

When the classroom environment and pedagogical practice are brought into line with the lived experiences of students, student performance is positively influenced (see reviews by Dilworth & Brown, 2001 and Gallego, Cole & Laboratory of Comparative Human Cognition, 2001). In addition, without attention to students' cultural and racial backgrounds, mathematics classrooms will continue to play a role in producing and maintaining the inequities that exist in society (e.g., Gutstein, 2003; Moses & Cobb, 2001; Oakes, Muir, & Joseph, 2003).

We purposely focus this section on building relationships as we intend to push beyond seeing teachers' work as eliciting students' thinking in mathematics and consider what it means for teachers and students to get to know one another in ways that lead to different opportunities for participation in mathematics for teachers and students, challenge the status quo, and allow for the possibility of the distribution of student and teacher voices.

### Drawing on Ideas of Identity and Culture<sup>7</sup>

Embedded in current definitions of mathematical understanding are notions of students' perceptions of themselves in relation to the mathematics. Notions of identity are included in understanding not only because educators want students to like mathematics for the purposes of engagement and motivation over time but also because developing a particular stance towards the mathematics is part of understanding the mathematics (National Research Council, 2002). The relationship students develop with mathematics—how they see themselves in relation to the mathematics— influences how they participate, how they make sense of the mathematics, and the different ways they persist. This is all a part of understanding mathematics. This places one's mathematical identity not as something peripheral to doing mathematics but as central.

Ge (2001) described identity as "being recognized as a certain 'kind of person' in a given context." Wenger (1998) described identity as the "pivot between the social and the individual" (p. 145). Both would argue that identities are constantly being formed and re-formed in the dialectic between social structures and individuals' lived experiences. Identities reflect histories of engagement in sociocultural communities, institutions, and practices. As Stuart

Hall (1996) explained, "[This view] accepts that identities are never unified and, in late modern times, increasingly fragmented and fractured; never singular but multiply constructed across different, often intersecting and antagonistic, discourses, practices, and positions" (p. 4).

These conceptions of identity illustrate the importance of thinking about classrooms as places where identities are constructed and reconstructed through discourse. In many mathematics classrooms the identities constructed through discourse practices perpetuate beliefs about who is mathematically literate, and often this construction differentiates students on racial lines (Boaler, 2002; Martin, 2000).<sup>8</sup> A number of researchers have begun to explore how understanding identities in the context of a classroom's discursive practices can help us understand students in a new way and see how to challenge existing inequities. For example, students are often located and locate themselves within dichotomous identities of achievement: successful versus struggling. Students' own sense of struggle may be hidden behind what they find appropriate to share and divulge about themselves to their peers or their teacher (see, e.g., Dutro et al., in press).

Researchers have recently begun to examine how individuals are positioned and position themselves within the mathematics classroom context (Gresalfi, 2004; Martin, 2000; Nasir, & Saxe, 2003). Just as we researchers have learned a great deal about the different ways that males and females may participate in and with mathematics, we are now just beginning to understand how students from different races and cultural backgrounds may also have different participation histories that influence how they engage in mathematics. Often minority students believe that they must choose between a strong academic and a positive ethnic identity (Nasir & Saxe, 2003). How the tensions continue to play out matters for how students engage in school and in mathematics. Martin (2000, 2003, 2006, in press) studies the co-construction of African American and mathematics identities, highlighting the challenges that many African Americans face in negotiating positive identities as mathematics learners. Martin has shown that mathematically successful African American students not only maintain their sense of self as African Americans and as students but also construct a number of other positive identities;

<sup>7</sup> We draw heavily here on work outside of mathematics education. This work has been reviewed in a number of places (see Dilworth & Brown, 2001) and not only serves as a basis for conceptualizing what can happen in mathematics classrooms but also provides details we see useful in mathematics classrooms.

