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CULTURE, RACE, POWER, AND MATHEMATICS EDUCATION

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For their tireless efforts toward equity and justice, we dedicate this chapter to
Rosa Parks
&
Coretta Scott King

INTRODUCTION

Considerable attention in mathematics education research has been paid to understanding and confronting differential mathematics achievement. Such research is complex, as it is situated within and framed by broader educational, social, and political contexts. Embedded in these contexts are issues of race, class, gender, language, culture, and power. Mathematics education researchers not only have to grapple with issues of mathematics teaching and learning, but also come to understand the ways in which these broader educational and cultural contexts shape opportunities for all students to learn mathematics (Cobb & Nasir, 2002; Martin, 2000; Moschkovich, 2002a). Moreover, such research brings into question the role of mathematics education by situating it within these broader contexts (Apple, 1992; Martin, 2003).

Race is one of the most, if not the most, salient framing characteristics for differential achievement in the discourse that surrounds the "achievement gap" (Schoenfeld, 2002; Tate, 1997). Additionally we, the authors of this chapter, were aware of the significance of race in our everyday work with teachers and students and noted that its impact in mathematics education went beyond issues of differential achievement. Thus, in this chapter we specifically examine research aimed at understanding the various intersections between issues of race and mathematics teaching and learning. We follow the field in rejecting perspectives of race as biologically determined and adopted a perspective of race as constructed, contested, and reified through social activity. Additionally, our synthesis of the research around race and mathematics education provides a context, as Perry (Perry, Steele, & Hilliard, 2003) suggested, to "grapple with the notion that not all racial minorities occupy the same political position in this society" (p. 9). This acknowledgment brings relations of power into our analysis. More specifically, as discussed later in this chapter, the racialization of mathematics education is intertwined with issues of power and authority, making it difficult, if not impossible, to examine issues of race without also considering the impact of power dynamics on mathematics teaching and learning.

We also note that the field often treats culture as race and vice versa (see special issue of *Educational Researcher*, 2004). Some work treats cultural characteristics of people from a racial group as homogenous and immutable; in this model, a static view of race determines culture. Other work opts to deal with local cultural practices as a way of avoiding seemingly static racial categories, often missing broader patterns of behavior that socially construct racial experience. Both of these trends speak to the difficult intersection between race and culture. Thus, we expanded our work to include research examining issues of culture and mathematics teaching and learning. We focus on research in mathematics education that has conceptualized culture not as a static individual characteristic, but as constantly negotiated by individuals in their everyday activities. Conceptualizing culture in this way means that cultural knowledge is an integrated system of learned patterns of behavior, ideas, and products with a focus on people's everyday lived practices (K. Gutiérrez, 2002; Moll & Gonzalez, 2004; Rogoff, 2003). This chapter attempts to highlight and suggest areas for future research that explores the complexity in students' cultural activity, racial experience, and mathematics education.

Individual Mathematical Performance

Before turning to a discussion of future research directions, we begin with a brief examination of the concept of individual mathematical performance as it relates to differential achievement and solutions to inequitable educational situations. Researchers and the media often report achievement gaps in mathematics across broad groups of students. Explanations for these gaps in mathematics achievement both structure larger agendas for addressing equity in schools and affect individual teacher-student interactions. Many of the explanations, however, both in the media and in research, explicitly and implicitly frame the problem as one of individual student learning, asserting that some students "just don't try hard enough" or "fail because they are disadvantaged." Although these explanations often stem from research that examines the success or failure of individual students, they are also mistakenly generalized to the differential patterns of achievement for *groups* of students.

Research that focuses on the mathematical characteristics and performance of individual students frames equity as an issue of equal access to high-quality mathematics education that allows *all* students to succeed. This notion of equity as equality suggests that equity can be realized when students have equal access to resources, high-quality teachers, and appropriate instructional support regardless of race, class, gender, and so on. However, researchers concerned with issues of social justice and longstanding social inequities, or what Ladson-Billings (2006) referred to in her American Educational Research Association Presidential Address as the "Education Debt," argue that "equality" in educational opportunities does not necessarily address the histories of groups and how those histories have shaped the social structures and beliefs at the base of opportunities in and outside of school.

Rochelle Gutierrez (2002) described the goal of equity in mathematics education as "being unable to predict student patterns (e.g., achievement, participation, and the ability to critically analyze data or society) based solely on characteristics such as race, class, ethnicity, sex, beliefs and creeds, and proficiency in the dominant language" (p. 153). She proposed a two-fold approach to achieving this condition: first, providing students with high-quality mathematics education, or what she called *dominant* mathematics, and second, supporting students in using mathematics to perceive and confront inequitable situations in their lives, or *critical* mathematics. In this chapter, we take up Gutierrez's call to the field, to explore the processes involved in differential mathematics achievement and to consider mathematics education as a means of and for a socially just society.

In support of this task, this chapter reviews research within and beyond the field of mathematics education that conjoins accounts of individual-level processes with critical social and cultural processes involved in learning and teaching (Allexsaht-Snider & Hart, 2001; Boaler, 2002; Greeno, 2004; Martin, 2000; Moschkovich, 2002a). Further, instead of making comparisons of individuals on the basis of what has been considered "normative" or "adaptive" (Baratz & Baratz, 1970; Leacock, 1971; Nieto, 2004; Secada, 1992), the research reviewed is concerned with elaborating and deepening conceptions of learning to account for differences and regularities both within and across social and racial groups as well as social and cultural contexts. As Secada (1992) and others noted, over the last 20 years, group comparisons have typically been developed within research with a majority of White children, primarily by White researchers, whose perspectives were shaped by their sociocultural experiences in the dominant culture. A charge to the field of mathematics education, then, is to conduct research within non-dominant populations of students who experience marginalization, and to attend to the positioning of these groups vis-à-vis their White counterparts and to broader sociopolitical structures and forces. *White* as a racial category also needs explication as it entails certain privileges and status within current educational systems (Lee, 2004). For these reasons, we focus this chapter on research that conceptualizes larger constructs such as culture, power, and race as ways to understand issues in mathematics education.

Organization of the Chapter

To help make explicit current understandings, research, and theory around culture, race, power, and mathematics education, we first review the literature that uses culture as a way of conceptualizing achievement differences within and between groups. This review focuses on literature that portrays culture as fluid, socially negotiated, and "lived in the everyday." This review attempts to understand the influence of what we summarize as *theories of cultural activity* on perspectives of learning, development, and culture and the relations between them with respect to differences in opportunities to learn mathematics for non-dominant students. Then we turn to mathematics education research that suggests it is not enough to examine culture without attending to broader issues of power and race. This section reviews research that takes into consideration the constructs of power and race at the classroom level and in larger contexts. This literature stresses the need to consider these constructs in order to fully understand and reconceptualize differential achievement in mathematics education. Finally, we discuss issues around and implications of researching culture, race, and power in mathematics education.

CULTURAL ACCOUNTS OF MATHEMATICS TEACHING AND LEARNING

Culture has long been a focus of research on individual differences in cognition, learning, and development (Lave, Murtaugh, & de la Rocha, 1984; Nunes, Schliemann, & Carraher, 1993; Rogoff, 2003; Saxe, 1988a, 1988b). However, over the past 10 years studies in this area have gained prominence and offered alternative perspectives on the role of culture in learning, in terms of both what counts as learning and who has access to it. One reason for this heightened interest is that research drawn from various theories of cultural activity has afforded an understanding of knowing and learning as a function of what an individual accomplishes over time and across the various communities and practices in which he or she participates.[1] These theories encompass such theoretical approaches as situated cognition, activity theory, cultural historical activity theory, and sociocultural theory. Findings across these lines of research point to the fact that mathematics classrooms are necessarily cultural and social spaces that can perpetuate social inequities by privileging certain forms of discourse and ways of reasoning or reorganize them by positioning multiple forms of learning and knowing as "having clout" (Cobb & Hodge, 2002; Gutierrez, Baquedano-Lopez, & Tajeda, 1999; Gutstein, in press-a).

Understanding the cultural entailments of mathematics learning requires complicated analyses of how people live and learn culturally both within and outside of the mathematics classroom. This chapter reports on (1) the links that researchers have uncovered between the diverse ways that students from different backgrounds negotiate learning within and outside of mathematics classrooms, (2) the structures for mathematics learning within mathematics classrooms, and (3) the relations students develop with the domain of mathematics. All told, this work suggests that differences in mathematical achievement among groups do not rest solely upon students' cultural/mathematical backgrounds, but also in the sociopolitical organization of mathematics classrooms (and mathematics education in general). Moreover, although culture is commonly characterized as synonymous with group membership, this perspective is broadened by an emphasis in this work on how individuals create, contest, and reconfigure roles and relationships within the communities in which they participate.

Research that takes a cultural activity perspective aimed wholly or in part at persistent inequities in mathematics education has found traction in focusing on the mathematics learning of nondominant students both inside and outside of the mathematics classroom. We examine contributions of this research to the field of mathematics education to improving understanding of the processes through which students negotiate mathematics learning and doing across a variety of contexts. One major contribution of this research is the extensive accounts of the participation of students and teachers in various *communities* of mathematics classrooms, the curricular and participation structures within these communities that guide the class's joint work together, and the relation of these structures to the identities students develop as

[1] *Participation* in this case refers broadly to the way that individuals interact within a community of practice—whether they play a central role in perpetuating what goes on inside of it or actively contest or challenge from the margins.

learners and doers of mathematics (see, e.g., Cobb & Hodge, 2002; Martin, 2000; Nasir, 2002).

The recognition of the mathematics classroom as a functioning community where teacher and student activity in it is shaped by (and shapes) a set of norms and practices for learning mathematics highlights the importance of issues such as competence, ownership, and alignment in engaging in this community. In particular, alignment between the practices and identities of home and school has implications for whether students negotiate ways of participating that serve their individual goals, as well as the goals of the classroom community (Cobb & Hodge, 2002; Hand, 2003).

A second and growing contribution of this research is documentation of the wide variety of mathematical practices and identities that students bring to the classroom from their home and local communities, which has expanded conceptions of competent classroom participation (see, e.g., Carraher, Carraher, & Schliemann, 1985; Lipka, 1994; Moll, Amanti, Neff, & Gonzalez, 1992; Nasir, 2002; Taylor, 2004). Students' practices and ways of reasoning are often marginalized in mathematics classrooms where teachers rely on traditional scripts of, and formats for, classroom instruction. Broadening mathematical activity to recognize and value the multiple ways that students participate in mathematics can draw in students who may normally be sidelined. Finally, this research offers promising models of classroom learning environments that begin to address issues of race and power in the mathematics classroom by focusing squarely on issues of cultural relevancy and social justice (see, e.g., Gutstein, 1997, 2003, in press-b; Ladson-Billings, 1994; Moses & Cobb, 2001a).

We begin the next section by explicating the key constructs of participation and identity that undergird the research from a cultural activity perspective. Next, we examine how these constructs have been employed to recenter analyses of student achievement to consider differences in students' *opportunities to learn* mathematics both in classrooms and more broadly. Examining opportunities to learn in mathematics classrooms for diverse groups of students has prompted new ways to think about differential access to engagement in mathematics in relation to the social and cultural resources that students bring to the learning environment. As a framework, opportunity to learn orients the review of the literature by highlighting particular themes that run across research with a perspective of culture as activity. These themes include (a) creating equitable opportunities to learn in the classroom, (b) broadening classroom discourse practices, (c) expanding conceptions of mathematical competence, (d) bridging in-school and out-of-school mathematics knowledge, and (e) reforming the culture of mathematics.

