CHAPTER 6

HOW EQUITY CONCERNS LEAD TO ATTENTION TO MATHEMATICAL DISCOURSE

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In this chapter, I consider how equity issues are connected to mathematical discourse and what kinds of attention to discourse are relevant to equity. Using commentary on the preceding chapters, I discuss issues raised by different approaches to equity and to discourse. My first question about the two themes, equity and discourse, comes from asking how one would go about separating them. In looking at the two main sections in this book, I first wondered whose work belonged in which category – equity to discourse or discourse to equity – and, more importantly, how one would decide. I am not objecting to the distinction; in fact, in writing this chapter, I found it generative. I found myself thinking about the boundary between the two themes, not in opposition to the distinction but because I found the boundary interesting. In my own work, I cannot really make that distinction, because the connections between equity and discourse are dialectical (although it has been a struggle to maintain this two-way connection). It is possible that these two themes have been particularly connected for me due to my personal history and intellectual trajectory.

I will explain with a little history, in order to locate the origins of my own interest in equity and discourse and also to provide a picture of my trajectory navigating the connections between them. I am originally from Argentina, the granddaughter of Jewish immigrants from Eastern Europe to Argentina and Brazil. My grandparents' first language was Yiddish, my mother's first language was Portuguese since she was born and raised in Brazil, and my father's first language is Spanish. My first language is Spanish, I learned some English in elementary school in Buenos Aires, but I did not consider myself bilingual until after I moved to the United States in high school.

Before becoming a researcher in mathematics education, I studied physics, mathematics and philosophy of science and taught mathematics at the college level for several years. I have worked principally in secondary mathematics classrooms with students of Mexican, Puerto Rican and Central American origin living in the United States. I see my research as focusing on mathematical thinking, learning and discourse. My interest in bilingual learners blossomed a few years after finishing my dissertation in 1992. My personal experiences of learning a second language as a child, being an immigrant as a teenager and becoming bilingual as an adolescent sparked my curiosity about bilingualism and second language acquisition. My commitment to improving the education of learners who are from non-dominant groups provides the motivation and sustains my dedication to research. Overall, the perspective I bring to these issues is the sociocultural and situated one on language and bilingual learners that I have described elsewhere (Moschkovich, 2002).

My Ph.D. work focused on cognitive science and mathematics education. I was able to address issues of what I then called "language" only in the last chapter in my dissertation – the rest of the thesis was a (very) cognitive analysis focused on describing student conceptions of linear functions and a second (more discourse-based) analysis of how these conceptions changed through discussions with a peer. This work was not presented or perceived as being focused on equity, even though all the students were from non-dominant, working-class communities (as well as bilingual in Spanish, Chinese or Tagalog) and one of the discussions I analyzed was bilingual in Spanish and English. During my post-doctoral positions (one at the Institute for Research on Learning, in Palo Alto, CA, and another at TERC, in Boston, MA), I was able to learn more about language, languages and discourse.

Although my initial work clearly focused on mathematics cognition and mathematical discourse, as soon as I started to work explicitly with Latino/a student populations and present analyses of bilingual mathematical discussions, I had an odd experience: my work started to be perceived as being about equity (when, in fact, this was the case even before my work focused on this specific student population). My experience is that those of us who study bilingual mathematical discussions are perceived as focusing on equity (not mathematical discourse, which is assumed to occur in monolingual mode), those of us who study cognition among students from non-dominant groups are perceived as studying equity (not mathematical thinking), while those of us who work in classrooms with immigrant children are perceived as focusing on equity (not learning and teaching in mathematics classrooms). Studying and working with a group of non-dominant students implies that the work we do is not about the things that human beings do: think, reason, talk or participate in mathematics classrooms, but about what one sub-set of human beings does. Therefore, this work is not about cognition, discourse or teaching writ large, but rather it is constructed as 'equity' work – in part, because it is relegated to being the study of how only *some* students learn (those students from non-dominant groups) and how we should teach those students.

This perception bothers me deeply for both practical and theoretical reasons. In terms of practice, this perception assumes that learners from non-dominant communities *are* the problem, because they learn in fundamentally different ways from regular folk, that teaching them requires special pedagogical tricks and that we cannot learn much about how regular folk learn (or how we should teach) from our work with learners from non-dominant communities.

In terms of theory, if the study of learning and teaching for learners from non-dominant groups is relegated to being only about that group, the study of learning and teaching (writ large) will continue to assume that there is a norm (regular folk, meaning those from dominant groups) and to reflect only the experiences of learners from dominant communities. Examples of so relegating non-dominant experiences abound in cognitive anthropology and cultural psychology, where the study fo thinming by people from non-Western communities is not categorized as psychology (writ large) but as cross-cultural psychology (see Lave, 1988, or Cole, 1996, for a discussion).

Studies that use only participants from a dominant group assume these experiences to be representative of *human* thinking processes set these experiences as a norm. Thus, a sample that is not representative is used to claim conclusions about the whole of human potential, as well as the range of variation in human thinking processes. One of my favorite examples of this phenomenon of using a select group to reach conclusions about general thinking processes is Perry's (1999) work on intellectual development. Perry's studies were assumed to describe what his title did, namely 'intellectual and ethical development in the college years', yet were based only on data for Harvard and Radcliffe undergraduates. Although about 20% of the students were at least female, all the interviewees were part of a very select group of human beings.