<sup>8</sup> We recognize that race is not the only way students are differentiated (e.g., language, gender, sexual orientation). However we focus here specifically on issues of race as we see the need for mathematics classrooms to attend to race more explicitly. Research on race and mathematics teaching is limited. See equity chapter in this volume for a more detailed examination of these issues.

they are not “acting white.” He frames mathematics teaching and learning as *racialized forms of experience*—where meanings for race and racism emerge in the day-to-day struggles for mathematics literacy among the African American adolescents and adults he has studied. In all of their stories of mathematics teaching and learning, race was salient. Martin (2006, in press) connects the identities developed by the African Americans in his study to the sociohistorical and structural forces that shaped the kinds of mathematics practices in which students participated. Martin (in press) argued for the need to

acknowledge that mathematics learning and participation, like many other areas in life can be viewed as *racialized forms of experience*; that is, as experiences where race and the *meanings for race* emerge as highly salient in structuring (a) the way that mathematical experiences and opportunities to learn unfold and are interpreted and (b) who is perceived to be literate, and who is not.

The complexity of issues of identity for students of color in the United States highlights the importance of understanding how minority students structure and manage emerging tensions as they construct and negotiate ethnic and academic identities in the course of their everyday activities.

### Drawing on Cultural Practices

Identities are shaped, constructed, and negotiated through cultural practices (Holland, Lachoitte, Skinner, & Cain, 1998; Lave & Wenger, 1991; Martin, 2000; Moll & Gonzalez, 2004; Nasir, 2002; Wenger, 1998). Understanding cultural practices becomes essential to understanding students’ evolving identities, both the cultural practices students engage in outside of school and those of the classroom.

Leacock’s (1971) definition of culture

refers to the totality of a group’s learned norms for behavior and manifestations of this behavior. This includes the technological and economic mechanisms through which a group adapts to its environment, its related social and political institutions and the values, goals, definitions, prescriptions, and assumptions which define and rationalize individual motivation and participation (p. 35).

So individuals’ ways of participating are shaped by the norms, values, and goals of the group. As teachers and students together create a new set of norms they must understand the existing norms for doing and talking to one another. Understanding the cultures—the

groups students have participated in—can help the teacher build relationships based on a depth of understanding and not on assumptions or stereotypes.

A challenge to developing relationships with students that draw on their histories and cultural experiences involves the deficit views of families that frequently exist. These deficit views often permeate mathematics classrooms (Oakes et al., 2003; Spencer, 2006). A number of researchers argue for the need to change deficit views of families and communities and look to draw on the strengths that exist (Brice-Heath, 1982; Civil, 2002; Cole, Griffin, & LCHC, 1987; Moll & Gonzalez, 2004). Researchers drawing on the *cultural difference* perspective rather than the *cultural deficit* perspective argue that teachers’ work requires that they find ways to reduce the cultural mismatch between the home and classroom cultures. The goal of reducing the mismatch is to use what the children already know, along with the associated cultural practices, as resources for understanding in the classroom (Moll & Greenberg, 1990, cited in Gallego et al., 2001). Many researchers have investigated and developed strategies to reduce mismatch, and Gallego and her colleagues in analyzing this work stated that, “these examples make it clear that a strategy of local accommodations of school culture to home culture can be educationally productive” (p. 979).

Moll and his colleagues documented how households contain accumulated *funds of knowledge*, the skills, abilities, and practices that support the functioning of the household. Moll and Gonzalez (1997) pressed teachers to come to know the cultures of their students. They argued that teachers need to become qualitative researchers in some ways as they come to understand students in their home environments, detailing the strengths and skills students use in the home that can be used to understand participation (including language use) in school. This work explicitly rejects the notion that the problem of underachievement either is located within the students or is due to students’ culture, and it shifts responsibility for underachievement to understanding what students do bring to school and how schools can draw on the wealth of knowledge and experience that the student brings (Moll, 1992).