Participation

Participation has become an important construct in situated and sociocultural analyses of students' school and classroom experiences (Boaler, 1999; Boaler & Greeno, 2000; Cobb & Hodge, 2002; Cobb, Stephan, McClain, & Gravemeijer, 2001; Engle & Conant, 2002; Gonzalez, Andrade, Civil, & Moll, 2001; Lave & Wenger, 1991; Martin, 2000, in press-b; Moschkovich, 2002a). As Sfard (1998) has observed, analytical frameworks that embrace the *participation metaphor* regard learning as a constant process of doing and becoming within a context populated by practices and activities in which individuals engage. An analytic focus on participation in studies of learning can highlight in what practices and activities students engage and how, as well as recenter analyses of student achievement and performance on the actual practices and activities in which students, teachers, and mathematics interact. Several researchers concerned with issues of equity in education broadly have achieved this recentering in different ways.

Cobb and Hodge (2002) focused on practice and participation in their analytical perspective on diversity and equity in mathematics education. They proposed a *relational perspective* that highlights "the relations between the specifically mathematical practices in which students participate in the classroom and the practices of the out-of-school communities of which students are members" (p. 251). They emphasized the continuities and discontinuities between students' ways of reasoning, talking, and interacting rooted in their out-of-school communities and those of their mathematics classroom. They argued that these relations, as they play out in classroom interactions, are the locus of the successes and inequities that arise in mathematics classrooms. In this formulation, what students are motivated to do in mathematics, how they engage in doing it, and, hence, what they are learning are understood through investigating patterns of students' participation in and across different contexts, in relation to the normative practices of the mathematics classroom. This analytical frame locates student achievement in the relationships between students' ways of participating in mathematics—which may be shaped by students' histories of engagement in their out-of-school communities—and the norms and valued practices of their mathematics classrooms.

Gutierrez and Rogoff (2003) used practice and participation to understand culturally related approaches to learning. They argued that although research on cultural learning styles was an important move away from deficit-model explanations, it led to an "overly static and categorical" approach to the relation between culture and individual participation and engagement in school-related practices (p. 19). They proposed that instead of attributing cultural differences to individual or group traits, researchers concerned with understanding how students' culture and communities influence their school achievement should also focus on "variations in individuals' and groups' histories of engagement in cultural practices" (p. 19). By distinguishing between membership in a particular group and participation in practices of cultural communities, researchers can attend both to regularities in the practices and organization of cultural communities as well as to how students differently engage in and make meaning of those practices.

A number of researchers have explored the implications of situations in which students' everyday practices are misaligned with classroom practices for students' social and academic positioning in the classroom (Diamondstone, 2002; Hand, 2003; Nasir, 2004). For example, Hand (2003) found that the *a priori* distinctions between social and intellectual activity that often get organized in mathematics classrooms can provoke tension between the ways of being, talking, and reasoning that students from diverse backgrounds bring to the mathematics classroom and the normative aspects of the mathematics classroom. She argued that "open" participation structures, or those that afford negotiation around the framing and positioning of participation, are more likely to encourage broad-based participation among a range of students, versus "closed" or rigid participation structures, which tend to foster student resistance. This perspective attends not only to the relation of students' participation practices in and out of the classroom, but also to the relation of this alignment to students' deep engagement in or opposition to classroom mathematical activity. Both Cobb and Hodge (2002) and Hand (2003) pointed to the relation of students' participation and engagement in school and mathematics to ongoing negotiation and development of who they are and who they want to become—in other words, students' developing and constantly negotiated identities.

Identity

The notion of identity is of central concern in studies of participation as it is intimately linked to social practice and is concerned with both what is made available to individuals in the various social and cultural communities they inhabit and how they enact their participation across them. Although the field of mathematics education (and education research more broadly) has yet to agree upon a working definition of *identity* (Sfard & Prusak, 2005), the theories of cultural activity that frame this review generally follow Wenger (1998) in proposing that, "identity serves as the pivot between the social and the individual" (p. 145). The working definition that the field eventually arrives at will need to attend to multiple aspects of identity formation and negotiation. For example, the concept of identity must account for the perceptions that individuals hold about themselves and for those held by others about them, and the relation of these multiple perceptions to an individual's social positioning in interaction. This definition will also need to acknowledge multiple identities (or dimensions of identity), such as being an African American and being a mathematics learner (Martin, in press-b), that individuals manage within and across contexts. What a perspective of identity of this kind theorizes is an *identity in practice* that is constantly being formed and reformed in dialectic between social structures and individual lived experiences. In this way, identity captures both the histories of engagement of various sociocultural communities and institutions and the practices they develop over time, as well as the trajectories of individuals as they negotiate and adapt these practices in and across local communities.

A number of researchers have examined identity negotiation and development within and beyond the mathematics classroom, particularly for nondominant students (Boaler & Greeno, 2000; Cobb & Hodge, 2002; Gresalfi, 2004; Martin, 2000, 2006, in press-a, in press-b; Nasir, 2002; Nasir & Hand, 2006; Sfard & Prusak, 2005). Martin's (in press-b) research, for example, focuses on the challenge many African Americans face in negotiating positive identities as mathematics learners both inside and outside of school. He argues that "any analysis of identity construction and students' becoming doers of mathematics must simultaneously consider African American identities as well" (p. 6). This is because mathematics education is shaped by a master narrative within society that positions African Americans as less capable in mathematics than their White peers. In response to and in contestation of the master narrative, Martin focuses on the success of some African American mathematics learners in overcoming structural and cultural impediments to mathematical achievement in order to forge new identities as Black mathematics learners. Martin's significant contributions to our understanding of racialized mathematical identity are explored further in the section on race and power.

Nasir has also examined the relation between identity and learning among African American youth but has explored this connection across multiple activity settings, including dominoes, basketball (Nasir, 2002), and the mathematics classroom (Nasir & Hand, 2006). Nasir studies the organization of social and intellectual resources for students' identity development and learning in relation to students' goals and strategies for participation in various social practices. Drawing on Wenger's *community of practice* model of learning, she has observed a relationship among students' goals, identities, and learning. Identity formation shapes and is shaped by learning. Similar relationships are found between goals and learning and between goals and identity. For example, in the case of elementary and secondary school students gaining competence in the game of dominoes, shifts in goals and identities accompanied age-related shifts in practice. More specifically, older, more experienced, and skilled players employed more complex strategies and had increasingly complex mathematical goals. Nasir also explored the notion of a *practice-linked identity* to capture the sense of connection that high school basketball players developed to the practice of basketball, in contrast to mathematics. In this study, players incorporated more of themselves into the practice of basketball as they drew heavily on a range of available resources for participation to accomplish their play. Nasir's research in this area has shown how identities involve aspects of both community (e.g., relationships) and learning (e.g., mastery), which both affect and reflect identity.

The literature on participation and identity illustrates the complexity underlying individual activity in any given social context, including a mathematics classroom. It also emphasizes the importance of examining the processes by which individual stakeholders in mathematics education (e.g., students, teachers, parents, policymakers, mathematicians) help to *construct* what "counts" as mathematics learning and what it means to be a mathematics learner, both within the local context of the mathematics classroom and in the broader system of mathematics education.

Assessing Opportunities to Learn

The consideration of participation and identity in research on mathematics learning communities shifts the focus from assessing what an individual student knows to discerning what she or he has an opportunity to learn within classroom mathematical practices (Greeno & Gresalfi, 2006). The construct of *opportunities to learn* (or OTL) initially referred to whether certain content appeared in curriculum materials or was included in the implemented curriculum. Recently the construct has been revived by a number of researchers to challenge a common assumption that learning is dictated by the curriculum, instead of being constructed within a classroom system of teachers, students, mathematical tasks, and material and ideological resources (Greeno, 2003; Lampert, 2001). This perspective highlights the enactment of mathematical content within a classroom culture, which affords particular opportunities for engaging with mathematical practices and ideas.

For example, it has been argued that mathematics instruction that prioritizes finding solutions or performing rapid computation over making sense of mathematical ideas and the connections between them can serve to constrain students' opportunities to engage deeply in mathematics (Boaler, 1998; Bransford, Brown, & Cocking, 1999; Carpenter, Franke, & Levi, 2003; Hiebert et al., 1997; Jacobs, 2002; Kilpatrick, Swafford, & Findell, 2001). Although this finding does not necessarily speak directly to the gap in achievement scores, researchers like Boaler (1997, in press) have linked meaningful participation in inquiry-based mathematics classrooms to greater affiliation with, persistence, and achievement in mathematics for women and students of color. There is general consensus in the field of mathematics education that mathematical practices that are guided by principles of mathematics reform, if implemented with fidelity to the curricular goals and intentions, can support powerful engagement in rich mathematics for *all* students (Kilpatrick et al., 2001; National Council of Teachers of Mathematics, 2000; Schoenfeld, 2002).

Opportunities to learn are related to identity in recognizing the diverse ways that opportunities can be *taken up* by students as a function of their cultural and mathematical histories. Student participation in the mathematics classroom is related to affiliation with and membership in local and broader communities (Nasir, 2002) as well as negotiation in moment-to-moment interaction about positioning oneself and being positioned by others (Wortham, 2006) with respect to these communities and the local classroom practices. Thus, differences in students' perceptions of and participation practices with opportunities to learn ultimately shape the nature of their mathematical experiences (Gresalfi, 2004).

To date, the research on opportunities to learn mathematics has focused primarily on comparing the experiences of dominant and nondominant students in classrooms, with less attention to the broader social and political structures shaping these learning environments. Issues of equity, however, run across multiple levels and social contexts and thus suggest that analyses of opportunities to learn be expanded beyond current research efforts.

Creating Equitable Opportunities to Learn

Researchers in mathematics education have investigated the relations between opportunities to learn mathematics for dominant (i.e., Whites and Asian Americans) versus nondominant students (i.e., African Americans, Latino/as, and women) in a variety of ways. The work of Jo Boaler and her colleagues, in particular, has figured prominently in this effort by identifying curricular strategies and classroom mathematical practices that serve to level the playing field in classrooms of students from diverse backgrounds.

Boaler's (1997, 1998, 2002, 2003, 2006) longitudinal studies of traditional versus reform mathematics curricula in the United Kingdom and the United States have focused on the nature of classroom mathematical practices under these different approaches, focusing specifically on what these curricula afford for the mathematical understandings that students develop and the views students construct of mathematics and themselves as mathematics learners. In her early work, Boaler (1997) found that reform mathematics classrooms were more likely to engage students in practices that focused on mathematical problem solving, developing a variety of solution paths, and providing justification for their mathematics work, and that those practices inherently offered opportunities for more students to participate in them. The students in the reform classrooms developed a conceptual understanding rather than just procedural knowledge, enabling them to apply this knowledge to a variety of tasks. Boaler (2002) has taken these findings further, demonstrating how reform mathematics can promote equity. Boaler and Greeno (2000) found that students taking Calculus developed significantly different perspectives on the role of learning mathematics depending on the nature of the classroom's mathematical activity (e.g., discussion-based format versus lecture-based format). Although these findings do not necessarily address issues of equity directly, Boaler and Greeno contended that students who developed a more "connected" relation to the learning of mathematics—meaning that they view mathematics as a meaningful aspect of their lives and important to who they see themselves becoming—were more apt to pursue mathematics over the long run. Thus, the nature of a classroom's mathematical activity could provide opportunities for more students to see themselves as mathematics learners.

