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EDITORIAL

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

Erin L. Dolan

Promoting the learning, development, and success of all biology students may be best accomplished by continuing our own work in biology education and by engaging in collaborative work that crosses disciplines.

BOOK REVIEW

Teaching the Core Concepts of Physiology: What, Why, and How

Gregory J. Crowther

In a new book, Joel Michael and colleagues argue that we can teach physiology better by infusing our curricula with specific core concepts developed and refined in faculty workshops and surveys. After defining the 15 core concepts and unpacking some of them, they discuss the integration of these core concepts into the teaching of physiology.

CURRENT INSIGHTS

Recent Research in Science Teaching and Learning

Sarah L. Eddy

This is a summary of current or noteworthy articles published in other journals.

ESSAYS

Building Better Bridges into STEM: A Synthesis of 25 Years of Literature on STEM Summer Bridge Programs

Michael Ashley, Katelyn M. Cooper, Jacqueline M. Cala, and Sara E. Brownell

This review of 46 reports on 30 unique science, technology, engineering, and mathematics (STEM) bridge programs published over the past 25 years notes the characteristics and goals of each program and whether programs were successful in meeting their goals. A set of recommendations for STEM bridge programs is presented in hopes of encouraging development of better bridges into college.

Aligning Practice to Policies: Changing the Culture to Recognize and Reward Teaching at Research Universities

Michael Dennin, Zachary D. Schultz, Andrew Feig, Noah Finkelstein, Andrea Follmer Greenhoot, Michael Hildreth, Adam K. Leibovich, James D. Martin, Mark B. Moldwin, Diane K. O'Dowd, Lynnmarie A. Posey, Tobin L. Smith, and Emily R. Miller

Evidence shows most teaching evaluation practices do not reflect stated policies, even when the policies specifically espouse teaching as a value. This essay discusses four guiding principles for aligning practice with stated priorities in formal policies and highlights three university efforts to improve the practice of evaluating teaching.

A Call to Use Cultural Competence When Teaching Evolution to Religious College Students: Introducing Religious Cultural Competence in Evolution Education (ReCCEE)

M. Elizabeth Barnes and Sara E. Brownell

To consider differences between the secular culture of many college instructors and the religious culture of many students, it may be beneficial to use a lens of cultural competence to create effective evolution education. This could be achieved within a new framework: Religious Cultural Competence in Evolution Education, or ReCCEE.

ARTICLES

A Vision and Change Reform of Introductory Biology Shifts Faculty Perceptions and Use of Active Learning

Anna Jo Auerbach and Elisabeth Schussler

The purpose of this study was to observe the instructional practices used by faculty ($N = 10$) throughout the 3-year process of curricular reform to determine whether the use of active-learning strategies increased. Instructors also participated in interviews to track their perceptions of instruction, planning, and active-learning use as the reform progressed.

The Relative Effect of Team-Based Learning on Motivation and Learning: A Self-Determination Theory Perspective

Lucas M. Jenö, Arild Raaheim, Sara Madeleine Kristensen, Kjell Daniel Kristensen, Torstein Nielsen Hole, Mildrid J. Haugland, and Silje Mæland

A quasi-experimental study tested the effect of lecture-based courses and team-based courses on students' motivation and learning. The results show that students in general were more autonomously motivated and competent in the team-based courses, relative to the lecture-based courses, but also less motivated and more externally regulated.

Students in Fully Online Programs Report More Positive Attitudes toward Science Than Students in Traditional, In-Person Programs

Viranga Perera, Chris Mead, Sanlyn Buxner, David Lopatto, Lev Horodyskyj, Steven Semken and Ariel D. Anbar

Changes in students' attitudes toward science following the completion of an online, introductory astrobiology course were examined. It was found that students in fully online degree programs had more positive attitudes toward science than those in traditional, in-person degree programs.

Undergraduate Performance in Solving Ill-Defined Biochemistry Problems

Cheryl A. Sensibaugh, Nathaniel J. Madrid, Hye-Jeong Choi, William L. Anderson, and Marcy P. Osgood

This mixed-methods study retrospectively examines the competency of graduating biochemistry majors in areas related to scientific process, including the abilities to generate hypotheses, design experiments, evaluate data, draw conclusions, and reflect upon performance.

Engaging Undergraduate Biology Students in Scientific Modeling: Analysis of Group Interactions, Sense-Making, and Justification

Andrea M.-K. Bierema, Christina V. Schwarz, and Jon R. Stoltzfus

This paper provides an analysis on how undergraduate students work together, justify their ideas, and make sense of key ideas during in-class scientific modeling activities in large-lecture classrooms.

