local practices and broader discourses interact to make certain identity artifacts available within an activity space; and 2) it offers an analytical scheme for tracking how the deployment of identity artifacts in social interaction mediates access to subject positions on a microgenetic level. I conclude by using the framework to analyze a second racial-mathematical episode presented in the previous chapter, thereby demonstrating the framework's value and reflecting on its limitations.

Sociocultural Theories of Learning and Identity

       The sociocultural perspective on learning has many roots, but one of the most influential has been Lave and Wenger's (1991) notion of "situated learning." Through a series of ethnographic studies of apprenticeship in various professional settings (e.g., tailoring, meat cutting), Lave and Wenger argued that learning occurs as people engage in everyday human activity. Contrary to theories of learning that focus exclusively on cognitive processes, from the situative perspective learning is something embedded (or "situated") in the context of the social

world. And further, rather than measuring learning only in terms of changes in abstract mental structures, Lave and Wenger maintained that learning was something that could be measured by shifts in participation. So as a novice tailor, for example, gains experience and learns the craft, she or he moves from a position of what they called "legitimate peripheral participation" to forms of participation more central to the learning community.

Building on this research, Wenger (1998) introduced a host of new theoretical constructs for analyzing learning and participation within the general situative paradigm. Although a full review of this complex piece of work is beyond the scope of this chapter, here I focus on one of its innovations: the relationship between learning and identity. For Wenger (1998), theorizing this relationship hinges on a broad conceptualization of "participation":

> Participation here refers not just to local events of engagement in certain activities with certain people, but to a more encompassing process of being active participants in the practices of social communities and constructing identities in relation to these communities. Participating in a playground clique or in a work team, for instance, is both a kind of action and a form of belonging. Such participation shapes not only what we do, but also who we are and how we interpret what we do. (p. 4, emphasis in original)

The fundamental idea here is that human activity is organized into "communities of practice," and that these contexts are both sites for acquiring new knowledge and places where participants come to identify (or disidentify) as members of those communities. Learning is about both knowing and becoming. Thus, returning to the previous example, as novice tailors come to acquire the skills of the trade, they simultaneously begin to perceive themselves as "tailors." Together these forces nudge them toward more central participation and membership in the local tailoring community. Similarly, in mathematics education one might say that an Algebra 1 student who learns to graph lines and calculate slopes is simultaneously becoming a "doer of mathematics" (Boaler, 2000).

Debates about the nature of "identity" have a long history. For instance, the question of whether identity is fixed or fluid has been contested as far back as the time of the ancient Greek philosophers (see Leonardo, 2000). In describing identity as a process, rather than an unchanging property of the self, Wenger's contribution to this historical dialogue is to tie the concept of identity to participation in particular communities of practice. From this it follows that because an individual's participation varies across communities of practice, then how one identifies will also change across local activity contexts. Consequently, Wenger concludes, it cannot be the case that individuals possess a single, totalizing Identity (capital "I") that they carry across all aspects of their lives. Instead, individuals concurrently juggle multiple identities that may conflict on occasion.

Another implication of Wenger's formulation is that identity is not a binary construct. That is, it would be reductive to say that people simply do or do not identify with a practice or as a certain type of person. Just as participation can be characterized in terms of a continuum or trajectory (i.e., from peripheral to central), identity can be thought of as a fluid negotiation in which individuals are always in the process of becoming. There is more to say about how Wenger conceptualizes learning and identity—and indeed I return to these ideas when I consider poststructural perspectives on identity later in the chapter—but for now, I turn to some illustrations of how these ideas have been taken up and elaborated in educational research.

Situative and sociocultural analyses in educational research

With its emphasis on social practices and trajectories of participation, situative theories of learning have been particularly influential in analyses of classroom activity. In an interview study of high school calculus students across multiple school sites, Boaler and Greeno (2000) found that students reported two contrasting profiles of mathematics classroom environments. Put simply, one set of students described a didactic learning environment in which students were expected to receive knowledge imparted by the teacher, while the other set of students described a classroom where they were expected to be active constructors of mathematical knowledge. Employing what they called a "practice-based interpretation," Boaler and Greeno argued that differences in students' perceptions reflected differences in the pedagogical practices between the learning environments. Whereas the didactic classrooms emphasized lecture and individual student work, the other type of classroom encouraged discussion and group work. The authors concluded that these practices not only mediated the types of mathematical knowledge available for students to learn, but also positioned students as being particular types of mathematics learners (Holland, Lachicotte, Skinner, & Cain, 2001).

In adopting a practice-based lens on learning environments, educational researchers have also extended the situative approach by leveraging insights from the progenitor of sociocultural theory, Lev S. Vygotsky. Of primary concern to Vygotsky (1978, 1986) was the role of tools and signs in the development of human mental functioning. In his view, the production, appropriation, and deployment of tools and signs in the service of goal-directed activity comprise a core element of the human experience. Indeed, these tools and signs—or what Cole (1996) has referred to as "cultural artifacts"—mediate our engagement with the social and physical world. Such mediating devices could be material, as in Vygotsky's example of tying a handkerchief around one's finger in order to remember something, but they also could be non-material, as in the way language systems mediate interpersonal communication. A fuller treatment of these ideas, in the context of Saussure's structural linguistics, is included later in the chapter.

Although Vygotsky did not explicitly broach the topic of identity, sociocultural theorists have used his theoretical perspective as a platform for conceptualizing identity formation. One approach has been to characterize identity as "a particular domain of the development of mental functioning" (Penuel & Wertsch, 1995, p. 87). The theoretical value in this framing is that it situates the question of identity within a Vygotskian framework: what kinds of tools and signs mediate the process of identity formation, and how do people negotiate them? For Penuel and Wertsch, these artifacts are the cultural and historical resources made available to individuals through their engagement in activity contexts, a view that is consistent with Wenger's (1998) situative perspective that locates identity formation in the social world.

Investigations of the learning process have integrated elements from both situative and sociocultural theory. Through research conducted in a number of in-school and out-of-school learning environments, Nasir and her colleagues (Nasir, 2004, 2011; Nasir & Cooks, 2009; Nasir & Hand, 2008; Nasir & Shah, 2011) have argued that learning and engagement hinge on the ways in which learning environments provide or constrain access to the building blocks of productive domain identities. Nasir and Cooks (2009) refer to these building blocks as "identity resources," which can be sub-divided into three categories:

> By *material resources*, we mean the way in which the physical environment, its organization, and the artifacts in it support one's sense of connection to the

practice. *Relational resources* refer to the positive relationships with others in the context that can increase connection to the practice. *Ideational resources* refer to the ideas about oneself and one's relationship to and place in the practice and the world, as well as ideas about what is valued or good. (p. 47, emphasis in original)

Building on Wenger (1998), Nasir and Cooks view these three types of identity resources as linked to the practices in which learners engage, a perspective they illustrated in their study of an African American high school track and field team. For example, one of the material resources they highlighted as central to the practice of running track was the "starting block," which is a special piece of equipment that prevents track athletes from slipping as they accelerate at the beginning of a race. On the one hand, the starting block represented an identity resource, in that athletes that knew how to use it became positioned as "experts." On the other hand, Nasir and Cooks argue that the starting block doubled as a resource for learning, since becoming familiar with the equipment was a part of learning the craft. In that sense, the artifacts around which a practice is organized can be consequential for learning and identity formation.

However, these resources were not made equally available to all of the athletes. In some cases, the track coaches controlled access to particular resources. For instance, if a coach felt that a particular athlete lacked the potential to be a great runner, that coach might not allow a participant to use a material resource (e.g., the starting block). Alternatively, if an athlete was perceived as promising, a coach might repeatedly apply a positive label to her (e.g., "Look here, you're going to be a *hurdler*"), thereby making available an ideational resource that may propel that athlete on a trajectory toward becoming a central participant in the practice.

In addition to the coaches, Nasir and Cooks also analyzed how certain activity structures served to mediate access to identity resources. For example, because track meets were daylong affairs, team members often socialized and bonded. In effect, the structure of the track meets afforded athletes an opportunity to take up relational resources. One can imagine that if the track meets had been shorter in duration, these resources might have been less available to participants (i.e., they would have had less of an opportunity to form relationships with their teammates).

Overall, the framework proposed by Nasir and her colleagues offers much in the way of analytical power. Focusing on the relationship between practices and identity resources, as well as on the mechanisms by which those resources are made accessible to participants, provides a nuanced model of the learning process. Indeed, other scholars have used similar theoretical lenses while studying how learning settings afford identity resources through a variety of mechanisms, such as participation structures (Hand, 2010; Polman & Miller, 2010); the imposition of social categories (Esmonde, Brodie, Dookie, & Takeuchi, 2009); and curricular organization (Horn, 2008). In the next section, I test the affordances and limitations of the sociocultural perspective by re-analyzing a racialized episode already discussed in the previous chapter.

The case of the racialized Precalculus test
Chapter 6 centered on racial-mathematical episodes gleaned from classroom observations and student interviews. When I analyzed such episodes in the previous chapter, my primary goal was to identify those aspects of classroom activity (e.g., asking classmates for help, testing) that students tended to perceive as racialized. Whereas in that analysis issues of identity were implicit, in this section I employ a sociocultural lens to more fully unpack the dynamics of

identity formation. In doing so, I weigh the explanatory power of two constructs (and their related theoretical frameworks): "practice-linked identities" and "identity resources."

One of the racialized episodes documented in this dissertation took place in a Precalculus class when students were taking a test, near the end of which three South Asian boys were the first to turn in their exams. As this was one of the few racial-mathematical episodes recorded through classroom observation, this particular datum is a good candidate for re-analysis since most sociocultural research also employs ethnographic data. For ease of reference, I begin by reproducing the data that was previously presented in Chapter 6:

It is 8:45 am, and students have been working on today's chapter test on logarithms for the past thirty minutes. Suddenly, Akshay gets up from his seat, walks to the front of the room, and hands his exam to Ms. Patterson: he is the first student to turn in his test. Several students look up momentarily and then continue working. Five minutes later, Vishal turns in his test, followed a minute later by Sanjay. It is 8:51. There are still twenty minutes to go before the bell rings. Another seven minutes pass until the rest of the class begins to turn in their tests.

(Field Notes, 2/25/11)

As it happened, I was scheduled to interview Akshay, the first student who turned in his test, later that day after school. Like every other interviewee, Akshay noted the pervasiveness of the "Asians are good at math" narrative. When asked for specific instances where he noticed such narratives arise, Akshay shared the following episode:

Akshay: I just thought of something: three Indian dudes come up [to the front to turn in their tests]. That was just my opinion, and I pointed it out and everyone was like, "Oh my god, they're Indian--they have to be geniuses in math!" And I was like, "Yeah, you're an idiot cause you were struggling [incomprehensible]." I find it to be that they were paying attention.

Shah: And so after class you pointed this out to other students and they said that?

Akshay: Oh no, no…just in general it's like…my friend Rico [a Latino classmate]–I told him, "Did you realize that the first three people in class that were done with the test were Indians?" He's like, "I know, huh?" And he's just babbling on about how like Indians are smart, and I was like, "Whatever dude."

A key component of a sociocultural analysis involves identifying the practices in which participants were engaged. Generally speaking, the practice that students were engaged in here was the act of testing (or being tested). However, of particular concern in this case was a certain activity structure embedded in that practice: the norms surrounding how completed exams were to be collected. Based on the notion of "practice-linked identities," then, we can ask the

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following question: what identities were being made available to these Precalculus students through this particular activity structure?

