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### CURRENT INSIGHTS

#### Recent Research in Science Teaching and Learning

*Sarah L. Eddy*

This installment presents summaries of three articles that explore the meaning of relevance, the relationship between instructor mindset and performance gaps, and a short intervention designed to decrease the costs students perceive for engaging in a challenging STEM course.

### MEETING REPORT

#### Breaking Down Silos Working Meeting: An Approach to Fostering Cross-Disciplinary STEM–DBER Collaborations through Working Meetings

*Daniel L. Reinholz and Tessa C. Andrews*

This report describes a working meeting designed to break down disciplinary and theoretical silos among discipline-based education researchers who study change in STEM higher education. The organizers aimed to foster collaborations among early-career scholars and support scholarly progress. The meeting design may be a useful model for other initiatives to increase cross-disciplinary collaborations in our fields.

### ESSAY

#### Implementing Cognitive Science and Discipline-Based Education Research in the Undergraduate Science Classroom

*Ido Davidesco and Catherine Milne*

This essay highlights learning and instruction strategies that can inform the design of undergraduate science courses. The implementation of these strategies is illustrated through an undergraduate science course for nonmajors called Science in Our Lives.

### ARTICLES

#### Defining and Measuring Students' Interest in Biology: An Analysis of the Biology Education Literature

*Ashley A. Rowland, Eva Knekta, Sarah Eddy, and Lisa A. Corwin*

Students' interest in their fields of study is an important motivating factor that affects their academic achievement and persistence in STEM. Here, the literature addressing students' biology interest is analyzed in order to clarify how this important construct is defined and measured by the biology education research community.

#### Implementation of Open Textbooks in Community and Technical College Biology Courses: The Good, the Bad, and the Data

*Kristyn E. Vander Waal Mills, Mark Gucinski, and Kimberly Vander Waal*

This study looked at general biology courses at four community and technical colleges that implemented traditionally published or open textbooks. Student outcomes, textbook utilization methods, and perceptions of textbooks were investigated.

### **Can Test Anxiety Interventions Alleviate a Gender Gap in an Undergraduate STEM Course?**

*Rebecca B. Harris, Daniel Z. Grunspan, Michael A. Pelch, Giselle Fernandes, Gerardo Ramirez, and Scott Freeman*

Historical gender gaps were addressed through interventions designed to reduce student test anxiety. A unique combination of exercises using expressive writing and reappraising physiological arousal was implemented. Improved exam performance for all students, regardless of gender, is reported.

### **Contrasting Cases: Students' Experiences in an Active-Learning Biology Classroom**

*Lisa B. Wiltbank, Kurt R. Williams, Lauren Marciniak, and Jennifer L. Momsen*

Four students describe their firsthand experiences as they participated in a semester-long active-learning biology class. In-depth examination of their profoundly different accounts leads to questions about the mechanisms by which active learning is "successful."

### **Introductory Biology in Social Context: The Effects of an Issues-Based Laboratory Course on Biology Student Motivation**

*Krissi M. Hewitt, Jana Bouwma-Gearhart, Heather Kitada, Robert Mason, and Lori J. Kayes*

This study examines how using socio-scientific issues (SSI) to frame lab activities impacts student motivation to participate in labs. When examined in the context of self-determination theory, the results show that using SSI can increase student motivation to participate over the course of the term due to increased feelings of relatedness.

### **Adding Authenticity to Inquiry in a First-Year, Research-Based, Biology Laboratory Course**

*Jane L. Indorf, Joanna Weremijewicz, David P. Janos, and Michael S. Gaines*

The University of Miami Authentic Research Laboratories course was a CURE that brought faculty research into the introductory biology lab. Participation in this lab led to high learning gains and increased the odds that students would have individual research experiences, graduate with a STEM degree within 4 years, and graduate with honors.