Boaler (2003) has continued to pursue these issues in her work and has recently reported a variety of findings in which issues of equity are fore grounded. She highlights the work of the Railside mathematics department, which was highly successful at producing strong mathematics learners in a diverse urban high school.[2] Boaler argued that the success of this department was largely dependent on the ability of the teachers to foster what she calls *relational equity* among all students in their classrooms. She described relational equity as focusing on how "students learn to treat each other and the respect they learn for people from different circumstances to their own" (Boaler, in press, p. 5). This perspective of equity links students' mathematical engagement directly with the deep sense of commitment and respect students develop for one another within the classroom mathematics community. To promote relational equity among students, the teachers at this school drew on strategies of complex instruction (Cohen & Lotan, 1997), which minimizes status differences among students and promotes group accountability (Boaler & Staples, in press). They also utilized an internally developed reform mathematics curriculum, which offered a rich set of group-worthy mathematics tasks for students to grapple with together. Boaler's work over the years has helped paint a nuanced picture of mathematics classrooms that focuses on meaningful and respectful mathematical engagement, where all students' mathematical ideas are respected and their mathematical identities are cultivated.

In-depth case studies of mathematics learning within classrooms and across schools, like the ones presented by Jo Boaler and her colleagues, offer critical perspectives on how teachers, departments, and school administrations create conditions for relational equity among their students. Rich and comprehensive analysis of the practices of teachers and departments that play a role in fostering these relations can be described as design principles for learning environments. Although these principles can help guide the development of better opportunities for students in mathematics within their local schools, they do not necessarily address the systematic and structural aspects of inequity in mathematics education. Additional research needs to be conducted on the application of these principles across a range of schools and classrooms, and the broader social and structural barriers that shape, support, and constrain their proper implementation.

[2] At the time of Boaler's (2002) study, Railside student demographics were approximately 38% Latino/a, 23% African American, 20% White, 16% Asian or Pacific Islanders, and 3% other groups.

Broadening Classroom Discourse Practices

One aspect of classrooms that support relational equity is that they utilize a discussion-based format, where students work in groups and as a whole class to engage deeply with mathematical concepts and procedures. Some researchers concerned with English language learners (ELL) and students from nondominant backgrounds suggest that organizing mathematics classrooms around inquiry-based discussion may sometimes serve to perpetuate inequities among students if language and status differences are not taken into account. For example, in her work as a teacher-researcher, Lubienski (2000, 2002) found that her high and low socioeconomic-status (SES) students experienced mathematical discussions differently. While the higher SES students claimed to feel confident in contributing to and sorting out the ideas presented, the lower SES students found discussions frustrating and wanted the teacher to show them how to do problems. Using examples from her classroom, Lubienski (2002) argued that one cannot assume that particular practices, such as open-ended discussions, will necessarily work for all students. Although she does not suggest an alternative practice, a possible interpretation of her finding is that lower SES students will be more successful if taught by traditional methods. This conclusion is inconsistent with Boaler's findings. A more nuanced interpretation of Lubienski's findings is that the practices she studied did not take into account the everyday discursive practices or ways of reasoning of the low SES students. For example, others have found that when students' diverse ways of communicating are taken up as part of classroom practices, all students involved benefit (Brice-Heath, 1982; Staples & Hand, 2004; Warren, Rosebery, & Conant, 1994).

Research that closely examines the role of language in mathematics classrooms has yielded significant insights into the linguistic resources that are often missed in classrooms with students from diverse cultural backgrounds. Moschkovich (1999, 2002a), in studying the participation of ELL students, has examined how classroom practices create opportunities for students to demonstrate their competence in mathematics. She has argued that teachers and researchers should not focus on what students lack (in this case mathematics vocabulary) but instead focus on how students participate in everyday and mathematical discourses as well as on how they draw on multiple resources to communicate mathematically. Specifically, by analyzing students' participation, Moschkovich (1999) found that students brought different ways of talking about mathematical objects (e.g., narrative, predictive, and argumentative) and points of view of mathematics situations to the discussions (e.g., standard definition of parallelogram versus dynamic view of trapezoid as half of a parallelogram). None of these ways of talking is privileged over the other; instead, each way of talking "can contribute in its own way to the mathematical discussion and bring resources to the conversation" (p. 12). Also, by examining the point of view that the students brought to the problem, Moschkovich illustrated how instead of concluding that the students were wrong or lacked vocabulary, they were simply bringing a different point of view than the teacher expected. Moschkovich concluded that taking a discourse approach to mathematical learning means considering the different ways of talking and different points of view students bring to discussions. This kind of approach shifts the focus of math instruction for ELL students away from vocabulary development toward mathematical content. In concluding her analysis of middle school math discussions, Moschkovich (2002a) provided further implications for mathematics instruction for bilingual and ELL students:

- Instruction should support engagement in conversations that go beyond vocabulary translation, and involve students in communicating about concepts.
- Teachers should support ALL students in participating in discussions. They can move toward this goal by providing opportunities for bilingual students to participate in discussions and by learning to recognize the resources that these students use.
- Instruction should also support students' use of resources from the everyday register, as well as resources such as gestures, objects, and students' first languages.
- Assessment must consider more than vocabulary, expanding to include how students use the situation, the everyday register, and their first languages as resources.
- Determining if a student's error is a conceptual misunderstanding or a language problem is not as important as listening to students and uncovering their competence, which requires a complex perspective. (Moschkovich, 2002a, p. 207)

Issues of language and discursive practices have implications for a large group of students. Mathematical and scientific language, with its particular precision, must be learned by all students. This is often accomplished as students are apprenticed into the community of mathematics and science during their elementary and secondary schooling. The discourse of the mathematical community seems to align with the discourse patterns of the dominant society (R. Gutiérrez, 2002), privileging students from that socioeconomic and language group. In advocating for a mathematics community that is more inclusive, attention may need to be focused in two directions: (a) to apprenticing students from nondominant groups into the mathematics community so that they develop the necessary discourse proficiency at the same time that the resources they bring to the classroom to explore concepts are validated and valued; and (b) to opening the domains of science and mathematics to reflect more of the diversity of the United States and the world. This may be a task that requires more attention from teachers who come from discourse communities that are different from those of the students. The work of Moschkovich (2002a), Lubienski (2002), and others has begun to define the issues and suggests questions that need to be addressed.

Expanding Conceptions of Mathematical Competence

Examining opportunities to learn in mathematics classrooms for diverse groups of students also prompts new ways to think about student achievement in mathematics. The recentering of analyses of student learning on student experience and practice allows for the identification of various student competencies not easily captured by traditional forms of assessment or, for that matter, those that were not previously valued as mathematical competence (Cohen & Lotan, 1997). Departing from traditional notions of *competence*, competence from a cultural perspective is recognized as being coconstructed by teachers and students in relation to classroom opportunities to learn and to what students are held accountable. This analytic shift from *achievement* to *competence* distinguishes a culturally biased deficit approach to assessment from a more culturally inclusive notion of mathematical understanding. Focusing on what students *are* doing opens conceptions of mathematical competence to the possibility of accommodating the diversity in students' ways of knowing and paths to learning.

One approach to expanding what it means to be mathematically competent is to investigate students' mathematical activities outside of school, challenging existing beliefs that pathologize or construct as deficient the cultural practices of nondominant populations. Since Gay and Cole's (1967) landmark ethnography on mathematics learning in a Liberian Kpelle society that focused on community-based out-of-school activities, sociocultural studies of mathematics learning have proliferated (see, e.g., Lave, 1988; Saxe, 1991; Scribner, 1984). Important conclusions of researchers comparing the everyday use of mathematics (e.g., selling candy or fruit, purchasing items at a local store) with performance in school mathematics contexts not only found students to be competent in mathematics in out-of-school contexts, but also suggest the importance of analyzing and drawing on children's informal strategies into the community of practice of the mathematics classroom (Carraher et al.,1985; Lave et al., 1984; Saxe, 1988a, 1988b; Taylor, 2004).

In the first of many studies of young Brazilian street vendors, Carraher et al. (1985) analyzed the everyday use of mathematics by children selling fruit on the streets of Recife, Brazil. The results of the study indicated that students competent in out-of-school settings could not reach equally accurate solutions to the same problem when posed as an in-school task, suggesting that the context in which problem solving is happening cannot be separated from the problem and the act of problem solving itself. Similarly, Lave et al. (1984), in a study comparing the problem solving done by grocery shoppers at the supermarket to their performance on paper-and-pencil tests, concluded that the supports present in the supermarkets could not be divorced from the problem solving process of making purchases. In other words, the environment of the supermarket provided supports for calculations that did not exist when the task was one given in a school-like format. The importance of the setting to the problem-solving process is indicated by this study as "people and settings together create problems and solution shapes, and moreover, they do so simultaneously" (p. 94). In both of these studies not only were people found to be competent in mathematics in out-of-school contexts, but this research also suggests that the environment in which problem solving takes place contributes to mathematical accuracy.

In studying how school mathematics learning is related to out-of-school mathematical practices, Saxe (1988a) found no statistically significant difference between schooled and nonschooled children for problems of currency arithmetic and ratio comparison in out-of-school contexts. On the other hand, in looking at differences in performance on school arithmetic problems, he observed that the children who were sellers did solve more problems drawing on the informal strategies developed in the marketplace than did the nonsellers. Saxe argued for drawing on informal strategies such as these in classroom practice.

In a study of how school mathematics learning might be supported by out-of-school mathematical practices, Taylor (2004) explored the purchasing done by children before and after school at local convenience stores in a northern California city. He documented conventions, artifacts, and other supports that assisted children in making purchases in these real-life situations. Taylor found that accessing the mathematics necessary to complete purchases required children to draw on knowledgeable others, such as older children and store employees. Taylor also found currency to be a powerful context to draw on in school. In working with young children on noncontextualized addition and modeling problems in a school context, Taylor has shown that the use of currency as a base-ten model provided more support in arriving at correct solutions to problems than did base-ten blocks. This study illustrated how students' everyday practices may support the learning of fundamental mathematics concepts in mathematics classrooms. It is important to point out that although these studies illustrate the mathematical fluency with which children engage everyday tasks, they do not suggest that these youth are incapable of success in school mathematics. Rather, studies of students' out-of-school mathematical activities expose a misalignment between the opportunities to learn in school mathematics and students' mathematical practices developed outside of the classroom.

The work of both Saxe (1988a) and Taylor (2004) suggests that expanding notions of mathematical competence to include the valuation of students' informal strategies developed in out-of-school contexts can support students' mathematical knowledge development within school contexts. Uncovering students' mathematical competency both in and out of school broadens the field's understanding of student mathematics achievement and begins to change conceptions of mathematical competence. However, broadening conceptions of mathematical competence by looking outside of the classroom provokes the question of how these insights can be applied generatively to classroom mathematics curriculum and instruction. Research examining the features of out-of-school mathematics activities in comparison to school practices may help bridge students' participation in mathematical activity, and mathematical activity that supports this engagement.

Bridging In-School and Out-of-School Mathematics Knowledge

One project that attempts to forge links between in-school and out-of-school knowledge is the Yup'ik project. The Yup'iks are a group of indigenous people of Alaska whose language and culture has been marginalized within the educational system by its emphasis on English-only language and middle-class, White American cultural practices (Lipka, 1994, 2002; Lipka, Wildfeuer, Wahlberg, George, & Ezran, 2001). The Yup'ik Project is a collaboration among university researchers, teachers (both indigenous and White) and Yup'ik elders to explore and describe the traditional number system used by the Yup'ik as well as the mathematics inherent in Yup'ik cultural practices. The project has begun to publish a culturally based curriculum (*Math in a Cultural Context*, Detselig Enterprises, Calgary, Canada) and has documented that the achievement of students whose teachers use the curriculum after receiving professional development surpasses that of comparable groups of students (Civil, 2001; Lipka, 1998, 2005; Webster, Wiles, Civil, & Clark, 2005).

