

Foregrounding equity in mathematics teacher education

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Published online: 24 December 2011
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In 2009, two special issues of the *Journal of Mathematics Teacher Education* were published on social justice and mathematics teacher education. The first issue is subtitled *Theoretical Studies in Social Justice*, and the second one is *Case Studies in Social Justice* (Gates and Jorgensen 2009). Part of the justification given for publishing the two volume

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series was the “considerable international interest in social justice around the world” (Gates and Jorgensen 2009). Gates and Jorgensen (2009) further stated:

in many parts of the world the link between social class and educational attainment is a key and central concern for educators, researchers and policymakers. Within the wider educational and sociological literature as well as within policy discourses there is an interest in the social context of learning and a recognition that we cannot be socially just merely by assuming everyone be treated equally. There is a further ...recognition that somehow schooling exacerbates social immobility, and reinforces current social stratification and social exclusion of marginal groups. It is further widely recognized that mathematics teaching in schools plays a significant role in the positioning of pupils and in their developing identities as learners and citizens. (p. 162)

This special issue of JMTE contributes to this discourse by focusing on *equity*.

Equity in mathematics education should be one of the most important concerns of teachers, administrators, policy makers, mathematicians, and mathematics educators. In fact, the Association of Mathematics Teacher Educator (AMTE), the National Council of Supervisors of Mathematics (NCSM), and the National Council of Teachers of Mathematics (NCTM), three national organizations that support teacher educators, mathematics teachers, and teacher leaders, have made equity a priority for their organizations (Gutiérrez et al. 2008). Position statements, standards documents, and various books identify key equity issues and recommend directions compelling all involved in the mathematics education of students to become aware of equity issues and to take steps toward eliminating the inequities that plague K-16 education.

Equity has been defined in a number of ways. For example, according to Gutiérrez (2007), equity is “being unable to predict mathematics achievement and participation of students based solely upon student characteristics such as race, class, ethnicity, sex, beliefs, and proficiency in the dominant language” (p. 41). Lipman’s (2004) concept of equity includes “the equitable distribution of material and human resources, intellectually challenging curricula, educational experiences that build on students’ cultures, languages, home experiences, and identities; and pedagogies that prepare students to engage in critical thought and democratic participation in society” (p. 3). In a like manner, NCTM (2008) states:

Excellence in mathematics education rests on equity—high expectations, respect, understanding, and strong support for all students. Policies, practices, attitudes, and beliefs related to mathematics teaching and learning must be assessed continually to ensure that all students have equal access to the resources with the greatest potential to promote learning. A culture of equity maximizes the learning potential of all students (p. 1).

Even though these definitions seem explicit in nature, achieving equity in the mathematics classroom is very difficult for most teachers. Not only is achieving equity difficult, there are also debates on how to describe the inequities in order to address them (Gutiérrez 2009; Martin 2009). For example, for more than 40 years, there have been discussions on how to “close the achievement gap” in the United States, a gap that was disclosed through the National Assessment of Educational Progress (NAEP) since the 1970s.

The achievement gap indicates disparities among groups of students usually identified (accurately or not) by racial, ethnic, linguistic, or socioeconomic status with

respect to a variety of measures, including attrition and enrollment rates, alienation from school and society, attitudes toward mathematics, and test scores (NCTM 2005, p. 1).

According to Gutiérrez (2009):

The excessive focus that U.S. [United States] researchers place on the gap between the mathematics achievement of White, middle-class students and that of African American, Latina/Latino, American Indian, and working class students, as well as English language learners, and the need to close the gap (termed “gap gazing”) sheds light on issues of access and achievement from a dominant perspective with little concern for issues of identity and power or broadened notions of learning from a critical perspective (p. 9).

However, Hilliard (2004) referred to the gap as the “quality-of-service gap.” He likened it to the “savage inequalities” discussed by Kozol (1991). Flores (2007) redefined the gap as an “opportunity to learn” gap, shifting the frame from looking at measures of educational outcomes to examining what students actually experience in schools, resulting in a very different way of describing disparities among students. This new frame calls attention to the fact that U.S. African-American and Latino students are less likely than White students to have teachers who emphasize high-quality mathematics instruction and appropriate use of resources. Therefore, understanding priorities related to changing the outcomes of teaching and learning is important to developing equitable teachers of mathematics.