Moreover, simply because work focuses on a non-dominant student population is not enough to claim that it address issues of equity. For example, I feel that my own work addresses equity issues not because I work with Latino/a students, but rather because I use a theoretical framework that focuses on the resources learners bring (and not the deficits) that teachers can use to support learning. In Vygotskian terms, I focus on *the potential for progress in what learners already know and do* (Vygotsky, 1978). That shift in the analytical focus from deficits to resources reflects an epistemological stance toward knowing and power that fundamentally alters the analysis of where the power lies.

1. MULTIPLE APPROACHES TO EQUITY DISCOURSE AND ETHNOMATEHMATICS

The chapters in this part of the book raise several issues regarding equity, discourse and ethnomathematics. I first summarize how each chapter addresses these issues and then consider each issue separately.

The first issue in connecting equity and discourse is how we approach (if not define) equity. In Chapter 2, Gutiérrez proposes four dimensions that are reflected in research addressing equity: access, achievement, identity and power. In her view, *access* relates to the tangible resources that students have available to them to participate in mathematics, including high-quality teaching, adequate technology and supplies, a rigorous curriculum, a classroom environment that invites participation, reasonable class sizes, tutoring, etc. *Achievement* focuses on tangible results for students at all levels of mathematics. Achievement involves course-taking patterns, standardized test scores and participation in mathematics courses at different academic levels (from elementary to graduate school). Studies focusing on identity examine whether students find mathematics meaningful to their lives and have opportunities to draw upon their cultural and linguistic resources (e.g. other languages and dialects, algorithms from other countries or different frames of reference). This dimension pays attention to whose perspectives and practices are valued. The *power* dimension can involve examining voice in the classroom – for example, who gets to talk and how contributions are taken up (or not).

Esmonde, in Chapter 4, defines equity as “fair distribution of opportunities to learn”. She thus combines two of the dimensions suggested by Gutiérrez, namely access and power. Esmonde concerns herself with aspects of equity related to participation in classroom practices, focusing on how students take part, the impact this has on others’ participation and also the effect of activity structures and local practices. She addresses an important question about access – access to what? – and considers student access not only to mathematical content and discourse practices, but also to positional identities. Esmonde considers positioning in terms of mathematical competence, which has a crucial connection to equity. This positioning works principally through discourse, in the sense of talk, dialogue or conversation among students and between students and the teacher (more on different senses of discourse later). In her study, Esmonde is careful to assert that identity and participation are not separate, but dialectically related. She also takes care not to equate participation in discourse practices only with talk. During group work, someone needs to be talking, but someone else also needs to be listening and thinking, as well as making meaning. And for a group’s interactions to be equitable, the participation of each group member needs to be treated as important, not only the contributions of one student positioned as smart or good at mathematics.

Esmonde explores two interesting situations that I think deserve further consideration. If each student in a small group is positioned as expert, then this is not equitable because even though they had all had equal opportunities to represent the group, none of them had opportunities to learn from each other. Since there were no opportunities for students to learn, the interactions were not equitable. Another situation should make us think further about how we structure the role of helper in small groups. She found that helpers began with their own understanding, rather than the understanding of the student who needed help. Thus, they developed a better sense of their own thinking, but did not help the student who needed help. In other words, ‘the rich got richer’ by working on their own ideas, rather than by listening to or building on the ideas of others.

Jorgensen describes issues central to school discourse, not only in mathematics but also in other content areas. At home, students learn not only the language of their communities (Spanish, English, etc.), but also specific varieties of that language appropriate to various social settings. In their home communities, they may or may not learn the language, dialect or register privileged in the school they will first attend. As important as the forms of language that children learn are the *uses* of language in their home communities and the ways people in various groups (e.g. children, adults, males, females) are expected to use it (Heath, 1983, 1986). For example, language can be used for storytelling, for recounting experiences, for explaining natural phenomena and for entertaining.

Jorgensen describes how in some communities children are expected to respond to questions, are encouraged to ask questions or get praised for listening politely. These specifics point to the importance of knowing and honoring the discourse practices in students' communities of origin. As young children, students will have appropriated notions of what constitutes a story, how one talks about a past event, how one explains a task (or, rather, does not explain it but demonstrates how it is to be done) or how one engages in argument (Moschkovich and Nelson-Barber, 2009).

The chapter by Wagner and Lunney Borden uses approaches to equity and to discourse that have both similarities and differences when compared with those of the two previous chapters. Their work on equity also addresses Gutiérrez' dimensions of access and power, but in ways different from Esmonde's research. In terms of access, Wagner and Lunney Borden are centrally concerned with supporting students from non-dominant groups to gain greater access to mathematics that is connected to their practices outside of school (at home, in the community, etc.), uncovering mathematics at work in local student communities and, overall, developing cultural sensitivity in mathematics teaching. Their hope is that culturally relevant curricula and resources will have an impact on the low participation of Aboriginal peoples in Canada in mathematics courses.