Moll and his colleagues have conducted seminal work on bridging the in-school and out-of-school knowledge of students from households in working-class Mexican communities (Gonzalez, Moll, & Amanti, 2005; Moll et al. 1992; Moll & Greenberg, 1990). These researchers developed a conceptual framework known as *funds-of-knowledge* to begin to account for the nature and structure of knowledge and skills organized in and across these households. Funds-of-knowledge are "historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being" (Moll et al., 1992, p. 133). The funds-of-knowledge work explicitly rejects the notion that the problem of underachievement either is located within the students or is attributable to their cultures and communities. Instead the locus of responsibility for underachievement shifts to the school and acknowledges the complexities of students' lives in and out of school, seeking to support the students' scholastic achievement by drawing on the wealth of their home and community experiences. Moll (1992) argued "that these families and their funds-of-knowledge represent a *potential* major social and intellectual resource for the schools" (p. 22).

Whereas the initial funds-of-knowledge work of Moll and his colleagues focused on language and literacy, the BRIDGE project extends the work to mathematics (Civil, 1995a, 1995b). An explicit goal of the project was "the development of mathematics teaching that builds on these students' backgrounds and experiences" (Civil, 1995a, p. 2), and it incorporated the same three basic components of the original project: (a) ethnographic household visits, (b) teacher-researcher study groups, and (c) classroom implementation and curriculum development (Civil, 1994). Views of the families as "somehow disorganized socially and deficient intellectually" were exploded during the data gathering and study-group analysis in the BRIDGE project (Moll et al., 1992, p. 134). When faced with caring and interested parents on the other side of the home interview table, teachers had to confront their notions of the homes these children came from as dysfunctional and begin to examine the potential that existed there (Moll et al., 1992). Civil (1998) suggested that this type of direct connection made between parent and teacher could have an impact on the teacher's thinking and could ultimately influence his or her teaching. The incorporation of mathematical funds-of-knowledge into school mathematics presented particular challenges, however, within this project. A question that evolved from the study of household funds-of-knowledge was the extent to which it was possible for schools to build on everyday mathematical situations (Civil, 1995b). Researchers found, for example, that frequently the mathematics in everyday activities was hidden, such that people engaging in the activity did not acknowledge what they were doing as mathematics and at times even directly rejected it being characterized as math (Gonzalez et al., 2001).

Although the BRIDGE project does seem to have positively affected teacher and student attitudes about school, and although learning clearly was happening in the BRIDGE classrooms, it is not as clear what mathematics the children were learning. As early as 1995, Civil was raising issues regarding the depth of mathematics the children were learning, stating, "unless we have a clearer picture of the mathematical opportunities in a module and on how to push for these, the modules risk to present only surface applications of mathematics, often not challenging enough for the students" (1995a, p. 15). Civil's (2001) recent work documents the explicit connections that students made between a gardening project that she designed with an intermediate grades mathematics teacher and area measurement. The activity was designed to foreground the mathematics by "looking for opportunities in which mathematics will occur naturally" (p. 404).

Moschkovich (2002b) summarized much of the work done in the area of integrating everyday mathematical practices into school mathematics in the interest of making "the mathematical practices of different groups accessible to more students" (p. 8). Her own recommendations for implementing such practices, however, carry a caveat about the overuse of everyday mathematics at the expense of academic mathematics. She is particularly concerned about the emphasis on practical mathematics being implemented or interpreted as part of a tracking policy or as a disguise for vocational education. "It is not merely using everyday mathematics that is important but making connections between the familiar practices of everyday activities and academic mathematical practices" (Moschkovich, 2002b, p. 9). In the end, Moschkovich is asking for a balance between everyday and academic mathematics that will not only motivate students to engage in the study of mathematics but will also provide them with the discursive practices they will need to pursue more advanced studies such as documenting and constructing narratives about their solution processes and reflecting on the "efficiency or generality of different approaches to a problem" (Moschkovich, 2002b, p. 9).

Reforming the "Culture of Mathematics"

Balancing the need for individuals to draw on practices, identities, and realities of their everyday, lived experience with the goal to master formal, domain-related practices and identities within the context of schooling has been a reoccurring theme in the field of education (Dewey, 1902, 1938). R. Gutiérrez (2002) framed this longstanding tension in a particular way with respect to equity in mathematics. Progress on equity cannot be made, she argued, as long as deficit perspectives continue to permeate research and practice, and the field of mathematics perpetuates a culture that excludes individuals with different perspectives (such as minorities and women). To create conditions for equitable mathematics education, she proposed that the field coordinate two different approaches to mathematics instruction. One is mathematics that "reflects the status quo in society, that gets valued in high-stakes and credentialing, that privileges a static formalism in mathematics, and is involved in making sense of a world that favors views and perspectives of a relatively elite group" (p. 151), or what Gutierrez called *dominant mathematics* (in which she included "reform" mathematics). She contrasted this with "mathematics that squarely acknowledges students are members of a society rife with issues of power and domination" (p. 151), or *critical mathematics*, that empowers students to challenge the structures, perspectives, and processes through which they are marginalized. The combination of *dominant* and *critical* mathematics, she argued, "serve as an entrance for students to critically analyze the world with mathematics, and being able to critically analyze the world with mathematics may be an entrance to engage dominant mathematics" (p. 152).

The contention that mathematics education is embedded in a broader "culture of mathematics" that is privileged and privileges a certain few is echoed by researchers who take a critical stance on mathematics education (Delpit, 1988; Ladson-Billings, 1997; Tate, 1994). This critical perspective is serving to push mathematics education research to take seriously issues of power, race/racism, and "White privilege" in mathematics education. In the section that follows, we highlight some of the contributions that the theories of cultural activity have made to the conceptualization and consideration of differences in opportunities to learn between dominant and nondominant students in mathematics education.

Summary

Researchers who study mathematics education with a perspective of learning as cultural activity have made significant strides in disentangling the issues involved in differential achievement—reconceptualized as differences in opportunities to learn. Due to the space constraints of this chapter, we have reviewed the research of only a select group of researchers who are recognized within the field as pioneering this work. This review is by no means exhaustive, and the research has suffered in general from complicated methodological and political challenges. However, the research reviewed here offers important insights into the processes by which a *participation gap* (Hand, 2003) between students from diverse social, cultural, and racial backgrounds can arise within mathematics classrooms and how classrooms can be structured to better afford opportunities to participate in mathematics by a wider range of students.

From a theoretical perspective, research based on a perspective of culture as constituted by and through activity provides new constructs for examining the interplay of culture and the individual. By focusing on participation and identity as key aspects of individual and joint social practice, this perspective acknowledges the role of both individual agency (as individuals choose, adapt, and reject practices) and sociocultural processes (as broader social, political, and racial practices and identities are remade in local classrooms) in shaping the learning experience. Thus, while acknowledging that students bring perspectives, values, and routines to the mathematics classroom from their home and local communities, this perspective emphasizes the processes of negotiation, reconciliation, and rejection that students manage with respect to their activities across multiple communities.

The complex nature of examining these processes within and beyond the mathematics classroom has been aided by the development of complementary methodological tools and techniques. Tools such as video interaction analysis and qualitative data analysis software and techniques such as documenting trajectories of participation and repertoires of practice help researchers capture, analyze, and identify features of learning communities and various aspects of participation within them. These features and aspects can then be linked back to broader cultural practices, discourses, tools and artifacts, and identities, which implicate issues of power and access in the classroom. Locating practices, scripts, and norms found in the local context of the mathematics classrooms within global social and cultural hierarchies can reveal the danger of "neutral" mathematics instruction in perpetuating inequitable processes that marginalize nondominant students.

Attending to the variety of ways individuals engage in mathematical tasks and other activities in different contexts, this perspective has also expanded the notion of what it means to do mathematics and to be a learner and doer of mathematics. On the one hand, definitions of mathematical thinking and reasoning have been widened to include the processes by which people solve mathematical problems informally with the material and social resources around them. Thus, part of calculating the statistics of a pro basketball player involves being part of a community of players and spectators who find this activity meaningful. On the other hand, learning mathematics in school and identifying oneself as a mathematics learner is bound up in social and cultural discourses that position particular mathematical practices as being "competent" or "rigorous" and certain individuals as being "smart" and "capable." Thus, what this research has revealed is how mathematics learning itself is organized within a cultural practice that can serve to either enfranchise or marginalize different groups of individuals.

Finally, one common thread across the research presented in these sections is the rejection of deficit and cultural-deficit thinking. Culture is acknowledged as a critical element in trying to understand the academic disparities between economically advantaged populations and impoverished ones. But instead of viewing the cultures of these families and communities as pathological and the source of academic school failure, culture is viewed as an area of students' lives that can contribute to academic success if appropriately understood. At the same time, however, this research has tended to shy away from making explicit links between opportunities to learn found in mathematics classrooms, cultural practices both in and out of the mathematics classroom, and persistent racial inequities (Cobb & Nasir, 2002; Martin, in press-b).

A potential tension in research aimed at identifying and valuing the cultural practices and identities of nondominant groups of students is the possibility of reifying what are basically essentialist accounts of racial and ethnic communities. This way of thinking, or essentializing of traits of groups of students, has potentially negative consequences for students subject to its application.

The obvious problem with essentializing is that, by treating cultural behaviors, values, and practices as fixed and immutable, it slips perilously close to committing at least two types of error that were observed with cultural deficit thinking. First, in associating and universalizing cultural practices and patterns to all members of a group, the space for the member to be treated as an individual shrinks. Essentializing contributes to a form of *cognitive reductionism* where cognitive complexity is simplified and diminished (Gutierrez & Rogoff, 2003). A person, as an individual, is rendered secondary in the process of teaching and learning. Second, as in the case of cultural deficit thinking, with essentializing there is a tendency to reify culture, that is, to see it as isolated, immune from impact of other cultures and the dominant social and economic forces. If the role of culture is going to be given a central place in educational research and practice, researchers must learn how to think and talk about cultural patterns and practices and student learning without slipping into essentializing and cultural-deficit thinking (Gutierrez & Rogoff, 2003). In order for culture to remain a viable explanatory construct for understanding and improving the persistent underachievement of certain student populations, much care and attention must be exercised in developing theories and pedagogies that do not essentialize cultural traits.

Much of the research reviewed in this section has focused on the conditions of individual classrooms or schools, out-of-school practices, or communities, with only limited attention to how historically based processes and structures that involve race and power have shaped these local contexts and practices over time. Thus, perhaps one of the most important challenges to arise out of research based on a cultural activity perspective is the need to better understand the relation between race and culture. On the one hand, research that isolates the individual from the cultural processes in which she develops has merged the two constructs, treating race and culture as if they were one and the same. In this way, the characteristics of all people from a racial group are treated as being homogenous. In this model race determines culture. On the other hand, the research just reviewed has tended to completely divorce the two and focus only on culture in its most apolitical sense. In this model, culture is all that matters. However, there are a growing number of researchers who have critiqued a focus on culture that excludes consideration of race and power.

