

Within and beyond Biology Education Research: Steps toward Cross-Disciplinary Collaboration

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Dear *LSE* Readers:

This has been a big year for CBE—*Life Sciences Education* (*LSE*). The journal's publisher, the American Society for Cell Biology, received continued funding from the Howard Hughes Medical Institute to develop three new features aimed at broadening the journal's reach and further promoting evidence-based teaching and biology education research (BER). First, we will begin offering online journal clubs with authors. Second, we will publish a series of self-guided tours of key research related to particular instructional strategies and themes (e.g., how to use group work or peer instruction effectively). Finally, we will annotate a selected set of papers in order to help readers who are new to education research understand how education studies are conceived, designed, conducted, interpreted, and reported. We encourage you to keep an eye out for the launch of each of these features, and we welcome nominations of authors, instructional strategies, and papers to highlight.

As I read each issue of *LSE*, I am excited to see how BER has matured, due in part to the increasing demand for evidence-based strategies to improve biology teaching and learning. Yet, many questions about how to promote the learning, development, and success of all biology students remain unanswered. BER scholars – meaning those within the life sciences studying issues related to teaching and learning in the life science – are ideally positioned to address these questions. We can draw from our own knowledge and experience in biology classrooms and other learning environments such as research labs and field sites. We can make use of tools and ways of thinking both within and beyond our disciplines – an idea known as “convergence.” According to a recent National Academies report, convergence is an “approach to problem solving that cuts across disciplinary boundaries” that “integrates knowledge, tools, and ways of thinking” to tackle “scientific and societal challenges that exist at the interfaces of multiple fields” (National Research Council [NRC], 2014, p. 1).

“Education is not rocket science, it's much harder.”

—George (Pinky) Nelson, astronaut, astrophysicist, and former director of the AAAS Project 2061

I agree whole-heartedly with this sentiment. I am convinced that improving the quality of biology education, and science education in general, is both a scientific and a societal challenge that will require convergence. I hope we embrace this challenge by continuing our own work in biology education and by engaging in collaborative work with other discipline-based education researchers (DBERs; e.g., physics education, chemistry education, geosciences education); specialists in higher education and faculty development; cognitive, educational, and organizational psychologists; and other scholars. We know that this kind of collaborative work will

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not be easy, as it requires developing a common language, coming to common understandings, and negotiating disparate standards, priorities, worldviews, and ways of working (Fiore, 2008; Stokols *et al.*, 2008). We also know that collaboration will bring diverse perspectives, viewpoints, experiences, and expertise to bear on a problem, resulting in more and better solutions (Page, 2008).

Several collaborative projects and initiatives are already making strides in this direction. Over the past decade, one cross-disciplinary team has conducted a series of studies of Science Faculty with Education Specialties (SFES) (Bush *et al.*, 2008, 2011, 2013). Their work has produced evidence-based, practical guidance for faculty and administrators on hiring and evaluating SFES (Bush *et al.*, 2006, 2014). Their studies have also generated empirical evidence that SFES positions can promote teaching change and that the specific disciplines of these positions may be less important than their institutional homes (Bush *et al.*, 2013, 2016). The Transforming Research in Undergraduate STEM Education conferences have brought together STEM DBERs to share current disciplinary knowledge, theory, and methods related to assessment, cognition, student success, and teaching. Abstracts and presentation slides are available on the TRUSE website.¹ The National Science Foundation also supported a meeting of cognitive psychologists and STEM DBER scholars to generate recommendations for promoting and supporting collaborative work among these disciplines (the resulting white paper is available on the website of the Center for Integrative Research on Cognition, Learning, and Education²). More recently, a cross-disciplinary group of journal editors generated a practical guide for evaluating DBERs for promotion and tenure (Dolan *et al.*, 2017). Several of these editors are part of a larger initiative, called the DBER Alliance,³ which aims to promote cross-disciplinary scholarship in undergraduate education, such as research on assessment of STEM practices, on broadening participation in STEM, and on institutional change (Henderson *et al.*, 2017).

LSE has also made strides in this direction by ensuring that our editorial board is composed of biology educators and biology education researchers, as well as scholars in related disciplines who can inform our work. In fact, this is one of the major perks of publishing in a society journal (Johnston, 2017). Practicing scientists and educators serve on the editorial board and can bring feedback from colleagues, departments, and institutions, which can be acted upon quickly and collaboratively by editors and publishers. For example, *LSE* was among the first education journals to allow prereview manuscripts to be posted on preprint servers. Society journals also reach the readers most interested in the work, a number that continues to grow each year for *LSE*. *LSE* now ranks third among 41 journals classified in “Education, Scientific Disciplines,” up from its rank of eighth to 10th over the past five years.

One might ask, if the biology education research community engages in more cross-disciplinary work, what will make the

results *biology* education research? I would argue to the contrary. If we keep our focus on ideas that apply to biology alone, we will miss much of what influences how biology is taught and learned. Our research and our students will benefit from our use of concepts, theories, and methods from other scholarly communities and disciplines. By coupling our practical goal of improving biology education with research that yields novel theoretical and mechanistic understandings of biology teaching and learning, we will be able to ensure that our work is both useful and impactful.

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¹www.chem.purdue.edu/towns/truse/.

²<https://circle.wustl.edu/>.

³www.trellscience.com/DBER-A/.