Discrepancies between students' own cultural practices and the cultural values of school mathematics instruction have been identified as a key reason for the lack of participation, interest and engagement in mathematics in Aboriginal student populations. Wagner and Lunney Borden recommend attention to differences in values and to appropriate teaching strategies. They also claim that an ethnomathematical approach to local mathematical practices "positions all mathematics as being culturally contingent" (p**. xx**) and their project draws on the expected outcome that "uncovered mathematical practices can inspire confidence in students who may assume they cannot do mathematics" (p. **xx**). This approach seems to parallel that of Jorgensen.

However, she focuses not on the content of mathematics instruction, but on students' home language practices.

Wagner and Lunney Borden seem to define discourses as world-views and cultural values: for example, when they refer to the "dominant discourses of the majority" (p. **xx**), "the discourses of mathematics and of cultures in conflict in colonialism" (p. **xx**) and when they refer to the differences between human interaction, in that interactions are "local, alive and dynamic" (p. **xx**) using 'discourses' in the sense of world-views. This is another way to define and approach discourse, one that is broader than seeing discourse as text, talk, utterance, etc. I believe that this subtle difference in approaches to "discourse" can be and has been confusing, so I will continue a bit further in contrasting different approaches to discourse, in the hope of clarifying what I have found confusing. I am not suggesting that this confusion is specific to these chapters or that it is in any way a defect. The confusion arises from the multiple interpretations and meanings of any word or concept. In my experience, these multiple interpretations cannot be avoided (and should probably be celebrated).

2. THREE POINTS OF FURTHER DISCUSSION

In this next section, I explore further three issues that arose for me in the preceding chapters: defining 'discourse', aspects of the discourse practices of school and challenges with the use of ethnomathematical approaches.

Defining 'discourse'

To start with, there is some confusion between the term 'language' and the term 'discourse'. Many commentaries on the role of academic language in teaching practice reduce the meaning of the term 'language' to single words and the proper use of grammar (for an example, see Cavanagh, 2005). In contrast, work on the language of specific disciplines provides a more complex view of mathematical language (e.g. Pimm, 1987), not only as specialized vocabulary (new words and new meanings for familiar words), but also as extended discourse that includes syntax and organization (Crowhurst, 1994) and the mathematics register (Halliday, 1978).

Theoretical positions in the research literature in mathematics education range from asserting that mathematics is a universal language through claiming that mathematics is a language to describing how mathematical language is a problem. Rather than joining in these arguments to consider whether mathematics is a language or reducing language to single words, I use a sociolinguistic framework to frame this chapter. From this theoretical perspective, language is a sociocultural, historical activity, not a thing that can either be mathematical or not, universal or not. From this perspective, the phrase 'the language of mathematics' does not mean a list of vocabulary words or grammar rules, but instead the communicative competence necessary and sufficient for successful participation in mathematical discourse.

One challenge in this endeavor arises because we all regularly participate in discourse and use language and, thus, we have developed intuitions about both discourse and language based on our personal experience. That experience with language is steeped in complex social, political and historical contexts and our intuitions may have developed into language attitudes. These may, at times, be in direct contradiction with empirical research on how people acquire language, use two languages or participate in conversations. Such intuitions lead to common pitfalls that need to be avoided when considering language and discourse in mathematics learning. One such is making superficial conclusions about language and cognition, such as that code-switching reflects forgetting a word or that the fact that a particular word does not exist in a national language means that speakers of that language cannot think of that concept. Both of these conclusions are massively contradicted by data.

There are multiple ways to approach and define discourse, from continuous text or utterances through Gee's conceptualization of Discourse (with a capital D) to the definition of discourse as world-view (for example, as in the phrase 'the discourse of colonialism'). I list only a few below (courtesy of the Merriam-Webster Dictionary), clustered into four categories:

1. a) Connected speech or writing; b) A linguistic unit (as a conversation or a story) larger than a sentence.
2. Verbal interchange of ideas, especially conversation.
3. Formal and orderly and usually extended expression of thought on a subject.
4. A mode of organizing knowledge, ideas or experience that is rooted in language and its concrete contexts (as history or institutions).

Gee's (1996) capital D 'Discourse' signals a view of discourse as more than just sequential speech or writing (#1), conversation (#2) or verbal presentation (#3). It may not (to my mind), however, quite extend to the broadest sense of discourse as world-view (#4). He writes:

> A Discourse is a socially accepted association among ways of using language, other symbolic expressions, and 'artifacts,' of thinking, feeling, believing, valuing and acting that can be used to identify oneself as a member of a socially meaningful group or 'social network,' or to signal (that one is playing) a socially meaningful role. (p. 131)

I would like to highlight some distinctions between the usual notion of discourse and Gee's definition of a Discourse. This is not the usual one used in linguistics textbooks, for instance specifying discourse as, "a sequence of sentences that 'go together' to constitute a unity, as in conversation, newspaper columns, stories, personal letters, and radio interviews" (Finegan and Besnier, 1989, p. 526). Using Gee's definition, Discourses are more than sequential speech or writing and involve more than the use of technical language; they also involve points of view, communities, values and artifacts. Mathematical Discourses (in Gee's sense), then, would include more than ways of talking or writing; they would also include mathematical values, beliefs, points of view and artifacts. In particular, Gee (1999) reminds us to consider how 'stuff' other than language is relevant.

