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FEATURE

Approaches to Biology Teaching and Learning **Teaching More by Grading Less (or Differently)**

Jeffrey Schinske and Kimberly Tanner 159–166

The authors explore a history of grading and review the literature regarding the purposes and impacts of grading. They then suggest strategies for making grading more supportive of learning, including balancing accuracy-based and effort-based grading, using self/peer evaluation, curtailing curved grading, and exercising skepticism about the meaning of grades.

RESEARCH METHODS

Understanding Classrooms through Social Network Analysis: A Primer for Social Network Analysis in Education Research

Daniel Z. Grunspan, Benjamin L. Wiggins, and Steven M. Goodreau 167–178

The authors introduce basic concepts in SNA, along with methods for data collection, data processing, data analysis, and conduct analyses of a study relationship network. Also covered are generative processes that create observed study networks and practical issues, such as the unique aspects of human subjects review for network studies.

ESSAYS

Misconceptions Yesterday, Today, and Tomorrow

Mary J. Leonard, Steven T. Kalinowski, and Tessa C. Andrews 179–186

We review the use and meaning of the term *misconceptions* in education research today, describe yesterday’s debates that account for the term’s controversy, and identify two areas of research related to misconceptions with implications for tomorrow’s biology education research and biology instruction.

Feedback about Teaching in Higher Ed: Neglected Opportunities to Promote Change

Cara Gormally, Mara Evans, and Peggy Brickman 187–199

Most college science, technology, engineering, and mathematics faculty members could benefit from more feedback about implementing evidence-based teaching strategies. The goals of this essay are to summarize best practices for providing feedback, to describe the current state of instructional feedback, to recommend strategies for providing feedback, and to highlight areas for research.

BioCore Guide: A Tool for Interpreting the Core Concepts of Vision and Change for Biology Majors

Sara E. Brownell, Scott Freeman, Mary Pat Wenderoth, and Alison J. Crowe 200–211

Using a grassroots approach to incorporate feedback from more than 240 biologists, the authors have taken the core concepts of Vision and Change and created the BioCore Guide—a set of general principles and specific statements that expand upon the core concepts, creating a framework that biology departments can use to align with the goals of Vision and Change.

ARTICLES

Teaching Assistant Professional Development in Biology: Designed for and Driven by Multidimensional Data

Sara A. Wyse, Tammy M. Long, and Diane Ebert-May 212–223

Graduate teaching assistants (TAs) may receive professional development (PD) to enhance their teaching of undergraduates. However, data about the effectiveness of these PD programs are almost entirely self-reported. Using an evaluation framework, we found that TA multidimensional data were more informative for evaluating the efficacy of TA PD.

The CREATE Strategy for Intensive Analysis of Primary Literature Can Be Used Effectively by Newly Trained Faculty to Produce Multiple Gains in Diverse Students Leslie M. Stevens and Sally G. Hoskins	224–242
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CREATE uses intensive analysis of primary literature to demystify/humanize science. Previously, CREATE produced cognitive/affective gains at a minority-serving institution. These data reveal that faculty members on a wide range of campuses can learn CREATE pedagogy in workshops, teach CREATE effectively in their first attempt, and elicit cognitive/affective gains in their students.

Is Peer Interaction Necessary for Optimal Active Learning? Debra L. Linton, Jan Keith Farmer, and Ernie Peterson	243–252
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This study compared the effect on student performance when active-learning exercises were completed individually versus in cooperative groups. Students who worked in groups on the exercises outperformed students who had completed them individually on the higher-level, essay questions on the exams but not on the lower-level, multiple-choice questions.

A Teaching Strategy with a Focus on Argumentation to Improve Undergraduate Students’ Ability to Read Research Articles Edwin B. Van Lacum, Miriam A. Ossevoort, and Martin J. Goedhart	253–264
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This article describes a teaching strategy for first-year undergraduate life sciences students at a research university, in which they learn to read authentic research articles by focusing on rhetorical moves that play an important role in the authors’ argument. We used cognitive apprenticeship as the pedagogical approach.

