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Feature
Current Insights

Recent Research in Science Teaching and Learning

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This feature is designed to point *CBE—Life Sciences Education* readers to current articles of interest in life sciences education as well as more general and noteworthy publications in education research. URLs are provided for the abstracts or full text of articles. For articles listed as "Abstract available," full text may be accessible at the indicated URL for readers whose institutions subscribe to the corresponding journal.

Education Research and Practice Articles

1. Cox, M. F., and Andriot, A. (2009). Mentor and undergraduate student comparisons of students' research skills. *J. STEM Educ. 10*, 31–39.

[Full text available: http://ojs.jstem.org/index.php?journal=JSTEM&page=article&op=view&path[]=1431&path[]=1253]

Cox and Andriot examine the relationship between what undergraduates report they learn from participating in research versus graduate and faculty mentors' perceptions of undergraduates' gains. The authors also explore whether discrepancies between undergraduate and faculty perceptions of undergraduates' research abilities correlated with aspects of the mentoring relationship, including duration or frequency of interactions between the undergraduate protégé, graduate mentor, and faculty mentor. Undergraduates, graduate mentors, and faculty mentors rated undergraduates' research abilities using a Likert-type scale survey. Undergraduates were also asked to rate aspects of the mentoring relationship such as quality, duration, frequency of interaction, and amount of help sought. Correlations are identified via independent sample *t* tests, which do not allow for predictions to be made regarding the effects of multiple variables. Undergraduates and faculty differed significantly in their ratings of several of the undergraduates' skills, including observing and collecting data, relating results to the "big picture," and framing research questions. Undergraduates and graduate mentors differed significantly only in their rating of undergraduates' ability to relate results to the big picture. Although the methodological details are vague, the authors report greater discrepancies in higher quality mentoring relationships. In other words, in high-quality relationships, students rated their research abilities more highly and faculty rated their abilities more poorly, while in lower-quality relationships their ratings were more similar. In addition, undergraduate and faculty ratings were most discrepant in relationships in which undergraduates sought little help from faculty mentors. The authors propose that these students are "operating under false assumptions" regarding their capabilities and thus do not seek the help they need.

2. Del Carlo, D. I., and Bodner, G. M. (2009). The "Chemistry Mafia": The social structure of chemistry majors in lab. *Electron. J. Sci. Educ. 13 (1),* article #6.

[Full text available: http://ejse.southwestern.edu/volumes/v13n1/articles/art6-delcarlo.pdf]

Del Carlo and Bodner examine how undergraduates interact during chemistry laboratory class to develop a sense of community, which has been shown to increase student achievement and retention in science majors. The work is framed by "symbolic interactionism," which aims to determine how social interactions influence meaning. Interview and classroom observation data were collected to identify the types and impacts of social interactions that occurred among students in chemistry lab courses. The authors identify a range of "off-task" activities and conversations, including interactions that "killed time" during lab tasks as well as joking or goofing off that made mundane lab tasks more fun. These interactions served as the foundation for students to develop an extended social network of chemistry majors who took courses and studied together. Students within this group were comfortable asking one another for help or correcting each other because they had come to know and trust one another before revealing their own academic weaknesses. Students who were not part of this social network felt that they were at a disadvantage. The authors make several recommendations based on their findings, for example, that undergraduate institutions establish venues such as student lounges for majors to interact socially and allow for off-task interactions during lab.

3. Eberlein, T., Kampmeier, J., Minderhout, V., Moog, R. S., Platt, T., Varma-Nelson, P., and White, H. B. (2008). Pedagogies of engagement in science: a comparison of PBL, POGIL, and PLTL. *Biochem. Molec. Biol. Educ. 36*, 262–273.

[Full text available: http://www3.interscience.wiley.com/cgi-bin/fulltext/120846973/HTMLSTART]

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In this study, Eberlein and colleagues describe, compare, and contrast three different approaches to teaching via "active learning": problem-based learning, process-oriented guided inquiry learning, and peer-led team learning. The authors highlight the social constructivist origins of these pedagogies, specifically, how learners construct knowledge through social interactions and how instructors facilitate or participate in these interactions rather than serving as the source of all knowledge to be learned. The key elements of each pedagogy are described in text and tabular form, allowing for easy comparison of features such as classroom characteristics, student roles and responsibilities, and grading. The literature regarding student outcomes and student and faculty acceptance of each approach is also reviewed.

4. Schwartz, M. S., Sadler, P. M., Sonnert, G., and Tai, R. (2009). Depth versus breadth: how content coverage in high school science courses relates to later success in college science coursework. *Sci. Educ. 93*, 798–826.

[Abstract available: www3.interscience.wiley.com/journal/121580319/abstract]

As part of a larger study titled "Factors Influencing College Science Success" (FICSS; see also Sadler and Tai [2007]), Schwartz and colleagues explore whether deep or broad high school science learning is a better predictor for success in college science course work. The dataset queried in this analysis was generated through administration of the FICSS survey to a nationally representative population of 18,000+ undergraduates. Students' grades in introductory science courses as reported by each professor for each student served as the dependent variable. The authors used hierarchical linear modeling—a form of multiple linear regression—to calculate the predictive value of particular variables, in this case, breadth versus depth in high school science learning. Breadth was defined as coverage of a series of topics identified as key for biology, chemistry, or physics, while depth was defined as one topic being covered for longer than a month. When student responses were examined within courses within institutions, depth had a consistently positive and significant relationship in biology only. When variables such as student background and high school achievement were included in the model, depth had a positive effect on college course success in all three disciplines. In addition, breadth had no effect on chemistry or physics course success and a negative effect on biology course success.

Life Sciences Education Articles

5. Anderson, T. R., and Schönborn, K. J. (2008). Bridging the educational research-teaching practice gap – Conceptual understanding, Part 1: The multifaceted nature of expert knowledge. *Biochem. Molec. Biol. Educ. 36*, 309–315.

[Abstract available: www3.interscience.wiley.com/journal/120847074/abstract]

Schönborn, K. J., and Anderson, T. R. (2008). Bridging the educational research-teaching practice gap – Conceptual understanding, Part 2: Assessing and developing student knowledge. *Biochem. Molec. Biol. Educ. 36*, 372–379.

[Abstract available: www3.interscience.wiley.com/journal/121413520/abstract]

In this two-part series, Anderson and Schönborn synthesize research on the nature of expert versus novice knowledge and skills as a foundation for making recommendations for undergraduate biochemistry instruction. In the first article, the authors describe their approach for guiding instructors in recognizing their own knowledge of biochemical concepts and principles and comparing it with the knowledge and skills they teach in biochemistry courses. This process then serves as a foundation for making instructional decisions that maximize the development of students' expertise. The authors describe in-depth several cognitive skills they argue are central to conceptual understanding and representative of expertise, including "mindful memorization" and analogical reasoning. In the second article, the authors briefly review the instruments and approaches available for measuring conceptual understanding and cognitive skills related to life science. They conclude by proposing a series of questions for assessing the cognitive skills necessary for conceptual understanding in biochemistry.

I invite readers to suggest current themes or articles of interest in life science education as well as influential papers published in the more distant past or in the broader field of education research to be featured in *Current Insights.* Please send any suggestions to: Erin Dolan (edolan@vt.edu).

REFERENCE

Sadler, P. M., and Tai, R. H. (2007). Transitions: the two high-school pillars supporting college science. Science. *317*, 457–458. www.sciencemag.org/cgi/content/full/317/5837/457 (accessed 11 September 2009).