Overall, Gee's definition of Discourse provides a *situated* perspective and, in my opinion, has several advantages. It reminds us that *Discourse is more than language* in several ways, so that we can avoid falling foul of that oversimplification. While Discourses certainly involve using language, they also involve other symbolic expressions, objects, people and communities. Another advantage of this definition is that it draws attention to the fact that *Discourses are situated both materially and socially*. Discourses involve not only talk, but also artifacts and social practices. And lastly, this definition assumes that *Discourses are not individual but collective*, or, as Hakuta and McLaughlin (1996) put it, "linguistic knowledge is situated not in the individual psyche but in a group's collective linguistic norms" (p. 608).

My own work (Moschkovich, 2002, 2004, 2007a, 2007b, 2007c) is theoretically framed using a situated and sociocultural perspective on bilingual mathematics learners to identify the mathematical Discourse practices in student contributions (e.g. Moschkovich, 1999). Following

Gee (1996, 1999), I use the term ‘Discourse’ with a capital D to signal that I am using a situated view of discourse as more than utterance or text. Mathematical Discourse is not disembodied talk; talk is embedded in practices and these practices are tied to communities. I use the phrase ‘mathematical Discourse *practices*’ (Moschkovich, 2007b) instead of ‘mathematical discourse’ to highlight that Discourses are embedded in sociocultural practices, to emphasize the plurality of these practices and to connect Discourse to mathematical ideas.

Using the term ‘practice’[1] shifts from purely cognitive accounts of mathematical activity to ones that presuppose the sociocultural nature of mathematical activity. I view mathematical Discourse practices as dialectically cognitive and social. On the one hand, mathematical Discourse practices are social, cultural and discursive because they arise from communities and mark membership in different Discourse communities. On the other, they are also cognitive, because they involve thinking, signs, tools and meanings. Mathematical Discourses are embedded in sociocultural practices. Words, utterances or texts have different meanings, functions and goals depending on the practices in which they are embedded. Mathematical Discourses occur in the context of practices and practices are tied to communities. Mathematical Discourse practices are constituted by actions, meanings for utterances, foci of attention and goals: these actions, meanings, foci and goals are embedded in practices.[2]

Talk is only one relevant semiotic system. Mathematical Discourse practices involve other symbolic expressions and objects. They involve multi-semiotic systems, not only speech, but also writing, images and gestures. The assumption that mathematical practices involve multi-semiotic systems is particularly important for analyzing mathematical activity cross-culturally. Otherwise, analysts might disregard semiotic systems (such as gestures and diagrams) that may be relevant.

Mathematical Discourse practices can also be connected to mathematical ideas. Cobb, Stephan, McClain and Gravemeijer (2001) define ‘mathematical practices’ as the “taken-as-

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[1] I use the terms ‘practice’ and ‘practices’ in the sense of Scribner (1984), where a practice account of literacy serves to “highlight the culturally organized nature of significant literacy activities and their conceptual kinship to other culturally organized activities involving different technologies and symbol systems” (p. 13).

[2] For a description of how discourse practices involve actions and goals and an analysis of the role of goals in the appropriation of mathematical practices, see Moschkovich (2004). For an analysis of how meanings for utterances reflect particular ways to focus attention, see Moschkovich (2008).

shared ways of reasoning, arguing, and symbolizing established while discussing *particular* mathematical ideas" (p. 126). They contrast social norms and sociomathematical norms (which are not specific to any one mathematical idea) with mathematical practices (which, according to their definition, are). By focusing on mathematical Discourse practices that are specific to a particular mathematical idea, analyses can be grounded in particular mathematical concepts.

There is no one mathematical Discourse or practice (for a discussion of multiple mathematical Discourses, see Moschkovich, 2002 and 2007b). Mathematical Discourses involve different communities (e.g. mathematicians, teachers or students) and different genres (e.g. explanation, proof or presentation). Practices vary across communities of research mathematicians, traditional and reform classrooms. But even within each community there are practices that count as participation in competent mathematical Discourse. As Forman (1996) points out, particular qualities of argument, such as precision, brevity and logical coherence, are valued. In general, being precise, explicit, brief and logical, abstracting, generalizing and searching for certainty are highly valued activities in mathematical communities. For example, claims are applicable only to a precisely and explicitly defined set of situations. as in the statement 'multiplication makes a number bigger, except when multiplying by a number smaller than 1'. Many times claims are also tied to mathematical representations such as graphs, tables or diagrams. Generalizing is also a valued practice, as in the statements 'the angles of any triangle add up to 180 degrees', 'parallel lines never meet' or '$a + b$ will always equal $b + a$'. Imagining (for example, infinity or zero), visualizing, hypothesizing and predicting are also valued Discourse practices.

