The state of discipline-based education research (DBER)

Discipline-based education research (DBER) has come to the forefront in recent years as a scholarly endeavor within biology and other science, technology, engineering, and mathematics (STEM) disciplines. DBER has developed from earlier work in the scholarship of teaching and learning (SoTL), which focused on reflective teaching and utilizing best practices within the classroom (4). SoTL is often interdisciplinary, as these “best practices” are universal in their application. For example, problem-based learning is a powerful instructional tool no matter which STEM discipline it is used in (3). In contrast, DBER is firmly rooted within its field and strives to understand the unique peculiarities of learning within that discipline. The goals of DBER include: how students learn within the discipline, student development from novice to expert within the discipline, and specific pedagogical approaches that promote learning of the discipline (4). Additionally, this research should guide classroom pedagogies, promoting diversity and ensuring the inclusion of all students.

In February 2014, Scott Freeman of the University of Washington and his colleagues published a paper in the Proceedings of the National Academies of Sciences that created a watershed moment in biology education. The article, titled *Active learning increases student performance in science, engineering, and mathematics,* was a meta-analysis of active learning studies in STEM classrooms and came to the very clear conclusion that active learning promotes student performance in the classroom (2). Not a new concept, but one that finally gained enough critical mass for such a meta-analysis and a resulting publication in a high-profile journal typically dedicated to traditional laboratory research. In his plenary at the Society for the Advancement of Biology Education Research (SABER) conference later that year, Freeman announced that we were entering “DBER 2.0”—the next stage of discipline-based education research. Now that we are beyond asking whether active learning works, he proposed that we have an ethical obligation to use these proven teaching techniques and start asking questions about *how,* *why,* and *for whom* do active learning strategies work. From my observations at this summer’s conferences (ASM’s Conference for Undergraduate Educators, SABER, and the Gordon Research Conference on Undergraduate Biology Education), it is clear that the biology education community has embraced Freeman’s idea of DBER 2.0 and is hard at work delving into these new questions.

Resources for DBER

As DBER grows, so do the expectations for publication. This means that we must also adjust expectations about the appropriate data we use to support our work. Student attitudes can supplement an analysis of a classroom activity, but this does not replace data that clearly show student learning outcomes; students may or may not like a teaching approach, but do they learn? On the other hand, attitudes may be a critical piece of a student retention or scientific outreach study. We may need to conduct interviews or focus groups outside of the classroom in order to explore why students answer questions in a certain way and discover any deeply-held misconceptions. Coding (i.e., characterizing and quantifying) student free responses is labor-intensive but can provide a rich source of information. If you do not know where to start with some of these methods and would like to learn, try talking to colleagues in the social science or education departments on your campus. Apply for training opportunities like ASM’s Biology Scholars Program (http://www.biologyscholars.org/) this February, and collaborate with biology education researchers at a neighboring institution.

The wide range of biology education articles published by *JMBE* can also help you understand assessment and DBER: Research manuscripts which ask critical questions about the scholarship of teaching and learning and include multiple metrics to “triangulate” data in support of a hypothesis; Curriculum articles (with associated learning objectives and multiple rounds of field testing data to illustrate student learning) written to implement in your classroom tomorrow; Perspectives essays to shed light on specific issues in biology education or pose new ideas...
within a broad context; brief Tips and Tools articles that provide new activities to invigorate your teaching; and Reviews that keep you up-to-date on current resources, including Journal Watch, which summarizes current research. By welcoming manuscripts with different formats and varying expectations of data analysis, we offer JMBE readers opportunities to examine SoTL and DBER from a variety of angles, implement vetted activities in their own class, and learn from the biology education community. This publication, along with the examples mentioned above, are among the many ways to expand your assessment toolkit and strengthen your own teaching practice.

New laboratory safety committee

The various sections mentioned above are guided by a fantastic group of volunteers who aid in the editing and peer-review process. As of 2015, we also have a new JMBE Laboratory Safety Review Committee consisting of volunteers who previously worked on the ASM Laboratory Safety Guidelines Committee: Dr. Jeffrey J. Byrd of St. Mary's College of Maryland, Dr. Elizabeth Emmert of Salisbury University, and Dr. Amy White from Virginia Western Community College. They have graciously volunteered to review each manuscript that involves a laboratory activity to make sure that activity adheres to the ASM Guidelines for Biosafety in Teaching Laboratories (1)—not only in terms of general biosafety level, but that the manuscript appropriately describes safety precautions for potential activity adopters who may not be aware of certain safety procedures. The JMBE Biosafety Review Rubric that the Committee uses to vet articles is published on the Author Guidelines page of the JMBE website and will help potential authors understand the expectations of this safety review. We anticipate that this review and the associated changes within JMBE manuscripts will promote greater understanding of potential risks and greater safety of students and instructors in the laboratory environment. The JMBE Laboratory Safety Review Committee began its work this summer, and, beginning in 2016, all manuscripts will undergo this review process. If you would like to volunteer for this committee or for another role, please contact jmbe@asmusa.org.

Upcoming Volume 17 (2016)

We are also excited to announce that Volume 17 (2016), in addition to the May and December issues, will include a themed issue dedicated solely to Scientific Citizenship. Available in March 2016 and led by Guest Editor Jack Gilbert of Argonne National Laboratory, the online-only issue will offer an interdisciplinary look at citizen science activities, trends, and research. While the call for themed manuscripts is over, we hope you will continue to submit your excellent biology education research, activities, and innovations for consideration for our May or December issues. Note that while very few manuscripts are accepted on the first try, we are dedicated to providing high quality feedback to help authors during the revision process. If you’re not sure which JMBE section best fits your work, or if you would like to talk over an idea for an article, do not hesitate to contact me either through jmbe@asmusa.org or slelliott@smcm.edu. The best part about my job as JMBE Editor-in-Chief is helping people figure out where and how to publish their biology education work.

Finally, I wish each of you a productive end of the semester and a relaxing holiday season. With a New Year comes a new semester and new beginnings. Very few jobs allow us to start anew as often as an academic calendar. I hope our gift to you can be something within these pages that inspires a new pedagogical approach or insight into teaching a particular subject. Take some time to rest, rejuvenate, and refuel to bring new enthusiasm to your classes in 2016.

REFERENCES