Development and Validation of a Rubric for Diagnosing Students’ Experimental Design Knowledge and Difficulties Annwesa P. Dasgupta, Trevor R. Anderson, and Nancy Pelaez	265–284
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A rubric for experimental design (RED) was developed to measure undergraduate biology students’ knowledge of and diagnose their difficulties with experimental design.

pClone: Synthetic Biology Tool Makes Promoter Research Accessible to Beginning Biology Students A. Malcolm Campbell, Todd Eckdahl, Brian Cronk, Corinne Andresen, Paul Frederick, Samantha Huckuntod, Claire Shinneman, Annie Wacker, and Jason Yuan	285–296
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The synthetic biology lab module pClone is ideal for beginning students to conduct authentic research—inexpensive and easy to prep. Students clone and characterize promoters and share their results in research-grade databases with significant learning in the core concept of information and several core competencies described in *Vision and Change*.

The School for Science and Math at Vanderbilt: An Innovative Research-Based Program for High School Students Angela Eeds, Chris Vanags, Jonathan Creamer, Mary Loveless, Amanda Dixon, Harvey Sperling, Glenn McCombs, Doug Robinson, and Virginia L. Shepherd	297–310
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The School for Science and Math at Vanderbilt is a unique 1-d-per-week “pull-out” program that provides a science, technology, engineering, and mathematics pipeline program for highly motivated and talented public high school students.

Writing Assignments with a Metacognitive Component Enhance Learning in a Large Introductory Biology Course Michelle Mynlieff, Anita L. Manogaran, Martin St. Maurice, and Thomas J. Eddinger	311–321
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Students score higher on postexam assessment topics learned via peer-reviewed writing, or when they correct exam questions initially answered incorrectly, compared with their nonparticipating peers.

Student Perceived and Determined Knowledge of Biology Concepts in an Upper-Level Biology Course Brittany Ziegler and Lisa Montplaisir	322–330
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To learn, students need to be actively engaged, which requires them to be metacognitive. Students lacking metacognitive skills can struggle with the learning process by not being able to determine what they do and do not know. Investigating the relationship between student perception and actual knowledge can provide insight into student metacognition.

Longitudinal Study of Student Attitudes in a Biology Program Malin J. Hansen and Gülnur Birol	331–337
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This study is among the first to report longitudinal results of student attitudes across a university program. Biology students become significantly more expert-like from the first year to the fourth year of the program, but students are still far from expert-like for problem solving–related attitudes. Also, after four years, high-performing students displayed significantly more expert-like attitudes than low-performing students.

DNA → RNA: What Do Students Think the Arrow Means? L. Kate Wright, J. Nick Fisk, and Dina L. Newman	338–348
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The authors investigated student understanding of central dogma concepts in a variety of settings. They found that students are not primed to think about “information” when presented with the canonical figure of the central dogma and uncovered interesting conceptual misunderstandings about the meaning of the arrows in the representation.

The Dominance Concept Inventory: A Tool for Assessing Undergraduate Student Alternative Conceptions about Dominance in Mendelian and Population Genetics Joel K. Abraham, Kathryn E. Perez, and Rebecca M. Price	349–358
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Biology undergraduates often have difficulty understanding dominance in genetics. The authors developed and evaluated the Dominance Concept Inventory, a tool to measure the prevalence of four alternative conceptions about dominance. It was found that the test is an effective tool and that introductory and advanced students harbor confusions about dominance.

CORRECTION

The Classroom Observation Protocol for Undergraduate STEM (COPUS): A New Instrument to Characterize University STEM Classroom Practices Michelle K. Smith, Francis H.M. Jones, Sarah L. Gilbert, and Carl E. Wieman	359
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On the Cover

Most college science instructors would benefit from more sustained support in implementing evidence-based teaching strategies. Typically, faculty receive feedback on their teaching through student evaluations or observations and evaluation by other instructors or administrators. These feedback mechanisms have drawbacks. In this issue, Gormally, Evans, and Brickman review best practices for providing instructional feedback. For example, faculty are more likely to make significant changes in their teaching when supported by coaching and formative feedback, rather than evaluative feedback. Gormally and colleagues outline additional strategies for providing and seeking feedback, and highlight areas for further research. In the top image, Kara Moloney, Assessment Coordinator, and Brad Henderson, Lecturer in the University Writing Program, discuss strategies for examining student learning to inform curricular and programmatic decision making. In the bottom image, Faculty Developer Cara Harwood and Michelle Vvylecka with the Undergraduate Research Center discuss ways to incorporate learner-centered teaching strategies in undergraduate STEM courses. All images courtesy of Leonard Cross with the Center for Excellence in Teaching and Learning at the University of California at Davis.