REFRAMING URBAN MATHEMATICS EDUCATION: THE SPATIAL POLITICS OF OPPORTUNITY

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Although equity-oriented discourse is working to move the mathematics education community from achievement-gap rhetoric toward a focus on opportunity gaps, it does not currently recognize the role of space and the politics of space in creating and maintaining opportunity gaps as it relates to mathematics education in urban settings. The purpose of this paper is to engage the task of re-conceptualizing urban mathematics education by proposing a framework for scholarship, policy, and practice. The authors engage scholarship in mathematics education, urban education, critical geography, and urban sociology to substantiate a socio-spatial framework for urban mathematics education, which features a visual schematic that locates mathematics teaching and learning—vis-à-vis a mathematics-instructional triad—within a system of socio-spatial considerations relevant to U.S. urban contexts.

Keywords: Equity and Diversity; Research Methods

An enduring challenge within mathematics education (and in education more broadly) has been to recognize the role that mathematics plays in societal stratification and to address systemic inequities that marginalize populations. "Equity" has been positioned as the key principle for responding to this challenge (National Council of Teachers of Mathematics [NCTM], 2000), and over the last few decades, equity-oriented discourse in mathematics education has developed alongside the emergence of urban mathematics education scholarship. The boundaries between the two domains are difficult to distinguish, thus the two are often conflated or interchanged based on common components related to issues of race, class, power, and status. We argue, however, that contemporary equity discourse has not adequately responded to the particular relationship between the "urban" as a socio-spatial construct and mathematics education. Until these discourses are more clearly framed, neither can fulfill its potential to contribute to the enduring challenge above.

Although we argue that equity and urban mathematics education are separable discourses, we acknowledge that the two are related. Particularly, equity discourse is helping the mathematics education community to move from an achievement gap orientation toward an opportunity gap orientation (Flores, 2007). Considering gaps in opportunity makes room for new analyses of mathematics education related to the ways in which opportunity is constructed within education discourses. In the inaugural issue of the *Journal of Urban Mathematics Education* (*JUME*), Tate (2008) issued a challenge related to conceptualizing urban mathematics education in relation to opportunity:

> The challenge is to build theories and models that realistically reflect how geography and opportunity in mathematics education interact. If this challenge is addressed, the field will be one step closer to making scholarship in urban mathematics education visible. (p. 7)

In a later *JUME* commentary, Rousseau Anderson (2014) returned to the need to consider space in urban mathematics education as "'place matters' in the study of urban mathematics education (p. 10). Our aim in this paper is to move further toward recognizing the role of space and the politics of space in creating and maintaining opportunity gaps.

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Background

The roots of urban mathematics education as a subdomain of mathematics education extend back at least to efforts during the 1980s (see Tate, 1996), concurrent with the development and publication of the NCTM standards for mathematics curriculum and evaluation (1989) and for mathematics teaching (1991). These developments also coincided with commensurable shifts in research as mathematics education scholarship around the world entered its much-discussed social turn (e.g., Meyer & Secada, 1989; also see Lerman, 2000; Martin & Larnell, 2013; Stinson & Bullock, 2012). For researchers, teachers, policymakers, and education-interested foundations in the United States (e.g., Ford Foundation, National Science Foundation), a crucial new question emerged: How would the then-new vision for school mathematics reform extend to and take shape in urban districts and classrooms (Tate, 2008)? This question remains central in the latest shift to the Common Core State Standards for School Mathematics.

Our aim in this paper is to broaden the discourse in urban mathematics education in ways indicated by Tate's (2008) challenge in the inaugural issue of *JUME*. According to Lou Matthews (2008), *JUME* founding editor-in-chief, the journal was founded "to open up a space in mathematics education that would honor and enrich the work in this domain [i.e., urban mathematics education]" (p. 1). The young journal's growing popularity signals that urban mathematics education has advanced to the point at which we may now begin to evaluate the production of knowledge in this subdomain—and, particularly, the building of "theories and models that realistically reflect how geography and opportunity in mathematics education interact" (p. 7). What has the study of urban mathematics education entailed? What can it become? The purpose of this paper is to take "one step closer" toward addressing these questions and toward new directions for urban mathematics education scholarship and practice.

