

Table of Contents

GENERAL ESSAYS AND ARTICLES

CURRENT INSIGHTS

Current Insights

Sarah L. Eddy

This installment of *Current Insights* reviews three articles that 1) characterize how instructor beliefs about intelligence are communicated to students, 2) explore the connection between instructor research and teaching identities, and 3) investigate how to broaden the definitions of student success used in research.

ESSAY

Reflective Practices in Education: A Primer for Practitioners

Haleigh Machost and Marilyne Stains

This essay serves as an introduction for practitioners to reflective practices in education. Benefits, methods for engaging in reflective practices and potential challenges are highlighted with further resources outlined in the supplemental materials.

ARTICLES

What a Difference in Pressure Makes! A Framework Describing Undergraduate Students' Reasoning about Bulk Flow Down Pressure Gradients

Jennifer H. Doherty, Emily E. Scott, Jack A. Cerchiara, Lauren N. Jescovitch, Jenny L. McFarland, Kevin C. Haudek, and Mary Pat Wenderoth

This paper details the development of the first reasoning framework to describe how students' reasoning about biological bulk flow pressure gradients develop toward scientific, mechanistic reasoning.

The Impact of Context on Students' Framing and Reasoning about Fluid Dynamics

Tara Slominski, Warren M. Christensen, John B. Buncher, and Jennifer Momsen

The notorious difficulty of human anatomy and physiology (HA&P) may stem, in part, from the nature of the discipline itself. This idea was tested by manipulating item context to reveal patterns in students' reasoning about fluid dynamics, a crosscutting phenomenon. Distinct differences were found in how students reasoned in HA&P versus non-HA&P contexts.

Virtually the Same? Evaluating the Effectiveness of Remote Undergraduate Research Experiences

Riley A. Hess, Olivia A. Erickson, Rebecca B. Cole, Jared M. Isaacs, Silvia Alvarez-Clare, Jonathan Arnold, Allison Augustus-Wallace, Joseph C. Ayoob, Alan Berkowitz, Janet Branchaw, Kevin R. Burgio, Charles H. Cannon, Ruben Michael Ceballos, C. Sarah Cohen, Hilary Collier, Jane Disney, Van A. Doze, Margaret J. Eggers, Edwin L. Ferguson, Jeffrey J. Gray, Jean T. Greenberg, Alexander Hoffmann, Danielle Jensen-Ryan, Robert M. Kao, Alex C. Keene, Johanna E. Kowalko, Steven A. Lopez, Camille Mathis, Mona Minkara, Courtney J. Murren, Mary Jo Ondrechen, Patricia Ordoñez, Anne Osano, Elizabeth Padilla-Crespo, Soubantika Palchoudhury, Hong Qin, Juan Ramírez-Lugo, Jennifer Reithel, Colin A. Shaw, Amber Smith, Rosemary J. Smith, Fern T sien, and Erin L. Dolan

Undergraduates participating in remote research programs experienced gains in scientific self-efficacy similar those observed in in-person research. Students experienced gains in scientific identity, graduate and career intentions, and perceptions of benefits and costs of doing research only if they started their remote undergraduate research experiences at lower levels.

Community-Derived Core Concepts for Neuroscience Higher Education

Audrey Chen, Kimberley A. Phillips, Jennifer E. Schaefer, and Patrick M. Sonner

Core concepts are overarching principles that identify patterns in facts and can be used as a foundational scaffold for curricula and assessment. This article describes the educational research process used to establish core concepts for neuroscience and provides examples of how the core concepts can be embedded in neuroscience education.

Identifying Group Work Experiences That Increase Students' Self-Efficacy for Quantitative Biology Tasks

Melissa L. Aikens and Alexander R. Kulacki

This study identified collaborative group work experiences that increased students' self-efficacy for quantitative biology tasks. It also related self-efficacy-building experiences to students' initial self-efficacy and gender/sex. Group work experiences identified by students are discussed in the context of self-efficacy theory.

Understanding Randomness on a Molecular Level: A Diagnostic Tool

Samuel Tobler, Katja Köhler, Tanmay Sinha, Ernst Hafen, and Manu Kapur

This article presents and analyzes a newly developed diagnostic tool—the Molecular Randomness Concept Inventory—to assess undergraduate students' understanding of randomness at the molecular level. Results from an undergraduate classroom study and think-aloud interviews revealed valid and reliable estimations of students' conceptual understanding.

