
STEM: Friend or Foe to Critical Mathematics Education?

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Should critical mathematics education (CME) embrace or reject the omnipresent STEM? We will outline some considerations and provide an interactive space for conversation on these and audience-motivated considerations. Audience participants are encouraged to come with responses to the session's title.

Overview

In the United States, and increasingly across the globe, science, technology, engineering, and mathematics (STEM) education is primarily linked to “vital preparation for today’s high-tech information economy” (Drew, 2011, p. 1) and has become a priority. However, the emphasis on human capital directly conflicts with goals of critical mathematics education (CME) (e.g. Gutstein 2008, Wolfmeyer, 2014). The confluence of actors promoting and implementing STEM also oppose more broadly the goals of critical education, especially via its conflation of reason, science, and technology, as this conflation contributes significantly to the ecological and social crises (e.g. Bowers, 1993; Martusewicz, Edmundson, & Lupinacci, 2011). This interactive symposium will first orient the audience to critical math education (e.g., Frankenstein, 1983; Gutstein, 2006; Skovsmose, 1994), then lay out the basics of STEM policies and discourses (e.g. Drew, policy statements). Next, we suggest that STEM conflicts with CME, and includes roundtable discussions for audience participation. We then argue the opposite: a robust optimism for STEM as a new site for CME. Finally, participants will share their own responses to the session title.

Section One: Conflicts between STEM and CME

To begin, we review a variety of work in CME (e.g. Frankenstein, 1983; Gutstein, 2006; Skovsmose, 1994). Next, each panellist will analyse an example of STEM conflicting with CME. Wolfmeyer discusses the emphasis that human capital plays in STEM education via his work-in-progress analysis of the STEM organization “Change the Equation,” via similar methodology used in Wolfmeyer (2014). He reveals a commitment to increased access to STEM careers, especially for women and people of color, and suggests this position is a soft-critical orientation to social justice in which economic relations of power are entirely ignored. To complement the social network analysis and results, Chesky presents her critical discourse analysis work on the media framing of STEM (Altheide & Michalowski, 1999; Fairclough, 1995; Lingard & Rawolle, 2004, Rogers, 2005). She reveals how U.S. news media portray STEM education as equitable practices that serve disadvantaged students, which misrepresents the objectives of STEM policy and conflates equity discourse to justify practices that are profoundly undemocratic (Gabbard 2000; Giroux, 2005; Martin, 2008). Next, Lupinacci presents an eco-critical (Martusewicz, 2001; Martusewicz et al., 2011) analysis of STEM, which broadens the CME perspective to address both social and ecological issues. We pose the inverse question: How can an ecological model, a heuristic for recognizing how we as humans culturally constitute and reconstitute understanding and how we might emphasize an ecological intelligence (Bowers, 2011)—or what Gregory Bateson refers to as an ecology of mind (Bateson, 1972; Bowers, 2011; Harries-Jones, 2002)—as the focal point for a subject inquiry be at the center of an integrated ecological inquiry? He focuses on the ways that mainstream STEM perpetuates the central cultural dualisms that subjugate.

Discussion Questions

1. Is STEM’s human capital emphasis, and especially its concern with increasing women and ethnic group success in STEM careers, in conflict with CME?
2. How does an eco-critical perspective engage previous critical math education scholarship; how does this broaden CME’s

- concern with STEM discursive practices?
3. What are other critiques of STEM policy, practice, discourse, and culture?

Section Two: Seeking the CME Space in STEM

Building off the session's devotion to *STEM-as-problem*, we next consider the possibilities of infiltration; despite our misgivings, how can we insert CME into STEM discourse, practices, and culture? In reviewing CME's application of mathematics content to social justice goals, Wolfmeyer merges mainstream STEM's interdisciplinary strengths (e.g. Straw, MacLeod, & Hart, 2012) with Gutstein's (2008) "reading and writing the world with mathematics." The interdisciplinary STEM space provides a fruitful setting for exploring social and ecological projects to be understood as CME. Chesky offers a distinct possibility for subverting STEM's economic objectives. Influenced by Badiou's (2003, 2005a, 2005b, 2008) theory of "event", Chesky argues that there is an aesthetic dimension of mathematics that is indeed part of the discourse of STEM. Following scholars (Sinclair, 2001; Tymoczko, 1993; Wang, 2001) who have begun to conceptualize an ontological awareness of mathematics, she explores techniques and curricula choices that insert the arts and ecology in STEM that meet both the dominant aims of STEM policy as well as the transformative visions of critical mathematics. Finally, Lupinacci proposes how the STEM space can challenge modernist Western industrial dualisms and their associated discursive influences to map an Either/Or onto how we—as educators and educational researchers—interpret the differences between STEM content and arts. The Deleuzian definition of difference offers a potential for reconceptualising STEM curriculum in support of social justice and sustainability, and these are linked to CME goals. Drawing from Deleuze (1994) and Bateson (1972), he examines the potential of pedagogical projects that recognize, respect, and represent difference as a valued productive and interpretive condition upon which everything exists. He introduces a theoretical approach to reconstituting STEM as inseparable from, rather than superior to, the arts (STEAM), with concrete examples.

Discussion Questions

1. Can the STEM space be successfully infiltrated by CME?
2. Do the examples of infiltrated-STEM as presented comport with mainstream STEM goals or truly subvert these?
3. What are other examples of infiltrating the STEM space?

Section Three: Discussion

The session's goal is to spark interest in, and dialogue with, the title question; participants come prepared with their own considerations about CME's place in STEM. We invite inquiries reflecting a broader conception of STEM. We hope the final discussion will critique STEM and present it as a space for infiltration. How are critical mathematics scholars engaging and working within STEM educational spaces and/or habits of mind? We encourage participants to draw from among the variety of frameworks appropriate to critical work, including critical race theory and critical disability studies and with goals that counter neoliberal projects and embrace community, democracy, Marxism, anarchism and/or anti-capitalism, for instance.

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