The key feature of the activity structure that figures prominently in this episode is the very public way in which students are allowed to signal that they have completed the test. Each instance of getting up, walking over to the teacher's desk, and turning in a test constitutes an identity statement visible to the rest of the class. Given that years of schooling already socialize students to believe that speed signifies academic competence, it can be argued that this activity structure was organized so as to make available hierarchically oriented ideational resources: "fast kids" and "slow kids" (cf. Horn, 2007). For students turning in their tests before their classmates, the practice was set up make it easier for those students to be positioned as "smarter" than the rest of the class. This might explain the reaction of Rico and some of his other classmates, who conclude that Akshay, Vishal, and Sanjay must be "geniuses in math"—not based on how well they did on the test, but rather because they saw them stand up and turn in their tests faster than anyone else.

For argument's sake one can imagine alternate configurations of this activity structure that might have afforded different types of ideational resources. What if Ms. Patterson had asked students to remain in their seats until the bell rang, at which point all of the tests would have been collected at the same time? Or what if a norm had been established that all students were expected to continuously check their work until time expired? Presumably, implementing these less public activity structures might have leveled the playing field, by making it harder for students to appropriate ideational resources grounded in status hierarchies.

Overall, this brief analysis illustrates some of the strengths of the "practice-linked identities" perspective. Superficially, how students turn in their tests seems a trivial component of the learning experience. And yet, the data suggest that in this case at least, the public feature of the practice was actually quite salient to students. The sociocultural approach is useful because it compels an interrogation of the practice itself, problematizing the relationship between activity structures and the identity resources they afford and constrain. Further, the focus on practices is also conducive to reflecting on potential remedies, which in the context of schooling often requires designing more equitable activity structures.

And yet, the merits of this perspective notwithstanding, a key aspect of this particular episode relevant to identity remains unexplained: how and why does race enter the picture? For in positioning Akshay, Vishal, and Sanjay as "smart" or "geniuses in math," it is evident that Rico and his classmates are attending to more than the fact that they were the first to turn in their tests. They are also noticing and making salient these three boys' racial identities. Thus, I propose that in addition to the notion of "fast (i.e., smart) kids" and "slow (i.e., dumb) kids," there must have been another ideational resource in play: that of the "intelligent, mathematically gifted Indian." But by what means was this racialized ideational resource made available?

As I have discussed, the categories of "fast kids" and "slow kids" can be linked to the organization of the activity structure, which reinforced the coupling of speed and competence. It is not immediately clear, though, that the same type of claim can be made about the racial-mathematical narrative (i.e., "Indians are good at math") that surfaced. What does race have to do with the practice of how students turn in a completed exam? In my view, these questions cannot be fully answered by a practice-based analysis of the norms and local activity structures of Ms. Patterson's Precalculus class. Rather, I argue that analyzing episodes of this type also entails situating classroom practices within a broader discursive context.

From that perspective, the analysis might be re-framed to consider the possible links between the practice and racial-mathematical discourse. That is, were there particular features of the practice that aligned with elements of racial-mathematical discourse, thereby making certain racialized ideational resources more available in the learning environment? This question hinges on the more general problem of how ideational resources are made available through discourse, an issue that is core to poststructural theory.

Poststructural Perspectives on Identity

This section is divided into three parts. First, I provide an overview of poststructuralism's core principles and how they build on and respond to structuralism. Next, I focus on a particular strand of poststructuralism: Michel Foucault's theory of discourse. Last, I discuss how discourses mediate "identity" formation[24], as explicated in the work of the Foucauldian scholar, Stuart Hall. Along with elements of sociocultural theory, the poststructural concepts I engage here will factor in the analytical framework I build later in this chapter.

Background on poststructuralism

Poststructuralism[25] is an umbrella term that refers to a variety of related but distinct theoretical perspectives put forth by French scholars beginning in the 1960s. Although later I discuss some of the differences between them, where these perspectives converge is in both building on and critiquing fundamental tenets of the paradigm known as structuralism.

Structuralist theory emerged as a response to humanism or "neoclassicism," which conceptualizes human beings as free, eminently rational entities operating independently of the social world. Challenging this view, structuralism called into question the unfettered autonomy of the individual, instead positing a world where human thought and action exist within the constraints of systems organized by structures. Solo (1975) elaborates:

> Opposed both to the neoclassical idea of mind and its romantic (transcendental, globalized) counterpart, structuralist thought in all its manifestations explains thought and behavior, of the individual or the group, as the operation of volition within the determinant structure of a cognitive system. The structure of that system, whose ultimate locus is always the unconscious individual mind, determines, hence is reflected in, hence is deducible from, the potentials, the boundaries, the character of thought and behavior." (p. 612)

The structuralist premise—that phenomena can be understood by analyzing the systemic structures within which those phenomena are situated—has been implemented across a variety of fields, including anthropology (e.g., Lévi-Strauss), literary theory (e.g., Barthes), and psychoanalysis (e.g., Lacan). In mathematics education, the most widely known instantiation of structuralism has been Jean Piaget's theory of genetic epistemology. Piaget sought to understand the processes by which human beings acquire knowledge over the course of the lifespan. Through empirical studies of young children, Piaget (1977) argued that rather than being absorbed directly from the external environment, the development of higher order mental

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[24] Here I place the term *identity* within quotation marks to indicate that poststructuralists employ a very different set of terminology that sometimes aligns and sometimes conflicts with sociocultural constructs.

[25] It should be noted that despite being labeled as such by intellectuals in the United States, not all French poststructuralists (e.g., Michel Foucault) embraced the moniker.

functions is undergirded by a set of innate cognitive structures. Not only do these structures serve to organize input from the external environment, but they also give rise to progressively sophisticated cognitive structures as human beings interact with that environment over time. According to Piaget, it is through this active process of construction that learning happens.

The version of structuralism most relevant to the present discussion is the work of the Swiss linguist, Ferdinand de Saussure, who conceived of language as a system of signs. A "sign" in Saussurean linguistics is a composite object consisting of a signifier and a signified. Signifiers are usually thought of as either verbal utterances or written text, but similar to cultural artifacts, they can also be metaphorical or ideational. Signifieds are the meanings to which signifiers refer. For example, the word "phone" (i.e., the signifier) typically refers to a physical device used to communicate across distances (i.e., the signified). Together, the signifier/signified relation constitutes the sign.

Of course, there is nothing fundamental about this relationship. After all, the word "phone" has no intrinsic meaning; it is nothing more than a concatenation of inscriptions when written, and a particular configuration of sounds when vocalized. There is nothing that requires the signification of "phone" as a physical communication device. More generally, the signifier/signified relation is arbitrary (Leonardo, 2003). So how, then, are meanings established according to Saussure's semiology?

Rather than reflecting an underlying material reality, Saussure conceptualized language as a space in which meanings were produced through difference. That is, core to his structural linguistics was the idea that the meaning of a particular signifier emerged through its relation with other signifiers. For example, "phone" signifies a physical communication device because other signifiers, such as "car" and "duck," do not signify a physical communication device. In other words, we come to know what a "phone" is by knowing what a "phone" is not. Similarly, what is a "leader" without a "follower," or what is meant by "patriot" in the absence of "traitor"? In the case of mathematics learning, what it means to be "good at math" is only understandable through its relation with what it means to be "bad at math." The meanings associated with these signifiers mutually constitute each other through negative relationships. Consequently, as long as the rules of a particular semiotic system could be identified, an analyst could determine the meanings possible within that system.

The structuralist position, however, came under attack on multiple fronts, most notably by the French philosopher, Jacques Derrida. Although Derrida agreed that meanings are constructed across difference, he disagreed with Saussure's logocentrism, or the "preoccupation with the fixing of meaning through speech" (Leonardo, 2003, p. 57). Instead, Derrida (1976) argued that meaning was always *deferred*. The term "deferral" has simultaneously a "past" and "future" connotation. To illustrate, let us return to the term "traitor." A dictionary search for this term yields the following definition: "a person who betrays a friend, country, or principle." One might argue, however, that this definition far from settles the meaning of "traitor," since each of the words in that definition would require definition. That is, what does "betray" or "friend" or "principle" mean? In that sense, the meaning of a particular sign is context-dependent, deferring to the historical uses of that sign and the historical meanings of other signs.

Also, whereas structuralists maintained that meanings could be determine a priori within the bounds of the semiotic system, poststructuralists like Derrida believed that the meaning of a sign was always contextual, deferred until, and contingent upon, its eventual use in the social world. In other words, meaning is fundamentally unstable or "undecidable," in that it never quite arrives. Together, the concepts of difference and deferral comprise Derrida's notion of *différance*.

Importantly, Derrida's interest in language was grounded in a concern that some meanings are always "centered" or privileged over other meanings, which subsequently become marginalized or excluded altogether. If a sign's meaning could truly be fixed once and for all, then one could claim the existence of an "absolute truth." This would be problematic because the authority to define this "truth" characteristically fell to the dominant group. Rejecting this view, Derrida argued that *multiple* meanings compete simultaneously for a claim to "absolute truth." For the sake of illustration, let us briefly revisit the discussion of the discursive field of mathematics learning in Chapter 2. As Schoenfeld (2004) notes, traditionalists in mathematics education aim to define mathematics learning mainly in terms of skills, procedures, and teacher lecture, a view that constitutes the dominant perspective in American schools. Reform educators, however, contest this truth claim, instead proposing an alternate conceptualization of mathematics learning that emphasizes conceptual understanding and group work. Both perspectives represent competing attempts to fix the meaning of what it means to learn mathematics in the United States.

And yet, from Derrida's point of view, neither the traditional nor reform perspective represents the "real" version of mathematics learning; neither has a more valid claim to "absolute truth." For Derrida trading dominant ideologies for marginalized ones would only lead to new hierarchies, which he considered the ultimate problem. For example, a feminism that critiques patriarchy only to propose a female-centered social structure is problematic because it trades one system of domination for another (Butler, 1990). On the other hand, hierarchy becomes unsustainable when all "truths" are de-centered and none are given precedence.

So Derrida's critique embodies the core tenets of the poststructural turn. However, his ideas represent but one strand of poststructuralism. For although Derrida studied the role of language as a constructor of meaning, his analysis was confined to written and oral texts. In contrast, other poststructuralists studied how language functions to construct meanings in the *social world*, a type of analysis that engaged questions of positioning and identity. To elaborate the poststructural perspective on this issue, in the next section I discuss the work of the French philosopher and historian, Michel Foucault.

Foucault's theory of discourse

During his lifetime, Foucault wrote on a range of topics, including mental illness, the history of clinical medicine, penal codes and the prison system, and the evolution of sexual practices. The fundamental question driving all of his work was this: What forces mediate the relationship between the individual and the social world? Foucault's (1980) approach to exploring this question hinged on how he conceptualized the "individual":

> Because it's my hypothesis that the individual is not a pre-given entity which is seized on by the exercise of power. The individual, with his identity and characteristics, is the product of a relation of power exercised over bodies, multiplicities, movements, desires, forces." (p. 73-74)

Signaling his disagreement with the humanist position, Foucault rejected the notion of individuals as "pre-given" entities, or the existence of an Identity (capital "I"). What he proposed instead was an individual that is "the product of a relation of a power"—an *effect* or outcome rather than a pre-existing, independent essence. Consistent with Derrida's agenda of de-centering privileged meanings, Foucault aimed to displace the individual as the central unit of analysis.

From his point of view, investigating the relationship between individuals and the social world required a shift in perspective: away from the individual as the primary source of meaning to the question of how configurations of the social world operate to constitute subjectivity.

But if individuals are effects of a "relation of power," by what means is this power exercised? Foucault believed that the exercise of power was intertwined with the production of knowledge. That is, the knowledges that society creates make claims about how the world works (i.e., what is taken as "truth"), thereby prescribing how individuals should be treated and how society should be organized. For example, consider the introduction of new categories of learning disabilities into the educational domain. Whereas before a struggling student may have been perceived as "someone who has trouble paying attention in class," with this new knowledge a school psychologist can diagnose this child as ADHD, a label that carries with it a host of implications about who that child "is" and how society should treat him or her. In other words, the child *becomes* ADHD—the learning disability has acquired the child (McDermott, 1993). The production of knowledge and the production of individuals as certain types of people (i.e., "subjects") are two sides of the same coin.