Issues with the discourse practices of school

In her chapter, Jorgensen raises issues that are central to school discourse, not only in mathematics but also in other content areas. As part of school discourse, discourse practices in mathematics classrooms share some characteristics with school discourse in general. Although these characteristics are not specific to mathematics classrooms, they are central for children's success. As Jorgensen and other researchers have described, ways of organizing discourse can either include or exclude students from participating, and can have an impact on student achievement. Discourse practices in several communities – British working-class (Walkerdine, 1988), native Hawaiian (e.g. Au, 1980), Navaho (e.g. Vogt, Jordan and Tharp, 1987) and African American (e.g. Heath, 1983; Lee, 1993) – have been documented as being at odds with different practices in school. However, this and other research (Lee, 1993; Lipka *et al.*, 1998; Nelson-Barber and Lipka, 2008) has also shown that is it not only possible, but also helpful, to incorporate children's language practices into classrooms.

Teachers and researchers need to understand children's home language practices. This is not an either/or situation and Jorgensen is not suggesting replacing one set of practices with another. Teachers can learn to value and build on students' linguistic skills while also explicitly modeling the discourse styles expected in school. The rules about who can talk when, about what, in what ways and communication routines are established in every classroom. The practice of incorporating students' own ways of using language into the classroom is now recognized as one contributory aspect to the success of some classrooms. For example, one approach to integrating community language practices that resulted in gains in readings scores is the Kamehameha school's integration of 'talk story' style of overlapping participation into native Hawaiian children's classrooms (Au, 1980). Another example is Lee's (1993) work with African American high school students' ways of talking.

The question to ask about language practices in the classroom is whether a classroom facilitates comfortable and productive participation for students from non-dominant communities, in terms of the roles, responsibilities and styles of learners' communication practices. Answering this question means having substantial information about and deep understanding of children's home practices and the local community (Moschkovich and Nelson-Barber, 2009). This entails not only knowing local activities that may be used in the mathematics classroom, but also students' language practices at home and in other community settings.

Such knowledge and understanding requires an ethnographic stance to research and practice. Such a stance draws on anthropology for notions of relativity that acknowledge the knowledge of the people studied (Spindler and Spindler, 1997). A relativistic stance entails trying to understand the knowledge of others in their own terms as much as possible, *prior* to comparing it with other knowledge systems, including those of experts. Relativism allows us to move from deficiency models of learners to exploring their reasoning in terms of its potential for progress, a move that is especially relevant to research with learners from non-dominant communities. A relativistic stance towards culture avoids reducing cultural practices to essential or individual traits. Studying mathematical activity in context means not only considering the place where the activity occurs, but also considering how context – the *meaning* that the place and the practices have for the participants – is socially constructed. It is not sufficient to describe the setting in which learning takes place (classrooms, stores, homes); rather, reasoning and learning need to be described within the larger set of sociocultural practices that happen to occur in particular physical settings. In mathematics education, an ethnographic stance has been identified largely with ethnomathematics.

Issues with using ethnomathematical approaches

Two of the chapters in this part of the book (by Jorgensen and by Wagner and Lunney Borden) illustrate several very important tensions in the use of ethnomathematical approaches. A central issue with these approaches, as Jorgensen points out, is that some ethnomathematical studies privilege western mathematics and fail to see the focal activity from the participants' perspectives. There are ways and examples of how to avoid this privileging. Two example of projects that seems to have managed to honor both local mathematical knowledge, as well as providing students access to the school mathematics they may need at other schooling situations, are the Yupik mathematics project (Lipka *et al*., 1998; Nelson-Barber and Lipka, 2008) and the "funds of knowledge" work (González, Andrade, Civil and Moll, 2001).[3]

Uncovering the mathematics in any local activity involves making outside judgments as to what counts as mathematical. In some instances, this approach has been criticized, because it usually entails someone who is not a member of the local community making that call from a position of power (a mathematician, a mathematics teacher, a researcher, etc.). On the one hand, this is problematic: in their chapter, Wagner and Lunney Borden provide examples of alternatives for finding and owning the mathematics in local activities. On the other, it seems that participants in everyday activity may regularly fail to see what is mathematical about what they are doing,

[3] Work in mathematics seems to have focused on content more than language practices. Both of the works cited in the above paragraph focus on the content of instruction rather than on the language practices of the local community, by bringing into the classroom mathematical topics based on local activity. It is possible that some community language practices were also brought into classrooms. By knowing the student communities well, the researchers and teachers were most likely aware of language practices in the community.

unless it is arithmetic computation. For example, this was the case when I observed a group of insurance salespeople whom I could see were engaged in substantial mathematical activity, but when asked directly only reported doing anything mathematical when they used arithmetic. It is usually the work of the ethnographer and researcher to uncover the mathematical activity. This is a tension that ethnomathematical approaches may always confront.

