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Revisiting Urban Mathematics Education: Towards Robust Theoretical, Conceptual, and Analytical Models

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There are unique, enduring challenges related to mathematics instruction in urban schools, and the most common concerns are related to issues of equitable access to mathematics learning opportunities. In this editorial, we argue that the complexity of teaching mathematics in urban schools requires the attention of mathematics scholars with unique training, expertise, and experiences. Developing mathematics instruction for urban spaces often involves refined research techniques, multi-disciplinary perspectives, and collaboration between diverse stakeholders. Specificity is the key to addressing these challenges. However, to date, the *Journal of Urban Mathematics Education* (*JUME*)—out of 69 mathematics education-focused journals (Nivens & Otten, 2017)—is the only journal venue devoted to mathematics teaching and learning in urban environments. Although other mathematics education journals and conferences accept scholarship related to urban schools, due to the vast nature of mathematics education research and limitations in journal space, the nuances of specific issues in urban mathematics education (e.g., preparing mathematics teachers well for high-needs urban schools) are underexamined and poorly understood.

Urban Mathematics Education Revisited

Many urban education journals accept mathematics education scholarship, but the challenge of specificity remains. Scholarly venues for publishing mathematics education research can sometimes lack the contextual depth necessary for understanding issues related to urban learning environments, while urban education research venues can lack an emphasis on the

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mathematics context in both teaching and learning. *JUME* provides a space for mathematics discourse at the intersections of mathematics education and urban education to inform the teaching and learning of mathematics in urban spaces.

Increasing the capacity of the next generation to realize the utility of mathematics is a shared goal of the broader mathematics education community. Yet, there is consensus amongst the leading organizations for mathematics education research and teacher preparation (e.g., the National Council of Teachers of Mathematics [NCTM], the Association of Mathematics Teacher Educators [AMTE], the Research Council on Mathematics Learning [RCML]) that the realization of this goal is highly dependent on the ability of the field to better serve all learners. According to NCTM (2014), "addressing equity and access includes both ensuring that all students attain mathematics proficiency and increasing the numbers of students from all racial, ethnic, linguistic, gender, and socioeconomic groups who attain the highest levels of mathematics achievement" (p. 1). Likewise, AMTE (2015) encourages mathematics teacher educators to strive to do the following:

> Recognize, challenge, and ultimately transform structures and systems of inequity that lead to inequity in mathematics learning and teaching based on race, culture, class, gender, sexual orientation, language, religion, and dis/ability in mathematics education, and empower P–12 teachers to do the same in their own classrooms. (p. 1)

Together these statements encompass the needs of a large segment of the population of learners historically underserved by mathematics education. However, what remains unseen is a similar commitment to the unique needs of learners in specific environments (i.e., rural, urban, and suburban spaces). Here we suggest reframing the equity goals of mathematics education and specifically urban mathematics education to reflect the need for *quantitative civic literacy*. In this article, we define quantitative civic literacy as the ability to formulate, employ, and interpret situations within and beyond one's community and other societal contexts quantitatively. In 2019, Raygoza questioned, "as we do the work of reimagining mathematics classrooms as interdisciplinary, problem-posing spaces that connect to students' lives, communities, and the world, how can we help prepare young people to develop as civic actors, using their mathematical knowledge and skills to build their *quantitative civic literacy?*" (p. 26). We contend that answering this question should be at the heart of urban mathematics education research and practice.

According to Martin and Larnell (2013), scholars of *urban mathematics education* should place attention on issues of power, race, and identity while addressing geospatial concerns locally and internationally through theoretically and empirically sound research. This can inform teaching, learning, and policy in urban mathematics classrooms. Importantly, urban mathematics education requires a geospatial perspective and approach to research and practice. A geospatial view "increases our understanding of education… by framing research in the context of neighborhoods, communities, and regions" (Tate et al., 2012, p. 426) and is important for urban mathematics education. Although mathematics teacher shortages, teacher quality, and standardized testing are common challenges, the influences of these factors are highly contingent upon the environment involved.