Enhancing Diversity in Undergraduate Science: Self-Efficacy Drives Performance Gains with Active Learning

Cissy J. Ballen, Carl Wieman, Shima Salehi, Jeremy B. Searle, and Kelly R. Zamudio

An active-learning pedagogy increased all students' science self-efficacy, but this increase led to improved academic performance only for underrepresented minority students—an improvement that eliminated the performance gap present in the traditional lecture semester.

Providing Social Support for Underrepresented Racial and Ethnic Minority PhD Students in the Biomedical Sciences: A Career Coaching Model

Simon N. Williams, Bhoomi K. Thakore, and Richard McGee

This study explores whether academic career “coaching” is a potential source of social support for PhD students in the biomedical sciences. For many of the underrepresented racial and ethnic minority PhD students, coaching provided additional social support in the form of emotional, informational, and appraisal support that they might not have received within their home institutions.

Implementation of a Learning Assistant Program Improves Student Performance on Higher-Order Assessments

Nadia Sellami, Shanna Shaked, Frank A. Laski, Kevin M. Eagan, and Erin R. Sanders

This study demonstrates that the positive effect of learning assistant (LA) implementation in a highly structured, flipped molecular biology class is not only the effect of active learning, but that students in courses with LAs perform better on exam questions requiring higher-order cognitive skills, with underrepresented minority students particularly benefiting.

Development of a Biological Science Quantitative Reasoning Exam (BioSQuaRE)

Liz Stanhope, Laura Ziegler, Tabassum Haque, Laura Le, Marcelo Vinces, Gregory K. Davis, Andrew Zieffler, Peter Brodfuehrer, Marion Preest, Jason M. Belitsky, Charles Umbanhowar, Jr., and Paul J. Overvoorde

Recent national reports call for increasing the quantitative acumen of biology students. The BioSQuaRE represents an assessment tool based on such reports. The iterative development of the instrument by science and mathematics faculty in collaboration with educational psychologists is described, and the tool's psychometric properties are summarized.

Measurement Instrument for Scientific Teaching (MIST): A Tool to Measure the Frequencies of Research-Based Teaching Practices in Undergraduate Science Courses

Mary F. Durham, Jennifer K. Knight, and Brian A. Couch

The Measurement Instrument for Scientific Teaching (MIST) is a survey specifically aligned with the scientific teaching (ST) framework and designed to gauge the frequencies of ST practices in undergraduate science courses. This paper describes the development of the MIST instrument, its implementation, and its potential uses for researchers and instructors.

The Effects of Practice-Based Training on Graduate Teaching Assistants' Classroom Practices

Erin A. Becker, Erin J. Easlson, Sarah C. Potter, Alberto Guzman-Alvarez, Jensen M. Spear, Marc T. Facciotti, Michele M. Igo, Mitchell Singer, and Christopher Pagliarulo

This article describes implementation of a practice-based graduate teaching assistant (GTA)-training program. GTA implementation of evidence-based teaching practices is measured across 160 hours of videotaped classroom instruction, and longitudinal changes in instructional practices are investigated. The impact of feedback on GTA adoption of evidence-based practices is also assessed.

**Graduate Training at the Interface of Computational and Experimental Biology:
An Outcome Report from a Partnership of Volunteers between a University and
a National Laboratory**

Albrecht G. von Arnim and Anamika Missra

This article presents an outcome study of career trajectories of a PhD program centered on computational life science. The evolution of the program over a span of 20 years is described, and a summary of how the program seeks to establish cohesion between computational and experimental biologists is presented.

**A Model for Postdoctoral Education That Promotes Minority and Majority
Success in the Biomedical Sciences**

Arri Eisen and Douglas C. Eaton

During science postdoctoral experiences, underrepresented minorities (URMs) disproportionately drop out, and models show interventions to increase URM scientists in academia could be most effective at this time. FIRST fellows, who are 50% URMs and 70% women, are as or more successful than a comparison group, due to their intentional community and explicit training in teaching.

On the Cover

Fluorescence micrograph showing the cross-section of bulrush (*Juncus* sp.) leaf, autofluorescing red (chlorophyll on external side of leaf) and blue (vascular bundles). The diameter of the stalk is approximately 3 mm. Image by Jan Martinek, Honorable Mention, 2011 Olympus BioScapes Digital Imaging Competition. Attribution Non-Commercial; No Derivatives License.