This is why Foucault felt deep skepticism for science in general. In his view, the problem is not that scientists produce knowledge. Rather, what Foucault found problematic is how this knowledge takes on the veneer of objectivity, how it masquerades as "neutral" and "natural." As Derrida argues, when one set of meanings is established as "true," other knowledges are marginalized. To clarify, Foucault did not claim that all knowledges are produced in a necessarily conspiratorial way: psychologists research learning disabilities because they want to make learning accessible for all students, not because they actively seek new ways to re-organize schools or to medicate children. Nevertheless, these knowledges are consequential for how individuals are positioned.

A key point in the learning disabilities example is that social categories, or what poststructuralists call "subject positions," are codified in language, which serves as the vehicle by which they are circulated in society (Weedon, 1997). The words we speak and write are not mere vocalizations or inscriptions; they also signify certain ways of being and regulate possible ways of understanding. Or to borrow from Althusser (1971), we can say that language *interpellates* or "hails" individuals as subjects, thereby positioning them as being certain types of people. And yet, the oral and written forms of language represent but two media through which subject positions are made available and deployed; non-verbal signs can also function to achieve the same effect.

To illustrate the point, consider an example from a slightly unusual source: children's literature. Lois Lowry's The Giver tells the story of a dystopian society governed by rules intended to homogenize various segments of the population. For instance, all young girls in this society under the age of eight are required to wear the same dress, which has its buttons in the back. Upon turning eight, though, a public ceremony takes place where each girl trades in her old dress for a new one, which has its buttons in the front.

From a poststructural perspective, this story shows how non-verbal signs can regulate forms of subjectivity. Superficially, the dress seems little more than a piece of cloth—why should it matter where the buttons go? It matters because if the buttons are in the back, the child needs assistance to put it on, but if the buttons are in front she can accomplish the task by herself. Consequently, the dress becomes something more than a material object, in that its very configuration affords (and limits) access to particular subject positions. With the buttons in the back, the dress interpellates the child as "immature" and "dependent," while with buttons in

front the dress positions the wearer as "of age" and "autonomous." The dress invites both the child and her community to view her in certain ways. So although it does not constitute oral or written speech, as a material artifact the dress can be said to function in a "language-like" way, in that the dress "speaks" these meanings and these meanings are "read" into the dress (see Barthes, 1967). In fact, the same can also be said of the public ceremony itself. As a cultural practice, the ceremony does not "speak," but those in attendance are meant to understand it as signifying a step toward becoming an adolescent.

Thus, the semiotic means by which individuals are constituted as subjects are not limited to traditional language, but can also include material objects and cultural practices (Wodak & Meyer, 2009). In his work, Foucault used the notion of discourse to capture this idea. Typically, "discourse" is used to refer to social interaction based on oral or written language, but Foucault conceptualized the term more broadly.[26] In the excerpt below, Weedon (1997) describes Foucault's formulation in a way that summarizes much of the discussion to this point:

> Discourses, in Foucault's work, are ways of constituting knowledge, together with the social practices, forms of subjectivity and power relations which inhere in such knowledges and the relations between them. Discourses are more than ways of thinking and producing meaning. They constitute the 'nature' of the body, unconscious and conscious mind and emotional life of the subjects which they seek to govern. Neither the body nor thoughts and feelings have meaning outside their discursive articulation, but the ways in which discourses constitute the minds and bodies of individuals is always part of a wider network of power relations, often with institutional bases (p. 105).

In this description Weedon points out that discourse cannot be reduced to how we talk and think about a particular topic. Besides their ideological component, discourses manifest in the material conditions of everyday life and mediate our engagement with the social world. As illustrated in the previous chapter, ideologies materialize through their embedding in regular discursive practices (Althusser, 1971; Leonardo, 2005), such as who students choose to ask for help when stuck on a math problem. It is in this sense that Weedon writes that "neither the body nor thoughts and feelings have meaning outside their discursive articulation."

The concept of discourse was the lynchpin of Foucault's empirical work. Take for example the book, *Discipline and Punish*, Foucault's (1975) seminal study of the evolution of penal methods around the time of the French Revolution. In the early 1700s convicts were punished in violent and public ways, as torture and public executions were standard fare. In part, the structure of these practices reflected the interests of the state, in that publicizing punishment served to remind people of the sovereign's hegemonic authority. However, as France moved into the second half of the 18th century, perspectives on punishment began to shift. Reform discourses emerged that aimed to re-articulate the meanings associated with "criminality." To that point, criminals had been perceived as targets of physical harm, but reformers sought to interpellate them as people worthy and capable of rehabilitation. This new ideology precipitated several innovations in the "technologies" of institutional punishment.

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[26] Some scholars use different terminology to draw this distinction. For example, Gee (2011) uses "discourse" to refer to language and the capitalized "Discourse" to refer to both language and non-verbal signs (what Gee calls "other stuff"). In this article I adhere to Foucault's terminology.

The most fundamental change, Foucault argues, was the design and construction of prisons, which converted punishment from a public spectacle to a more private sort of activity. Further, the physical body ceased to be the primary focus of punishment. Instead, new methods were developed to discipline prisoners' behavior and ultimately rehabilitate (and regulate) their very "souls." The concept undergirding these methods of behavior modification was surveillance, the idea being that prisoners would be more likely to eschew "aberrant" behavior if they were conditioned to feel that they were constantly being watched. This hypothesis manifested in several ways, but Foucault gave particular attention to prison architecture.[27] He described how the physical layout of the prison (e.g., a multi-windowed guard tower positioned in the center of a courtyard) was designed to maximize observation—both real and imagined. Another disciplinary technology was the practice of placing prisoners in cells for solitary confinement. This was based on the belief that a physical space for individual contemplation could facilitate repair of the soul.

Overall, Foucault's study is instructive because it underscores several theoretical points that will become central later in this chapter. First, discourses are multi-modal: the discourse of punishment in 18th century France included the language people used to talk about convicts and define "punishment," but it also included the material artifacts and institutional practices associated therein. In other words, from the gallows to the executioner, from the blueprints for the prison to the practice of solitary confinement—although none of these physical objects, roles, or actions "speaks," in Foucault's model they all represent "language-like" elements of discourse. Metaphorically, just as the little girl's dress in The Giver embodies that society's norms about adolescence, the dominant discourses of punishment are "baked" right into the cement of the prison's walls. In both cases, societal narratives can be "read" or inferred from the materiality of the social world.

Second, discourses provide the means by which individuals are hailed as "subjects." Certainly, the convict about to lose his head can be called an "enemy of the state" by his executioner, but the very practice of *public* execution also interpellates him as someone who has transgressed the king's sovereignty. As Leonardo (2003) reminds us, this speaks to the double meaning of "subject," in that people "…become subjects through discourse as they take up positions within and between statements: hence, subjectivity. But as they do this, they also become subjects of the division of labor: hence, subjection" (p. 39; cf., Ricoeur, 1986). As a final point, Foucault's work shows that discourses are fluid, not static—they can and do change across time and space. Whether it is "punishment" or "mathematics learning," the fact that we as a society collectively bring meaning to these things means that how they are defined is never fixed forever and always.

My purpose thus far has been to provide a brief introduction to some of the basic terminology and tenets of poststructuralism. Having laid this groundwork I now turn to poststructural conceptions of "identity," paying particular attention to the work of Foucauldian cultural theorist, Stuart Hall.

"Identity" through a poststructural lens

A central point in the previous section was that individuals do not exist in the world with a pre-given essence. Rather, individuals are hailed into subjectivity through discourse. But where

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[27] Specifically, Foucault analyzed the notion of a "Panopticon," an architectural design proposed by the English philosopher, Jeremy Bentham. Its architectural principles have been invoked in institutional settings besides prisons, including schools and hospitals.

does "identity" fit in this picture? Earlier in this chapter I discussed situative and sociocultural perspectives on identity, which define it as a "possible self" or "way of being" that is afforded by engagement in cultural practices. In poststructural terms, this definition renders "identity" synonymous with what we have been calling a "subject position." So is this merely a difference in terminology, or are there actual conceptual differences in how poststructuralists operationalize "identity"?

Although his views cannot be said to represent those of all poststructuralists, Stuart Hall offers one perspective that may shed light on this question. In the excerpt below, Hall (1996) defines "identity" in a way that builds on Foucault's notion of discourse:

> Identities are thus points of temporary attachment to the subject positions which discursive practices construct for us (see Hall, 1995). They are the result of a successful articulation or 'chaining' of the subject into the flow of the discourse, what Stephen Heath, in his path-breaking essay on 'Suture' called 'an intersection' (1981:106). (p. 6)

Two points stand out in this definition. First, Hall draws a clear distinction between "identities" and "subject positions." Whereas discourses make available subject positions (i.e., "possible ways of being"), identities are "points of temporary attachment" to those subject position. Second, Hall highlights the idea of "suture," noting that these attachments come about as subjects are "chained" into the "flow of the discourse," a process he also refers to as being "sutured into a story" (Hall, 1996, p. 4).

Suturing is a concept that helps specify Althusser's notion of "interpellation." Discourses hail individuals as subjects (Leonardo, 2003), but how precisely does this hailing occur? The key idea is juxtaposition: individuals are affixed or "sutured" to particular subject positions (i.e., interpellated as being certain types of people) when they are brought in close proximity to those positions. Further, identities are built across *difference*, in the sense that identity is a function of "what you are" and is concurrently reinforced by "what you are *not*":

> Above all, and directly contrary to the form in which they are constantly invoked, identities are constructed through, not outside, difference. This entails the radically disturbing recognition that it is only through the relation to the Other, the relation to what it is not, to precisely what it lacks, to what has been called its *constitutive outside* that the 'positive' meaning of any term - and thus its 'identity.' (Hall, 1996, p. 4; italics in original)

Here the notion of "difference" echoes Saussure's (and Derrida's) contention that, in part, signifiers accrue meaning in their relation to other signifiers. Hall emphasizes the boundary-making tendency of identity formation—to be considered "in" requires the construction of an "out."

This point can be illustrated by considering the case of individuals being interpellated by racial discourses, when people are "…signified and brought into the racial universe" (Leonardo, 2005, p. 407). For example, as a racial label "Black" accrues meaning only when it is compared with other signifiers. On the one hand, what "Black" comes to signify emerges through its relation with other racial signifiers, such as "Asian" and "White." Whereas Asians and Whites tend to be interpellated as "smart" and "academically oriented," Blacks tend to be sutured with

terms like "at-risk." In part, Blacks come to be positioned as "at-risk" because they are not Asian or White and consequently *not* "smart" or "academically oriented." The polar opposition in these subject positions is not coincidental. Rather, as I argued in Chapter 4, the hierarchies fostered by this dialectic are one of the reasons that racial discourses exist in the first place.

Of course, the picture is not all that rosy for Asians either. At the same time that they are granted access to certain subject positions, other "possible selves" are rendered less available. For instance, being labeled "smart" means that being "athletic" is out of the question; if one is deemed "academically oriented" then one cannot be "social"; and being interpellated as "technical" comes at the expense of being seen as "creative." Ultimately, the identities that are generated through the process of suture are characteristically double-edged in this way because their production is governed by the "constitutive outside." And while these binaries are not "real," they are treated as such because identity is often treated as if it were a zero-sum game.

Further, as Hall points out, subjects are not merely sutured to specific signifiers, but to entire *stories*[28] (or discourses) that tell them "who they are." Labeling a young Black learner "at-risk" is about more than the odds of that child dropping out of school; it also invokes discourses of future criminality and limited economic prospects. One might imagine how a very different set of identities would be possible by affixing the term "successful" or "promising" to "Black." Suturing causes subjects to be recruited into a web of narratives that regulate the identities available to them.