Overview of the Socio-spatial Framework for Urban Mathematics Education

In the spirit of addressing Tate's challenge (also see Rousseau Anderson, 2014), our objective is to posit a new theoretical framing for scholarship in urban mathematics education—the first of its kind (Figure 1). In this section, we detail the theoretical concepts undergirding the framework. We

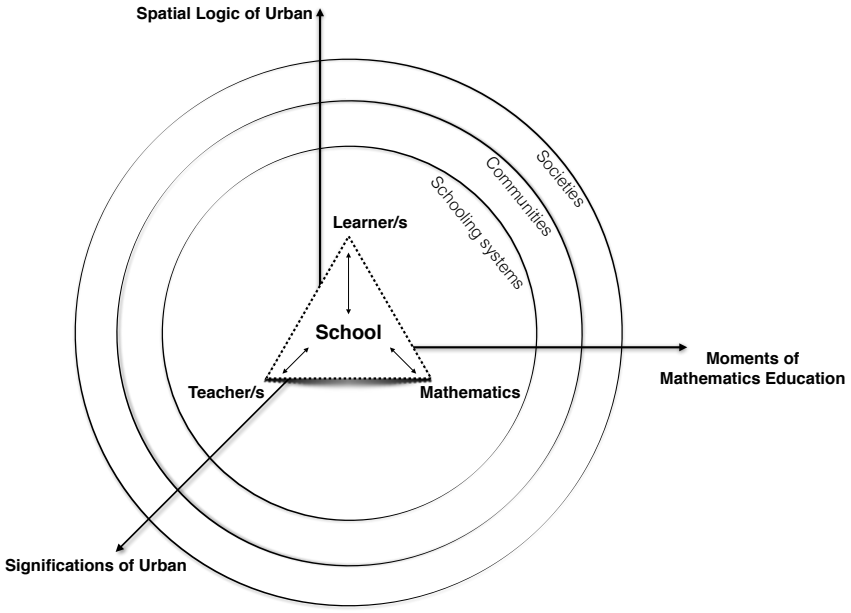

Figure 1. Socio-Spatial Framework for Urban Mathematics Education Scholarship

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situate this framing squarely (but not entirely) in mathematics education—using as our central unit of analysis the mathematics-instructional triad of teacher(s), learner(s), and mathematics (Cohen, Raudenbush, & Ball, 2003; NCTM, 1991; Stein, Smith, Henningsen, & Silver, 2009). We also incorporate the various theoretical orientations—e.g., cognitivism/behaviorism, constructivism, sociocultural perspectives—that have emerged amid "moments" of mathematics education during the past century (Stinson & Bullock, 2012). We represent these theory-driven moments of mathematics education scholarship as a dimensional axis that intersects with the socio-spatial elements of the framework.

The NCTM Research Committee (Gutstein et al., 2005) argued that, in order for researchers to advance equity in mathematics education, we must "break with tradition, expand boundaries, and cross into fields outside of mathematics education *and* outside education" (p. 96; emphasis original). In this spirit, we extend beyond mathematics education, looking toward the interdisciplinary areas of urban sociology, critical geography, and urban education scholarship to consider the various forces that influence mathematics teaching and learning in urban spaces as well as the social significations that shape interactions in urban settings. We recognize, however, that the task of defining urban has been an overwhelming challenge across disciplines, and our attempt here is to incorporate what is known inasmuch as we can given what is available to us contemporarily (Milner & Lomotey, 2013).