Civil has taken these ideas into the mathematics classroom through the BRIDGE Project. The explicit goal of the project was the development of mathematics teaching that builds on students’ backgrounds and experiences (Civil, 2002; González, Andrade, Civil, & Moll, 2001). Although this work points to the potential of bringing parents and families into schools so teachers see students’ strengths, it also makes explicit the challenges of actually building on the everyday

mathematics knowledge and experiences of students in schools. Civil found that often the mathematics in everyday activity was hidden: People did not see themselves as doing mathematics and often rejected the idea that what they were doing was mathematics (Gonzalez et al., 2001). And although this work is challenging it does begin to point to the fact that students' competencies identified outside of the classroom are often not used as a resource in school.

Hand (2003) analyzed classroom dynamics in two reform-driven algebra classrooms in an urban high school. She found what she has termed a *participation gap* between the two classrooms. In one classroom any activity that was not directly related to the lesson was treated as a potential distraction to students' learning and thus prohibited. In contrast, in the other classroom, the teacher searched for links between mathematics and the knowledge and practices that the children brought with them to the classroom. In the class where the teacher validated students' contributions, greater participation was evident. Erickson and Mohatt (1982) found that when teachers used language patterns that approximated the students' home cultural patterns or balanced these patterns with the Anglo instructional patterns typically used in school, they were more successful in improving student academic performance. Here the goal was to include student culture in the classroom as authorized knowledge. In work with African American students researchers have found that teachers have successfully built on forms drawn from African American churches. The teachers built relationships in their classrooms that were marked by social equality, egalitarianism, and mutuality stemming from a group rather than an individual ethos. The focus was on collective and personal responsibility (Henry, 1992; Hollins, 1982; Foster, 1993, all as cited in Dilworth & Brown, 2001).

The work of Lipka and the Alaskan Natives, 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, 2005; Lipka, Wildfeuer, Wahlberg, George, & Ezran, 2001), draws upon the knowledge of the Yup'ik elders in making curricular decisions. Yup'ik elders, teachers, bilingual aides, students, school-board members, and university faculty created a working environment where both insider and outsider knowledge was valued. In this way the teaching of mathematics became a community project that drew on and respected both local knowledge and more traditional mathematics. The researchers have documented that the achievement of students whose teachers used the curriculum after receiving

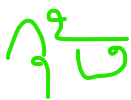
professional development surpassed that of comparable groups of students (Lipka, 1994, 2002; Lipka et al., 2005; Lipka, Wildfeuer, Wahlberg, George, & Ezran, 2001).

Moschkovich (2002), through her work on discourse and language, has pushed for making the mathematical practices of different groups accessible to students in classrooms. She has stated that it is not the using of everyday practices that is itself important but rather making connections between familiar practices and academic mathematical practices. She suggested that there needs to be a balance between the everyday and academic mathematics so students can be encouraged to engage in the study of mathematics while also providing them the discursive practices necessary for pursuing mathematics. The goal of the work that draws on students' cultural experiences is to understand and use the resources students bring to the classroom, thereby allowing students to accept and affirm their cultural identity while at the same time developing a critical perspective that can challenge the existing accepted practices of schooling. This work points to the value of teachers' understanding students' identities and cultural practices in building classroom relationships. Bringing these identities within the classroom walls legitimizes different forms of participation and allows for more diverse mathematical knowledge.

### Teaching As Building Relationships Around Identity and Culture

Although we can make a theoretical argument and provide a number of existence proofs that attending to both identity and cultural practices in building relationships with students makes a difference in students' participation, the field continues to try to identify what exactly it means to attend to identity and cultural practices in mathematics classrooms. We argue here that educators can learn from culturally relevant pedagogy (and related literatures) and the critical stance it takes in providing opportunities for students of color and use it as a way to think about the types of relationships that can be built with students, families, and communities to shape the teaching and learning of mathematics.