But to leave it here would yield an incomplete characterization of identity formation. I began this chapter with a quotation from W.C. Fields: *"It ain't what they call you, it's what you answer to."* This statement captures the sentiment that identity formation is a two-sided process. That is, although the social world may interpellate us as being certain types of people, thereby suturing us to certain subject positions, we as individuals still have an opportunity to respond in the affirmative or to resist. Or as Hall (1996) puts it:

> The notion that an effective suturing of the subject to a subject-position requires, not only that the subject is 'hailed', but that the subject invests in the position, means that suturing has to be thought of as an *articulation*, rather than a one-sided process, and that in turn places *identification*, if not identities, firmly on the theoretical agenda. (p. 6; italics in original)

What he means is that for an identity to take hold, an individual must also buy into the subject position being imposed. A math teacher can tell a student that he will never be a mathematician, but an "effective suturing" requires the student to assent to the teacher's hail.

So while it is true that we are constantly being positioning, it is not the case that we are always passive recipients of this positioning.[29] Institutions may attempt to bypass our consent altogether, but it is not the case that an oppressive social world renders us utterly helpless. We are not deterministic effects of forces completely beyond our control. Whether we actively accept, passively accept, reject, or repurpose the world's hails, all such responses are forms of agency.

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[28] The narrative element of identity formation that Hall points out echoes the perspective put forth by Sfard and Prusak (2005) that defines identities *as* stories.

[29] It should be noted that W.C. Fields's quote can just as easily be inverted: It ain't what you call *yourself*, it's what *they* answer to. In other words, sometimes the roles are reversed: individuals act as first-movers by positioning themselves, at which point the social world responds to *them*.

And yet, in acknowledging human agency we must be careful not to romanticize it and drift back toward humanist assumptions about identity. On the one hand, as Gee (2011) rightly suggests, "Language allows us to be things. It allows us to take on different socially significant identities" (p. 2). On the other hand, this freedom to choose is not unlimited because the work of identity is always situated within discourse and concomitant power relations. As a result, the forms of agency possible in any given moment are a function of the discourses available to an individual, since the acts of agency themselves are discursive in nature (Leonardo, 2003). Still, the limits on agency notwithstanding, identity in Hall's conceptualization is something that arises through a two-sided process of suturing and identification, or what Hall refers to as "articulation."

The final characteristic core to Hall's framework is the view of "identity" as unstable, as something that never quite arrives. Concurring with Derrida's stance on the meaning of signs, Hall maintains that identities are always deferred. That is, just because someone hails you as a certain type of person, or just because you position yourself as a certain type of person, does not mean that this identity has become "yours" forever and always. Neither does it mean that it is "you" (i.e., the hail entails a fundamental misrecognition). As Hall notes, identities are *temporary* points of attachment—the sutures are provisional and can be torn apart at any time.

How does Hall come to this conclusion? First, he points out that the process of suturing is never an exact fit. Whether we are being hailed by others, or whether we are attempting to suture ourselves into a particular story, the affixing of a subject position is always either over- or under-determined. For example, imagine that you are learning to cook, and a dinner guest tells you that you are a "great chef." Associating you with this subject position is probably an over-reach; you might become a "great chef" one day, but embracing the label now is like trying on a shoe that is three sizes too big. Alternatively, a less polite guest—unlikely to be invited again—might suggest that you are an "awful cook," but this probably gives you too little credit. It is a "Goldilocks problem" *par excellence*: the porridge is either too hot or too cold. The suturing is always inexact.

But even when a subject position seems a perfect match, and an identity seems to take hold, Hall's second point is that this is a temporary state of affairs. Sooner or later something comes along to re-interpellate an individual such that this old identity is de-stabilized. Of course, this is not necessarily a bad thing. If an individual has been sutured to (and identified with) a pejorative subject position, the instability of identity leaves room for the possibility of change. The process of interpellation recruits individuals into discursive fields that also consist of counter-subject positions, which may be available in any instance. All in all, the point is that identity formation is not a smooth, one-off event. Instead, it is a "constant, agonistic process" that proceeds in fits and starts (Hall, 1996, p. 14).

And yet, this theoretical perspective would appear to have a fatal flaw: if identity is as unstable and fractured as poststructuralists contend, then how is it that we can still function in the world? How is it that we are all not paralyzed by the uncertainty that comes with never knowing "who we are" and always being in flux? The fact is that we do not re-invent ourselves from scratch and we are not recognized afresh in every new situation. Although the cycle of positioning and response is in perpetual motion, there exists relative uniformity in the types of positioning and response that occur on a daily basis. As Butler (1990) would say, this uniformity is achieved through repetition.

To illustrate, consider how we are repeatedly recruited into the dominant discourse of gender over the course of our lifespan. Dating as far back as our time in the womb, when a

medical technician diagnoses our sex from a sonogram, we become subject to the discourse of gender. Upon birth we are hailed again, as we are given "boy names" or "girl names" based on that sex. When we are brought home we are placed in a crib that sits in a room that was painted blue or pink in anticipation of our arrival. As we grow older we play with certain toys, we dress a certain way, and we engage in certain cultural practices (e.g., bar mitzvahs, quinceañeras, insisting on driving because "that's what men do")—all of which suture us into discourses of gender. So despite the fact that the identity of "woman" is not a pre-given essence, it is not surprising that people come to treat it as such: the positioning-response mechanism is repeated so frequently and so consistently that it *simulates* a stable gender identity even though none actually exists (Butler, 1990).

The impact of repeated positioning is also evident in what surprises us and what we take as "common sense." Imagine that someone you work with—who has historically self-identified as a "man" and been identified as a "man"—one day comes into work dressed in drag as a woman. While you might be surprised, it likely would not change your perception of his gender. If this happened a couple more times that week, though, the surprise would probably wear off and how you interpellate your co-worker with respect to gender might begin to change. If your co-worker dressed in drag everyday for the next year, the "man" identity would almost certainly become unstable and perhaps a new identity would begin to "thicken" (Wortham, 2006). Again, as Butler (1990) argues, the point is that repeated "performances" of identity are needed in both directions: to de-stabilize long-standing sutures and to cement new sutures into place.

In February 2012, an Asian American basketball player named Jeremy Lin became the starting point guard for the New York Knicks. For a two-week period the nation was captivated as Lin led the previously hapless Knicks to a seven-game winning streak. Why did Lin fascinate the public as much as he did? Certainly, his play during this period was statistically exceptional, but the media coverage showed that his story was also very much about race: the juxtaposition of "Asian" and "basketball star" surprised people. Lin defied the dominant discourse about Asians, as well as the dominant discourse about what a basketball player is supposed to look like.

But there had been other players of Asian descent that had excelled in the NBA—why did Lin become such a phenomenon? I would argue that not enough Asians had played in the NBA at that point to normalize this particular identity. Certainly, if he were to continue a high level of play for the rest of his career, people will be less surprised at Lin's success. However, the racialized discourses about who can succeed in basketball would change only when this type of identity performance is repeated many more times. In contrast, as I have shown in this dissertation, the image of an Asian person succeeding in math causes no such dissonance precisely *because* it has become part of our cultural common sense.

Summary

From a poststructural point of view, there are no individuals outside of discourse. People do not possess a unified, singular "self" that remains constant independent of context. Instead, poststructuralists contend that individuals are interpellated as discursive subjects from the moment we enter the world. However, as Stuart Hall points out, identity formation is a two-sided process, and individuals can accept, reject, or repurpose the ways in which the world hails them.

"Identity," then, is an *effect* or outcome of this process. Specifically, Hall (1996) highlights three key aspects of identity formation: 1) identities are constructed through difference; 2) identities are forever deferred or unstable; and 3) identities pretend stability because suturing is a repetitive (and generally consistent) process. Compared with sociocultural

theory, poststructuralism offers a closely related but distinct conceptualization of identity. In the next section I draw from both perspectives to build a hybrid framework for analyzing identity formation, which I demonstrate by applying it to several pieces of data from previous chapters.

Racial-Mathematical Discourse and Identity

The purpose of this chapter is to analyze the impact of racial-mathematical discourse on student learning vis-à-vis the notion of "identity." To that end, I have reviewed two broad theoretical perspectives on identity: sociocultural theory and poststructural theory. In this final section, I synthesize ideas from both perspectives in a hybrid framework for analyzing identity formation in local moments of activity. I begin by providing a bird's eye view of the framework, which addresses two issues that are of central concern to both sociocultural theorists and poststructuralists: 1) how identity-related cultural artifacts come to be made available in an activity context; and 2) how the appropriation and deployment of those artifacts mediates access to subject positions.

Regarding the first issue, the framework conceptualizes the emergence of particular identity artifacts as byproducts of the dialectic between social practices and sociohistorical discourses. On the one hand, sociocultural analyses of identity in educational research tend to focus mainly on the dynamics of people's engagement in concrete practices. On the other hand, poststructural analyses tend to privilege more abstract considerations of the discursive contexts within which those practices are situated. Here I argue that a robust understanding of identity formation depends on our ability to bridge these analytic tendencies, by parsing the relationship between local practices and broader discourses. To illustrate this aspect of the framework in the particular case of racial-mathematical discourse, I revisit the racialized episode discussed earlier in the chapter involving students turning in a completed Precalculus exam.

Regarding the second issue, the framework offers a window onto the effects of positioning at the fine-grained level of moment-to-moment social interaction. Specifically, it reveals the process of identity articulation as power-laden, in that as individuals are hailed into subjectivity through language, some subject positions are made accessible while access to others is closed off. To illustrate this second aspect of the framework I return to another racialized episode analyzed in the previous chapter, where the enrollment of an African American boy named James in an advanced math class was challenged by his classmates.

Overview of the framework

Building on the situative, sociocultural, and poststructural conceptualizations of identity and identity formation outlined thus far, I define identity as follows: Identity is the unstable effect of an ongoing, two-sided negotiation—which involves positioning and response—between individuals and the social world. And further, this negotiation occurs as individuals engage in everyday social practices that, in turn, are situated within discourse.

This conceptualization of identity is captured in Figure 8 below. At the heart of the diagram is the positioning-response dialectic. Both the initial hail and the response are forms of positioning, or attempts to suture the individual into a particular set of subject positions. Responses are bids to re-position subjects. Notice also that neither the person nor the "social world" is given primacy in this negotiation. That is, although it is frequently the case that the social world positions people (who then respond), it is also true that people are the ones to position themselves relative to the social world (which then responds). Again, the key point is

that people are not passive recipients of the world's hails; they play a role in the construction of their identities.
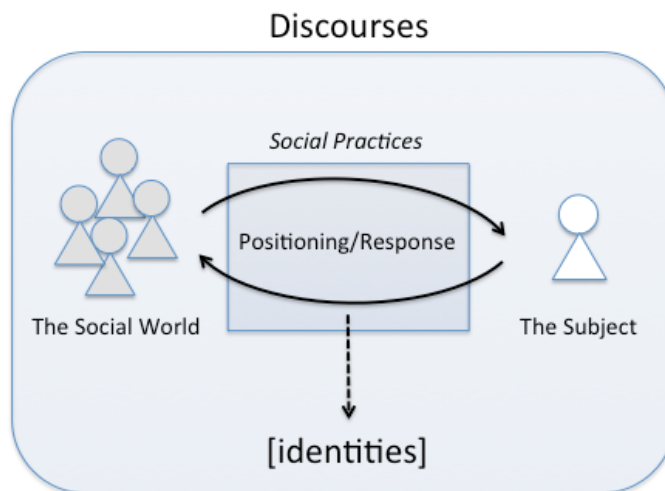

Figure 8. A hybrid framework for conceptualizing identity formation.

