Cultural studies of rural science education

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Received: 1 October 2015 / Accepted: 31 October 2015 / Published online: 27 September 2016
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Cultural Studies of Science Education (CSSE) is now in its second decade as the primary professional journal presenting science education as a practice within people's lives. This position, while becoming more commonplace across the science education literature (Parsons and Carlone 2013), still is distinctive for its stance in placing science as a fully cultural practice situated within a complex ecology of learning amidst competing human interests. Science and learning in this view is less interesting for the hope and ability of a variable population to achieve a common 'literacy', but rather for the myriad ways in which the cultural production of science interest and engagement can more accurately be seen in all of its human diversity using a naturalistic lens. This descriptive project, very much the purview of social science research concerned with accurately representing what *is* the case in human learning with the sciences, is one of the primary purposes of the journal.

Science as social practice taken up in human lives is then—naturalistically, empirically, and scientifically—most accurately seen as set of *sciences*. It is a heterodoxy inclusive of the orthodox knowledge base and narrative arc that conventional science produces, as well as the burgeoning work amongst others including feminist, Indigenous, queer, decolonized, and critical race lenses on science, scientific practice, and science teaching and learning. In this, the purposeful cultural study of science education captures a more realistic picture of science in all of its rhizomic growth, multiple directions, and diversity of human experience. This approach is a critical one, pushing back to more clearly delineate and

Lead Editors: L. Avery and D. Long.

This paper is part of the special issue Cultural Studies of Rural Science Education.

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problematize the limits of dominant deficiency oriented science education research and teaching all too commonplace within the field heretofore.

Our critical, culturally grounded approach also broaches and discloses evidence of an arbitrary and problematic boundary in the production of science education research. More often than not, the normative ends sought to represent evidence of ‘improvement’ in science education have ignored the epistemological diversity that myriad cultural expression demands. This has been well trod in the past by many including Ken Tobin (2008) and Jay Lemke (2001). Uncritical examination of concepts of improvement, in this way, leaves itself open to push-back from people leading various ways of life that may reject or simply not care about the moral imperative of science education’s dominant project. Science education research, unlike canonical works in educational studies such as Willis’ (1981) does not have a substantive vocabulary or robust theoretical accounting for resistance. The default analytic has been to cast science resisters or the indifferent as deficient as the corpus of conceptual change and misconceptions research illustrates. For example, in my ethnographic work with creationists (Long 2011), few amongst them would see coming to accept that evolution had taken place as a likely improvement in their lives. While not personally endorsing creationism as a legitimate orthodox scientific position, this kind of analysis does remind us that the ontological reality of people living lives with such views are inarguably part of that which social science shows us to be legitimate ways of being in the world. Their existence does not require our approval. In some ways less polarizing, feminist, Indigenous, queer, decolonizing, and critical race (amongst other) approaches to science education, under the multivalent banner of critical theory, have begun a drumbeat demand that scientific knowledge and scientific practice come under close scrutiny for often latent and sometimes explicit masculine and white supremacist biases. All of these approaches have been well represented in the pages of CSSE. In time, the hope is that the dominant views within science education research will be respective of these plurality of views—not excepted from.

Proceeding with a cosmopolitan theoretical orientation, CSSE has arguably been a stalwart in science education research for its insistence on radically listening (Tobin 2009), and searching for new lights. In this way, authors in CSSE have collectively served both the aforementioned descriptive project of more accurately illustrating the diversity of ways in which humankind engages science(s) within their lives. Importantly, it also opens a broader horizon of sometimes congruent, but often competing ends by which science is used to develop differing conceptions of the good in teaching, learning, and human flourishing. Amidst these competing ends, it is our contention that for all of the journal’s good, our perspectives can be enriched further by accounting for what we see as a metropolitan centric, urban bias in science education research generally, and also within CSSE specifically. In short, studies of rural science education do not have a clear voice in our understanding of the field and conceptions of what represents educational progress.