In recent decades, there has been considerable momentum in the humanities and the social sciences to consider space as a social construction that is integral to social analysis (Arias, 2010). This *spatial turn* renders geographic considerations equal to—and mutually constructed with—temporal and social considerations in the analysis of social phenomena (Warf & Arias, 2009). In many ways, this framework represents a spatial turn within mathematics education research in which temporal (i.e., the Moment of Mathematics Education axis), social (i.e., the Significations of Urban axis), and geographic (i.e., the Spatial Logic of Urban axis) elements are taken together as mutually constitutive of urban mathematics education.

To inform the framework with respect to the social meanings that shape urban mathematics education, we draw on Leonardo and Hunter's (2007) typology of significations that circumscribe urban education (also see Martin & Larnell, 2013). We represent that typology as an axis of the framework that intersects with spatial considerations of urban, drawn from scholarship in critical geography (e.g., Soja, 1980; Thrift, 2003). The coordinate representation is intended to signal a socio-spatial dialectic regarding the urban—that is, that social significations and spatial considerations necessarily intersect "to realistically reflect how [spatial] geography and [social] opportunity in mathematics education interact" (Tate, 2008, p. 7). We then add a third axis to situate the socio-spatial elements in relation to the evolution of mathematics education and the theoretical orientations association with these evolutionary "moments" (Stinson & Bullock, 2012).

Mathematics-instructional triad as the central element of the framework

At the center of our framework are interactions among learners, teachers, and mathematics curriculum (see Figure 2). Not only does this center the processes of formal and informal mathematics teaching and learning, but in terms of the diagrammatic representation of the framework, the triad represents a kind of coordinate point with respect to the social, spatial, and mathematics-education "theory-moment" axes. As such, the framing allows for questions that relate mathematics teaching and learning, social contexts, spatial logic, and the evolution of the mathematics education enterprise (also see Weissglass, 2002).

Spatial logic axis of the framework

Most often, discussions of urban space are connected to population density and physical geography (see Milner, 2012). While these elements contribute to our understanding of urban as a means of geographical classification, they are insufficient in that they do not allow for a nuanced

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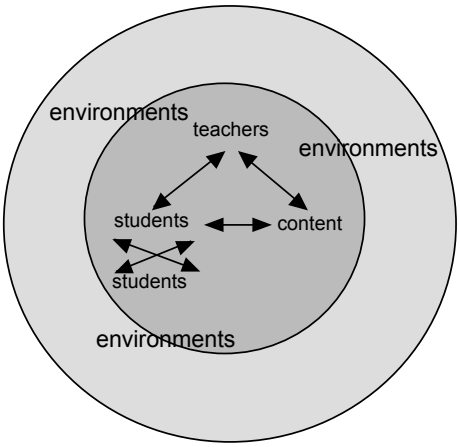

Figure 2. Mathematics-instructional Triad, with Cohen & Ball's (2000) focus on interaction

understanding of space and the non-geographic (i.e., affective) meanings associated therein. To substantiate the spatial aspect of this framing, we draw primarily on human geography and Thrift's (2003) four conceptions of space: (a) empirical-constructing space, or the ways in which space is rendered measurable or objective; (b) interactive-connective space, or the pathways and networks that constitute space; (c) image space, the visual artifacts that we readily associate with space; and (d) place space, or our everyday notion of spaces in which human beings reside (p. 102). These conceptions of space form a spatial logic that is not limited to a geographical sense of urban space and that takes into account meanings associated with space. The strength of articulating four distinctive conceptions of urban allows one to look across their various permutations in ways that provide a nuanced perspective on space.