In all this, discourses function as the medium through which identity formation takes place. This means that discourses provide the "raw materials" or artifacts that are appropriated and deployed in acts of positioning, which in turn occur in the context of people's everyday engagement in social practices (e.g., taking a Precalculus test, running track, cooking pasta, being placed in solitary confinement). And because discourses are multi-modal, these artifacts come in a variety of forms, such as oral and written speech, beliefs or narratives, institutional practices, and even material objects.

Lastly, as Figure 8 shows, identities are outcomes of these perpetual processes. The purpose behind putting "identities" in brackets is that, as was discussed before, identities are only *temporary* attachments to subject positions. Akin to Xeno's paradox, identities never quite arrive; they are deferred and provisional. As soon as you or the social world is certain that they know "who you are," another cycle of positioning-response de-stabilizes those identities and others may settle in.

Overall, the diagram in Figure 8 captures the basic features of the framework. However, this level of generality—while useful for explaining its fundamental components—obscures the micro-processes that facilitate identity formation. That is, how and why certain subject positions become available in a given moment of activity and not others, and how language functions to grant or constrain access to subject positions. I take up these issues in the following two sections.

Revisiting the case of the racialized Precalculus test

Recall the racialized episode presented earlier in this chapter where students had completed a Precalculus exam and were getting up from their seats to turn in their tests. Although nothing explicitly racial was said—indeed the room was completely silent—somehow some students in the class interpreted the episode in racial terms. And further, based on the observation that the three students to turn in their tests were of Indian descent, they concluded that the episode proved that Indians are "geniuses in math." This surprising interaction begged

the question: why did race become salient in a situation that would seem to have nothing to do with race?

Given the relevance of this episode to issues of identity, I first turned to sociocultural theory, which has been widely used in analyses of identity formation in educational research. Core to this line of research is the idea that identities are linked to the configuration of social practices (Esmonde, 2009a; Nasir & Hand, 2008). More specifically, that different practice configurations make different "identity resources" (Nasir, 2011) or "identity artifacts" (Leander, 2002) available in the activity setting. Once these identity artifacts are made available, they can be appropriated by participants and deployed for the purpose of positioning and identification (Holland et al., 2001).

This perspective led me to consider the practices in which the Precalculus students were engaged. While generally speaking the students were taking the test, the critical moment in the episode occurred when students were turning in their tests. As the earlier analysis showed, because the particular configuration of this practice in that classroom permitted students to very publicly turn in their tests as soon as they finished, the practice allowed for certain students to be positioned as mathematically superior because they turned in their tests faster than their classmates. From a sociocultural standpoint, one can say that the practice afforded the identity of a "math genius," and that this artifact was subsequently deployed to identify those students.

However, as I argued before, while this might explain why Akshay, Vishal, and Sanjay were identified as "smart" or "mathematically gifted, this analysis does not explain why they were simultaneously constructed as racial subjects. That is, they were not just positioned as "math geniuses"; they were positioned specifically as "*Indian* math geniuses." Thus, focusing on the practice and the local context of the classroom provides partial insight into the identity dynamics of the episode, but it does not tell the entire story.

In my view, this is where the poststructural notion of discourse can be analytically useful. In a sense, every mathematics classroom is governed by a local discourse that defines what "mathematics" is and what it means to do and learn mathematics within the walls of that classroom. This local discourse is constructed through a variety of channels, including norms—both general and math-specific (Yackel & Cobb, 1996)—classroom practices, and broader cultural discourses about mathematics and mathematics learning. In that light, it is possible to dig even deeper into the reasons behind the emergence of the math-related identity artifacts.

There is nothing inherent in the practice of letting students turn in a math test whenever they finished that caused students to read it as indexing mathematical ability or "smartness." Rather, I argue, it was the relation between the practice and its discursive contexts that made it possible for those identity artifacts to emerge. As I discussed in Chapter 2, the dominant discourse of mathematics learning in the United States conflates speed with competence and intelligence. That is, "fast kids" are "smart kids," and "slow kids" are "dumb kids." This is the discursive context within which all mathematics classrooms are situated. In the present case, the three boys turning in their tests before everyone else were interpreted through this dominant discursive lens, and it is because of that the practice made available those identity artifacts.

However, this did not have to be the case. Even hegemonic discourses can be disrupted through the implementation of alternate pedagogies that seek to re-signify the notions of "intelligence" and "ability" (see Boaler, 2008; Cohen & Lotan, 1995). In doing so, teachers and students can co-construct local discourses within the classroom that defy the prevailing cultural logic about mathematics learning. Imagine a classroom where the local discourse of mathematics learning was organized in such a way that "finishing first" did *not* signify intellectual status. It is

plausible that in this context, students might not have given a second thought to some classmates finishing before others, even with the practice configured in the exact same way.[30] In sum, the dynamics of identity are only partially related to the configuration of a social practice. Instead, the identity artifacts that become available in a given moment are a function of how discourses mediate the ways in which the practice is taken up in that context.

This idea is important because a similar analytical approach can be used to explain how and why this episode became racialized. Just as the practice of students turning in their Precalculus exams is situated within discourses of mathematics learning, it is also situated within the racial-mathematical discourse that permeates the United States. Further, recall that throughout this dissertation I have shown that perceptions of intellectual capacity lie at the heart of racial-mathematical discourse. And within racial-mathematical discourse, "fast kids" and "smart kids" become indistinguishable from "Asian kids." As a result, when students participate in a practice that has the potential to signify intellectual hierarchies, it becomes more likely that three boys turning in a test are perceived as three *Indian* boys. Again, it is the link between racial-mathematical discourse and the contours of the practice that creates the possibility that *racialized* identity artifacts, such as the "Indians are math geniuses" narrative, are made available.

Theoretically, given the tight braiding between race, intelligence, and mathematical ability in racial-mathematical discourse, it may be the case that certain classroom practices are more conducive to cuing racialized identity artifacts, especially those practices that provide opportunities for students to publicly display or accrue intellectual status. Reflecting on the findings in Chapter 6, the racial-mathematical episodes shared by students occurred in the context of four typical classroom practices: testing, asking classmates for help, participating in whole-class discussion, and making judgments about who belongs in advanced math courses. Given the present discussion, perhaps it is not surprising that all of these practices are critical sites where the intellectual stakes are high, rendering them quite compatible with racial-mathematical discourse.

Overall, the key idea is that discourses precede and pre-figure social practices. Indeed, the practices themselves are discursive productions. So while activity settings are organized around practices, understanding activity—and identity formation in particular—also requires consideration of the discourses that contextualize the practice (see Figure 8). It is through discourse that the practices become comprehensible. To be clear, I am not proposing that poststructural theory supplant sociocultural theory, or vice versa. Indeed, both are necessary and should be used in concert.

While sociocultural theory emphasizes practices, it does not dismiss the importance of broader contexts (see Saxe & Esmonde, 2005). To be sure, the focus on artifact mediation places issues of culture and history firmly on the sociocultural agenda, at least from a theoretical standpoint (Leontiev, 1978; Vygotsky, 1978). Pragmatically speaking, however, sociopolitical forces like racial discourses tend to be treated as background, if at all. Rarely do sociocultural studies problematize society-level phenomena in a substantive way, opting instead for a decidedly local kind of analysis that "has been less inclined to emphasize relations of power as indexed and constructed through artifacts" (Leander, 2002, p. 203). Poststructuralism, for its part, tackles issues of power head-on, but is not concerned with the detailed parsing of activity

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[30] Of course, given that social practices themselves are discursive artifacts, it is likely that in this type of classroom such a practice might not even have been implemented in the first place. In other words, alternate discourses do not just promote alternate ideologies, but they also engender alternate material practices (Leonardo, 2003).

that sociocultural theory has shown to be crucial. So whereas neither perspective by itself is sufficient for unpacking the nuances of identity formation, together they yield significant analytical power.

Mediating access to subject positions
Although identity artifacts might be made available in an activity setting, it does not necessarily follow that participants appropriate or deploy them. In the previous example, although the relationship between racial-mathematical discourse and the practice of publicly turning in one's test when finished might theoretically make available racialized identity artifacts, students in the class do not necessarily have to appropriate those artifacts and read the episode as racialized. Still, if this does happen, the question becomes: What is the impact of those deployments on the articulation of students' identities?

In Chapter 6 I presented data from an interview with an African American boy named James, a 12th grader enrolled in Precalculus. When asked whether people would have treated him differently in math had he been Asian instead of African American, James said that he would have been expected to always have the correct answer. He also told me that he would have made a different first impression on the first day of Precalculus earlier that year:

James: When I walked into the Precalculus class this year, like the first couple days or whatever, I was getting questions like, "Oh *you're* in this class? For real?" And I would say, "Yeah…yes I am." I mean I wouldn't really trip. I kind of looked it off like I don't even care. But yeah I think the first impression would have been different, for sure.

Shah: Who was telling you that when you walked in?

James: I think it was Troi [a Sa'moan friend and classmate] and like somebody else…I don't remember. I showed them my schedule like before we even had that class, but they were like, "*You're* in this class?" I was like, "Yeah."