In the call for articles for this special issue of JMTE, the following topics were highlighted:

- Theoretical frameworks and definitions related to pursuing equity in teacher learning.
- Research and/or review of research related to effective ways to enable prospective and practicing teachers to be aware of the factors that influence students’ mathematics achievement and to be models and/or advocates for equitable classroom practices. This may include research on any of the following:
 - Impact of expectations and beliefs on student achievement (and therefore inequities in the mathematics classrooms);
 - The many roles that culture plays in the teaching and learning of mathematics;
 - The complex influences that affect mathematics learning, such as school factors [e.g., “tracking” policies, assessment or instructional practices, language policy (e.g., states that limit bilingual education effect on math teaching for ELLs), and availability of appropriate resources];
 - Students’ attitudes/beliefs that include their self-perceptions and expectations regarding their mathematics ability and their beliefs about mathematics;
 - Teacher influences on students’ mathematics identities and the related impact on students’ positive or negative dispositions toward mathematics; and
 - Family influences, which include parental involvement and expectations, socio-economic status, and cultural customs.
- Professional development models or practices that have effectively enabled teachers to better serve the range of learners in their classrooms.
- Research on pedagogical strategies that allow English language learners to develop critical problem-solving skills and other higher-level skills related to mathematics.

- Impact of instructional strategies such as differentiated instruction and collaborative teaching models on students with learning disabilities and other exceptionalities.
- Teachers' knowledge and understanding of policy issues that can create disparities among and across groups of students based on race/ethnicity, gender, language, ability, and socio-economic status.

Twenty-three manuscripts were submitted to the guest editorial panel for consideration, of which six were selected for publication through a blind-review process. Even though they all focus on teacher preparation and professional development of United States' teachers, we hope that mathematics teacher educators from countries around the world will find the ideas informative and instructive. All six articles address some aspects of culture and how teachers should take students' cultural backgrounds and communities into consideration when they plan lessons and interact with students and their parents. Most of the authors centered their work on helping teachers to connect the mathematics taught in classrooms to students' cultural backgrounds, homes, and communities, as well as to other authentic contexts. Culturally relevant pedagogy and culturally responsive teaching were the dominant frameworks upon which the works were based. Culturally relevant teaching is defined as pedagogy of opposition specifically committed to collective, not merely individual empowerment (Ladson-Billings 1995). Ladson-Billings (1995) further stated that culturally relevant pedagogy

rests on three criteria or propositions (1) Students must experience academic success; (2) students must develop and/or maintain cultural competence; and (3) students must develop a critical consciousness through which they challenge the status quo of the current social order (p. 160).

Ford (2005) described a culturally responsive classroom as one where:

1. Diversity is recognized and honored—a color-blind and culture-blind philosophy is avoided;
2. Cultural mismatches are minimal, not only among students, but also between teachers and students;
3. Teachers take the time to get to know students for the unique individuals they are—students feel physically and emotionally safe to be themselves;
4. Formal and informal, standardized and non-standardized assessments are fair and equitable;
5. Materials are culturally relevant and meaningful—students' backgrounds and experiences are central to teaching and learning;
6. Lesson plans and activities are infused with multicultural content—content that is respectful; and
7. Teachers display cultural sensitivity and competence (p. 30).

As these propositions and characteristics indicate, culturally relevant pedagogy and culturally responsive teaching intersect in many ways. In fact, Sleeter (2011) asserted that Ladson-Billings' (1994) theory of culturally relevant pedagogy is a conception of culturally responsive teaching that is based on Ladson-Billings' study of effective teachers of African-American students. Thus, in research on equity in mathematics education, either one of these may serve as a viable framework to analyze both teaching and learning. Articles in this issue of *JMTE* illuminate the intersection mentioned above, as researchers describe their studies and their quests to determine effective practices of *teachers* and effective methods for helping teachers to develop pedagogical practices related to the

important mathematics that *students* need to know and learn in meaningful ways. Analysis and recommendations focus on strategies to incorporate *students'* cultures and interests in the *teaching* of mathematics.

Wager's article reinforces the need for teachers to learn about how students use mathematics in their out-of-school practices and provides strategies to engage teachers in developing lessons that build on students' out-of-school experiences. The article adds to the literature on tensions and dilemmas around building on out-of-school practices. For instance, building on her example of soccer, just because students are interested in soccer does not mean that they will be necessarily interested in measuring a soccer field. Is it enough to use students' experiences and interests outside school as contexts for problems? To which extent should we mathematize the experiences that children bring from out-of-school? In the example in the article, if the Hmong child did not want to connect the practice of making story cloths to measurement, should we?

Bonner and Adams discuss a case study of an African-American teacher who interacted with her students in ways in which four interconnected foundational cornerstones of culturally responsive mathematics teaching (CRMT), communication, knowledge, trust/relationships, and constant reflection/revision, were systematically unearthed to develop an initial working theory of CRMT that directly informs classroom practice. The teacher's understanding of the students' community and her genuine care for the students helped her to maximize the students' potential. The teacher also had the respect of the students' parents. The authors discussed how some of the teacher's strategies might not transfer well to other students and situations, but that mathematics teacher educators and supervisors, and school administrators who seek to promote equity in mathematics can extract valuable information for their school settings based on the practices of the teacher in this case study.

