Toward a socio-spatial framework for urban mathematics education scholarship

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Gregory V. Larnell

University of Illinois at Chicago

Erika C. Bullock

University of Memphis

Author Note

Gregory V. Larnell, Department of Curriculum and Instruction, University of Illinois at Chicago. Erika C. Bullock, Department of Instruction and Curriculum Leadership, University of Memphis.

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Correspondence concerning this manuscript is welcomed by both authors: Gregory V. Larnell, Department of Curriculum and Instruction, College of Education, University of Illinois at Chicago, 1040 West Harrison Street (MC 147), Chicago, IL 60607. Contact: glarnell@uic.edu. Erika C. Bullock, Department of Instruction and Curriculum Leadership, College of Education, Health and Human Sciences at University of Memphis, 419A Ball Hall, Memphis, TN 38152. Contact: Erika.Bullock@memphis.edu.

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Toward a Socio-Spatial Framework for Urban Mathematics Education Scholarship

> 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 (Tate, 2008, p. 7).

During the past two decades, urban mathematics education has emerged as a vibrant new area of scholarship—evinced most recently by the arrival and proceedings of the *Journal of Urban Mathematics Education* (*JUME*). The roots of this subdomain of mathematics education extend back at least to efforts during the 1980s (see Tate, 1996), concurrent with the development and publication of standards by the National Council of Teachers of Mathematics (NCTM) for mathematics curriculum and evaluation (1989) and for the practice of mathematics teaching (1991). These developments also coincided with commensurable shifts in research; mathematics education scholarship around the world was entering its much-discussed social turn (e.g., Meyer & Secada, 1989; also see Lerman, 2001; Martin & Larnell, 2013; Stinson & Bullock, 2012). For researchers, teachers, policymakers, and education-interested foundations in the United States (e.g., Ford, 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 presentation is to broaden the discourse in urban mathematics education in ways indicated by the above epigraph excerpted from Tate's (2008) commentary in the inaugural issue of *JUME*. Urban mathematics education scholarship 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 the present 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 Scholarship

In the spirit of addressing Tate’s challenge (also see 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 situate this framing squarely (but not entirely) in mathematics education scholarship—using as our central unit of analysis the well-regarded math-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.