What I am interested in here are the effects of positioning/response cycles at a microgenetic level (see Wortham, 2004). The framework conceptualizes these effects in terms of participants' access to subject positions, which, as Esmonde (2009b) notes, can be thought of as an opportunity to learn. For analytical purposes, this episode can be parsed into a sequence of snapshots: the subject positions available to James *before* this interaction, Troi's positioning of James, the effects of that positioning on James's identifications, and the effects of James's response. Each of these snapshots is represented in Figures 9 through 12.
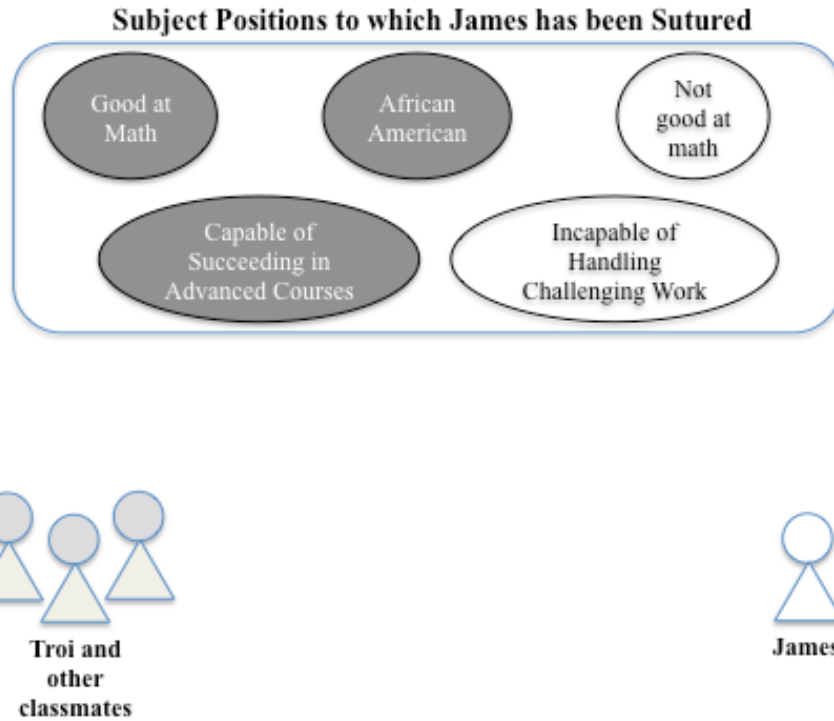
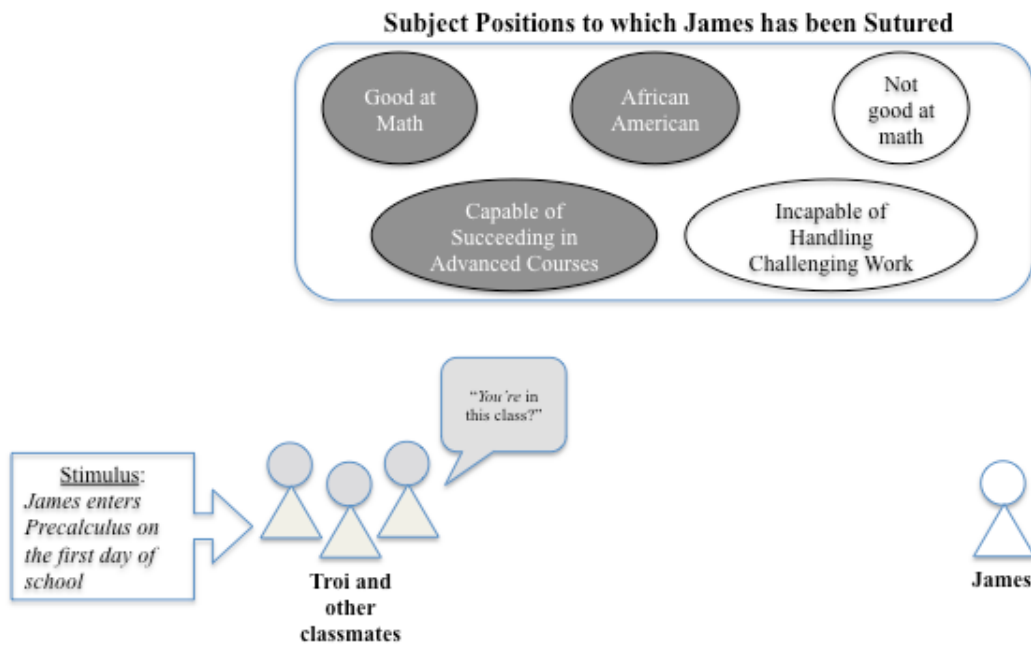*Figure 9.* James's approximate identifications before the episode.
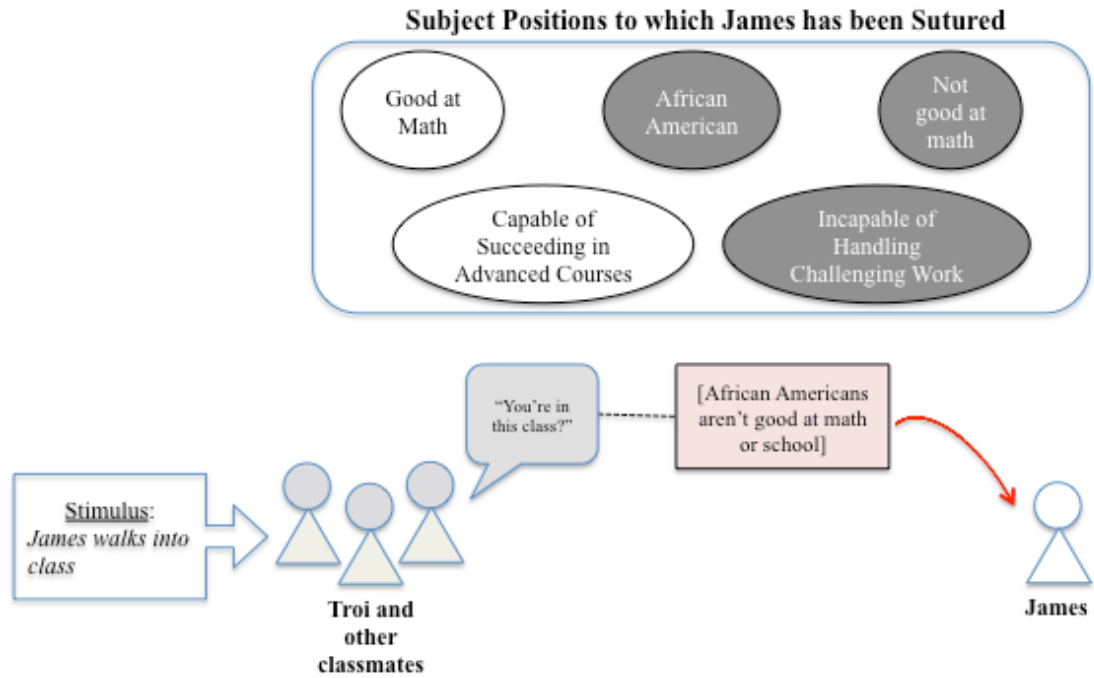

Figure 10. Troi's positioning.

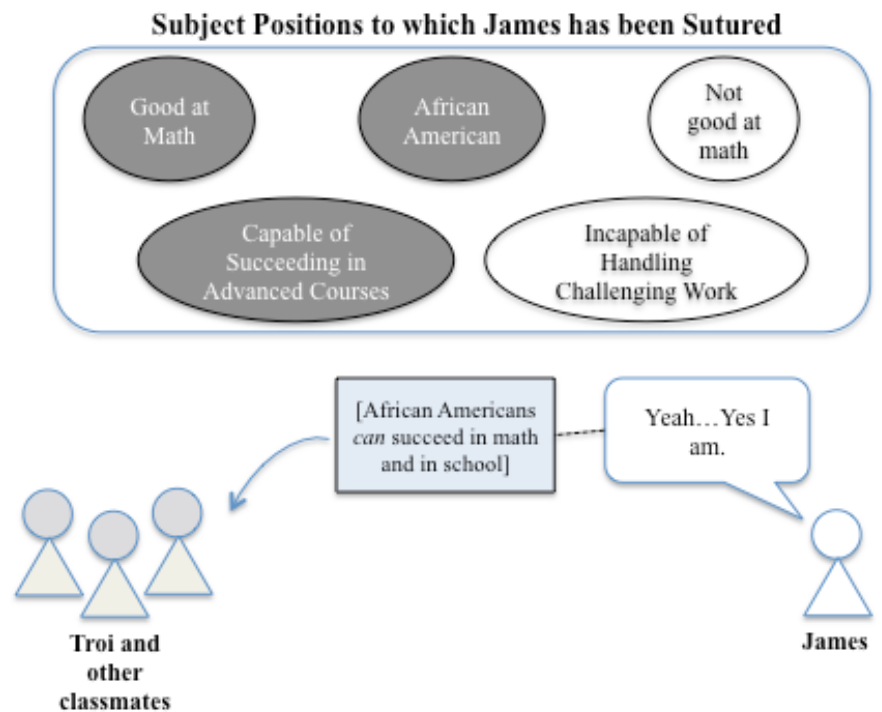*Figure 11*. The potential impact of Troi's positioning.

Figure 12. James's response.

While recounting his personal experiences learning mathematics early in the interview, James described himself as someone who had always excelled in math. He spoke with pride about "knowing how to add when I was like three or four or five years old," and winning math tournaments in elementary school. In middle school he was one of only four students in his 8th grade algebra class who was recommended by his teacher to be placed in Geometry as a 9th grader, which was considered "advanced" at Eastwood High. Although James failed that class, he attributed his struggles to "being a freshman and not taking things seriously," as opposed to a lack of mathematical ability. Eventually, James persevered and reached Precalculus in 12th grade.

These identifications are represented in Figure 9. The subject positions of someone who is "good at math," "African American," and "capable of succeeding in advanced courses" are fully shaded because, based on the available data, James clearly sutured himself to these positions. Alternatively, the subject positions of someone who is "bad at math" and "incapable of handling challenging work" are left un-shaded because there is no data to suggest that James identified himself as such. Altogether, this configuration can be called his *initial* "identity state" prior to the interaction with Troi.[31]

The episode begins when James walks into Precalculus on the first day of school. Upon entering the room, Troi questions James's enrollment in the class (Figure 10). It is not at all clear that Troi had race in mind when he made this statement. To be sure, there was nothing explicitly racial about it, but James still interprets Troi's question in racial terms. He takes up Troi's question as a racialized challenge, and, once again, we are left with the problem of why race emerged into a latently mundane situation.

As in the previous case with the Precalculus test, the phenomenon here can be explained by examining the practice and its discursive context. Troi engages James in the practice of determining who belongs in which mathematics courses. Historically speaking, this practice in the United States has been highly racialized (Oakes, 2005). Considering the interaction within this context, it is clearer how and why racialized identity artifacts become available in this interaction. To James, Troi's surprise constitutes a *racial* surprise, and James takes up Troi's question as a deployment of racial-mathematical and racial-academic narratives about African Americans being bad at math and/or apathetic about school (see Figure 11).

In doing so, Troi recruits James into these discourses; he interpellates James as someone who does not belong in advanced mathematics with the rest of his friends. This interpellation aims to alter the subject positions to which James has access. Troi's positioning seeks to suture him to positions that frame him as "bad at math" and "incapable of handling challenging work." However, James resists this positioning, defiantly responding that he *is* enrolled in Precalculus. This move can be interpreted as a bid to re-open access to his previous self-understandings.

In fact, James mentions that he attempted to resist a similar positioning prior to this particular episode when he showed his course schedule to his classmates in order to prove that he actually was enrolled in an advanced math class. From a sociocultural perspective, James

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[31] Before proceeding several caveats are in order. First, the notion that it is possible to characterize a person's "identity state," especially based on such limited data, is an obvious simplification. However, one might imagine how ethnographic data collected over time might serve this purpose. Second, the five subject positions listed in Figure 9 are not meant to be exhaustive; I focus on these only to demonstrate the framework. Third, I do not claim that the identity dynamics in Figures 9-12 are actually occurring in James's head; rather these are representations meant to illustrate the *hypothetical* impact of positioning on an individual's identifications. Finally, while this episode almost certainly also holds implications for Troi's identity formation, for the sake of simplicity I analyze the episode here only from James's perspective.

deployed a material object, his course schedule, as an identity artifact for the purpose of suturing himself to more academically oriented subject positions. James's use of physical objects and semiotic objects (i.e., language) underscores the point that identity artifacts (i.e., discursive elements) are multi-modal (Leander, 2002; Nasir & Cooks, 2009).

To summarize, sociocultural theory expounds on the processes by which people appropriate tools and signs (i.e., artifacts) in the service of goal-directed activity (Leontiev, 1978; Vygotsky, 1978). Although this perspective is often used to shed light on situated cognition, it is also applicable to the dynamics of identity formation. Once identity artifacts are made available in an activity space, they can be appropriated and deployed like any other artifact to achieve particular goals. Given this dissertation's interest in racial-mathematical discourse, the present discussion demonstrated how racialized identity artifacts can be deployed in ways that mediate access to subject positions, or the "possible selves" available to people. And while this may not be the explicit goal of these deployments, my analysis suggests that it may be their effect.

Of course, the positionings for which identity artifacts are leveraged are not always oppressive. Indeed, artifacts can be deployed in order to "figure" new cultural worlds that do not facilitate marginalization or domination (Holland et al., 2001). It can be said that James, for example, was attempting to figure a world for himself where African Americans are deemed mathematically capable, thereby re-signifying both the cultural space of the advanced mathematics classroom and what it means to be African American in an educational context.

Summary

In this chapter I attempted to theorize the impact of racial-mathematical discourse on learning in terms of identity. To that end, I proposed a general framework for analyzing identity formation that builds on insights from both sociocultural theory and poststructuralism.

The framework addresses two issues. First, it explains the emergence of identity artifacts in an activity setting by analyzing the link between locally configured practices and the broader discourses within which they are situated. Second, it examines how the deployment of those identity artifacts in social interaction mediates access to subject positions at a microgenetic level. Broaching these analytical questions requires both theoretical perspectives, since sociocultural approaches are well suited for parsing people's engagement in social practices and characterizing local activity settings, while poststructuralism offers tools and methods to dissect discourses.

To demonstrate the framework's theoretical value, I re-visited two racial-mathematical episodes presented earlier in the dissertation. Analysis shows that racial-mathematical narratives function as identity artifacts that students deploy in ways that mediate the subject positions available to them. And given the content and structure of racial-mathematical discourse detailed in Chapters 4 and 5, it is plausible that access to mathematically oriented positions is more limited for students from historically marginalized groups (i.e., Blacks, Latina/os, Polynesians) than for Asian and White students.