Rubel and Chu discuss research based on Centering the Teaching of Mathematics on Urban Youth (CTMUY), which is an integrated research and professional development project, focused on improving classroom-level opportunities to learn mathematics provided to students at high schools in underserved urban neighborhoods. In the article, they provide an overview of CTMUY's guiding framework for teaching mathematics, culturally relevant mathematics pedagogy (CureMap), and the local context of the CTMUY partner schools. They also discuss the importance of students' opportunity to learn meaningful mathematics at high levels and teachers maintaining the cognitive demand of tasks.

Vomvoridi-Ivanović explores Mexican-American prospective teachers' use of culture. She points out that even though prospective teachers may originate from the same culture as their students, they still need help designing and reflecting upon authentic tasks that are cultural and contain important mathematics. An important finding in the study presented in this article is that when using "binder activities" that were mostly activities adapted from reform-based curricula, the prospective teachers used culture to make personal connections with the students, but not mathematical connections. However, when working on the "recipe project," which had a closer cultural connection to the children and involved a group of mothers, the prospective teachers used culture as a resource to the actual activity of doing mathematics.

Turner, Drake, Roth McDuffie, Aguirre, Bartell, and Foote believe that a critical aspect of learning to be an effective mathematics teacher for diverse learners is developing knowledge, dispositions, and practices that support accessing and building on children's mathematical thinking, as well as capitalizing on children's cultural, linguistic, and community-based knowledge and experiences. They present a conjectured learning trajectory for prospective teachers' (PSTs') development related to integrating children's *multiple mathematical knowledge bases* (i.e., the understandings and experiences that have

the potential to shape and support children's mathematics learning—including children's mathematical thinking, and children's cultural, home, and community-based knowledge), in mathematics instruction. Furthermore, Turner et al. discuss how their teacher-learning trajectory can serve as a tool for mathematics teacher educators and researchers as they focus on PSTs' development of equitable mathematics instructional practices for diverse learners, not only during methods coursework, but also throughout early career teaching.

Jan Yow reports findings from a study conducted within a teacher education program to help highlight the importance of equitable instruction of mathematics for all students. The researcher developed four scenarios of her oppressive and liberative teaching practices. Prospective teachers were then asked to write scenarios describing their oppressive and liberative teaching practices. Her results showed that prospective teachers found it easier to write liberative teaching practices of themselves than oppressive examples. She also revealed that developing prospective teachers who are aware of equity in teaching requires ample time to discuss authentic issues in diversity.

These six articles addressed several important issues related to equity; however, they only represent a few that were listed in the call for papers. Moreover, since the call for papers was released, additional concerns related to equity and the preparation of teachers of mathematics have surfaced. For example, during the past two years, more than 44 states in the United States of America adopted the Common Core State Standards (Note: These are not referred to as national standards, since the national government was not involved, rather the governors of each state, as well as other state leaders, developed and adopted the standards, hence the name, which we shorten here to "common standards"). These common standards are characterized as: evidenced-based; aligned with college and work expectations; clear, understandable, and consistent; focused on rigorous mathematics content and application of knowledge through high-order skills; build upon strengths and lessons of current state standards; and are informed by other top performing countries, so that all students are prepared to succeed in our global economy and society. Some claim that these common standards will provide an opportunity for more students to be afforded the opportunity to learn important mathematics. However, others are concerned that this goal will not be achieved. Important questions include: Will all teachers be ready to deliver them in the manner that is intended? Will teachers implement the standards in a manner that takes the students' cultures and values into consideration? Will teachers receive the preparation and professional development needed to implement the standards well enough to close the "achievement gap," "quality-of-service gap," or "opportunity to learn gap" that we find so hard to talk about in constructive ways? What research is needed in mathematics teacher education to show the influences of the Common Core State Standards on teachers' equitable or inequitable teaching of mathematics?

Internationally, we are increasingly aware of the implications of a global world. Yet, implications of how this informs equity in the preparation of mathematics teachers is an emerging need. Questions of merit include: What access do all students have to technologies that can support their learning of important mathematics? Does culturally responsive teaching include a focus solely on the students' culture, or also on awareness of the many cultures that are also relevant in a global society? How might teachers and teacher candidates be engaged in considering the implications of a global society on creating their own culturally responsive classroom?

As we ask teachers to display cultural sensitivity and competence (Ford 2005), we must ask mathematics teacher educators to enact research and teaching practices that address the needs of all learners. We urge readers to consider engaging in and disseminating research in the areas covered in the call, yet unaddressed, such as the impact of instructional

strategies like differentiated instruction and collaborative teaching models on students with learning disabilities and other exceptionalities, and teachers' knowledge and understanding of policy issues that can create disparities among and across groups of students based on race/ethnicity, gender, language, ability, and socio-economic status.

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