Social-signification axis of the framework

"Urban" is not simply a geospatial concept; it also carries social and political meanings. Accordingly, urban mathematics education scholarship must engage its social and political dimensions—i.e., relating mathematics teaching and learning to the many ways in which urban can be experienced, influenced, shaped, and contested. Toward offering some conceptual framings, the social-signification axis of our framework includes Leonardo and Hunter's (2007) three significations of urban: urban-as-sophistication (or cosmopolitan space), urban-as-pathological (or urban as "dirty, criminal, and dangerous;" p. 789), and urban-as-authenticity (or the politics of authenticity). This view of urban as more than just physical space also challenges the prevalent use of urban as a proxy descriptor for poor, Black, and Brown populations who inhabit these spaces and disproportionately fall victim to the segregation and concentrated poverty (Darling-Hammond, 2013). Such employment of "urban" ignores the heterogeneity of urban space, its politics, its people, and their experiences (Fischer, 2013).

Theory-Moment Axis of the Framework

Stinson and Bullock (2012) outlined four moments of mathematics education research since its emergence as a research domain. These moments—the process-product moment, interpretivist-constructivist moment, social-turn moment, and socio-political-turn moment—are characterized by particular theoretical orientations—cognitivism, interpretivism/constructivism, sociocultural theories, and theories of power, respectively. These moments are overlapping categorical periods of research, practice, and policy (also see Gutierrez, 2013). These periods have often been indexed by a crisis metaphor (Washington, Torres, Gholson & Martin, 2012).The third axis incorporates these moments and the associated theoretical orientations.

With a third axis in the framing, we attempt to construct what could be called a mathematical-socio-spatial dialectic. That is, we situate the mathematics-instructional triad within the dimensional space of not only the socio-spatial dialectic but also with respect to the ongoing "moments" of mathematics education theory and practice (Stinson & Bullock, 2012; also see Martin & Larnell, 2013). Put differently, the axes represent the intersectionality of geography (or spatiality), social opportunity, and the development of mathematics education, which is what Tate (2008) originally outlined.

Implications: Urban Mathematics Education and Equity

Central to this framework is the understanding that urban mathematics education is a complex domain in its own right. It is *more than just* mathematics education performed with—or on—people who are labeled "urban" based on race and/or class signifiers. Additionally, it is more than just a descriptor for situating traditional or reform-oriented mathematics teaching and learning in certain locales (i.e., the "inner city"). Thus, it is important that we address explicitly the need for a consideration of urban mathematics education that is separate from—yet connected to—prevailing equity discourse in mathematics education. Examining mathematics education in urban spaces through an equity-oriented lens appropriately centers conversations on children of color and their mathematical identities and experiences. However, engagement with the urban in such work is often limited either to contextual descriptors connected to racial demographic and free-and-reduced-lunch data or to situated applications of mathematics curricula or pedagogies in spaces inhabited by people who are largely Black and/or Brown and poor.

As a descriptor in research, "urban" functions as a sort of veil. This veiling allows the researcher to acknowledge race and class in superficial ways that obscure weightier systemic issues related to race and class. This urban-as-veil perspective also frames our collective understanding of urban populations in ways that—perhaps ironically—obscure populations that do not align with notions of urban educational contexts as Black, Brown, and/or poor. The challenge with this veiling is that it allows equity discourse to disengage from the substantive issues in urban education, racism, and classism that inhabit mathematics classrooms and other aspects of the "network of mathematics education practices" (Valero, 2012, p. 374). We propose that this framework for urban mathematics education encourages a more complex understanding of "urban" that attends to the role of place in mathematics education and, additionally, unveils race and class as distinct categories that each warrant significant analysis in their own right.

These examples represent common ways in which equity discourse interacts with the urban in mathematics education. However, these approaches miss possibilities for understanding the implications of place on mathematics teaching-and-learning environments. We propose that engaging the elements of this framework allows equity-oriented mathematics education researchers to remove the urban veil in a way that acknowledges the roles of place, race, and class as distinct and mutually constitutive. Specifically, it aims to position urban mathematics education as a system of connections among mathematics, race, class, power, and the politics of space. This positioning allows mathematics education researchers to explore the interactions between geography and opportunity within a multidimensional framework that acknowledges the political underpinnings of opportunity gaps that equity discourses reveal.

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