CONSIDERATIONS OF RACE AND POWER AT THE CLASSROOM LEVEL

Thus, we turn to mathematics education research that has considered explicitly issues of culture *and* issues of race and power as they intersect with mathematics teaching and learning. Specifically, this section highlights research that provides models of classroom learning environments that focus squarely on issues of cultural relevancy while also taking into consideration issues of race and power (see, e.g., Frankenstein, 1990, 1995, 1997; Gutstein, 2003, 2006; Ladson-Billings, 1994, 1995, 1997; Moses & Cobb, 2001a, 2001b), thus making race and power central constructs in confronting differential achievement in mathematics education.

The Algebra Project

The Algebra Project, for example, is a mathematics literacy effort with a grassroots implementation process (Moses & Cobb, 2001a, 2001b; Moses, Kamii, Swap, & Howard, 1989; Silva, Moses, Rivers, & Johnson, 1990). The program is designed to make Algebra available to all seventh- and eighth-grade students despite their previous levels of academic achievement. The curriculum is created to develop algebraic thinking using projects that engage students with concrete experiences supported by a culture of mutual inquiry. These experiences are drawn from or build on practices of the communities in which students live. Addition and subtraction of negative numbers, for example, is taught within the context of trips. But the subway context that is used for inner-city kids in Boston is exchanged for a bus trip for students living in rural areas of Mississippi. The curriculum explicitly acknowledges that the mathematics must connect with the lived experiences of students.

The work of Moses and colleagues also makes central issues of race and power, equating the need for mathematical literacy in today's society with the need for Black registered voters in Mississippi in 1961. Moses and Cobb (2001a) have argued that differential access to algebra, which disproportionately excludes African Americans, Latinos, and poor White students from college preparatory mathematics classes, is serving as a form of structural discrimination resembling the use of literacy tests in the '60s. Moreover, algebra is the forum where students learn the symbolism necessary for developing technological knowledge demanded in today's high-tech job market. Thus, mathematical literacy is not just needed for access to college preparatory mathematics classes but is also necessary to meaningfully participate, with economic viability, in today's society. Mathematical literacy, then, is the key to citizenship; it becomes a civil-rights issue, and a necessary component in promoting economic and civic equality.

More recent work of the Algebra Project, the Young People's Project, encourages students to take up this right (Kirkland, 2002). Their work organizes young people to work to change their education and the way they relate to it, that is, encouraging students to "demand to understand" in an effort to challenge and transform their marginalization. Specifically, the Young People's Project is dedicated to the creation of mathematically literate communities through the recruitment and training of core high school and college Math Literacy Workers. These Math Literacy Workers come from the communities the Algebra Project seeks to serve, and they focus on developing their knowledge capacity so that they are able to organize and manage math literacy work independently. This work might consist of mentoring middle and elementary school students, providing ongoing after-school workshops for younger students, providing community events for families and community members, and facilitating team organizing for mathematics competitions. In the process, the Math Literacy Workers collectively contribute to the development of ever-expanding networks of mathematically literate young people. For this to occur, though, young people themselves must demand the right to receive a quality education, and the Young People's Project is working to create that demand.

The work of the Algebra Project, and the extended work of the Young People's Project, focuses squarely on issues of cultural relevancy by building a curriculum that explicitly connects with students' lived experiences. Additionally, this work considers the effects of power structures on mathematics teaching and learning by acknowledging the gate-keeping role of mathematics. Their work explicitly confronts this gate-keeping role of mathematics education by helping *all* students, particularly those traditionally denied opportunities, pass through the gates. It has the potential to confront differential mathematics achievement and provide quality mathematics instruction to all students. More research is needed that looks at the effects of the Algebra Project and the Young People's Project on student achievement in mathematics.

Culturally Relevant Pedagogy

Other compelling models of classroom learning environments consider both the multiple constructs of culture, race, and power, and how students can use their knowledge (of mathematics and other subjects) to challenge current oppressive and inequitable structures (see, e.g., Frankenstein, 1995, 1997; Gutstein, 2003, 2006; Ladson-Billings, 1994, 1995, 2001; Tate, 1994, 1995). Ladson-Billing's (1994, 1995, 1997, 2001) work, although not specific to mathematics education, provides a theory of culturally relevant pedagogy that speaks to issues in mathematics education, and as such is important to consider here. From her study of eight successful teachers of African American students, Ladson-Billings developed a theory of culturally relevant pedagogy. Specifically, she argued for the importance of a three-pronged approach to culturally relevant teaching that proposes to (a) produce students who can achieve academically where achievement is not limited to standardized assessment, (b) produce students who demonstrate cultural competence, and (c) develop students who can both understand and critique the existing social order. Two of these three components will be expanded upon here: cultural competence and understanding and critiquing the existing social order (or developing a sociopolitical consciousness).

As a pioneer of culturally relevant teaching, Ladson-Billings argued that teachers should develop in students a cultural competence. That is, students should be provided with "a way to maintain their cultural integrity while succeeding academically" (Ladson-Billings, 1995, p. 476). In classrooms that promotes cultural competence, teachers must first be aware of their own culture and its rôle in their lives (Ladson-Billings, 2002). They can then work to effectively respond to students from different cultures and classes while valuing and preserving the dignity of cultural differences and similarities between individuals, families, and communities. A classroom that promotes cultural competence acknowledges that everyone has a cultural history that shapes their identity. Moreover, in such a classroom, the academic and cultural assets students bring to the classroom are seen as enriching the community, and the students and teacher together continuously strive to learn about one another and the assets each person brings. Additionally, Ladson-Billings (2001) argued that in classrooms that promote cultural competence in students, the teacher "uses culture as a basis for learning" (p. 98). That is, teachers aim to capitalize on students' prior knowledge, and they view students' culture as a means through which they can acquire new knowledge.

In addition to promoting students' cultural competence, teachers enacting a culturally relevant pedagogy provide students with the tools they need to understand the social structures around them, see how those social structures (such as institutional racism) may affect their lives, and teach students how to challenge those structures. In classrooms where teachers employ culturally relevant pedagogy, teachers and students together create knowledge "in conjunction with the ability (and the need) to be critical of content" (Ladson-Billings, 1994, p. 93). To be critical of content means culturally relevant teachers attempt to make knowledge problematic, challenging students to view knowledge as a means for transforming the world in which they live. For example, in a more contextualized examination of two classroom teachers in her study, Ladson-Billings (1994) noted that both teachers held exceptionally high expectations (demonstrated through both words and actions) of their students while simultaneously helping students understand that societal expectations for them are generally low. In this way, students recognized the teacher's act of holding high expectations and their own efforts to meet those expectations as acts to challenge and defy prevailing societal beliefs.

Although Ladson-Billings is not referring specifically to the teaching of mathematics, mathematics education researchers argue similarly, noting that mathematics teaching entails a shift from thinking of preparing students to live within the world, as it currently exists, to thinking about how to prepare students to restructure "those social systems . . . in order to remove barriers that women, minorities, and others experience" (Secada, 1989, p. 47). Mathematics educators need to work toward using mathematical knowledge to empower students to work for social justice and to confront issues of unequal power relationships that exist in the world in which we live (Martin, 2003). Thus, mathematics education faces a twofold imperative: It needs to provide students with mathematics instruction that includes the mathematics deemed necessary for success in the current system (a similar component to Ladson-Billings *academic achievement*) while simultaneously providing students an opportunity to use mathematics to expose and confront obstacles to their success (Apple, 1992; R. Gutierrez, 2002; Gutstein, 2003, 2006; Martin, 2003; Secada, 1989; Tate, 1994, 1995).

Teaching Mathematics for Social Justice

Teaching mathematics for social justice addresses both of these components. Math teachers employing social-justice pedagogies address the first imperative by recognizing the necessity of mathematical knowledge and including mathematics-specific goals for their students (see, e.g., Frankenstein, 1990, 1997; Gutstein, 2003, in press-a). They address the second imperative by engaging students in using mathematics to analyze their world critically in an effort to ultimately promote a democratic society in which all have an opportunity to participate fully (see, e.g., Frankenstein, 1995; Gutstein, 2003; Skovsmose, 1994).

Frankenstein (1990, 1995, 1997), for example, described her attempts to teach mathematics for social justice with working class adults in basic college mathematics courses. In these courses, Frankenstein employed a critical mathematics pedagogy focused explicitly on using statistical tools to analyze social issues critically (e.g., income data, wealth distribution, home mortgage distribution, the tax system). Her critical mathematics pedagogy involved promoting "the ability to ask basic statistical questions in order to deepen one's appreciation of particular issues [and] it also involved the ability to present data to change people's perceptions of those issues" (Frankenstein, 1990, p. 336). The goal of this critical analysis was to prompt students to question their assumptions about how society is structured and to enable them to act from a more informed position on social structures and processes.

Gutstein (2003, 2006, in press-a, in press-b) also described his enactment of a social- justice pedagogy in a Chicago public middle school with a predominately low-SES Mexican and Mexican American population. His work further demonstrates how such a pedagogy addresses issues of culture, race, and power and works to promote students' use of mathematics to transform oppressive structures. Gutstein (in press-b) conceptualized the pedagogy of teaching mathematics for social justice as developing four main components: "a) academic 'success' (i.e., both mathematical power and what is needed to pass gate keeping tests); b) sociopolitical consciousness; c) a sense of social agency; and d) positive social and cultural identities" (p. 8).

To achieve his goals of teaching for social justice, Gutstein created 17 real-world mathematics projects that connected to students' lives (e.g., examining wealth distribution; analyzing SAT and ACT exam scores by race, class, and gender; questioning whether racism is a factor in mortgage loan opportunities). To achieve the mathematics-related objectives in the classroom, Gutstein used *Mathematics in Context*, a curriculum developed by the National Center for Research in Mathematical Sciences Education and the Freudenthal Institute (1997-1998). More specifically, Gutstein employed a *pedagogy of questioning* in his classroom. He created a classroom environment where students posed their own meaningful questions, engaged in understanding their own realities in sociopolitical context, discussed interrelationships and complexities among questions, engaged and analyzed multiple perspectives, and interacted with questions that connect to actions and social movements. Mathematics played a central role in this pedagogy of questioning. Students used mathematics to develop sociopolitical understanding of their life conditions and broader society. For example, students used mathematics to uncover what the money for one B-2 bomber would mean in terms of college education for thousands of Latino/Latinas. In this project, students

> used mathematics to investigate and calculate the various costs for different ways to use public money; they considered ramifications, shared their views with others, and wrote about them; put their mathematical analyses into sociopolitical, historical context; and built community, a shared sense of purpose, and a dramatically different orientation toward mathematics and its use in understanding reality. (Gutstein, in press-b, p. 24)

The results of Frankenstein's and Gutstein's work are promising. Frankenstein (1997) found that the use of critical mathematics pedagogy changed her students' perceptions of mathematics and their ability to understand mathematics, both important factors in helping students reach the mathematics-specific goals of the course. At the same time, she engaged her students in using mathematics to analyze their world. For Gutstein's students, many developed mathematical power, and the cocreation of a classroom environment where students discussed significant issues of justice and equity, and where students actively and consistently raised their own questions, seemed to foster agency among students.

Although teaching mathematics for social justice holds potential for addressing differential achievement in mathematics because of its simultaneous consideration of issues of culture, race, and power and their intersection with mathematics teaching and learning, more research is needed that examines the effects of the implementation of such pedagogy on students' mathematical learning. It is important, however, to note that when determining whether this pedagogy is effective in terms of students' learning of mathematics, researchers must also consider the purpose of mathematics education. In the cases described here, the purpose of mathematics education is not functional literacy, or "at best, to generate a few more individual successes" (Gutstein, 2006, p. 211); rather, the goal is to conceive of mathematics knowledge as the ability to use mathematics to critique and transform oppressive structures—math literacy is "knowledge for liberation from oppression" (Gutstein, 2006, p. 211).