In general, analyzing identity formation in mathematics learning contexts is critically important because identity and engagement are inextricably linked. The more students disidentify as capable doers of mathematics, the less likely they are to stay engaged in the learning process. Still, a limitation of the proposed framework is that in the absence of additional data, I cannot (and do not) make definitive claims about how racial-mathematical episodes actually influence student engagement. In a future study, though, this framework can be used to conduct fine-grained analyses of multiple episodes over time for a given student. When these microgenetic "snapshots" of identity formation are coupled with longitudinal data on a student's

participation patterns, it would then be possible to map a student's trajectory of identification indexed to his or her trajectory of engagement. That is, one could model the impact of various positionings on a student's access to particular subject positions, as well as how changes in access affect a student's opportunities to learn over time.

In the final chapter of this dissertation I use the notion of students' access to academically productive subject positions to reflect on the design of equitable learning environments. Specifically, I consider how mathematics classrooms can be reconfigured to mitigate the effects of racial-mathematical discourse.

Chapter 8: Discussion and Future Research

Much has been made of racial performance gaps in education. However, less attention has been paid to how race interacts with the learning process itself at the level of classroom interaction. This dissertation introduced the notion of *racial-mathematical discourse* in an effort to understand how race mediates the learning process in mathematics, a subject typically thought to be "neutral" and "culture-free." In this final chapter, I reflect on how the findings of this research contribute to our understanding of learning in general and mathematics learning in particular. Further, I consider some ways in which those findings might be leveraged in the design of more equitable learning environments. Last, I discuss limitations of the present study in the context of promising directions for future research.

Learning as Racialized Process

Race remains a significant facet of everyday life in the United States, and schools and classrooms are not immune to its impact (Ladson-Billings, 1998). In most educational research the link between race and learning is conceptualized in terms of racial disparities in students' material opportunities to learn (e.g., access to advanced coursework). This approach, which treats race as a demographic variable, has been useful in revealing systemic educational inequities that fall along racial lines (Darling-Hammond, 2010; Lubienski, 2002; Oakes, 2005). And yet, its potential for illuminating how race interacts with the finer-grained processes of learning is limited.

To that end, this dissertation conceptualized race as a discourse, a perspective grounded in poststructural theory that treats race as more than a set of static categories. Indeed, what we take "race" to mean is continuously constructed through institutional structures and social interaction (Goldberg, 1993; Omi & Winant, 1994). In that sense, I argued that a discursive lens on race is better suited to a study of the racial dynamics of learning environments. The pivot to racial discourse was also instrumental in bringing to the fore a critical set of phenomena: racial narratives.

Psychological research on "stereotype threat" has shown that under certain conditions, the explicit or implicit cuing of racial narratives can produce a statistically significant decline in test performance (Steele, 1997; Steele & Aronson, 1995) In that body of work, the effect of race on learning is understood in cognitive terms, as the fear of being seen as confirming a prevailing stereotype fosters anxiety that may, for example, obstruct access to working memory (Krendl, Richeson, Kelley, & Heatherton, 2008). This dissertation sought to build on this work in two ways: by moving beyond the experimental setting to explore the dynamic role of racial narratives in everyday learning situations, and by examining how race interacts with other aspects of the learning process besides testing.

Mathematics offered an especially fruitful context for studying these issues, since it is one of the only subjects for which a well-known racial narrative exists: "Asians are good at math." Superficially, this narrative would seem to be only relevant to Asian learners. However, a key finding from this dissertation is that students make sense of "Asians are good at math" in relation to narratives that position other racial and ethnic groups as mathematically less capable (e.g., "Blacks are bad at math"). This relationality is significant because it suggests that race in mathematics education does not pertain only to Asian students, but instead implicates learners of all racial backgrounds. Thus, rather than existing in isolation, the "Asians are good at math" narrative is actually a single node within a broader racial-mathematical discourse that is

structured in a hierarchical fashion. This finding validates Martin's (2009) notion of a presumed "racial hierarchy of mathematical ability" in the United States.

Documenting the existence of racial-mathematical discourse, as well as mapping its content and structure, was a primary goal of this dissertation and represents a step forward for research in mathematics education and the learning sciences. Prior research had shown that students are keenly aware of the "Asians are good at math" narrative (Nasir, Meltzoff, O'Connor, Cvencek, & Wischnia, 2012), but little was previously known about students' knowledge and perceptions of other racial-mathematical narratives, as well as how the narratives relate to each other. The present study sheds new light on that issue. Further, mapping the content and structure of racial-mathematical discourse provided a starting point for understanding how racial-mathematical discourse affects the learning process.

The data provided numerous moments where racial-mathematical narratives arose in the context of learning situations. Analysis revealed that the emergence of the narratives served several different purposes. In some cases, students reported the narratives being deployed in dialogue with their peers, often as a way of explaining why one classmate succeeds and another struggles in math. At other times, students appropriated racial-mathematical narratives as lenses for interpreting and explaining visual patterns of classroom activity (e.g., why classmates seem to ask the Asian student for help instead of other students). Overall, this research shows that rather than a collection of static mental objects, racial-mathematical discourse gets taken up in a dynamic fashion as it becomes embedded in the social fabric of the learning environment.

But how might all of this become consequential for student learning? In the present study, the proposed connection between racial-mathematical discourse and learning hinges on the notion of identity. That is, racial-mathematical discourse matters for learning because it regulates students' access to the resources needed to build productive domain identities. Racial-mathematical narratives constitute artifacts of the learning environment and play a fundamental role in this process. The invocation of racial-mathematical narratives to explain why a classmate received the highest grade on a math test, or to question if a peer belongs in an advanced math class, should be understood as acts of positioning. Narratives like "Polynesians are bad at math" are identity statements, and when students appropriate and deploy such narratives they make claims about their own mathematical potential and that of their peers, about who is and who is not capable of learning mathematics. In short, racial-mathematical narratives operate as "tools of the self" (Holland, Lachicotte Jr., Skinner, & Cain, 2001, p. 28).

Conceptualizing racial-mathematical narratives as artifacts of the learning environment is useful because it offers a way of thinking about mathematics classrooms as racialized spaces. It shows the value in situating learning within sociohistorical context (Cobb, Gresalfi, & Hodge, 2009; Martin, 2000; Wortham, 2006). Race does not emerge in classrooms because there is something fundamentally racial about classrooms. Indeed, there is nothing inherently racial in the practice of "asking classmates for help," and yet this was the practice most frequently cited by students as a racialized aspect of the mathematics classroom.

The reason students are able to read race into apparently race-free classroom practices is that the walls of a classroom cannot prevent the racial discourses that permeate society from penetrating the boundaries of the local learning environment. From this point of view, it is not difficult to imagine how other discourses (e.g., related to gender, class, religion) could also take up life in learning settings in similar ways. In this regard, poststructural theory—which to date has received little attention in the mathematics education literature (Stinson, 2008 and Walshaw,

2001 are exceptions)—proved useful in elucidating how societal discourses function to constitute individuals as subjects at the level of everyday social interaction.

As a final point regarding how this dissertation contributes to our understanding of learning, consider the overlap between racial-mathematical discourse and discourses of intelligence. On a theoretical level, Foucauldian discourse analysis revealed that intelligence is a fundamental concept that undergirds the discourse of race and the discourse of mathematics learning in the United States. I argued that this nexus might help to specify the surprising compatibility between race and mathematics, which on the surface seem strange bedfellows. This theoretical claim was borne out by the empirical data, where students made sense of race in the context of mathematical ability while alluding to racialized perceptions of intellectual capacity.

The centrality of intelligence to racial-mathematical discourse is a significant finding because it compels us to reimagine how we understand the enterprise of learning mathematics. On the one hand, mathematics represents a curricular obstacle on the way to higher education (Moses & Cobb, 2001; Schoenfeld, 2004). In that sense, learning mathematics can provide access to material goods, such as a well-paying job. On the other hand, mathematics in the United States has also come to represent a cultural symbol of intellectual capacity—succeeding in mathematics demonstrates to the world that a child is "smart."

For students whose intellectual potential has never been questioned, this point is of little consequence. However, for students belonging to racial groups that have been stigmatized as intellectually inferior, the act of learning mathematics can take on deeper meaning. For some students, graphing parabolas and factoring polynomials are about much more than content or getting into college. Indeed, learning mathematics is about reclaiming the cognitive status denied them as a result of their racial affiliation. And in an era where intelligence has become the primary marker of humanity (Mills, 1997), proving one's intellectual capacity allows one to lay claim to full personhood. Thus, not only does mathematics constitute a material gatekeeper, this dissertation suggests that for some, it also functions as an existential gatekeeper.

Designing Equitable Learning Environments

In sum, this research shows that racial-mathematical discourse intersects with learning in ways that prevent all children from accessing forms of subjectivity that position them as mathematically capable. The implications of this are not abstract; the lack of opportunity to build productive domain identities can have a material effect on students' engagement in the learning process (Nasir & Hand, 2008). If a learner does not perceive her/himself as being capable of succeeding in a subject like mathematics, he or she may not persist in problem solving or choose to ask questions in class. If certain students are never asked for help because a racial narrative frames them as mathematically deficient, they cannot, for instance, accrue the learning benefits associated with tutoring others. Thus, access to the resources central to identity construction is a matter of equity (R. Gutierrez, 2008; Horn, 2008; Nasir, 2011).

To be sure, students are not powerless in the face of these racialized discourses. There are many examples in the literature of individuals persevering in the face of racism to find success in mathematics (Martin, 2000; McGee & Martin, 2011; Stinson, 2008). But just because some students have managed to defy what society expects of them, we should be careful not to romanticize their agency, or underestimate the structural forces and everyday practices that continually reinvent and solidify the status quo. Ultimately, the burden falls on educators to reconfigure learning environments in ways that make it possible for students to exercise agency.

The purpose of this dissertation was not to devise or test interventions. However, the findings of this research do point to ways in which racial-mathematical hierarchies might be disrupted. In this section I contemplate direct and indirect strategies to tackling the problem.

Direct approaches to undermining racial hierarchies

Like the general public, many math teachers[32] in the United States do not see race or even culture as obviously relevant to an abstract, "neutral" subject like mathematics. Even teachers committed to equity issues might not appreciate the significance of racial-mathematical discourse. For if race is understood as a demographic variable, then "equity" might be narrowly defined in terms of structural issues alone, such as patterns in course enrollment.

I do not mean to disparage this approach. As a classroom teacher myself, this was how I framed racial equity: if the demographics of my advanced math classes matched those of my school writ large, I used to feel that equity had been achieved. But recall that at Eastwood High School, the research site for this dissertation work, there were no major racial disparities in course enrollment. The AP Calculus class, for example, was *not* disproportionately populated by Asian and White learners, as is the case in many racially diverse schools. In spite of this, racial-mathematical discourse—along with the inequities it fosters—was alive and well.

So the first step toward mitigating the effects of racial-mathematical discourse is making teachers aware that race can and often does take up life in their mathematics classroom and can become consequential for learning. But then what? Something teachers can do immediately is to treat explicit invocations of racial-mathematical narratives with same level of gravity as they would blatantly racist statements. Instead of letting the "Asians are good at math" narrative slide as an innocuous joke, teachers might consider opening a conversation with their students about the narrative's harmful implications students of other racial and ethnic backgrounds.