### **Benefits and Challenges of Instructing Introductory Biology Course-Based Undergraduate Research Experiences (CUREs) as Perceived by Graduate Teaching Assistants**

*Ashley B. Heim and Emily A. Holt*

Qualitative methods are used to describe and ascribe meaning to the perceptions that graduate teaching assistants (GTAs) have regarding their roles serving as the primary instructors and research mentors for introductory biology course-based undergraduate research experiences (CUREs). Findings highlight benefits and challenges experienced by GTAs teaching CUREs, based on multiple emergent interview themes.

### **Evaluating Psychosocial Mechanisms Underlying STEM Persistence in Undergraduates: Scalability and Longitudinal Analysis of Three Cohorts from a Six-Day Pre-College Engagement STEM Academy Program**

*Sophie Kuchynka, Danielle Findley-Van Nostrand, and Richard S. Pollenz*

This report shows that increases in self-efficacy, sense of belonging, and science identity in first-year STEM students show a positive correlation to increased university and STEM retention across several cohorts of up to 222 students. Positive changes in university and STEM belonging indirectly predict an increase in science identity.

### **The Influence of Microaffirmations on Undergraduate Persistence in Science Career Pathways**

*Mica Estrada, Gerald R. Young, Jill Nagy, Emily J. Goldstein, Avi Ben-Zeev, Leticia Márquez-Magaña, and Alegra Eroy-Reveles*

The two reported studies advance the measurement and understanding of microaffirmation kindness cues and assess how microaffirmations relate to historically underrepresented and historically overrepresented undergraduate student persistence in science-related career pathways.

### **Seductive Details in the Flipped Classroom: The Impact of Interesting but Educationally Irrelevant Information on Student Learning and Motivation**

*Jeffrey Maloy, Laura Fries, Frank Laski, and Gerardo Ramirez*

A large-scale study in an undergraduate genetics course provides evidence that, contrary to previous studies performed in educational psychology labs, interesting anecdotes not relating to course learning objectives do not harm student learning in the context of a flipped classroom.

### **Use of the Test of Scientific Literacy Skills Reveals That Fundamental Literacy Is an Important Contributor to Scientific Literacy**

*Justin F. Shaffer, Julie Ferguson, and Kameryn Denaro*

In this study, it was found that student performance on the Test of Scientific Literacy Skills (TOSLS) was strongly correlated with SAT reading scores, suggesting that fundamental literacy skills are an important component of scientific literacy skills.

### **Mixed Student Ideas about Mechanisms of Human Weight Loss**

*Kamali N. Sripathi, Rosa A. Moscarella, Rachel Yoho, Hye Sun You, Mark Urban-Lurain, John Merrill, and Kevin Haudek*

This paper summarizes trends in student tracing of matter across scales in descriptions of human weight loss mechanisms. The results reveal that students are able to hold both Normative and Nonnormative ideas about this process, which is key for instructors to keep in mind as they teach such processes.

### **“Seeing” Data Like an Expert: An Eye-Tracking Study Using Graphical Data Representations**

*Joseph A. Harsh, Molly Campillo, Caylin Murray, Christina Myers, John Nguyen, and Adam V. Maltese*

This study used eye tracking to compare how students and scientists direct their attention when making sense of graphs. Experts focused on information relevant to data interpretation, using directed search patterns. Novices were more likely to complete graphing tasks by drawing on cues and used more sporadic search patterns.

### **Exploring Students’ Descriptions of Mutation from a Cognitive Perspective Suggests How to Modify Instructional Approaches**

*FangFang Zhao and Anita Schuchardt*

From a cognitive science perspective, scientific phenomena such as mutation can be perceived as entities or processes. An examination of students’ ideas about mutation revealed that, even after instruction, students tend to perceive mutation as an entity instead of a process, suggesting ideas for instructional interventions.

### **Biological Variation as a Threshold Concept: Can We Measure Threshold Crossing?**

*Elise Walck-Shannon, Janet Batzli, Josh Pultorak, and Hailey Boehmer*

Biological variation is fundamental to understanding evolution and provides a target for analysis of threshold concept crossing. Using think-aloud interviews of undergraduates, this study analyzed discourse, troublesome explanations, and liminal and integrative thinking. Combining these dimensions permitted identification of patterns indicative of threshold crossing.