Frakenstein's and Gutstein's work describes the practices of teacher researchers who are committed to teaching for social justice. The next question is how to build on that work to study what it means for the "average" teacher to learn to teach mathematics for social justice. Gau (2005), in a study of eight secondary mathematics teachers engaged in learning to teach for social justice through the creation, implementation, observation, and revision of a mathematics lesson that incorporated social-justice goals, found that teachers struggled to find a balance between the mathematics and the social justice. For one group, this meant that the mathematics took priority over the social justice, and in four separate lesson implementations they never addressed the social justice goals of their lesson. For the other group of teachers, this meant that mathematics need not be tied in all the time. Instead, they focused on developing the social-justice goal of their lesson, to the detriment of the mathematics. In fact, in this latter case, teachers seemed to be so focused on having students come to a particular conclusion, that they inappropriately interpreted data, suggesting to students that the data supported conclusions that were, in fact, not founded by the data.

Additionally, although teachers in both groups conceptualized teaching mathematics for social justice similarly to that expressed in the literature, they did not ever express that it include the goal of students' learning mathematics. Rather, they conceptualized it as students' using known mathematics to analyze and confront inequities, suggesting that the social-justice component is always an "add on" to the curriculum. More work is needed in this area to see what teachers struggle with as they learn to teach mathematics for social justice, and the implications this has for the potential of such a pedagogy to affect both students' learning of mathematics and students' ability to use mathematics to critique and transform oppressive structures.

Researchers who work in the area of mathematics teaching for social justice (see, e.g., Esmonde, 2006; Gau, 2005; Gutstein, 2003, 2006) also note that such teaching is not just a collection of supplemental projects that could be "dropped into" any context. Rather, this pedagogy permeates all aspects of the classroom. It is a pedagogy that is "forged *with*, not *for*" students and is continually negotiated as students' understandings of their own sociopolitical contexts grow and as the questions they wish to explore evolve (Freire, 1970/1993, p. 30). Additional research on the implications of teaching mathematics for social justice on achievement is still needed, but this work, along with the work of Moses and colleagues in the Algebra Project and Ladson-Billing's theory of culturally relevant pedagogy serves to highlight work that places culture, race, and power at its center.

RACE AND POWER

In the previous section, we examined research that places culture, race,[3] and power[4] at the center in understanding issues of mathematics teaching and learning. Here that examination continues. However, whereas the previous section examined these constructs within the context of the classroom, this section will be situated within a broader, structural context. More closely, this section highlights larger policies and mandates that shape and structure mathematics education. The focus is on two questions. First, how do issues of race and power manifest themselves within the structures that provide mathematics education to students? Second, how might an analysis of race and power within this broader context help in understanding differential achievement in mathematics?

It is important to mention that two issues focus the discussion in this section. First, presently little research centers itself within mathematics education and provides a structural analysis of race and power. Where this literature does exist, we have sought to cite it and its contribution to the field. However, because of the limited amount of such research, in some instances we cite researchers outside of mathematics education that examine race and power. A second reason flows directly from the first. Because there is limited research within the field, this section raises issues and questions with respect to race and power in relation to mathematics education. Many of the issues raised here draw on the experiences and work of the authors in schools and districts that serve poor and minoritized communities. Such communities provide a rich context within which to explore the impact of racialized experiences and power dynamics on differential achievement in mathematics.

Structuring Opportunities to Learn Mathematics

Orfield, Frankenberg, and Lee (2003) stated that the level of segregation of schools is worse now than in 1968. Students of color and Whites are increasingly not in the same schools. Moreover, only 15% of the intensely segregated White schools have populations in which more than half are poor enough to receive free and reduced lunches. For Black and Latino students the percentage is 86%. Schools in communities predominantly consisting of Blacks and Latinos are poorer, and they generally have fewer AP courses, fewer credentialed teachers (Darling-Hammond & Sykes, 2003), more out-of-field teachers (Ingersoll, 1999; Rogers, Jellison-Holmes, & Silver, 2005), and buildings in worse conditions (Oakes & Saunders, 2002). Kozol (2005) and others (Frankenberg, Lee & Orfield, 2003; Hunter & Donahoo, 2003) have ascribed this situation to a new form of apartheid in the U.S. school system, where low-income public schools have become hypersegregated with populations of up to 99% students of color.

Along with the material conditions in "apartheid" schools, Kozol (2005) notes that in urban schools there are another set of conditions around how we talk about students and the ways they are expected to participate. Kozol points out that he has heard hypnotic slogans like "I'm smart! I know that I'm smart," repeated everyday, "but rarely in suburban schools where potential is assumed" (p. 36). These non-material conditions shape the opportunities of students of color—often blaming them for their own failure. At the same time that these students are blamed for their failure, the system of mathematics education continually fails them. As such, even if the material conditions were equitable, the non-material normative aspects of schools would still construct failure for students of color (Oakes & Lipton, 1999).

The literature on access and opportunity to learn mathematics documents how experiences differ along racial lines. Overall, segregated minority schools offer less access to upper-level math and science courses, many not offering courses beyond Algebra II. Oakes, Muir, and Joseph (2000) wrote that,

> A student can only take a high level class in science and mathematics if his or her school offers such classes or if his or her school opens up access to these courses to all students. In other words, how far a student can go down either the mathematics or science pipeline depends on his or her access to particular courses. (p. 12)

On the basis of a student's race, he or she can expect to experience mathematics education differently (Hunter & Donahoo, 2003). Students of color often experience a lesser form of education, in mathematics and otherwise. In contrast, adequate mathematics course offerings (Lee, Burkham, Chow-Hoy, Smerdon, & Geverdt, 1998), qualified mathematics instructors (Rogers et al., 2005), quality mathematics curricula, and mathematics teachers who respect their culture

[3] By *race*, we mean the very real ways in which a student's skin color (and the social significance that society attaches to that skin color) frames that student's educational opportunities and experiences.
[4] In terms of *power*, we refer to the set of relationships and hierarchies that frame interactions.

and hold high expectations of them is the minimum expectation for White children. Whereas a Latina student can expect to attend a school with a large number of courses below Algebra, a White student can expect, as a matter of course, that the classes necessary for her to prepare herself for college will be present at her school. In this sense, statistically speaking, whiteness has a higher property or currency value. With whiteness comes advantage, more valued cultural practices as well as property, educational buildings in better neighborhoods that draw higher taxes, and therefore more funding.

As described in earlier sections, White culture often determines what is "normal" and also constructs the dialogue or ideology for understanding the "other." This dialogue is constructed and reinforced in mathematics education, for example, when achievement scores are reported in terms of race, and lower test scores are ascribed to race (ignoring the fact that "White" is also a racial category). Educators fail to ask how the racial and cultural entailments of whiteness provide opportunities for large groups of White students to be consistently ahead of their Black and Latino/a counterparts. Instead, the success or failure of a White student often gets framed as an individual act, acclaiming or pathologizing the individual rather than the race.

Ideologies are embedded within language and ways of talking that perpetuate stereotypes of the "other." These broad Discourses, as Gee (1990) and colleagues call them, structure the ways of talking about children of color, communities of color, and structure our individual actions (Gee, 1990; Gee, Hull, & Lankshear, 1996). Gee (1990) calls this dialogue Discourse with a big *D* because it contains ideologies, beliefs, practices, and ways of being that further the power of the dominant culture. There is more going on in individual success or failure, or individual interaction, than what is actually seen in front of us. Individual interaction sits inside of a historical reality; it sits within history, within a context, and within a relation of power. The stories embedded in these Discourses limit the ways of talking and thinking about people of color and can limit how one thinks about their intelligence and abilities, quality of family life, and cultural resources (Kana"iaupuni, 2005; Ryan, 1971; Warren, 2005).

Counterstorytelling is a method that "aims to cast doubt on the validity of accepted premises or myths, especially ones held by the majority" (Delgado & Stefanic, 2001, p. 144). Counterstories or counternarratives challenge the privileged discourse, or way of talking and relating, giving voice to people of color and critiquing racialized stereotypes. These counternarratives construct alternative Discourses to the mainstream, counteracting the essentializing that exists within the dominant narrative. The stories that researchers like Kozol (2005) and Martin (2003, 2006, in press-a, in press-b) bring to the education community serve as counternarratives to the myth that schooling and mathematics education are neutral and color blind. In the following sections, race and power are central in creating counternarratives about the neutrality and color blindness of policies both inside and outside mathematics education.

The increasing segregation, decreasing access, and pervading Discourses place race and educational structures as central in educational opportunity. We see these areas as important for the field to explore in relation to mathematics education in particular. Though much of this work has been done outside mathematics education, we think the work on counternarratives provides an area for future research to challenge prevalent Discourses and to open access to those not in power.

Mathematics for All

In the 1980s, several national reports were released that called attention to serious problems in mathematics and science education; one of them was *A Nation at Risk* (National Commission on Excellence in Education, 1983). Among the findings reported in *A Nation at Risk* were that from 1963 to 1983 average mathematics SAT scores dropped nearly 40 points, only one third of 17 year-olds could solve a mathematics problem requiring several steps, and between 1975 and 1980 remedial mathematics courses in public 4-year colleges increased by 72%. The business and industry sector also provided impetus for improving mathematics education by demanding an improvement in workplace proficiency. Criticism had been directed at public education because employees failed to demonstrate, beyond the use of computational algorithms, proficiency levels in reasoning and problem solving (Vandegrift & Dickey, 1993).

In response, national organizations produced documents that advocated changes in mathematics curricula. The National Council of Teachers of Mathematics (NCTM) produced the *Curriculum and Evaluation Standards* (NCTM, 1989), and the Mathematics Sciences Education Board (MSEB) published *Everybody Counts* (MSEB, 1989) and *Reshaping School Mathematics* (MSEB, 1990). These documents described the goals for mathematics education as problem solving, mathematical power, access to technology, and constructivist learning (Huetinck, Munshin, & Murray-Ward, 1995). These documents were part of a national movement reconstructing how educators think about the teaching and learning of mathematics.

The NCTM *Standards* (1989) took a particular stand on equity as well:

- In developing the standards, we considered the content appropriate for *all* students.
- The mathematical content outlined in the standards is what we believe *all* students will need if they are to be productive citizens of the twenty-first century. (italics added)
- We believe that *all* students should have an opportunity to learn the important ideas of mathematics expressed in these standards. (italics added) (p. 9)

The statement made by these excerpts is that all students should have the opportunity to learn high-level mathematics and all students need to learn mathematics. There is an implicit counter-Discourse within this movement; namely that African-American, Latino, and poor children can and should learn mathematics. This national movement intended to bring about greater levels of mathematics achievement for all students. It was born out of a desire to increase the level of mathematics literacy of Americans and to help prepare more students for mathematics-dependent fields such as engineering and computer technology.