There are other ways in which teachers can address the issue directly and make counter-narratives more available to students. For example, interview data revealed that some students linked contemporary racial-mathematical narratives to perceived cultural histories of achievement in mathematics. That is, Arabs are deemed good at math because "algebra" is an Arabic word, which shows that math is "in their blood." Given that such historical factoids held salience for students, teachers may build into the curriculum examples of the mathematical achievements of historically marginalized cultures (e.g., how the Mayans invented zero). This tactic resonates with the ethnomathematics movement (Powell, 2002), which has sought to highlight African contributions to mathematics.[33]

Along similar lines, teachers might present examples of mathematically successful non-Asians of color in society. Schools in general can make a concerted effort to highlight students from historically marginalized groups excelling in mathematics. The achievements of these students can recognized through school assemblies and by posting their photographs in hallway displays. Admittedly, none of these solutions are radical or groundbreaking, but this does not mean that schools currently implement such race-conscious tactics in any sort of systematic way.

Further, one might question their impact in the face of something so potent and entrenched as racial-mathematical discourse. This is a valid concern. Interviews revealed that the

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[32] Although much of this dissertation has focused on students' knowledge of and experiences with racial-mathematical discourse, it would be interesting and useful in a follow-up study to better understand how teachers make sense of these issues.

[33] Of course, teachers must be cautious since an unintended consequence of this approach may be that it reifies prevailing beliefs about mathematical ability as fixed at birth.

discourse is incredibly durable. Even when students cited examples of mathematically successful Black, Latina/o, and Polynesian classmates, for instance, these classmates were seen as outliers. Their existence did not trouble the taken-for-granted narratives about who can succeed in math. This would suggest that trying to change the dominant racial-mathematical discourse by attending to the racial optics of a learning environment (i.e., "fighting fire with fire") would be ineffective.

Certainly, in one-off doses such an approach most likely would have little impact. However, imagine a school where these kinds of micro-practices were implemented on a regular basis over a long period of time. As Butler (1990) points out, it is only through *repeated* performance that discourses begin to change. Racial-mathematical discourse in its current form has considerable inertia. Indeed, my data show that students perceive multiple sources, both in and out of school, as fueling the discourse. Teachers and administrators cannot control how Asians are depicted in the media, or whether a comedian tells a joke about Black students not taking calculus. But through purposeful reflection and professional development, they can affect how mathematics learning and mathematics learners are represented with respect to race within the confines of their school.

Indirect approaches to undermining racial hierarchies

Some of the interventions documented in the literature that have successfully addressed racial inequities in mathematics education have done so without tackling race head-on. For example, consider Fullilove and Treisman's (1990) successful efforts to improve African American students' performance in college calculus. In part, the "Mathematics Workshop Program" that Treisman and his colleagues created was successful due to increased instructional time and effective support structures. Apart from these pedagogical factors, though, a critical element in their approach was to frame their intervention as an "honors program" rather than a "remediation program." From an identity standpoint, this framing allowed the participants to be seen (and to see themselves) as intellectually capable, as opposed to intellectually and academically deficient.

How the practices of learning are framed has been shown to matter in other contexts as well. Researchers of stereotype threat have found that simple interventions, such as telling students that a test measures "processes of problem solving" rather than "ability," can mitigate and even eliminate the pejorative affects of cuing a racial narrative. Similar to Treisman's work, this intervention focuses on managing people's perceptions of their own intellectual capacity. Thus, it may be possible to undermine racial-mathematical discourse indirectly by implementing classroom pedagogies that attend to issues of intellectual competence.

One intervention of this type that has been used in mathematics classrooms is called Complex Instruction (CI), which involves a set of pedagogical techniques and structures designed to equalize intellectual status in the classroom (Cohen & Lotan, 1995; Boaler & Staples, 2008). CI is grounded in the view that mathematical problem solving involves multiple competencies. Consequently, students are encouraged to collaborate on problems, and group work is structured so that the group's success depends on contributions from every student. Further, teachers actively look for opportunities to publicly position lower-status students as competent in front of their peers.

A major finding in this dissertation is that race colors how students perceive certain classroom practices, such as asking classmates for help and participating in whole class discussions. In most classrooms, these practices are opportunities for students to accrue status,

which can be problematic from a racial standpoint when students only perceive classmates from certain racial backgrounds as displaying competence. Although an intervention like CI does not explicitly address race, it may still have an impact on racial-mathematical discourse by reconfiguring classroom participation structures in ways that more fairly distribute opportunities to be identified as intelligent. If all students have the chance to demonstrate that they are "smart" and mathematically competent, then theoretically this might reduce the likelihood of cuing and perpetuating the dominant racial-mathematical discourse.

Of course, being explicitly praised as "intelligent" may not always be beneficial for learning (Mueller & Dweck, 1998). Further, the problem of intellectual hierarchies is not limited to how students engage in the practices of a learning environment. The notion of "innate intelligence" is also reified through language, such as when some students are labeled "gifted" or said to learn "faster" than other children. Discourses of intelligence are so closely braided with educational discourse in the United States that it is hard to see them as distinct. Teachers face the difficult challenge of monitoring their own intelligence-oriented language, as well as how such language is invoked in their classrooms. Perhaps the notion of "smartness" has become fraught to the point that it is beyond rehabilitation, in which case the best path may be to eschew it altogether (Leonardo & Broderick, 2011). Pedagogies that foster "growth mindsets," or the idea that "your basic qualities are things you can cultivate through your efforts" (Dweck, 2006, p. 7), may offer a way forward.

Ultimately, there are no panaceas; each intervention has its affordances and tradeoffs. Disrupting racial-mathematical discourse in learning settings will require a multi-pronged approach, which involves the simultaneous implementation of an array of pedagogical reforms that address race in both a direct and indirect manner. The ideas discussed here offer a starting point for the design of more equitable learning environments.

Limitations and Future Research

One limitation of this dissertation research involved the methodological challenge of capturing race in "real-time." As I have noted, extended participant observation yielded few clearly racialized episodes. However, student interviews yielded numerous racial-mathematical episodes, some of which occurred in the focal classrooms but went undetected. The mismatch between the observational data and interview data suggests that more sensitive data collection instruments may be necessary to identify implicitly racialized moments.

For example, video data would provide a continuous record of classroom activity, which could be analyzed to track patterns of participation that might reveal more subtle forms of racialization. It could be that early in a school year, when students are less likely to know their classmates, who is deemed to be "smart" or "mathematically gifted" is more heavily influenced by widely known racial narratives like "Asians are good at math." However, as students become better acquainted over the course of the school year, who gets asked for help may be less a function of racial ideologies and more a product of knowing each other's actual performance (i.e., which students have the highest grades in the class). Video analysis, coupled with survey data, might prove useful in exploring hypotheses of this sort.

A second limitation of this research was the lack of outcome measures. Although the dissertation makes a valuable contribution in dissecting racial-mathematical discourse, as well as demonstrating how it takes up life in classrooms, the question of how it might influence engagement is more speculative than empirical. Given that many of the racial-mathematical episodes identified in the data were short, isolated events, the odds of finding a causal link

between a particular episode and subsequent pattern of engagement are low. However, reconceptualizing racial-mathematical episodes more broadly as kinds of positioning events where status is negotiated may be more productive. Status hierarchies in classrooms can form over a variety of issues, including race, gender, class, and differences in prior knowledge, just to name a few (Esmonde, 2009a). By documenting the various status events experienced by a given student, and also measuring shifts in that student's engagement over time, it may be possible to show how identity moments accumulate to mediate a student's learning trajectory (see Langer-Osuna, 2011).

Another limitation of this work is that because it engages a relatively new area of educational research, the generalizability of the findings cannot be adequately assessed. How might racial-mathematical discourse manifest in other demographic contexts? Would it be more or less pronounced in a more racially homogeneous school? How might the absence of an Asian student population affect the ways in which race interacts with students' learning experiences in mathematics? Looking beyond the United States, what kinds of racial narratives hold salience in other national contexts? And even if the content of racial-mathematical discourse differs in other countries, to what extent does its fundamental structure remain constant?

Finally, I note that because this dissertation provides a means of understanding how racial-mathematical discourse interacts with the learning process, it opens the door to the study of how this discourse contributes to social construction of race in the United States. That is, when racial-mathematical discourse is invoked, not only does it constitute students as certain kinds of mathematics learners, but it also interpellates them as racialized subjects. Given the prominence of the "Asians are good at math" narrative, this study raises many questions about the racial positionality of Asians, in particular, but as the dissertation suggests, positioning is a general phenomenon.

The most basic question is this: how and why did Asians—as opposed to other racial groups—come to be tethered to mathematics? In the past, other groups have been linked with mathematical genius, but today a narrative about "Greeks being good at math" does not exist. As a kind of "racial project" (Omi & Winant, 1994), then, what ideological or political purposes does the "Asians are good at math" serve? What are the racial implications of associating Asians with mathematics, a subject that has typically been associated (albeit erroneously) with cold, logical efficiency, a lack of creativity, and anti-social behavior? In what ways does this relationally assign characteristics to other racial groups?

Earlier I theorized racial-mathematical narratives as cultural artifacts. It may seem now that "Asians are good at math" is an idea that has always existed, but like all artifacts it has a history. How and when did it emerge? What is its discursive relationship to the "model minority" discourses that emerged in the wake of the Civil Rights Movement post-1965? How does the perceived mathematical ability of Asians in Asia inform the racialization of Asians in the United States? Here I was able to briefly touch on some of these issues, but a comprehensive exploration of these provocative questions must be left for a future study of race itself.

To conclude, educational equity demands that all students have access to the resources they need to learn, including high quality curriculum, advanced courses, good teachers, and safe schools. But in addition to these material resources, students also need access to the resources that allow them to build identities conducive to learning. This dissertation proposed racial-mathematical discourse as one set of forces limiting access to those resources. But as history has shown, even the most hegemonic of discourses can be changed, and it is my hope that this work will inform the design of new types of learning environments that help spark that change.

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Appendix A: Interview Protocol

1. Why don't we start by you telling me a little bit about yourself (your family, where you grew up, etc.)?

2. How's it going in math class this year? Why is it going well/not so well?
   ➔ Has it always been like that for you? How was math in middle school and elementary school?

3. If you had to place yourself on a scale of someone who is super in math and someone who is not so good, where would you put yourself?
   ➔ Do you think your classmates see you that way? Why?

4. (Show student cartoon at right.) Okay, let's shift gears a bit. I'm going to show you this cartoon about math I found on the Internet. What do you think the cartoon is getting at? Do you agree?
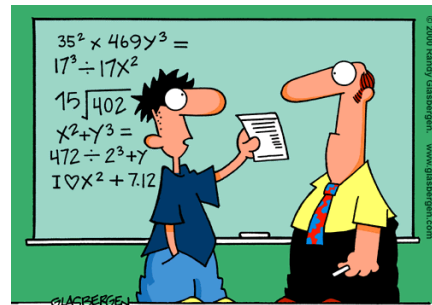
"I HAD MY DOCTOR DO A D.N.A. BLOOD ANALYSIS. AS I SUSPECTED, I'M MISSING THE MATH GENE."

5. I've heard some people say that doing well in math shows that you're smart. What do you think about that?
   ➔ Do you have to be smart to do well in math?
   ➔ How does math compare with the other subjects in school?

6. Have you heard people say that some groups are better than others at math? What have you heard people say? (If student does not interpret in racial terms, then: For example, some people say that Asians are good at math. Have you heard people say that?)

7. How do you think about "Asians are good at math": do you agree, disagree, or are you kind of the in the middle?
   ➔ Why do you think people say that *Asians are good at math*?
   ➔ When people say "Asians," which Asians are they talking about?
   ➔ Have you seen that (stereotype) affect friends of yours? Do you have any times you can remember that you can tell me about?

8. How do you identify in terms of race or ethnicity?
   ➔ So as a (Black, White, Dominican, Asian, etc.) person, how has "Asians are good at math" affected your experiences learning math?
   ➔ Do you think your experiences learning math would have been different if you were/were not Asian? How so?

9. Besides "Asians are good at math," are there things people say about other groups in math? What do they say?
   ➔ For example, have you heard people say that boys are better at math than girls?