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"Cultures as Toolboxes": An Introduction to the Special Issue Focused on STEM

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As Sandra Harding poses in the title of her book, *Is Science Multicultural?* (1998), so, too, does this special issue of the *Journal of Multicultural Affairs* raise a parallel (but expanded) question. Is the teaching of science, technology, engineering and mathematics (STEM) multicultural? And if so, what might or could this look like, and what are the implications? Harding (1998) hints at the possibilities, stating, "...nature itself is heterogeneously organized such that there can be no one uniquely valid representation of it" (p. 67). So again, is STEM multicultural, and if so, in what ways?

In beginning to answer these questions, the six articles included in this special issue speak to different aspects and qualities of this complex set of issues. With each article pressing on some point related to the ways the field of STEM is deeply tangled in matters of oppression, marginalization, invisibility, and generally hegemonic beliefs and practices, the authors included here give voice to issues, ideas, and innovations that are urgent and compelling, and that illuminate ways forward for educators, researchers, and learners.

United by a common focus on honoring and building upon the lived experiences of learners, which often includes self, the authors in this special issue each speak with tremendous reverence and humility about the work and wonderings they present. With purposeful attention to elevating the voices and perspectives of those not traditionally included in STEM-related conversations, each article that follows provides a window into an urgently important line of thinking.

Beginning with a look at the work of early career teachers, Kyndall Brown, in his article titled, "Dispositions of First Year Teachers Who Teach Mathematics for Social Justice," follows the work of three recent graduates from his teacher preparation program. Building from their work in Brown's mathematics methods course as teacher candidates, and with a tight focus on the ways these new educators experienced and named their positionalities, Brown sought to illuminate the means by which the teachers worked to empower their students in specific ways. Using an inquiry project as a springboard for this social justice work in the context of mathematics, each of the three educators showcased in this work were able to create powerfully transformative projects that were tightly aligned to the Common Core State Standards for Mathematical Practices (National Governors Association for Best Practices & Council Chief State School Officers, 2010) (NGOBP & CCSSO), which serve as powerful examples for other educators to consider.

Similarly concentrating on the works of pre-service teachers in mathematics, Jim Ewing highlights the urgency in preparing educators to serve English learners. In his article, titled, "Facilitating Pre-service Teachers to Learn the Mathematical Practices and Engage English Language Learners," Ewing describes how he underscored the key constructs in two of the Common Core State Standards for Mathematical Practices (NGOBP & CCSSO, 2010) while simultaneously eliciting effective teaching strategies from his teacher candidates. Using a technique modeled after an approach described by de Oliveira (2011), Ewing strengthened and deepened the professional practices of his preservice teachers, to the point that he fostered a sense of empathy in the preservice teachers for the students in their care.

Without question, readers at any point in a teaching career can find points of connection in Ewing's work to familiar contexts.

Shifting the focus to the symbiotic learning experiences between a seasoned educator (a White male) and a 13-year-old Native American student, Colby Tofel-Grehl, in her article titled, "Critical Reflections on Teacher Conceptions of Race as Related to the Effectiveness of Science Learning," presents a case study attending to the use of e-textiles for instructional purposes, which represents a technology-infused spin on traditional needle-and-thread handiwork. The two perspectives Tofel-Grehl presents—that of the teacher and that of the student—provide a rich context with multiple points of entry for readers to consider. Speaking to the ways in which the thoughtful use of e-textiles in a STEM setting can lead to a sense of empowerment for students, and provide avenues for the incorporation of identity into STEM work, Tofel-Grehl invites readers to consider the ways in which the use of e-textiles may enrich the understandings of students and forge deep connections to the process of learning. Tofel-Grehl invites readers to envision the use of similar approaches in their own settings.

Noting the rise in unqualified and underqualified teachers in mathematics and science, Natalie King's contribution, "When Teachers Get It Right: A FOCUS on Black Girls' STEM Learning Experiences," foregrounds the voices of students—seven Black girls ranging from grade 4 to grade 7 - - who participated in community-based informal STEM learning, which took place during the summer. The summer STEM-focused program described in this piece amplifies the often-silence voices of Black girls, with King noting that "even though Black girls are interested in science and mathematics, they often feel unwelcomed and experience racism and sexism in their

classes." King's statement resonates beautifully with Harding's (1998) critiques of the pervasive eurocentricity in STEM fields, stating, "Central among the presuppositions of eurocentric discourses are that peoples of European descent, their institutions, practices and favored conceptual schemes, express the unique heights of human development" (p. 14). With an emphasis on "culturally healthy" practices (Ladson-Billings, 1989), King's work can provide educators with important insights into key ideas to best promote academic success and engagement in STEM learning.

Taking the conversation to highlight practices at the institutional level, G. Sue Kasun and David Lopez describe programs implementing *Native science* in their article, "Native Science in Practice: Cases for Broadening Understanding and Engagement of Science in Education as a Plea for Future Generations." I am made to think, again, of the work of Harding (1998), as she notes, "Different peoples are repositories for historically developed and continually refined beliefs about different parts of nature" (p. 64). Echoing this idea, and beginning with a nuanced description and working definition of Native science, Kasun and Lopez include contemporary connections to issues such as the Dakota Access Pipeline to help readers deeply conceptualize the key constructs in Native science. From here, Kasun and Lopez provide illuminations of "academic programs that have have incorporated Native science in indigenous communities by integrating concepts of Native science in the curricula." Kasun and Lopez conclude with implications for classroom teachers, underscoring the need for deep familiarity and intimacy with the local cultures of students and the broader community, and include a press to focus on "larger cultural

factors and discontinuity that act as barriers for indigenous students.”

Finally, authors Lisa Zagumny, Holly Garrett Anthony, and Sally Pardue turn the research lens in a new direction as they interrogate their own study of women in the field of engineering. Returning to a set of data they collected ten years ago, Zagumny, Garret Anthony, and Pardue, in their article titled, “Becoming Women Engineers: Dismantled Notions and Distorted Perspectives,” find that time has provided them with new and more relevant insights. I am reminded of a quote by Gudmundsdottir (2001), who said, “Through years of participation in a given cultural activity, people in all cultures gradually develop distinct ways of knowing about, understanding, and perceiving their shared physical and social reality (p. 231).” With Zagumny, Garret Anthony and Pardue being enlivened by fresh perspectives, this generative re-visiting of their earlier work revealed new and important constructs that offer illuminative paradigms to those engaging in related research.

To return to the question posed in Harding’s (1998) text, *Is Science Multicultural?*, an answer emerges through the articles in this special edition. Hinted at in the title of one of Harding’s chapters, “Cultures as Toolboxes for Sciences and Technologies” (p. 55), I believe the answer is a yes, science (and technology, engineering, and mathematics) certainly have the potential to be multicultural, if we collectively rally against the systemically oppressive structures currently demarcating the borders and boundaries of STEM works. The common thread of pluralism which runs through each article, speaking to multiple perspectives and viewpoints, elevates the role of these varied voices such that the voices are central and even necessary to our ongoing work. With tremendous care shown in the reverential treatment of historically

marginalized perspectives and voices, each author has offered a new window into our collective thinking.

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