The 2000 NCTM *Principles and Standards* pushed notions of equity in mathematics education further by having one of six principles focus specifically on equity. The equity principle states,

> *All* students, regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to study—and support to learn—mathematics. . . . Equity does not mean that every student should receive identical instruction. . . . All students need access each year to a coherent, challenging mathematics curriculum taught by competent and well-supported mathematics teachers. . . . Well-documented examples demonstrate that all children, including those who have been traditionally underserved, can learn mathematics when they have access to high-quality instructional programs that support their learning. (italics added, pp. 11–13)

The 2000 *Principles and Standards* show a marked increase in attention to equity in comparison to a decade earlier. Again, the idea embedded in the *Standards* is that everyone can learn mathematics, though this is spelled out in more specificity in the 2000 *Standards.* Both sets of standards, though there is a shift in attention, frame the goal of mathematics education as a problem "for all."

The mathematics education community has taken several steps in moving schools towards the goal of greater equity in the mathematics education of students. Such efforts include comprehensive reviews of the mathematics achievement progress of traditionally underserved students such as English language learners, girls, and African Americans (Lee, 2002; Reyes & Stanic, 1988; Schoenfeld, 2002; Secada, 1992; Tate, 1997) and research studies that have revealed gross inequities in the course-availability, course-placement, and learning opportunities of these underserved students (Oakes, 1990; Oakes, Quartz, Ryan, & Lipton, 2000; Paul, 2003). The field of mathematics education is deeply indebted to the work of these scholars-many of whom are outside of the field of mathematics education research. However, we want to argue for increased efforts—within the mathematics education community—that attend to issues around the structures of schools in general and to issues of race, racism and the racialized experiences of students of color that are enforced through these structures. We argue that the lack of attention to these issues may account for the lack of progress towards equity. We posit that one cannot overcome the inequity experienced by students of color and in schools that serve these students without addressing how and why those inequities came to be and are held in place. Race and the Discourses around race continue to bring inequities into being and hold them into place. Furthermore, power—the set of relationships and hierarchies that frame interactions—is often ignored in the efforts at reform in mathematics education. As with race, power both brings into being and holds into place the inequities that we presently see in schools. By focusing our attention on equity, we deal only with effects while ignoring the causes of the inequity that we see. The issue is not only that underserved children have access to far fewer rigorous mathematics courses, but that they attend schools where such disparities are not questioned or critiqued. The realities of race (the real ways in which students' skin color and the social significance assigned to that skin color) and power (implicit and explicit ways that larger structures, institutions, and normative ways of talking and thinking shape the access, opportunity, and experiences of individuals and groups) hold such inequities in place—making them accepted, acceptable, and normal.

Dismantling the inequities that these scholars bring to the fore such as underfunding certain schools (Kozol, 2005; Oakes, Rogers, Silver, Horng, & Goode, 2004; Rothstein, 2000), a shortage of certified mathematics teachers (Darling-Hammond & Sykes, 2003; Ingersoll, 1999), tracking (Oakes, 1985), cultural conflicts, and standardization (Rogers et al., 2005), we believe, is a matter of wrestling with and confronting Discourses, practices and the ideologies (such as racism) which hold these structures in place. We use this next section to raise issues and questions as to how the mathematics education community deals with equity, race, and systematic power relationships.

Moving from Rhetoric to Reality

A number of researchers have offered critiques of the NCTM standards and the "Mathematics for All" movement, asking whether the call to provide quality mathematics instruction *for all* is simply rhetoric (Apple, 1992/1999; Martin, 2003). Martin (2003) cited several events that have shaped and tested the mathematics education community's commitment to equity including specific calls for greater equity (Reyes & Stanic, 1988) and seminal documents such as the NCTM *Standards*. After nearly 2 decades of equity-minded reform, he argued there have been very few appreciable outcomes for African American, Latino, and Native American students (see, e.g., Lee, 2002; Schoenfeld, 2002; Tate, 1997). The color-blind discourse prevalent in NCTM's seminal documents (1989, 2000) may be a contributing factor in the mathematics education community's inability to make more headway towards equity.

The 1989 standards use equality rather than equity as a frame. Such a framing does not recognize that students have different needs and that the same instruction will not necessarily produce equitable results. The 2000 standards show a shift from equality to equity. The document notes specifically that there is no one-size-fits-all program for students. ("Equity does not mean that every student should receive identical instruction. . . . All students need access each year to a coherent, challenging mathematics curriculum taught by competent and well-supported mathematics teachers," p. 11.) However, this document still makes no mention of race or power and the ways in which these factors make access to mathematics education inequitable (Apple, 1992/1999). Instead this latter document frames inequity as an issue of personal characteristics, background, and instruction only ("All students, regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to study—and support to learn—mathematics. . . . all children, including those who have been traditionally underserved, can learn mathematics when they have access to high-quality instructional programs that support their learning," pp. 11–13). Such a framing makes this document, and its consumers, vulnerable to ideologies of deficiency (Cuban & Tyack, 1988; Hull, Rose, Fraser, & Castellano, 1991). Furthermore, this lack of attention to race, gender, and SES allows historical, social, and economic reasons for underachievement to be cast as individual deficiencies (Cuban & Tyack, 1988; Hull et al., 1991).

Martin (2003) has argued that the color-blind discourse (i.e., "for all") found in these policies and documents glosses over the complexities of race and power so present in schools and school systems. For instance, Martin asked who are the students currently not receiving quality mathematics instruction (i.e., who are the *all* spoken of in these documents)? Why are *all* of these students currently not receiving quality mathematics instruction? For whom do we traditionally not consider this content appropriate? What backgrounds keep students from access to high-quality mathematics? These questions bring texture and complexity to the current efforts at equity and force educators to confront the great effort that will be required to achieve it.

Grappling with the realities posed in the previous questions focuses attention on the racialization of mathematics education. More closely, these questions bring light to how the opportunities of students within mathematics are distributed differentially based upon their race (and the social significance assigned to their race). These opportunities are not only technical (e.g., course offerings), but normative such as the conceptualizations of, the talk about, and beliefs around non-White students, their families, and their communities. It is often these norms (that embed themselves in schooling structures, opportunities, and differential resources) that make the attainment of equity so problematic. Although the call for "Mathematics for All" is noble, if it does not address these normative ways of talking and thinking, it will not change the realities of education for students of color.

Next, we present two examples from our work in schools to raise structural and policy issues for mathematics educators to address and document in future research. We situate both cases within the contexts that they arise and use them to encourage different kinds of questions for mathematics educators to research.

Algebra for All[5]

In California, the call for "Mathematics for All" has played out specifically in policies that require all of its eighth-grade students to take a 1st-year Algebra course. The California mandate, "Algebra for All,"

[5] Details about this study can be found in Spencer (2006).

serves as an instantiation of the larger "Mathematics for All" movement, and we use this mandate to draw out questions that the mathematics education community needs to address in more depth to better understand issues of equity, race, and power in schools. The structures of schools are reified.

In recent years, Algebra has been declared a necessity for all students (Moses & Cobb, 2001a; Paul, 2003). Part of the outcry for greater access to Algebra is based upon the gate-keeping power of this course to college preparatory mathematics (Moses & Cobb, 2001a). Students who finish Algebra in middle school are positioned to take mathematics courses in high school that are necessary for 4-year college and university admissions. Research revealed that a large number of African American, Latino, and Native American students were not engaging in this course in middle school (Oakes, Joseph, & Muir, 2003). As a result, many in the mathematics education community supported and endorsed a middle-school requirement of Algebra. California took up this decree, requiring its districts to enroll all of its eighth graders in Algebra. On the surface, this decree appears quite egalitarian. Yet, the implementation of such a decree has had significant problems.

The same beliefs, conceptions, labels, and Discourses about urban students that kept them enrolled in non-Algebra courses before the mandate have kept them enrolled in inferior "Algebra" courses after the mandate. Mandates and decrees constantly get interpreted through existing lenses and Discourses within schooling practice. The more the field can understand the lenses, Discourses, and beliefs embedded in the structure of schooling, the more researchers can document and develop successful future reforms to address inequities. These Discourses, in the passing on of ideologies and beliefs, are a form of power acting on the educational opportunity of students of color. In the following section, we pose how using the lens of Discourse can help us research race and power in relation to the "Algebra for All" mandate.

Labels: Recurring Ideologies

Oakes et al. (2003) report on the implementation of the "Algebra for All" mandate in urban districts in California. The mandate, adopted in 2000, has led to all eighth-grade students being enrolled in "Algebra." Subsequent to the mandate, Paul (2003) documented the proliferation of Algebra and pseudo-Algebra courses. Courses were titled with names such as pre-Algebra, 2-year Algebra, 1-year double-dose Algebra, Math Essentials, and Honors Algebra. Typically, only one of these courses, for example Honors Algebra, actually fulfilled the Algebra requirement that makes students eligible for the college-preparatory mathematics track in high school. Because only a small number of students are allowed to enroll in Honors Algebra, these iterations of Algebra courses work to recreate the inequity that they profess to correct.

This re-naming of courses serves as one example of how a potential change in structure gets reified because the people and their ideologies around learning mathematics have not changed. Despite the changes in course titles, the dispositions towards students changed little (Oakes et al., 2003). Prior to this decree, teachers' conceptions of "remedial" students focused their instruction on math facts because of perceived mathematical ability associated with lower track classes (Raudenbush, Rowan, & Cheong, 1993). After the decree, teachers conceptions remained the same, however, this time, they were referring to their "Algebra Essentials" students (Spencer, 2006). This Discourse about "remedial" students keeps teachers from engaging students in complex or nonprocedural work, and maintains talk about homework not being turned in and a general lack of parental involvement. Algebra students were given a host of intellectually stimulating, complex, and real-world mathematics problems to engage with (Raudenbush, Rowan, & Cheong, 1993). In opposition to the remedial students, the Discourse in reference to Algebra students constructs them as capable, hardworking, well-raised, and advanced. In addition to reinforcing ideological norms, labels reinforce structural inequities. The new titles further disenfranchised students- giving them the illusion that they were actually engaging in a college-preparatory mathematics course- without changing the actual content and goal of their courses (Oakes et al., 2003; Spencer, 2006). The labels have power in that they route students into or away from college-bound trajectories. Furthermore, these routes shape students' relationships to mathematics. Put another way, how students see themselves as thinkers and learners of mathematics.

Historically, the same rationales given for why particular students could not think, learn, or achieve 50 years ago are the same rationales presently given for why they cannot think, learn, or achieve (Cuban & Tyack, 1988; Hull et al., 1991; Spencer, 2006). Labels such as Algebra Essentials, lazy, low skilled and remedial serve as a proxy for African Americans and Latinos without dealing with racial implications. The labels signify underlying ideologies about students of color (Cuban & Tyack, 1988; Hull et al., 1991; Spencer, 2006). Not explicitly attending to race allows these ideologies to remain with superficial changes, no matter how well thought-out the policy.

This perpetuation of inequity and deficit views suggests that the work of mathematics education is to find ways to maintain concern with mathematics content, teaching, and learning, while attending to race and power to understand how the arrangement of mathematical opportunities inside and outside of school interact and contribute to current and historical inequities (Atweh, Forgasz, & Nebres, 2001; Gutstein, 2003; Martin, 2000; Oakes, 1990). In addition, mathematics educators need to develop meaningful interventions, inside and outside of school, to empower marginalized students with mathematics so that they can change the conditions that contribute to inequities (Abraham & Bibby, 1988; Anderson, 1990; Apple, 1992/1999; D'Ambrosio, 1990; de Arbreu, 1995; Frankenstein, 1990, 1994; Gutstein, 2002, 2003; Martin, 2000; Moses & Cobb, 2001a).