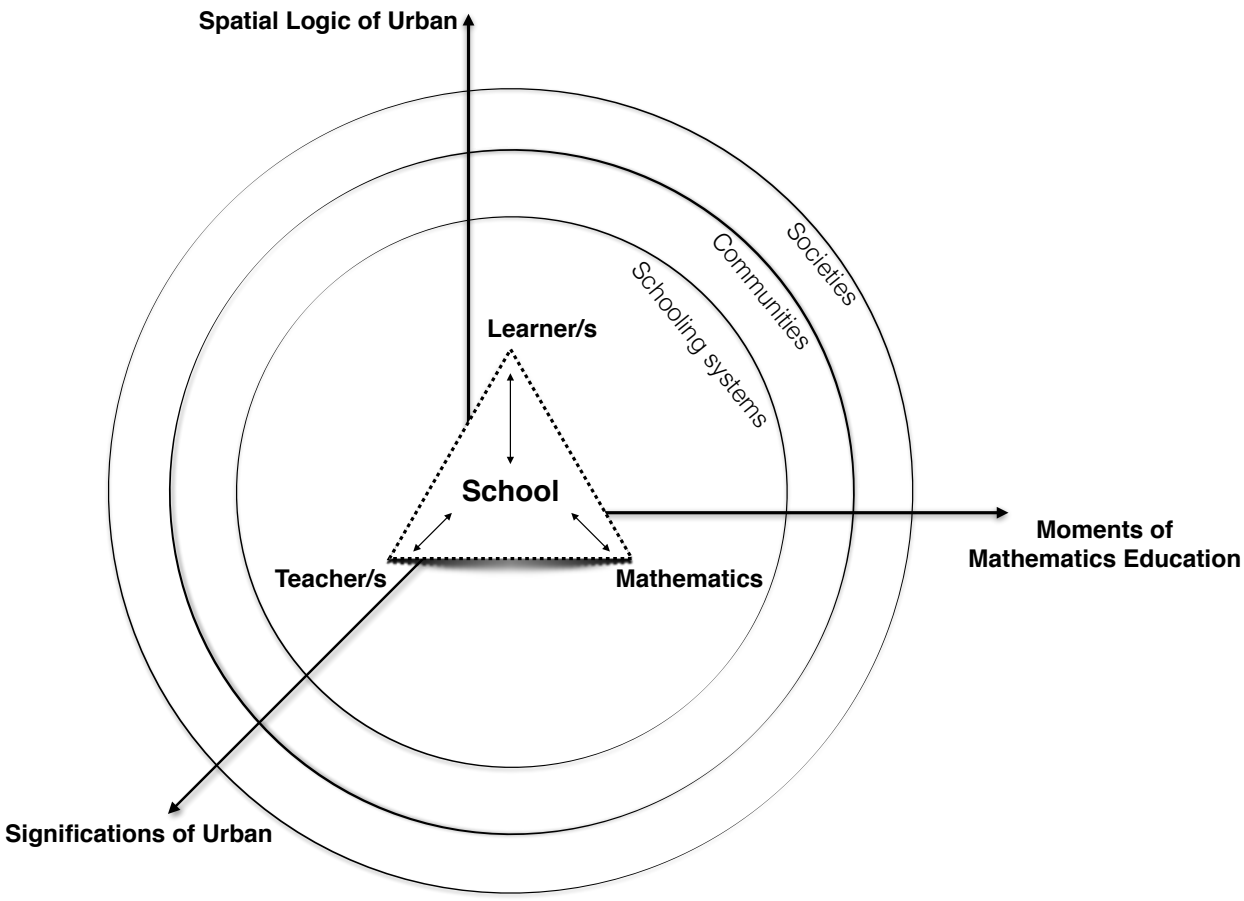

Figure 1. Socio-Spatial Framework for Urban Mathematics Education Scholarship

Extending beyond mathematics education, we look 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). 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) and urban sociology (e.g., Johnson, 2012). The coordinate representation is intended to signal a socio-spatial dialectic regarding the urban—that is, that the social significations and spatial considerations necessarily intersect to determine meaning for urban such that, as Tate (2008) suggested: "to realistically reflect how [spatial] geography and [social] opportunity in mathematics education interact."

Math-instructional triad as the central element of the framework

At the center of our framework are the interactions and participation among learners, among teachers, among learners and teachers, and other interactions permuted according to learners, teachers, and mathematics curriculum (see Figure 2). As Cohen and colleagues (2003) suggest, "Teaching is what teachers do, say, and think with learners, concerning content, in particular organizations and other environments, in time" (p. 124). This depiction of a triadic relationship is traceable beyond mathematics education scholarship to the works of John Dewey, Jerome Bruner, Theodore Sizer, and others (Cohen & Ball, 2000). In terms of the diagrammatic representation of the framework, the triad represents a kind of coordinate point with respect to the social, spatial, and math-education "theory-moment" axes.

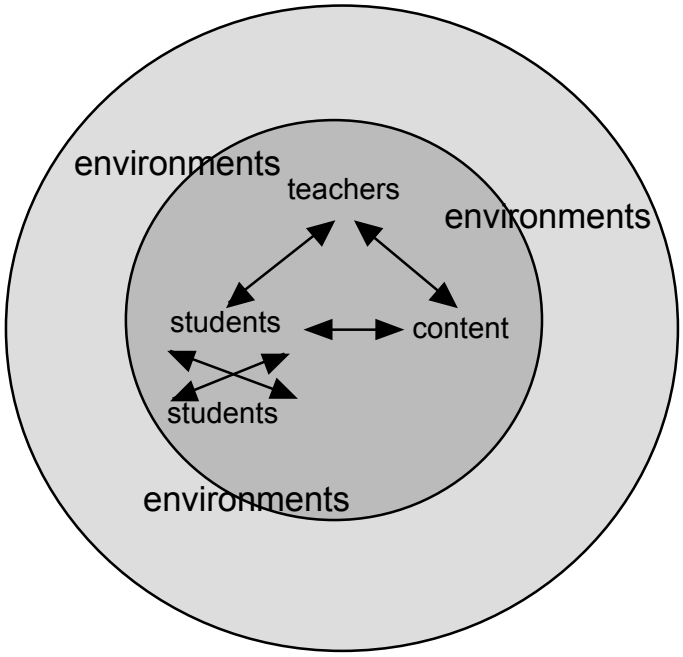

Figure 1. Math-instructional Triad, with Cohen & Ball's (2000) focus on interaction