National mathematics achievement trends indicate that learners in urban spaces continuously underperform based on data from the National Assessment of Educational Progress (NAEP). For instance, only 31% of fourth graders and 27% of eighth graders in urban schools are proficient in mathematics based on data from the NAEP Trial Assessment of Urban Districts (National Center for Education Statistics, 2017). Mathematics education scholars also recognize that persistent learning differences present in urban spaces require further attention from the mathematics education research and teacher education community (Capraro et al., 2009; Varelas et al., 2012). However, conducting mathematics education research in urban spaces is only the first step toward urban mathematics education research and fostering quantitative civic reasoning.

For example, McKinney et al. (2009) examined the pedagogical and mathematics instructional skills of 99 in-service teachers serving in a high-needs urban elementary school. The researchers used NCTM's (2000) *Principles and Standards for School Mathematics* as a framework to characterize the practices of the teachers in their study. The results indicated the mathematics teachers in this urban school strictly adhered to the curriculum and pacing guides, with minimal deviation, therefore failing to address unique student needs and/or attenuating instructional differentiation. Additionally, the mode of instruction was often lecture with an emphasis on memorizing algorithms and procedures through drill and practice. Although this is only one depiction of teaching and learning mathematics in urban settings, the authors recognized that given the unique challenges facing urban schools, these practices were problematic. The practical significance of improved mathematics teaching and learning in urban schools is critical and should not be understated. Yet, the actualization of specific pedagogical trends, policies, and practices in urban schools has been historically hindered by a lack of robust theoretical, conceptual, and analytical models to move the field forward.

In the inaugural issue of *JUME,* one of the foremost scholars in urban mathematics education, William Tate, urged the field to "build theories and models that realistically reflect how geography and opportunity in mathematics education interact" (Tate, 2008, p. 7). Tate's rationale was that if urban mathematics education scholars and educators do not develop and test theories pertinent to urban environments, they cannot adequately inform classroom practices in urban schools. As mentioned above, *JUME* is the lone scholarly outlet dedicated to urban mathematics education scholarship and thus remains the steward of the theory development, knowledge construction, and practical application related to urban mathematics education research. *JUME* is highly regarded within the field of mathematics education, yet urban mathematics education cannot support instructional practices in high-needs classrooms if robust theoretical, conceptual, and analytical models are not at the fore-front of the knowledge generation process for the academic gatekeeper of urban mathematics education.

Therefore, as we onboard the new *JUME* leadership team, we aim to continue emphasizing "theory building and empirical evaluation" (Tate, 2008, p. 6) while placing increased emphasis on scholarship that unpacks, critiques, and reframes our current understandings of urban mathematics education. These works should foster new scholarly directions for experts and provide a deeper understanding of urban mathematics education for novice

urban mathematics education researchers. These intellectual interactions are essential to the development of robust theories, practices, and policies that support the teaching and learning of mathematics in urban schools.

Towards Robust Theoretical, Conceptual, and Analytical Models

As the new editorial leadership of *JUME*, we are dedicated to the nexus between theory and practice. Thus, we are soliciting manuscripts that promote robust theoretical, conceptual, and analytical models, as well as manuscripts that inform the development of quantitative civic literacy for urban teachers and learners. To this end, the new editorial team is seeking the following submission genres to support the development of theory, policy, and practice to inform urban mathematics educational praxis in quantitative civic literacy:

1. Evidence Synthesis and Systematic Reviews

A systematic review provides empirically derived summaries of the research literature that can be either quantitative (i.e., meta-analysis), qualitative (i.e., metasynthesis), or hybrid. Arguably, one of the most important aspects of a systematic review is the ability to characterize the effectiveness of interventions on important outcomes related to teaching and learning mathematics in urban spaces. These data are essential to the knowledge construction process as it relates to theory and model building. Comprehensive systematic reviews are essential to the development of theories and models to support mathematics teaching and learning in urban schools. For instance, a systematic review of the literature outlining the development and characterization of quantitative civic literacy within mathematics education would help to move the field of urban mathematics education forward. Unfortunately, *JUME* has had limited success publishing evidence synthesis and systematic reviews (i.e., research synthesis, meta-analysis, and metasynthesis). There are many promising new directions and approaches to systematic reviews, such as mixed-methods research syntheses, network meta-analyses, and Bayesian meta-analyses. Ultimately, the new *JUME* editorial team asserts that urban mathematics educational researchers need to synthesize the literature to move the field forward by assessing trends and identifying unknowns.

2. Broader Use and Application of Different Theoretical and Conceptual Approaches to Mathematics

Mathematics and the teaching and learning of mathematics is not limited to the mathematics classroom (Berry, 2021). As such, how students interact with and learn mathematics across contexts as well as how teachers can find opportunities to teach mathematics should be investigated. This work can draw on informal learning environments accessible to learners in urban contexts. Explorations of integrated learning, such as high-quality STE(A)M learning experiences (e.g., Roberts et al., 2019), in both formal and informal settings are also necessary. Researching how mathematics is meaningfully learned, taught, and/or applied in other subject areas is also important. By expanding the focus beyond the formal mathematics classroom, mathematics education research will contribute to the goals of *Catalyzing Change* (NCTM, 2020) by exploring how various theoretical and conceptual approaches allow us to broaden the purposes of learning mathematics and develop deep

mathematical understanding (Berry, 2021). Informal mathematics learning experiences are uniquely suited to examine quantitative civic literacy, as the informal nature of these settings provide a natural conduit to community and students' lived experiences.

3. Participatory Action and Youth Participatory Action Research

Finally, participatory and youth participatory action research is necessary to move robust theoretical, conceptual, and analytical models into mathematics education classrooms to deconstruct power dynamics, challenge authority, and restore dignity for all in mathematics classrooms. According to Gutiérrez (2017),

> We cannot claim as our goal to decolonize mathematics for students who are Black, Latinx, and Aboriginal while also seeking to measure their 'achievement' with the very tools that colonized them in the first place. When we consider the relationship of power to mathematics, we cannot be content with notions of power that are limited to solving difficult problems in mathematics classrooms. We must be open to deconstructing power dynamics, challenging authority, restoring peace and dignity, repairing settler colonialism, and positing new questions that need to be asked. (p. 12)

Participatory and youth participatory action research in mathematics classrooms are characterized by researcher-initiated inquiries that provide unique opportunities to center the inquiry around issues of equity and social justice (Desai, 2019), partnerships developed by in-service teacher-researchers within schools (Raygoza, 2016), and researcher-student partnerships within out-of-school time activities (Mackey et al., 2021). We argue that partnerships between mathematics education researchers, teachers, students, parents, and the broader community are essential for the actualization of change in urban mathematics education through the development of quantitative civic literacy.

Conclusion

Teaching mathematics in urban schools requires specialized knowledge and skills, which is more than just knowledge related to fostering classroom access, equity, and diversity. On the contrary, knowledge of access, equity, social justice, and diversity are requisite to successful teaching in all mathematics classrooms. Thus, these skills are necessary for teaching in urban schools but insufficient. In this commentary, we argue for a reframing of urban mathematics education in a manner that promotes quantitative civic literacy. Specifically, given our dedication to urban mathematics education, it is imperative that we foster the ability of students and teachers in urban spaces to formulate, employ, and interpret their lived experiences through a critical quantitative lens in order to place attention on issues of power, race, and identity that can influence teaching and learning in urban environments. Moreover, we hope to realize the initial goals of urban mathematics education by soliciting manuscripts that promote the development of robust theoretical, conceptual, and analytical models to support the field. As the new stewards of *JUME*, we will work diligently to reach this goal by continuing the dedication to excellence set forth by the editorial teams of the past and moving the journal forward to increased success in the future.

Biographies

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