Culturally relevant teaching, from Ladson-Billings's (1995) perspective, must develop students academically, support and nurture cultural competence, and develop a sociohistorical or critical consciousness. Culturally relevant teachers organize their classrooms and interactions with their students in ways that are guided by the following principles: (a) Treat students as competent and they will likely demonstrate com-



petence, (b) provide instructional scaffolding so students can move from what they know to what they need to know, (c) focus the classroom on instruction, (d) extend students' thinking and abilities, (e) gain in-depth knowledge of both students and the subject matter, and (f) link student understanding to meaningful cultural referents. How these principles are instantiated matters greatly. Although some may argue that these principles signify good mathematics teaching, what differs here is the focus on the relationships with students, and how students are respected for who they are and what they bring to the classroom (Ladson-Billings, 1995). Ladson-Billings has argued that culturally relevant teaching fosters student achievement and provides ways for students to maintain cultural integrity, develop academic success, and recognize, understand, and critique current social inequities (Ladson-Billings, 1995).

Many scholars have pursued the notion of culturally relevant teaching (see reviews by Gallego et al., 2001; Mercado, 2001). And a growing body of research shows how African American, Latino, and Native American students draw on their cultural and community knowledge to help them succeed in mathematics (Gutstein, 1997, 2003; Martin, 2000; Nasir, 2002).

Gutstein, Lipman, Hernandez, and de los Reyes (1997), in a multiyear study of mathematics teaching in a Mexican-American community, focused on three components they saw as critical to culturally relevant teaching: thinking critically in general and about mathematics, building on both students' informal math knowledge and their cultural and experiential knowledge, and gearing teachers' orientations to students' cultures. In their observations of mathematics lessons, the researchers watched teachers encourage students to explain and justify their answers, push students for multiple interpretations, and encourage mathematical communication (p. 720). They observed teachers' using students' out-of-school knowledge to help students understand mathematical concepts. And teachers came to understand and acknowledge students' cultures by building relationships with students and families.

Gutstein (2003) continued this work through a 2-year study in an urban, Latino seventh/eighth grade mathematics classroom where he taught using these principles of culturally relevant pedagogy along with reform curricula. Gutstein worked to help students develop sociopolitical consciousness, a sense of agency, and positive social and cultural identities while also supporting them to "read" the world using mathematics, developing students' mathematical power, and changing their disposition towards mathematics. He

found that, although it was challenging to merge his various goals, attending to both sets of goals supported student participation and learning.

Like Ladson-Billings and Gutstein, Frankenstein (1990, 1995, 1997) has looked for ways to connect to students' lived experiences so that students develop mathematical understanding while learning to challenge social inequities. Frankenstein operated from the position that effective curricular choices build upon students' existing funds of knowledge. She found that students were often reluctant to acknowledge—despite the gap in their formal mathematical knowledge base—that they are already quite capable logical thinkers in their everyday lives as consumers and workers. In addition, Frankenstein found that several of her students had a very particular vision of what counted as legitimate school knowledge, and as such she faced some resistance to addressing social justice issues through mathematics. For Frankenstein, mathematics can be a tool for grappling with social issues. She argued that the incorporation of ethnomathematics into mathematics curricula can be both culturally and intellectually empowering for students and can lead to increased participation in mathematics.

Most of this work studies exceptional teachers trying to challenge social inequities. However, Gau Bartell engaged more typical teachers in learning to teach mathematics for social justice. Gau Bartell (2005) engaged eight secondary mathematics teachers through the creation, implementation, observation, and revision of a mathematics lesson that incorporated social justice goals. She found that the teachers struggled in balancing the mathematics and social justice. In one group, mathematics "trumped the social justice," as teachers never addressed social justice issues, and for the other group, the mathematics was often not connected with social justice. In this group, teachers were so focused on guiding students to a particular idea that they supported conclusions that the mathematics did not. Although this work speaks to the difficulty for teachers to change their practice to incorporate social justice issues, researchers are just beginning to develop these ideas. It represents a fruitful area for future inquiry.