While ethnomathematical approaches bring tensions with them, there are also several advantages to such approaches that make engaging with these tensions worthwhile. First, ethnomathematics provides an *ecological view of mathematical practices*, because it assumes that mathematical reasoning practices are multiple, heterogeneous and connected to other cultural practices. An ethnomathematical perspective is connected to equity issues that go beyond uncovering the mathematics in local activities to seeing children's mathematical competence in the classroom. Since this approach expands the kinds of activities considered mathematical beyond the mathematics in textbooks or schools (D'Ambrosio, 1985; Nunes, Schliemann and Carraher, 1993) and expands the definition of what counts as mathematical, we are more able to uncover and see the competence in learners reasoning, even (and especially) when this reasoning may not look or sound like schooled mathematical thinking.

Using this perspective focuses data analysis on uncovering the mathematical structure in what participants are *actually* doing and saying. This kind of analysis makes students' mathematical activity more visible and describes the mathematical concepts students are grappling with, even when these concepts may not be immediately evident to participants or be expressed as formal mathematics. Taking an ethnomathematical stance means seeing student mathematical activity in the classroom not as a deviant or novice version of academic or school mathematical practices, but instead viewing it as an activity where participants use social and cognitive resources to make sense of situations.

In my own work, I use an ethnomathematical perspective to frame the description of mathematical activity among bilingual Latino/a learners. This framing is motivated by equity concerns and serves to avoid deficit models of learners. By shifting the focus from looking for deficits to recognizing the mathematics in student contributions, as well as by expanding the definition of what counts as mathematical, we are more able to uncover and see competence and thus avoid deficit models.

Lastly, Wagner and Lunney Borden raise a serious issue regarding how ethnomathematical approaches are perceived and used. If what we learn about the mathematical activities of any particular group or community is relegated to being only 'how those people do math', then we are in deep trouble in terms of equity. Here is an example of what I think the trouble is. When I tell people that I study how adolescents learn algebra, I usually get responses about bad experiences with algebra instruction. But when I tell someone that I work with Latino/a bilingual learners, the question I usually get is: *How do Latinos/as learn algebra*? I usually respond that they learn algebra in much the same way that all humans being learn mathematics – by making sense. But they do this in conditions that do not promote sense-making, such as instruction in a language they do not yet understand. My point is that underlying such questions is the assumption (supported by stereotypes) that Latino/s students learn differently from other adolescents, when instead the issue is that the *conditions* surrounding these learners are different. They are still a subset of human beings, a subset of adolescent learners, and so on.

These stereotyping issues may not go away until we uncover and address deeply held assumptions about intelligence or ability and how these notions are related to language, culture and particular communities. Another way to address these stereotypes is to be careful to distinguish between the *conditions of* learning and the *processes for* learning. For example, children in poor schools in the United States lack sufficient access to qualified teachers, advanced mathematics courses and material resources for learning (school buildings in decent condition, books, etc.). When we study learning and teaching mathematics in typical classrooms with students from non-dominant communities or look at their achievement scores on tests, we are thus reporting on the results of learning and teaching under the worst possible conditions, rather than on learning and teaching processes that would most benefit these students. Thus, it is important both to study and to disseminate examples of studies that describe teaching, curriculum, programs and approaches that have been successful for this student population.

3. EQUITABLE AND SUCCESSFUL PRACTICES IN U.S. MATHEMATICS CLASSROOMS

What might be equitable practices for students from non-dominant communities in mathematics classrooms? Overall, I would define equitable practices in mathematics classrooms as those that:

> a) support mathematical reasoning and mathematical discourse (because we know these lead to conceptual understanding and learning);
>
> b) broaden participation for students from non-dominant communities (because we know that participation is connected to reasoning and learning).

Classroom practices that support mathematical reasoning and broaden participation provide opportunities for students to for students use multiple semiotic resources to participate in, combine and value multiple mathematical discourse practices. Equitable classroom practices also honor student resources, in particular the 'repertoires of practice' among students from non-dominant communities.

Although research does not provide recipes for teaching nor a quick fix, there are some general recommendations to guide researchers and teachers in developing their own approaches to supporting equitable practices in mathematics classrooms for students from non-dominant communities. For example, Brenner (1998) provides a framework for cultural relevance for instruction and curriculum (for more details, see also Moschkovich and Nelson-Barber, 2009), one that includes the following considerations: *Do mathematical activities connect to those in local community? Does the classroom facilitate comfortable and productive participation? Do roles and responsibilities fit with learners' communication practices? And does instruction enable children to build on their existing knowledge and experiences as resources?* Three of the chapters in this part show that these questions can be addressed in many different ways: Esmonde consider whether and how participation is productive for students; Wagner and Lunney Borden consider how mathematical activities connect to those in the local community; Jorgensen considers how classroom language practices fit with those of students' home communities.

Students from non-dominant communities also need access to curricula, instruction and teachers shown to be effective in supporting the academic *success* of these students. The general characteristics of such environments in the United States are that curricula provide “abundant and diverse opportunities for speaking, listening, reading, and writing [and that instruction] “encourage[s] students to take risks, construct meaning, and seek reinterpretations of knowledge within compatible social contexts” (García and González 1995, p. 424). Some of the characteristics of teachers who have been documented as being successful with students from non-dominant communities are: a) a high commitment to students’ academic success and to student–home communication; b) high expectations for all students; c) the autonomy to change curriculum and instruction to meet the specific needs of students; d) a rejection of models of their students as intellectually disadvantaged. Curriculum policies should follow the guidelines for traditionally underserved students (AERA, 2006), such as instituting systems that broaden course-taking options, avoid systems of tracking students that limit their opportunities to learn and delay their exposure to college-preparatory mathematics coursework.