CSSE had at its onset an explicitly cosmopolitan theoretical orientation. Every orientation has its affordances and constraints. It is in this spirit that we shine a different critical light back upon the ontology of CSSE and its cosmopolitan orientation to consider yet more vital perspectives. To have a cosmopolitan perspective, as we shall proceed, and in the spirit of Kwame Anthony Appiah (2006), is to know and commit one’s self to an ethic that “there are many values worth living by and that you cannot live by all of them” (p. 144). As we assert, the types of lives represented most often by science education research, proceeds with metropolitan assumptions of access to certain kinds of institutions and cultural capital. Institutes, universities, zoos, aquariums, science centers—all more often than not—are centered in urban settings. Even within the burgeoning literature of racism

and classism's affects on science and STEM participation, a set of metropolitan assumptions about life and human interaction dominate. In this way, echoing Appiah, a cosmopolitan orientation can be a clear benefit for many due to the concentration of cultural capital in metropolitan centers, and the socially networked avenues of social capital interlinked within them. As we echo Immanuel Wallerstein (1998), the interactions of actors within these networks, and the flow of ideas and capital within them are not a symmetric relationship. Instrumental benefits of science and scientific practice, at least in its current neoliberal, corporatized form, dominates value systems within urban areas.

We proceed with a simple organizing principle. As science and STEM rhetoric continues to be amplified within educational policy conversations, it is equally the case that there are whole swaths of students in schools and learning adults—often geographically diffuse—for whom formal science learning and practice is not easily acquired within schools or the community, and for whom pursuing science as a career is not easily practicable. Unlike being thrown into a cosmopolitan setting by happenstance of birth, there are those who equally will develop their identity tied to rural places.

University education and locations of work will be what they are, but the matter of injustice through differential access and asymmetric science educational opportunity remains. We enjoin the CSSE conversation with this special issue on rural science education not to cloud the existing, but small body of literature on rurality and science education, but to reemphasize the need for a continuing conversation and examination of issues germane to such ways of life. As some of the articles within this issue attest clearly and compellingly, the dispersed nature of rural life is in fact replete with its own generative production of conceptual diversity and novel forms of learning. It is a diversity often in very close touch with the natural world in ways that metropolitan life has increasingly distanced itself due to increasingly anthropocentric notions of appropriate human lifeways and neoliberal logics of practice (Henderson and Hursh 2014). Equally so, at least in the United States, the 'rural' has also come to be represented within metrocentric civic discourse as essentially conservative and retrograde, standing as a barrier to notions of progress. Papers within this issue both dramatically challenge and in some cases underscore these points. Karen Eppley and Ann Kingsolver explicitly position science education in rural places within a social justice agenda. Regardless, there is a richness and complexity with the work presented of contemporary rural science education both by original papers and forum conversations stemming from them. We can continue to learn from different lights.

Heather Zimmerman and Jennifer Weible walk us through an environmental education project they conducted with high school students that involved the students engaging in watershed studies in their local habitat. This watershed unit included scientific investigations around water quality, watershed delineation via watershed walks with local officials, and an exploration into the social impacts of hydrofracturing of shale gas as well as other potential human impacts on the local watershed. Several intriguing and thought-provoking considerations arose within this unit as the students explored their relationship to place, and the ways in which they articulated their experience with this investigation. Students taking action—or not as this case illuminates—raises questions regarding the role of social justice, environmental justice and environmental activism in rural science education. Thoughtful insights are offered by Abby Kinchy whose own personal experience working with community water monitoring projects, has shown that “civic education is needed just as much as science education” when working with watershed studies. Lacey D. Huffling, Heide B. Carlone and Aerin Benevides take this further pointing to the critical environmental education literature to find examples of what “action steps” look like in practice

and they advocate that these steps be then explicitly taught within environmental education. Using the Zimmerman and Weible paper as a stepping off point, Karen Eppley then cites the need for increased attention to education for social justice in rural places. In particular, she calls for rural educational research that reaches practitioners and researchers who may not regularly read nor conduct rurally focused research, but also to more explicitly position science education in rural places within a social justice agenda.

