Four reprinted ZDM articles and two new chapters comprise Part II of this book that deals with issues in equity and matters that pertain to culture. By culture, we have in mind a dynamic ensemble of common artifacts and shared relations and understandings that shape the complex identities of groups of individuals (Pellegrino 2007). Hence, so-called diverse mathematics classrooms bring with them cultures that, as a consequence, “challenge our ability to define equity in a straightforward, uncomplicated manner” (Jordan 2010, p. 155). Language as an ideological artifact (see Radford’s chapter) constitutes people and their worldviews as a group, including how they see and project themselves to others. Oral mathematical practices exemplify shared relations that operate under the category of rules and, more generally, symbol systems, where such rules and systems pertain to abstracted expressions that have been drawn from familiar, local, and communal ways of representing things over some period of time (Bruner 2001). Across the six studies that comprise this section, we find the pervasive influence of social and cultural factors in the manner students learn and see the value of mathematics. However, from an equity standpoint, it is also important to assess how such learning and value seeing could expand access and enable social mobility among such diverse groups of learners beyond the four walls of the mathematics classroom (Jordan 2010).

Forgasz and Mittelberg in their chapter provide large-scale empirical evidence of an interaction between Grade 9 (northern) Israeli students’ gendered perceptions of mathematics and the relevant cultural, ethnic, and other social realities that influence their views. While mathematics has consistently and historically been stereotyped as a male discipline, Forgasz and Mittelberg in their interesting study extrapolate reasons for persistent patterns of gender differences in cognitive and affective measures in mathematics. In their study, they compared Jewish and Arab Israelis with their Australian counterparts using two language-translated scaled instruments that have initially been validated in the Australian context. The results indicate similarities in gendered perceptions about the discipline of mathematics between the Australian and Jewish Israeli groups, which could be explained in terms of their shared modern and westernized perceptions. Across the two groups, mathematics is a neutral discipline, that is, it is neither a male nor a female domain. However, more Australians than Jewish Israelis tend to challenge the stereotypical view that mathematics is a male domain. Among the Arab Israeli group, the results are rather
ambiguous. While they agree that mathematics is both “a neutral and a female domain, they appear uncertain about it being a male domain.” In fact, “the female Arab Israelis agreed, but their male counterparts disagreed, that mathematics is a male domain.” Triangulated classroom and school performance data among Arab Israelis drawn from other sources strongly indicate that females tend to be more successful than their male counterparts in those contexts, however, the “strongly gendered expectations of women’s roles in the Arab Israel ethnic community and workplace prevent the female group from translating such educational successes into occupational opportunities and participation in the labor force,” a situation that markedly differs among the Jewish Israeli group.

In his chapter, Barton employs a (Derridean) deconstructivist strategy as he attempts to “talk into existence” a disseminated space where “an alternative relativistic philosophy” could possibly thrive. Marking conceptual constraints in both classical and social constructivist views and practices of mathematics, Barton explores the “possibility of the simultaneous existence of culturally different mathematics” via a “below the surface” extrapolation of QRS systems that are specific to cultural groups who “make sense of quantity, relationships, and space” based on their collective discursive practices or systems that evolve over time. What such systems imply is that “there is no presumed external mathematics or rationality by which one system is judged better than another” as it is “entirely an internal process, a human process, a cultural process.” Drawing on evidence from several cultures, Barton illustrates how mathematics conveys its humanly constructed significance, which means to say that the manner in which it is constructed influences outcomes (i.e. the reality that is eventually constructed) and, thus, its validity is not about whether it is “right or wrong” but whether it is “simply useful or not.” Hence, for Barton, an ethno-mathematical lens into mathematical practices predisposes an (relativist) attitude of seeking for functional meaning and the QRS system that support it.

The chapter by Knijnik, Wanderer, and de Oliveira provides a powerful counterdiscourse to “the school curriculum invisibility of the cultures of nonhegemonic groups” whose peculiar and situated “ways of dealing mathematically with the world” highlight the “centrality of looking at cultural differences in mathematics education.” In their chapter, Knijnik, Wanderer, and de Oliveira examine the relationship between cultural processes tied to oral mathematics and those processes that are used with a simple electronic calculator in the context of an adult pre-service teacher education that was organized by a Brazilian landless people’s social movement. While the authors share the view that there is a relationship between mental calculation skills in different cultural contexts and the corresponding written calculation or numerical procedures, they also foreground how an understanding of such numerical practices is inseparably linked to the cultural setting itself. Oral mathematics, they note, is “part of the cultural practices in which they gain their meaning… [and] as an artifact constituted by and constituting culture.” Findings from their two-year ethnographic research with participants who are members of “a peasant culture” indicate a preference toward oral (and not written) mathematical practices that are “connected to labor activities and to the purchase and sale of products for daily consumption,” which differ from school mathematical
practices that value competence in written numerical processes that are applied of-
tentimes in the absence of any meaningful contexts. For instance, the participants understand and employ rounding depending on the context in which it is used in everyday activity and in transaction with other people. Also, they add (and sub-
tract) whole numbers and decimals orally by using a decomposition (place-value) strategy that operates within a left-to-right algorithm, which differs from written school-based algorithms that value right-to-left processes. When they learn to use a calculator, they develop an understanding that it should not be used “in a merely mechanical way” but primarily in supporting orally calculated estimations and in providing exact answers especially in situations that involve complex calcula-
tions.