4. SOME RECOMMENDATIONS FOR FUTURE RESEARCH ON EQUITY AND DISCOURSE

Looking back at the four chapters in this part of the book, I see agreement on the central directions for research that focuses on equity and/with/through discourse. In closing, I review how the four chapters serve as exemplars for future research in three ways (recommendations #1 to #3) and then, based on my own work (Moschkovich, 2010), I make one further recommendation (#4).

Recommendation #1: Avoid essentializing cultural practices

The four chapters use conceptual frameworks that do not essentialize cultural practices nor describe culture as individual traits. In general, research should follow the examples set in this part and consider how students draw on multiple ‘repertoires of practice’ from home, everyday, school, etc. (Gutiérrez and Rogoff, 2003). In order to avoid essentializing cultural practices, researchers suggest that we consider ‘hybrid’ practices (Gutiérrez, Baquedano-Lopez and Tejeda, 1999) that are based on more than one language, dialect, register or practice.

In general, we can assume that communication styles and home cultural practices are heterogeneous and hybrid in any community, dominant or non-dominant (González, 1995).

Researchers working with populations of students from non-dominant communities should keep in mind that learners from any community can and do participate productively in a variety of roles, responsibilities, communication styles and mathematical activities that include hybrid practices. One example of a hybrid language practice is switching languages during a conversation, a practice called code-switching (for examples of code-switching work in mathematics, see Khisty, 1995; Moschkovich, 2002, 2007c; Setati, 1998; Setati and Adler, 2001). Monolingual speakers on both sides of national borders often perceive this practice as a deficiency. Regardless of what our personal experiences of code-switching may be, research in sociolinguistics (e.g. MacSwan, 2000; Valdés-Fallis, 1978, 1979; Zentella, 1997) has shown that code-switching is a complex language practice that is not only cognitive but also social, cultural, historical and political, and, most importantly, not a deficiency.

Recommendation #2: Avoid deficit models

The four chapters also serve as exemplars of work that does not frame learners using deficit models. In different ways, using different approaches, the work in this part shows that there is a multitude of ways that research can avoid deficit models. All four chapters, in one way or another, focus on resources rather than deficits. This is a general way to avoid deficit models by considering not only the challenges students face, but also the resources (e.g., González, Andrade, Civil and Moll, 2001) and competences (e.g. Moschkovich, 2002, 2007a) they bring to mathematics classrooms.

Deficit models can be heard in comments that focus on what these learners cannot do, such as “These students cannot ______”. While there is nothing inherently wrong with observing what students cannot do, deficit models are characterized by an emphasis on a lack of competence. If observations of what students *cannot* do are not accompanied by an analysis of what students *can* do, they provide an incomplete picture of these learners. Furthermore, deficit models of learners are usually tied to cause-and-effect explanations linked to the learners’ home communities: these students cannot do *x* because their parents, homes or communities are not doing *y*. (For examples of how pervasive deficit models are, see McDermott and Varenne, 1995.)

Two of the chapters (Jorgensen’s and Wagner and Lunney Borden’s) provide examples of how using a relativistic stance to study mathematical reasoning practices is a strategy for avoiding deficit models. This stance requires, in part, that when we observe learners from other cultural groups, linguistic communities or socioeconomic classes, we learn as much as possible about the norms of learners' home communities, not only through observation, but also by means of reading research studies that might be relevant. Empirical research on communication styles for non-dominant student populations may provide a relevant knowledge base for research. However, research on communication styles should be used with caution. These studies can serve as examples of how communication practices might vary, as Jorgensen does in her chapter, but not as a basis to make broad generalizations about the communication styles for any group of learners or any individual.

Another way to avoid deficit models is to move away from comparisons to a norm. For example, comparisons between bilingual and monolingual speakers are not a useful focus in mathematics classrooms (Moschkovich, 2010), because they ignore competences that distinguish fluent bilinguals – such as code-switching – and miss how bilingual language competence is simply different from monolingual competence (Zentella, 1997). Comparisons between monolingual and bilingual learners, students from dominant and non-dominant communities or speakers of standard English and speakers of other varieties, and so on, assume monolingualism, standard English or living where one was born as the norms for student experiences. Instead of focusing on comparisons to a norm that few students from non-dominant communities fit, studies need to examine student competences in their own right and explore the complexity of the experiences of students from non-dominant communities as they relate to mathematical reasoning, learning and instruction.

Recommendation #3: Recognize the complexity of language and discourse practices

There is also agreement across the four chapters in that the authors recognize the complexity of language and discourse, and have moved away from simplified views of language as vocabulary. Mathematical discourse is much more than vocabulary. While vocabulary is necessary, it is not sufficient. Learning to communicate mathematically is not merely or primarily a matter of learning vocabulary. The question is not whether students should learn vocabulary, but rather how instruction can best support students as they learn both vocabulary and mathematics. Vocabulary drill and practice is not the most effective instructional practice for learning either vocabulary or mathematics. Instead, vocabulary experts describe vocabulary acquisition as occurring most successfully in instructional contexts that are language-rich, actively involve students in using language, require both receptive and expressive understanding and require students to use words in multiple ways over extended periods of time (Blachowicz and Fisher, 2000; Pressley, 2000).