Building upon Glen Aikenhead's (1996) conceptual work on educational border crossing, Lisa A. Borgerding invites us to consider the cognitive risk taking for some rural religious conservative students thinking about evolution in the Midwest of the United States. For some students, as Borgerding attests, the boundaries of science and faith, and what counts as epistemological authority can be quite hazardous. Keith Taber expands on this theme, emphasizing the continuing utility and necessity of emphasizing the nature of science as an ameliorating pedagogy to such tension. Lee meadows offers compelling firsthand experience from his own personal and professional lives on the relative effectiveness of border crossing as a pedagogical model.

Karim-Aly S. Kassam, Leanne M. Avery and Morgan L. Ruelle make a timely and compelling case of the primacy of the Aristotelian concept of *phronesis* for understanding the depth of knowledge produced in rural settings for and with science and STEM. Presenting case studies in rural New York and amongst the Lakota and Dakota, they draw out and articulate that rurality, remoteness, and Indigenous ways of knowing are not only deep, valid interpretations of their respective worlds, but also, in the face of global issues such as climate change, may be a critical font of alternative thinking needed to solve global problems. Responding and continuing this conversation, Gregory Lowan-Trudeau further analyzes and critiques concepts of urban, rural, remote, and where and under what power such concepts are enforced. He animates this reflecting on the Métis experience in rural Canada.

From the Catskill Mountains of New York, Leanne M. Avery and Bryan J. Hains unpack the science knowledge and practical wisdom within the oral traditions of town elders in a small town and region. By drawing out contextually grounded examples, richness of understanding and place-based logics illustrate the often contingent nature of some science understanding. Eleanor Abrams and Michael Middleton, build upon the conversation of Avery and Hains to both connect the Catskills example to work within urban education and reality pedagogy, emphasizing the ethical dimensions of this needed work. Michael Fortunato moves the conversation in a different direction, by questioning the potential loss of information from rural settings to the overall educational ecology through analysis of current standardized testing regimes. Finally, Sarah Riggs Stapleton reflects on her own science learning experience in rural North Carolina, presenting a further critical example of rural knowledge captured and reproduced through oral traditions.

Bryan J. Hains, Gary L. Hansen and Ronald J. Hustedde shed much needed light on the historically tangled and often heated debate regarding the role of agricultural science education in the subfield of science teacher education. They utilize Pierre Bourdieu's sociological field theory as a lens to analyze the contemporary position of agricultural education in both the education field and the subfield of science education. They call for critical venues within agriculture education to question the status quo and challenge the acceptance of commonly held views. Employing an Institutional Theory perspective and highlighting the recent demise of the Department of Education housed in the College of Agriculture and Life Sciences at Cornell University—New York State's premiere land grant institution—as a “cautionary and motivational tale”, John W. Sipple respectfully

cautions Hains, Hansen, and Hustedde's to pursue their call for "re-engagement" of the field at a much slower and introspective pace.

Ann Kingsolver brings to the table numerous practical resources for critical science education in rural Appalachia in order to enlighten our perspectives on what diversity means (or does not) in rural Appalachia. Sharing her own experiences growing up in Appalachia, and using theoretical underpinnings from the Appalachian Studies literature, she deepens our awareness of the persistent stereotypical representations (often homogenized). In so doing, she offers nuanced pedagogical strategies for science educators that encourage broad perspectives on knowledge, diversity, and possibilities in rural communities.

Acknowledgments We hope the scholarly conversations continued in the pages of this special issue continue to prompt new directions in thinking about science education in all its forms and locations. Our thanks to the authors of this issue for their contributions and the chief editors of CSSE for valuing this work.

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