Factors Predicting the Extent to which STEM Students Value Cross-Disciplinary Skills: A Study across Four Institutions

Lindsay B. Wheeler, Katerina V. Thompson, Gili Marbach-Ad, Patrick Sheehan, Jacqueline L. Bortiatynski, and Cindy Ghent

Relationships between graduating STEM majors' value of cross-disciplinary skills, classroom experiences, prior research experience, discipline, race, and gender were explored within an expectancy-value theory of motivation framework.

Improving University Life Science Instruction with Analogies: Insights from a Course for Graduate Teaching Assistants

Sara Petchey, David Treagust, and Kai Niebert

Effective analogies can support science teaching at university but require systematic planning, bridges to student prior knowledge, and active student interaction to find the analogy's strengths and limitations. This analysis of graduate teaching assistants' analogies in a professional development module showed the utility of a structured guide to analogy design.

Scientist Spotlights in Secondary Schools: Student Shifts in Multiple Measures Related to Science Identity after Receiving Written Assignments

Dax Ovid, L'vannah Abrams, Tess Carlson, Mark Dieter, Paulos Flores, David Frischer, Jolie Goolish, Michelle La-Fevre Bernt, Amber Lancaster, Christopher Lipski, Joshua Vargas Luna, Lucy M. C. Luong, Marlene Mullin, Mia Janelle Newman, Carolina Quintero, Julie Reis, Freja Robinson, Allison James Ross, Hilary Simon, Gianne Souza, Jess Taylor, Katherine E. Ward, Yvonne Lever White, Emily Witkop, Christine Yang, Aliza Zenilman, Eddie Zhang, Jeffrey N. Schinske, and Kimberly D. Tanner

Secondary student outcomes after completing at least three Scientist Spotlight assignments were investigated through multi-school collaborations. Across demographics, students significantly increased relatability to and nonstereotypes about scientists. Larger pre-post shifts in students' relatability to scientists correspond to in-class discussions.

How Administration Stakes and Settings Affect Student Behavior and Performance on a Biology Concept Assessment

Crystal Uminski, Joanna K. Hubbard, and Brian A. Couch

Administration conditions can affect how students engage with concept assessments. Building on a validity framework, the grading stakes and administration setting for a concept assessment were systematically varied and the resulting student behavior and performance were analyzed to understand the impact of administration conditions on student outcomes.

The Aspects of Active-Learning Science Courses That Exacerbate and Alleviate Depression in Undergraduates

Tala Araghi, Carly A. Busch, and Katelyn M. Cooper

An interview study of 29 undergraduates with depression from six institutions examined the relationship between depression and active learning in college science courses. This report examines how depression impacts students' experiences in active learning and which aspects of active learning alleviate and exacerbate students' depressive symptoms.

SPECIAL ISSUE ON COMMUNITY COLLEGE BIOLOGY EDUCATION RESEARCH

Quantitative Biology at Community Colleges, a Network of Biology and Mathematics Faculty Focused on Improving Numerical and Quantitative Skills of Students

Joseph Esquibel, Deborah L. Rook, Sondra M. LoRe, John H. Starnes, Jillian M. Miller, Jennifer G. Buntz, Alys Hugo, Christianne B. Nieuwsma, Heather Seitz, Ahrash Bissell, Louis Gross, Stacey Kiser, Suzanne Lenhart, Michael A. Mills, Claudia Neuhauser, Irene Corriette, Sarah Prescott, Kristin P. Jenkins, and Vedham Karpakakunjaram

Quantitative Biology at Community Colleges (QB@CC) is an NSF-funded, RCN-UBE grant that builds collaborative teams of biology, mathematics, and statistics faculty from community colleges across the United States to generate ready-to-implement, open-access modules that integrate math and biology content. QB@CC provides professional development opportunities for faculty to strategize teaching quantitative skills as part of biology curriculum.

Cross-disciplinary CURE Program Increases Educational Aspirations in a Large Community College

Rika Meyer, Madhura Sohani, Stacy M. Alvares, Katharine Hunt, Christina Sciabarra, and Jacqueline Goeres Gapinski

This article describes a multidisciplinary course-based research experience (CURE) program at a large community college and explores the impact on student outcomes, including research skills, student confidence, and educational aspirations.

On the Cover

Macrophages Eating Colored Shigella Candies, by Santosh Chauhan, Institute of Life Sciences, India, Co-author: Subhash Mehto

The image shows a macrophage (Mouse bone marrow-derived macrophages) engulfing Shigella Flexineri. Several host proteins are (red, white, and green) are recruited over the Shigella. Nucleus (DAPI, Blue). The picture is captured using Leica SP8 confocal in lightning mode.