Civil, Planas, and Quintos in their chapter underscore the significance of “rec-
ognizing” (low-income) immigrant students’ social contexts and, specifically, their parents’ perceptions, in explaining how and why they tend to perform and achieve differently in school mathematics. For the authors, “the notion of recognition needs to be interpreted not only as an acceptance of differences but also as an alternative to broaden meanings for the mathematical practices and ideas.” Drawing on qualitative data from two countries, Civil, Planas, and Quintos note that the changes in the structures of the students’ “learning opportunities are likely to be framed by what their parents think and expect.” Their findings show that while the parents in both countries share the view that it is important for their children to acquire the appropriate mathematical behavior at school in order to be successful, they, how-
ever, react differently to the “teaching of mathematics in their new country… from accepting them and trying to adapt to the new system to experiencing some form of conflict.” For example, the parents in Barcelona (Spain) attribute their children’s low mathematics achievement and difficulties to the fact that they are still in the process of adapting to the new environment that has its own systems of language and norms. While some of the parents in Tucson (USA) hold a similar view, there are a few other parents who also express the concern that some arithmetical top-
ics are taught early and with depth in their home country (Mexico, in particular) compared with the approach used in the US system. Proficiency in the use of aca-
demic language is also a significant issue, and as the authors note, “to ignore how language can operate as a barrier in the education of immigrant children, including their mathematics education, goes against any attempts to provide an equitable ed-
cucation for all children.” Some parents who perceive a separation between learning mathematics and language consequently teach their children to inhibit themselves from participating in classroom discussions until they become language proficient. Other parents who are not provided with (indirect and ongoing) access to bilingual programs feel frustrated at not being able to support their children in their mathe-
matical work.

The chapter by Barwell explores “the full richness and complexity of language use” that characterizes linguistically diverse mathematics classrooms and possible implications for equity in the teaching and learning of mathematics. Drawing on his classroom experiences with diverse students in Quebec, northern Pakistan, and England, including his thorough analysis of the available literature base on the topic,
he articulates four tensions between: school and home languages; formal and informal language in mathematics; language policy and mathematical classroom practices; and a language for learning mathematics and a language for getting on in the world. For example, heteroglottic epistemologies, especially among second language learners, continue to thrive in a system in which “home languages are often marginalized.” Further, while formal or standardized mathematical registers could facilitate collective understanding of institutional mathematical knowledge, tensions arise when there they are not meaningfully linked to students’ informal (and everyday) expressions. An unintended consequence of official language policies involves the suppression of minority languages “on the road to monolingual proficiency,” which then depicts “diversity... as something to be accommodated rather than an intrinsic and valuable aspect of mathematics classroom life.” The political tour-de-force of language, where high-status languages (e.g. English) are loaded with significant sociopolitical value as a way of coping with global demands, oftentimes overshadows the educational value that comes with learning mathematics by drawing on students’ aboriginal or immigrant languages. In their commentaries to Barwell’s chapter, Planas, on the one hand, advances the necessary counteraction of mathematical identity re-construction via the notion of orchestration, while Radford, on the other, surfaces the significance of alterity and the ideological dimension of (mathematical) language.

Schlöglmann in his chapter addresses ways in which lifelong learning programs in mathematics for adults in Western industrialized countries can be meaningfully developed in order to redress various social inequities they experience as a result of having had an insufficient level of education. While Schlöglmann’s analysis of the general concept (and models) of lifelong learning in the current literature introduces us to its complex, “heterogenous” nature, what is clear at least among adult learners in developed countries, especially the unemployed, is the fact that they find themselves needing to acquire new skills due to the rapid “economic and technological, [and global] changes” that are currently affecting various work environments. Schlöglmann then provides an interesting reconstruction of the history and development of mathematics from a social perspective that enables us to obtain a sense of the different functions in which mathematics has been used in society over time and how it emerged as a central tool in various aspects of human life. Schlöglmann’s closing section involves a reflection of a large empirical study on “the state of mathematics education within the adult education system in Austria” that he conducted with his colleagues. In his reflection, which focuses on the participants’ motivations for participating in adult education courses and their attitudes toward mathematics and mathematics learning, he points to both the value that the participants place in obtaining “higher education” and the affective (emotional) conditions that influence their relationship to (learning) mathematics. In their commentaries to Schlöglmann’s chapter, Wedege discusses, among others, the issue of “the so-called justification problem,” while Dindyal underscores the need to have policies that provide incentives for participating in adult courses in mathematics and the development of an appropriate mathematics curriculum and venue for adults that seriously consider their “approach to learning and interests into account.”
References