How is a complex view of mathematical discourse related to equity issues? The move away from discourse as vocabulary has crucial implications for equity. When mathematical discourse is reduced to vocabulary, students who come into classrooms from non-dominant communities are likely to be on the receiving end of this over-simplification. Their instruction will focus on superficial approaches to ‘fixing’ their lack of vocabulary. Instead of having opportunities to use mathematical language to communicate about and negotiate meaning for mathematical situations actively, their experiences will be reduced to the passive studying of vocabulary lists.

Another step in recognizing the complexity of language and discourse is to embrace the multi-modal and multi-semiotic nature of mathematical discourse (O’Halloran, 2005; Radford *et al*., 2007): this move also has crucial implications for equity. Two issues to consider concern how participation is more than talk and how we interpret silences. Participation is more than talk: there is also quiet participation as evidenced by gaze, posture or later talk on the topic. If we assume that only students who talk are participating, we will miss the thoughtful yet engaged student who may be quiet and listening during a heated discussion, but joins in later with an insightful comment. It is also crucial to be careful about how we interpret silence. Although we can observe who does and does not speak, we cannot usually know why. Making inferences about imagined cultural, linguistic or cognitive reasons for silence is both unwarranted and dangerous.

Lastly, simplifying discourse usually involves creating dichotomies and these dichotomies often reflect differences in power. There are several dichotomies used to separate types of mathematical activity – for example, abstract/concrete or everyday/ academic – that reflect a division of intellectual labor. These dichotomous categories are grounded on two fundamental assumptions: there are folk who have one and not the other; one of these is better or more valued than the other. Historically, those who have not had the kind of knowledge that is most valued have been those from non-dominant communities, colonized or marginalized not only by material conditions, but also by how researchers have perceived and labeled their thinking practices. Lave (1988) describes this division of intellectual labor:

> Functional theory underlies the web of relations between academic, novice, and jpf (just plain folks) worlds. In this theory, duality of the person translates into a division of (intellectual) labor between academics and 'the rest' that puts primitive, lower class, (school) children's, female, and everyday thought in a single structural position vis-a-vis rational scientific thought. (p. 8)

This division of intellectual labor is fundamentally oppressive and inequitable. Therefore, shifting away from monolithic and dichotomous views of mathematical discourse practices is also closely tied to addressing equity issues.

Recommendation #4: Shift away from monolithic views of mathematical discourse

Research and practice need to shift make a fundamental shift away first from conceiving *mathematical discourse* or *mathematical practices* as uniform and second from dichotomized views of discourse practices (such as 'everyday or academic'). Mathematical discourse is not a singular, monolithic or homogeneous discourse. It is a system that includes multiple forms and ranges over a spectrum of mathematical discourse practices, such as academic, workplace, playground, street-selling, home, and so on. Researchers should consider the spectrum of mathematical activity as a continuum rather than reifying the separation between practices in out-of-school settings and the practices within school. Analyses should consider everyday and scientific discourses as interdependent, dialectical and related rather than assume they are mutually exclusive. Instead of debating whether an utterance, lesson or discussion does or does not count as being mathematical discourse, studies should instead explore what practices, inscriptions and talk mean to the participants and how they use them to accomplish their goals.

It is important for research and practice to move away from construing everyday and school mathematical practices as a dichotomous distinction. During mathematical discussions, students use multiple resources from their experiences across multiple settings, both in and out of school. Everyday practices should not be seen only as obstacles to participation in academic mathematical discourse. The origin of some mathematical discourse practices may be everyday practices and some aspects of everyday experiences can provide resources in the mathematics classroom.

Research needs to stop construing everyday and school mathematical practices as a dichotomous distinction for several reasons. First, a theoretical framing of everyday and academic practices (or spontaneous and scientific concepts) as dichotomous is not consistent with current interpretations of these Vygotskian constructs (e.g. O'Connor, 1998; Vygotsky, 1986). Vygotsky (and other theorists) describe everyday and academic practices as intertwined and dialectically connected. Second, because classroom discourse is a hybrid of academic and everyday discourses, multiple registers co-exist in mathematics classrooms. In general, Goody (1977) reminds us of the inadequacy of dichotomous categories for describing modes of thought or approaches to knowledge, "since both are present not only in the same societies but in the same individuals" (p. 148).

Most importantly for supporting the success of students in classrooms, academic discourse needs to build on and link with the language students bring from their home communities. Therefore, everyday practices should not be seen as obstacles to participation in academic mathematical discourse, but as resources to build with, in order to engage students in the formal mathematical practices taught in classrooms. The ambiguity and multiplicity of meanings in everyday language should be recognized and treated not as a failure to be mathematically precise, but rather as fundamental to making sense of mathematical meanings and to learning mathematics with understanding.

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