**Summary**

Within this section on building relationships the theory and literature point to the importance of understanding students beyond how they think about mathematics. Although understanding how students think about mathematics is critical and has been shown to make a difference for teachers' and student learning, understanding students in terms of their

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race, cultural histories, and previous experiences enables teachers to build relationships that challenge assumptions and open opportunities.<sup>9</sup>

Just as knowing how individual students' thinking is supported by knowing trajectories of students within particular content domains, knowing students' identities in relation to school and mathematics is supported by knowing the communities in which they have participated. If teaching involves orchestrating and negotiating participation, as we have argued here, teachers need to understand students' participation histories. Teachers need to recognize the forces inside and outside that shape the multiple identities for students as they engage in mathematics.<sup>10</sup> Teachers need to know how to draw students' identities into the mathematical work, support them to evolve in how they participate, honor different forms of participation, and structure opportunities that allow for different participation forms. We have described some work that begins to document what this can look like in a mathematics classroom. Yet researchers still know little; we particularly know little in terms of the type of critical stance some would argue for in creating classroom cultures and supporting participation. Teachers clearly, though, hold many assumptions about how certain groups of students do or should participate that can narrow forms of participation (often due to their own experiences), and opportunities are needed within the context of teaching to learn to challenge those assumptions in ongoing ways so that each student is challenged to participate in and understand the mathematics.

"Bringing the lived experiences" of students into the mathematics classroom is both challenging and controversial. It is challenging in that researchers who have begun to try to accomplish this have found resistance from a variety of sources, including the students themselves. It is controversial because including lived experiences can be accomplished in a way that focuses on deficit and not strength. The challenging and controversial nature of the work only points to the need for building relationships in classrooms that allow for a multidimensional understanding of each other and the mathematical work.

Ms. Michaels and Ms. Jimenez. Both Ms. Michaels and Ms. Jimenez engaged in some aspects of practice supported by research findings that emerged from large-scale reform projects. They posed a sequenced set of problems, elicited student thinking, asked follow-up questions, facilitated classroom discussion around mathematical ideas, and used what they knew about students' mathematical thinking. They each engaged in these practices to different degrees and in somewhat different ways, and those differences had an impact on student participation. What is unknown from the short description of a single lesson in these teachers' classrooms are the details about how the teachers orchestrated mathematical conversation, the norms established in each of the classrooms around what it means to do mathematics, and the kinds of relationships teachers had developed with their students. Knowing more about each of these would enable us to have a better sense of how and why the practices in these two classrooms played out in the way they did and how they shaped student participation. We argued throughout this chapter that there have been important advances in research on classroom practice since the publication of the last *Handbook*. We can articulate and detail some critical features of classroom practices. We know what to begin to look for in Ms. Michaels's and Ms. Jimenez's classrooms. We recognize the need to know more about what surrounds those classroom practices, and this is illustrated by what we do not know about Ms. Michaels's and Ms. Jimenez's classrooms, no matter how much detail we provide about the interaction from one day. We believe that the field is in a productive place to move understanding of classroom practice forward by attending more closely to the relationship between the already articulated critical features of classroom practices and the surrounding discourse, norms, and relationships.

### Three Features of Classroom Practice

We chose to focus the chapter on three features of teachers' classroom practice: discourse, norms, and building relationships. We chose to focus on these three aspects of mathematics classroom practice because consensus is building that students need opportunities in classrooms to share their mathematical thinking, discuss alternative approaches to solve problems, use mathematical tools flexibly, and so on. Providing students these types of opportunities requires

## CONCLUSION

We began this chapter with two brief scenarios drawn from the mathematical teaching practices of Ms. Mi-

<sup>9</sup> One needs to be careful here in avoiding essentializing by drawing on narrow preconceived notions of cultures. Notions and understandings about cultural histories need to be continually challenged to support the development of a complex set of understandings about culture and the student in relation to his or her culture.

<sup>10</sup> We see this as part of what Ball, Goffney, and Bass (2005) called for in having teachers bring an *equity awareness* and willingness to act on that awareness to the mathematics classroom.