Introduction:
Innovative STEM Professional Development for Urban Educators: Multiple Perspectives on the MSUrbanSTEM Project

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In this article, we provide a brief overview of the contents of this special issue of the Journal of Computers in Mathematics and Science Teaching. The issue focuses on an innovative teacher professional development program for STEM educators working in urban contexts. More specifically, 124 STEM educators from Chicago Public Schools, seeking to develop their teaching and leadership capacity, participated in a yearlong blended learning experience designed by faculty at Michigan State University. The six articles in this special issue provide multiple perspectives (theoretical, curricular, and research-based) on the project, allowing us to present the project in its complexity and richness, something that individual articles would not be able to do. This introductory article provides some context and background for the overall program, highlighting what each of the five subsequent articles in the issue will cover.

> *I think that all schools and all theories can be useful in particular places and at given times. … as time goes by, and as we change, objectives vary and the point of view moves around…. For a point of view to have any useful purpose, you have to be completely committed to it and defend it to the death. And this even when a little voice is murmuring inside you at the same time "hold on tightly, let go lightly." — Peter Brooks in the Shifting Viewpoint*

> *We should never lose sight of the fact that children and teachers in classrooms are conscious, sentient, and purposive human beings, so no scientific explanation of human behavior could ever be complete. In fact, no unpoetic description of the human condition can ever be complete. —David Berliner*

In this article, we provide a brief overview of the contents of this special issue of the *Journal of Computers in Mathematics and Science Teaching*. The issue focuses on an innovative teacher professional development program for STEM educators working in urban contexts: The MSUrbanSTEM project (msurbanstem.org). More specifically, 124 STEM educators from Chicago Public Schools, seeking to develop their teaching and leadership capacity, participated in a yearlong blended learning experience

designed by faculty at Michigan State University. The six articles in this special issue provide multiple perspectives (theoretical, curricular, and re-search-based) on the project, allowing us to present the project in its complexity and richness, something that individual articles would not be able to. This introductory article provides some context and background for the program overall, foreshadowing and highlighting what each of the five subsequent articles in the issue will cover.

Introduction to the Project

One hundred and twenty-four teachers from Chicago Public Schools participated in an inventive, integrated yearlong professional development program aimed at building STEM teachers' capacity to lead and inspire innovative practices in urban K-12 schools. This program was designed and implemented by faculty and staff in the Master of Arts program in Educational Technology at Michigan State University. These teachers were selected by the *College of Education* at *Michigan State University* through a rigorous process based on their commitment to teaching in urban schools, knowledge of content, and prior achievement and evidence of promise in the field. Participants received a graduate certificate in STEM and Leadership from Michigan State University and nine masters level credits that they could transfer towards a master's degree in the future. They also received monetary support in the form of a scholarship, a tablet computer for their use. Finally, they had to commit to two years of post-graduation service as a STEM teacher in urban schools.

The design of the MSUrbanSTEM program built on our prior experience with the Master of Arts Program in Educational Technology (the MAET program). Specifically, the MAET program uses a unique and rigorous approach towards instruction and professional development with the goal of supporting and developing thoughtful, innovative practitioners who integrate content, technology and pedagogy in creative ways.

Some of the key tenets of the approach were:

Learning by Design. The instructional approach involved real world, hands-on engagement with tools, pedagogies and their relationship to core constructs in the STEM disciplines.

Deeply connected to classroom practice and standards. The design of the instruction was driven by the needs of real teachers as they wrestle with problems of practice. In this, focus is maintained both on powerful disci-

plinary ideas even while keeping state and national standards (such as Common Core standards) in mind.

Multiple levels of conceptual integration across modes of delivery. The MSUrbanSTEM program integrated across multiple modes of delivery (face-to-face, hybrid and online), to find the appropriate balance between these different modes of interaction for maximal support for the broader pedagogical goals of teacher professional development.

Innovative use of technology. The emphasis in the MSUrbanSTEM project was not on imparting knowledge on the latest and greatest tools but rather aimed to help teachers thoughtfully repurpose existing tools at their disposal to meet student-learning goals.

Development of learning communities. The MSUrbanSTEM learning community extended well beyond the time spent in specific programs or courses. The fellows become part of affinity groups that span across the world and could avail of the collective expertise of the community.

The Special Issue: Multiple Perspectives on MSUrbanSTEM

Research on educational programs faces a fundamental and essential tension. By definition, research tends to be driven by specific theoretical frameworks and research questions, generating their strength from this specificity and narrowness of vision. But educational researchers also understand that there is much more to the project or activity than was or could be captured by *one* study. Any article that seeks to provide an overview of the project provides breadth but lacks depth and specificity. We believe that this special issue provides the right balance between breadth and depth—by allowing us to construct a richer description of a teacher professional development program through five articles, each of which use different lenses. It is through these articles that some of the richness of the project can be captured and presented to readers.

The first two articles provide a broader context for the overall project. The first article by Seals, Mehta, Wolf and Marcotte (*Theory and implementation of an innovative teacher professional development program*) focuses on the underlying theoretical and epistemological frames that the designers of the program kept in mind as they developed MSUrbanSTEM. The second article, by Horton, Shack and Mehta (*Curriculum in practice of an innovative teacher professional development program),* describes how the theoretical and epistemological frames described in the first chapter actually becomes instantiated in practice and curriculum. After setting the theoretical

and curricular context the next three articles focus on different aspects of the project in a more data-driven manner. The article by Rosenberg, Greenhalgh, Wolf, and Koehler (*Strategies, Use, and Impact of Social Media for Supporting Teacher Community within Professional Development: The Case of one Urban STEM Program*), focuses on the use of social media in the program, specifically on how communication tools (such as the website, Facebook and Twitter) were used to support the development of community across the program. The last two articles provide case studies of teachers who were members of MSUrbanSTEM around their learning and experience in science and mathematics. The article by Mehta, Mehta and Seals (*A holistic approach to science education: Disciplinary, affective and equitable)* describes the work, methods, and experiences of three science teachers who took initative to explore, create, and share engaging learning experiences for their students. Finally, the article by Cosby, Berzina-Pitcher, and Horton (*Math is all around us: Exploring the teaching, learning and professional development of three urban mathematics teachers)* provide three case studies of mathematics teachers, seeking to demonstrate how, these teachers, despite a host of challenges, developed projects that provided meaningful learning opportunities for their students.

All in all, the articles in this special issue speak to different aspects of theory, research, and practice – they attempt to go beyond the specifics or intricacies of tools, and towards providing a broader framework, or guiding ideas and takeaways that can inform how we think about teacher professional development in urban contexts around STEM. One of the strengths of this special issue is that it allows readers to get a rich, multi-faceted holistic picture of the MSUrbanSTEM project, which would not be possible from just a single article. We believe that it allows for a more sophisticated understanding of a range of ideas and perspectives and has the potential to inform the design and implementation of teacher professional development programs in the future.

Credits

This special issue (and the program that helped create it) is the result of the hard work and effort of a large team of people. First and foremost we would like to thank Gary Marks, wearer of many hats, including editor of the *Journal for Computers in Mathematics and Science Teaching*, for his support for this special issue. From the moment we broached the idea to him (over 2 years ago) to this day, Gary has been helpful, flexible and available.

CONCLUSION

We believe that this special issue will be an important step toward exploring new models of teacher professional development in the STEM disci-

plines. In conjunction with our authors, we have tried to bring ideas, theory and strategy to the table to serve teacher educators in preparing the teachers of tomorrow.