For example, instead of the state imposing a blanket eighth-grade Algebra mandate, what if the large urban district or a researcher posed the question: Why are more African American and Latino/a students not enrolled in college-preparatory mathematics courses? Educators could start to answer this question by interviewing African American and Latino/a students, asking them about their experiences in mathematics, the reasons for their course choices, and their future goals. Next, researchers may interview African American and Latino/a parents and ask about the goals that they have for their children. Finally, observing mathematics classrooms and talking with teachers about why they do not recommend more of their Black and Latino/a students for college-preparatory mathematics courses could inform the field about how to design interventions to change classroom practices to open opportunities for students of color. After this work, which is only the beginning, mathematics educators would have more knowledge to inform curricular, administrative, and policy decisions as to how mathematics instruction can better serve African American and Latino/a students and teachers of these students.

Such an approach demystifies the *all* and places a face on those students whom the district is currently not serving. It also gives credence to the lives and experiences of minoritized children and communities, and it forces schools and teachers to confront dynamics of power and race that exist within their school. This approach shares power with students, parents, and communities rather than subjecting them to the mandates of politicians and administrators. Instead, the current "Algebra for All" mandate reifies the stratified system of education existent in these schools. It misrepresents the reality to students and community members who believe that their children are engaged in high-quality Algebra coursework.

Standardized Labels: The Continued Process of Racialization

Many of the same issues previously discussed have manifested themselves in national and local movements towards greater standardization. Policies that establish accountability systems, high stakes standardized tests, and mandated curricula also work to reify labels and more importantly ideologies about children and communities of color.

The culture of standardization places students in groups based on judgments about their academic abilities. These judgments often fall into deficit modes of thinking and are solidified in the schooling institution through state-, district-, and school-sanctioned labels. In California, these labels evolved into terms like *far below basic*, *below basic*, *strategic*, or *intensive*. Grouping students by test performance sanctions these labels, making them more acceptable, and creates an institutional Discourse of deficit thinking tied to linking ability with individual standardized test scores (Perry et al., 2003; Rose, 1988). This deficit Discourse in schools, as before, is more often associated with students of color.

Labeling is one way of grouping by race while never making explicit that these labels construct how students of color are seen. Put another way, these labels become proxies for speaking about students of color without referring to race (Perry et al., 2003; Pollock, 2004; Rose, 1988). For example, whereas a teacher or administrator may be reticent to say that their African American boys have trouble sitting still in class, they might state that their "kinesthetic" students have trouble keeping still in class. Taken a step further, they might add that their kinesthetic students need "hands on" lessons to learn. *Kinesthetic*, unlike *African American*, is an ahistorical and seemingly neutral term. It does not carry with it centuries of oppression and denied rights. It therefore fits with a color-blind ideology (DeCuir & Dixson, 2004) and is an acceptable way of talking about students of color. Similar terms such as *Attention Deficit Disorder (ADD)*, *hyperactive*, *remedial*, and more recently *far below basic* and *math essentials* operate in the same manner. Such labels avoid and cover up the complex and real issues of racialized experience that we as educators need to begin to grapple with. By not documenting, understanding, or deconstructing these Discourses we do not produce work that adequately counters long standing racial and power differentials and the ways that they shape the mathematical experiences of minoritized students.

Summary

Our aim in this section on race and power was to illustrate how not using power and race as central analytical tools in the work of mathematics education reproduces current inequitable practices. Although these cases are preliminary and the descriptions of them largely based on the experiences of the authors involved in this work, they help to illustrate how Discourses and schooling practices are taken for granted, normal, and neutral because they are part of the schooling institution. Better understanding and unpacking the social systems, policies, and narratives that structure classroom learning can help mathematics educators implement new reforms, navigate the political system, and develop policies that work for, rather than against, African Americans, Latinos, and the poor. This would require us to develop new understandings about how power employed through policy, states, districts, Discourses and Whiteness influences the learning that goes on in classrooms. It also means listening and taking up the concerns of those not empowered by the current system in researching mathematics education.

CONCLUSION

Over the last 10 years, there has been a growing concern within education and mathematics education that we need to examine what is happening for groups of students. Although there is recognition that teaching matters, research suggests that as we consider teaching, we cannot ignore cultural histories or essentialize them, and we cannot ignore that learning occurs within schools and communities that are shaped by cultural histories. Research is accumulating that demonstrates that the structures of schooling and society serve to both support and limit student opportunities. However, as we found throughout this chapter, we still know little about the details around how cultural histories and social structures shape and are shaped by communities and their histories. In mathematics education research, we know even less about these details.

The lack of available literature in mathematics education suggests that race, racism, and power remain undertheorized in the field. In other words, the literature does not sufficiently address how race interacts with the experiences of students of color or White students in mathematics education. The high value placed on mathematics education, the career opportunities open to those with strong mathematics backgrounds, and the qualifications for entrance into elite universities situate mathematics in a different way than many other fields. Therefore, it is possible that how racism and the normative ways of talking about students of color play out is different with respect to mathematics from other disciplines. The ways that these normative Discourses that build themselves into the institution of mathematics education through course names such as Math Essentials and labels like *far below basic*, are one example of enacting power on students in systematic ways. The literature does little to make explicit how the schooling institution enacts power, in fairly implicit ways, on students of color. Hopefully, this chapter raises issues for mathematics education researchers to further explore how issues of race, racism, and power structure opportunities and experiences for all students so the field can find ways to counteract inequities.

Standardized tests serve as an example of how social structures and cultural histories shape access, opportunities, and experiences of groups of students. This review suggests that these tests often hold cultural, racial, and social-class biases, making them better assessors of students' cultural practices or their SES, revealing little about students' mathematical understanding. Moreover, standardized-test results have deep consequences for students of color, as the results are often used to inappropriately sort students. As long as differential achievement is associated predominantly with standardized-test scores, students of color will continually be harmed by an inequitable distribution of individual sanctions due to a limited understanding of achievement and neglect of the history of underserving them. Additionally, such sanctions place responsibility on the students for overcoming disparities in achievement, funding, and opportunity to learn that society-at-large and the institution of schools create and perpetuate.

The characterization of inequities in mathematics education synthesized throughout this chapter underscores the benefits of and necessity for (a) researching the concerns of those who have been disenfranchised, (b) questioning the privilege of the powerful, (c) recognizing classrooms as racialized spaces, even all-White classrooms, and (d) looking outside the field of mathematics education for theoretical perspectives and methodologies that can contribute to our understanding of culture, race, power, and mathematics teaching and learning.

Researching Culture, Race, and Power in Mathematics Education

The examination of race, culture, and power with respect to student achievement and learning in mathematics raises different questions for our current system of mathematics educators. Research questions are needed that can help guide studies of mathematics education in both untangling and challenging processes that perpetuate current inequity and injustice in mathematics education and in society writ large. A few researchers have already proposed research questions that attempt to address issues of culture, race, and power in mathematics education (see, e.g., R. Gutierrez, 2002; Gutstein, 2006; Martin, in press). These questions stem from the perspectives that these researchers hold about the relations of race, culture, and power in mathematics, the nature of mathematics teaching and learning, as well as the role of mathematics education in society. These researchers share a concern with analyzing what counts as mathematics learning, in whose eyes, and how these culturally bound distinctions afford and constrain opportunities for students of color to have access to mathematical trajectories in school and beyond. The questions offered by Martin, Gutstein, and Gutierrez share a common theme in observing that mathematics education, and assumptions within it about mathematics teaching and learning, have historical, cultural, and political underpinnings, that have privileged White, middle- and upper-class students over students of color.

We have also embedded questions within the chapter in an effort to reveal subtle power relations, racialized experiences, and implicit ideologies and practices that constrain the development of a more equitable system of mathematics education. This is also an attempt to challenge the field to move beyond studies of mathematics teaching and learning that reduce culture to race, race to non-White students, and that inadvertently strengthen narratives and Discourses that marginalize and oppress. In proposing new areas of research, we do not seek to minimize the work that has been done to date to bring about greater equity in mathematics education. We also recognize the difficulty of doing such research in a contentious social and political climate, and simultaneously with the development of new methodological tools and frameworks.

However, different kinds of questions often require different methodologies. Asking questions about systematic inequities leads to methodologies that allow the researcher to look at multiple levels simultaneously. This means that mathematics education research should take a multifaceted approach, aimed at multiple levels from the classroom to broader social structures, within a variety of contexts both in and out of school, and at a broad span of relationships including researcher to study participants, teachers to schools, schools to districts, and districts to national policy. It is important, then, that researchers understand that policies *do* play out as well as *the ways in which* they play out at the classroom, school, district, and state levels.

Methodologies that capture the relationships between individuals, groups, classrooms, schools, communities, and social structures are needed. In other words, research that avoids looking at these elements in isolation has much more potential for informing the field and policy decisions about culture, race, and power in relation to teaching and learning mathematics. For instance, Spencer (2006) provides a multi-level framework for studying the mathematics achievement of African American students. In this framework, Black student participation and identity, the mathematics content present in classrooms, teacher's dispositions towards and explanations about the participation of their African American students, schools' responses to the needs of African American students, and the historical context within which the school is seated each take a central role. The potential of such a framework is in its ability to address the complex and relational nature of a phenomenon such as "student achievement." For example, such an analysis could help answer how the historical significance assigned to a particular group of students impacts the relation of a school to that group as well as the relation of that group to the school. More central to our work, such an analysis may help us understand how a teacher's perceptions of students as doers of mathematics impacts how that group views themselves in the enterprise of learning mathematics.

Both qualitative and quantitative research have strengths and limitations. Work using narratives, ethnographies, and historical analyses allow research to speak to multiple levels of practice in order to see nuanced details. Although these methods are sometimes discredited, not counted as research, or not given the same respect as other forms, their multilevel nature situates them as particularly powerful in understanding the details of relationships discussed in this chapter. Standards of quality and thoroughness can be achieved just as in quantitative analyses. Similarly, quantitative methods such as multilevel modeling can uncover systematic issues of inequity. Although multilevel modeling such as Hierarchical Linear Modeling (HLM) is already respected as a form of research, when using such techniques we must be just as thoughtful and careful that we are actually measuring what we intend. The measures must be sensitive enough to allow for the subtle ways that culture, race, and power can influence teaching and learning in mathematics classrooms. When this is the case, multilevel modeling allows researchers to understand complex causal relationships that can uncover power dynamics within social structures that shape the experiences of groups. This quantitative work allows researchers to understand complex relationships on much broader scales than by using qualitative methods. We recognize that quality research of this sort is difficult and challenging to do. However, if we are to take equity seriously, we cannot avoid engaging with these issues in new ways.

In addition to different kinds of questions and methodologies, this work will push the field to develop new ways of understanding results. We attempt to provide some different frameworks for understanding the relationships between culture, race, and learning in this chapter. This is not an argument for a particular framework; rather, multiple lenses and theoretical perspectives will be needed to understand our work in relation to social structures and cultural and racial histories. If mathematics education researchers were all to challenge our assumptions about why we have the results we do, it might open up new insights into the complex relationships discussed in this chapter. New frameworks for understanding the interactions between culture, race, and power would shape how we discuss and understand the work of mathematics education.

The seemingly color-blind, neutral polices in mathematics education and in education in general, and discourses about students and student achievement, serve to privilege some students and cultural practices over others. Our discussions in this chapter reveal that not paying explicit attention to the ways race and power manifest themselves in such policies can lead to a masking of the racialization of mathematics education and of the damaging effects of recurring ideologies for students of color. These challenges considered, if the nation is to take seriously current inequities in math education, then it is unacceptable for the field of mathematics education to ignore something that so obviously defines the relationships and realities of many students in the United States.

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