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Commentary

The legacy of Productive Disciplinary Engagement

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ABSTRACT

This theme issue examines the possibilities and realities that regulate learning opportunities for students and teachers in diverse science classrooms harnessing the design principles of Productive Disciplinary Engagement (PDE). I shall begin my commentary by situating the PDE framework within the discourses of 21st century learning and education. Next, I shall consider the rationale and goals of the PDE framework and then move on to discussing the sociocultural embodiment of the framework in the case studies discussed. I shall finish my commentary by considering the educational significance of the PDE framework and by visioning the next generation of research around PDE. A call for longitudinal studies around PDE is proposed that are able to illuminate the psychological, social and cultural practices of learning communities over time, evidencing learners' changing relationships to learning, disciplinary knowledge, their social relationships as well as to schooling in general.

In this theme issue we are zooming in to the possibilities and realities that regulate learning opportunities for students and teachers in science classrooms harnessing the design principles of Productive Disciplinary Engagement (PDE). As these papers clearly show, the documented practices are embedded in socio-culturally framed eco-systems of the classrooms and schools of which dynamics support and also challenge the realization of the intended goals of the framework. The empirical case studies discussed provide researchers and educators with lenses through which to examine and understand the social construction of science teaching and learning within and across diverse classrooms. Rather than providing normative guidelines, this theme issue makes visible the sociocultural practices of science education based on PDE, including the nature of students' engagement and meaning-making processes in disciplinary work. Studies of this nature are likely to open up dialog with their audience and potentially further develop students' learning opportunities in science education and beyond.

I shall begin my commentary by situating the PDE framework within the discourses of 21st century learning and education. Next, I shall consider the rationale and goals of the PDE framework and then move on to discussing the sociocultural embodiment of the framework in the case studies discussed. I shall finish my commentary by considering the educational significance of the PDE framework and by envisioning the next generation of research around PDE.

1. PDE framework and 21st century learning requirements

This theme issue is situated in space and time during which public discourses in many countries are questioning whether existing education systems are able to support learners' growth for life and work in the 21st century (e.g. Dumont, Istance, & Benavides, 2010). These concerned discourses are no longer generated by research communities in education and learning

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sciences, but also by practitioners working in different fields of education and beyond, working life representatives, educational policy makers, parents and, not the least, by learners themselves.

Rich and vivid discourses about the future of education appear to have generated a global movement in which individuals and collectives in both public and private sectors are constructing roadmaps, methods and tools for education transformation that would better respond to the realities and learning requirements of this century. Particularly important skills and competencies to be addressed more strongly in curriculum and classroom practices include critical thinking skills, problem-solving skills, collaboration and communication skills, new literacy skills, creative skills as well as learning to learn and life skills (e.g. Trilling & Fadel, 2009). The significance of creating pedagogical spaces that support learners' active and productive engagement in disciplinary learning is also widely recognized (Brown, 1997; Engle & Conant, 2002; Ford & Forman, 2006).

But how can educational transformation happen so that it really touches the lives of every learner, equipping learners with knowledge, skills and competencies so that they can thrive in their lives and contribute to the common good of our society? Despite educational investments and reform efforts, we know how challenging it is to make a sustained change on prevailing teaching and learning practices based on more conventional models of education (Etelapelto, Littleton, Lahti, & Wirtanen, 2005; Fischer, 2011; Sarason, 1990; Thomson & Hall, 2008; Tyack & Cuban, 1997).

This theme issue, with its rich, empirically grounded research studies, elaborates on a potential framework, Productive Disciplinary Engagement (PDE) that clearly has a lot to contribute to the transformation of teaching and learning practices at this historical point of dynamic change. Although the articles of the theme issue do not directly address the '21st century rhetoric on learning and education', it feels worthwhile to contextualize all this important work within this societal discourse. In this way, we are able to extend our thinking about the legacy of PDE framework not only for advancing Productive Disciplinary Engagement in science but, more broadly, for its contribution to guiding the transformation of educational practices into the 21st century. The design principles of the PDE framework, namely, learning to pose intellectual problems, taking authority in meaning making and learning, being accountable to others, social norms and practices of schooling, classroom communities and the disciplines as well as being able to harness all relevant resources in the learning process are clearly important skills on their own right. They are not only subsidiary means to construct disciplinary learning but important learning dispositions that strongly resonate with the overall learning requirements of our society.

2. What is unique about PDE framework?

Research in education and in the learning sciences has already generated a rich knowledge base on human learning and development (e.g. Bransford et al., 2006; Brown, 1997; Ford & Forman, 2006; Sawyer, 2006). Research has also been able to develop education principles, models and pedagogies for supporting active and meaningful learning in different classrooms and disciplines, and among different learners. Collaborative learning, problem-based learning, inquiry learning, learning by design, interdisciplinary learning, authentic learning, learning in a community of learners, and expansive learning are among the many pedagogical heuristics that have been documented in the research literature. Among others, these approaches have evidenced a shift from teacher-centered toward learner-centered approaches. These approaches have also evidenced a shift from individual orientation toward socially oriented notions of constructive processes (Brown, 1997; Hakkarainen, 2010; Sawyer, 2006).

Despite the potential of these learner-centered pedagogies, research has also clearly shown that the educational value of most of these approaches depends on engaging students in the pursuit of complex problems, sharing and creating of knowledge, breaking boundaries between formal and informal as well as between different communities of practice and promoting the development of learner agency (Hakkarainen, 2010). Research has also shown that in order for these pedagogies to be productive their success is strongly related to curriculum, instruction, assessment practices, teacher's professionalism, and the overall teaching and learning cultures of classrooms and schools (Kumpulainen & Renshaw, 2007; Trilling & Fadel, 2009).

We have also learned that research knowledge does not easily transfer to practice (Sabelli & Dede, 2001). Consequently, although these pedagogies can also be found to flourish in some schools and classrooms, they are more like 'beautiful exceptions' rather than a common practice. Also the fact that the field is rich and diverse has made it difficult for teachers to implement the heuristics and their specific scripts in their unique classrooms in systematic ways.

Unlike many pedagogical frameworks and models based on specific scripts, the PDE framework was originally created to provide guiding principles for both designing and understanding learning environments that seek to foster students' deep involvement and productive engagement in disciplinary work. The framework was developed as a response to the need to bring coherence and unity to the many existing design principles for creating effective learning environments with a specific interest to mathematics and science classrooms (Engle, 2011; Engle & Conant, 2002).

The core concepts of the framework, i.e., engagement, disciplinary engagement and Productive Disciplinary Engagement as well as the principles for fostering PDE, i.e. problematizing, authority, accountability, and resources create a common frame of reference for educators and researchers to explore and interpret teaching and learning practices within and across disciplines, classrooms and their sociocultural settings. These core concepts and principles form the base line for collectively making sense and for further developing learning environments. In all, the design principles of the PDE framework provide both structure and flexibility in their implementation into pedagogical practice. This is likely to lead to rich understandings about the possibilities and challenges of this framework in transforming traditional pedagogical practices and students' learning opportunities, as also evidenced in this publication.