### **A Biology Core Concept Instrument (BCCI) to Teach and Assess Student Conceptual Understanding**

*Tawnya L. Cary, Caroline J. Wienhold, and Janet Branchaw*

This article describes the process of development and the collection of evidence of validity for four Biology Core Concept Instruments (BCCIs) to be used in teaching and assessing student learning. A BCCI template that is based on the *Vision and Change* conceptual elements is presented for use in developing additional instruments.

**The Influence of Social Supports on Graduate Student Persistence in Biomedical Fields**

*Mica Estrada, Qi Zhi, Ezinne Nwankwo, and Robyn Gershon*

This paper describes a 1-year study with 101 historically underrepresented (HU) and majority biomedical doctoral students. Results, using PROCESS mediation analyses, gave evidence that providing diverse mentoring and support systems, which increase science identity, will be beneficial, especially to HU graduate students.

**Investigating Instructor Talk in Novel Contexts: Widespread Use, Unexpected Categories, and an Emergent Sampling Strategy**

*Colin D. Harrison, Tiffy A. Nguyen, Shannon B. Seidel, Alycia M. Escobedo, Courtney Hartman, Katie Lam, Kristen S. Liang, Miranda Martens, Gigi N. Acker, Susan F. Akana, Brad Balukjian, Hilary P. Benton, J. R. Blair, Segal M. Boaz, Katharyn E. Boyer, Jason B. Bram, Laura W. Burrus, Dana T. Byrd, Natalia Caporale, Edward J. Carpenter, Yee-Hung M. Chan, Lily Chen, Amy Chovnick, Diana S. Chu, Bryan K. Clarkson, Sara E. Cooper, Catherine J. Creech, José R. de la Torre, Wilfred F. Denetclaw, Kathleen Duncan, Amelia S. Edwards, Karen Erickson, Megumi Fuse, Joseph J. Gorga, Brinda Govindan, L. Jeanette Green, Paul Z. Hankamp, Holly E. Harris, Zheng-Hui He, Stephen B. Ingalls, Peter D. Ingmire, J. Rebecca Jacobs, Mark Kamakea, Rhea R. Kimpo, Jonathan D. Knight, Sara K. Krause, Lori E. Krueger, Terrye L. Light, Lance Lund, Leticia M. Márquez-Magaña, Briana K. McCarthy, Linda McPheron, Vanessa C. Miller-Sims, Christopher A. Moffatt, Pamela C. Muick, Paul H. Nagami, Gloria Nusse, K. M. Okimura, Sally G. Pasion, Robert Patterson, Pleuni S. Pennings, Blake Riggs, Joseph M. Romeo, Scott W. Roy, Tatiane Russo-Tait, Lisa M. Schultheis, Lakshmikanta Sengupta, Greg S. Spicer, Andrea Swei, Jennifer M. Wade, Julia K. Willisie, Loretta A. Kelley, Melinda T. Owens, Gloriana Trujillo, Carmen Domingo, Jeffrey N. Schinske, and Kimberly D. Tanner*

Investigation of Instructor Talk—noncontent language used by instructors in classrooms—in more than 60 new course contexts revealed widespread use. While 90% of Instructor Talk could be characterized using the initial Instructor Talk framework, new examples emerged that led to the development of a parallel Negatively Phrased Instructor Talk framework.

**CORRECTION**

**Laboratory Courses with Guided-Inquiry Modules Improve Scientific Reasoning and Experimental Design Skills for the Least-Prepared Undergraduate Students**

*Lawrence S. Blumer and Christopher W. Beck*

*On the Cover*

Pollen grains: Male germ cells in plants and a cause of seasonal allergies. (Photo credit: Edna, Gil, and Amit Cukierman, Fox Chase Cancer Center, Philadelphia, PA)