Spatial axes of the framework

To substantiate the spatial aspect of this framing, we draw primarily on and discuss Thrift's (2003) for conceptions of space in relation to the other aspects of the framework: (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 certain kinds of spaces; and (d) place space, or our everyday notion of spaces in which human beings reside—even if notions of "human" and "being" are actively being reconsidered (p. 102). Each of these types refers to ways in which space is conceptualized in relations to human geography, and not necessarily with respect to either a strictly geographical sense of urban spaces or the meanings that are derived from them. This allows us to avoid constraints of a spatial logic that is determined solely by, for instance, characterizations based on population density or physical geography (see Milner,

2012). 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

It is clear that urban is not simply geospatial; it also carries social and political meanings. Therefore, considerations of the urban in mathematics education must engage these social and political dimensions directly because "'place matters' in the study of urban mathematics education" (Rousseau Anderson, 2014, p. 10). 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). It has become apparent that "urban" does not always refer to the geographical urban space; rather, studies have used the label 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 that often characterize these spaces (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

With a third axis in the framing, we attempt to construct (at least initially) what could be called a mathematical-socio-spatial dialectic. That is, we situate the math-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. The moments of mathematics education—the "process-product," "constructivist-interpretivist," "social turn," and most recently perhaps, "sociopolitical turn"—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).

A Curricular Example

To give you a sense of how we might realize this framing in terms of curriculum, let me describe the contours of a classroom-level task that might be aligned to such a framework. In this current moment in math education, there has been considerable momentum toward developing Freirian social-justice oriented tasks that use math as a tool with which young learners may "re-read and re-write the world." This aligns with our socio-political turn axis in math education. To relate to the other axes, the purpose of this task could be for learners to question the arrangement of public transportation in an urban city and plot out a new system that might lead to more accessibility for its citizens. Without detailing the mathematical concepts, procedures, and processes involved, the task would require students to position themselves as urban planners and negotiate the relationship between the interactive-connective function of public transportation (which corresponds to our spatial axis) and the extent to which that feature of urban space relates to sophisticated and pathological significations of urban--i.e., the extent to which access to public transportation might contribute to or interrupt certain urban conditions.

This is a single curricular example, but we use it to argue that tasks that engage with the interconnections of the three axes of this framework will fall under the purview of urban math education. Admittedly, this example is located in the curricular realm and we have proposed a framework for math education *scholarship*. How, then, do these connect? Researchers who engage urban math education must first acknowledge urban math education as a domain itself rather than a collection of disparate features of race and class. It is only then that urban math

education can become visible and realistically reflect how geography, opportunity, and math education interact.

So, what has the study of urban math education entailed? And what can it become? These two questions represent past and future orientations for urban math education. Our goal is to bring together a set of concepts that can map present scholarship toward potentially more robust future research. The proposed framework brings together math teaching and learning, on the one hand, and the ever-evolving relationship between urban space and urban conditions (or meanings) on the other.

Objectives, Connections to Principles to Action, and Structure of the Session

The primary objective of the paper is to engage the task of conceptualizing urban mathematics education scholarship by offering a theoretical framing that pushes beyond traditional notions of "urban" in relation to education and mathematics education particularly. Our hope is to continue building and refining this framing toward application in research on mathematics learning, teaching, policy, and curriculum in urban spaces. We see this purpose mapping on to the NCTM *Principles to Action*--namely the need to inform the process by which principles become action, particularly in urban classrooms and districts. By examining the calls that *Principles to Action* forwards--particularly the attentiveness to issues of access and equity as essential elements--we hope to deepen the collective discourse regarding the well-cited challenges of urban mathematics education while adhering to the "nonnegotiable belief" of developing the enterprise of mathematics education for all students.

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