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# The social bases of disciplinary knowledge and practice in productive disciplinary engagement



Gregory J. Kelly\*

*Pennsylvania State University, United States*

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## ABSTRACT

In this commentary regarding the four articles in this special issue, I focus on three inter-related issues for Productive Disciplinary Engagement (PDE). First, I consider the disciplinary aspects of engagement as related to teaching and learning science. Second, across the four studies, I note the importance of the discursive work needed to frame the disciplinary inquiry in an educational community through the establishment of norms and practices for interaction. Third, conclude by considering the implications for PDE of social nature of scientific knowledge.

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## 1. Introduction

The focus on productive disciplinary engagement (PDE) offers much potential for the field of education. The framework sets parameters to establish educational events that situate students in potentially effective learning contexts with relevant resources for learning disciplinary knowledge and practices. Each of the four articles in this issue engage PDE in different ways and in doing so make visible different dimensions of the complex work of science teaching and learning. The framework is well aligned with the broader social, epistemic, and conceptual goals advocated for science instruction (Duschl, 2008) and is consistent with a thoroughly social epistemology for science learning (Kelly, McDonald, & Wickman, 2012; Kelly & Sezen, 2010). The four articles raise questions about PDE, but also about the future of science education more generally. What can be learned about PDE through the specific examples? How do instances of descriptive work advance theory? What are next steps for research in science education framed around a PDE perspective?

I have chosen to focus on three inter-related issues across the four articles in this issue. First, the framework considers disciplinary engagement. Engle (2011) is careful to note that disciplinary practice can be contested. Furthermore, she recognizes that sharp differences about what counts as authentic disciplinary inquiry should not limit educational practice. This is an important point, as answers about the nature of scientific knowledge and practices cannot easily be ascertained. We cannot wait until the time when philosophers, sociologists, or anthropologists of science identify the true nature of disciplinary inquiry, without controversy and disagreement, while teaching in a traditional manner. Nevertheless, I shall examine the notion of what counts as authentic, and consider the differences of descriptive and normative practices (Kelly, Carlsen, & Cunningham, 1993).

Second, the proposed framework, and its active application in each of the four chapters, provides ways of considering the discursive work of the teachers in the educational settings (Kelly & Brown, 2003). In each of the examples, teachers in the

\* Tel.: +1 814 863 1489; fax: +1 814 865 8733.

E-mail address: [gkelly@psu.edu](mailto:gkelly@psu.edu).

educational settings needed to make choices about next steps, based on the interactive discourse and actions of the participants. This discursive work could be supported or constrained by the educational curricula, milieu, and educational goals. In this way, PDE occurs through concerted efforts of teachers and students, within frames of reference for interaction that are constructed over time.

Third, I conclude by considering the implications for PDE of the social nature of scientific knowledge (Zuckerman, 1988). The social norms for interaction in educational settings need to be examined to effectively promote the learning goals of PDE. A social epistemology in philosophy of science (Longino, 2002) may provide some orientations to support discourse processes supporting norms supporting learning for individuals and communities (Kelly, 2011). A social epistemology presupposes some relevant social group or groups. PDE raises questions about the referent for such a social group or groups.

## 2. Science studies, authenticity, and normative action

One important issue related to productive disciplinary engagement (PDE) is the disciplinary aspects of engagement. Engle and Conant (2002) were careful to define this in general terms and recognize the degree of plausible differences about what may count as disciplinary practices, while not being hampered by such diversity of opinion. Meyer (this volume) takes up this challenge to consider the ways that such disciplinary engagement needs to involve “*scientifically authentic investigations*,” including importantly, participation of scientists in the classroom interactions. The chapter then identifies a number of ways to engage ELL students in authentic scientific practices, showing the potential pedagogical benefit of such practices.

To attempt to advance this conversation, I will take a step back and reconsider the nature of the relevant communities, scientific and educational, and the ways that studies of scientific knowledge and practice can be read in education. The empirical study of scientific practice has led to a number of interesting contributions to thinking about education (for reviews, see Kelly et al., 1993; Roth, McGinn, & Bowen, 1996). While contributions from the history and philosophy of science have had an important role in curriculum development, sociology, anthropology, and rhetoric of science have also shown the actual work of scientists by focusing on empirical studies of practice in scientific settings (Kelly, 2008). The fields of science studies (multi-disciplinary study of scientific knowledge and practice) have had implications for thinking about the nature of science, inquiry, and research methodology in science education. Importantly, the complex nature of scientific communities, from work on the point of discovery, to treatment of disciplinary controversies, to the production of texts through peer-review, has come to light through such empirical inquiry. These studies show the very different goals and orientations of scientific research groups, laboratories, and fields have from the normative orientations of educational institutions. Similarly, scientific communities have very different aims from that of educational communities. These descriptive studies of science should not be translated into normative practices for education (Kelly et al., 1993). For example, the agonistic struggle across research groups and occasional vicious attacks by competitors may serve the institutional goals of creating objective knowledge (at the expense of interpersonal relationships) for science (Pinch, 1995), but fail to serve the developmental, supportive roles needed in educational settings.

This does not suggest that reading science studies would not be helpful, or that the matter should be ignored. I am suggesting that the notion of authenticity raises many questions, and whereas expanding the repertoire of social practices that count as scientific is often helpful, authenticity in and of itself is problematic. Nevertheless, Meyer (this volume) does make a valid point that developing some specificity around disciplinary inquiry would be helpful. Furthermore, Meyer is careful in noting ways that the students’ activities are more authentic than they might otherwise experience, rather than claiming school science is actual scientific investigations. So, while whole cloth adoption of scientific practices may not be effective pedagogy, some discussing about disciplinary knowledge and practice may help practitioners understand ways that PDE can be implemented to achieve educational goals.

My suggestion is that science studies be read from an educational point of view. New understandings and ways of viewing science can contribute to educators’ views about what counts as disciplinary inquiry. While this is true, we need to recognize that science education has knowledge, practices, and norms for educating in its own right, which can be modified by science studies and any other number of fields. We should look to ways that science is practiced in other settings, while recognizing the importance of education for the development of science and the ways that knowledge in education can contribute to science. Science education has conceptual, epistemic, and social goals (Duschl, 2008), at least some of which stand regardless of authenticity relevance to science. Furthermore, while I am an advocate of the value of drawing from science studies in education, and I believe there is still much to be learned from such studies, educators also need to consider science outside the traditional bounds of professional scientific fields. Roth & Barton (2004) provide a number of examples of how citizens can engage in socially responsible action that can arguably count as science, while not being members of the professional scientific establishment. Looking to such work can extend our educators’ referents to other ways of being and doing science, thus opening up the notion of disciplinary engagement.

## 3. Framing cultural practices through discursive work

The four articles in this volume address the four principles for fostering PDE. Looking across the instances, and consistent with the overall theory, we can identify the discursive work needed to frame the disciplinary inquiry in an educational community through the establishment of norms and practices for interaction. Across the four articles, there is considerable

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