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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.

1. Sikora J, Pokropek A (2012). Gender segregation of adolescent science career plans in 50 countries. *Sci Educ 96*, 234–264.

[Abstract available: http://onlinelibrary.wiley.com/doi/10.1002/sce.20479/abstract]

In this study, the researchers analyze a subset of data from the 2006 Program for International Student Assessment (PISA) survey to identify gender disparities in adolescents' science career plans. Their analyses aimed to determine 1) whether interest in computing, engineering, and mathematics (CEM) versus biology, agriculture, and health (BAH) careers differed between boys and girls; 2) whether gender differences were greater in postindustrial versus developing countries; 3) whether boys and girls differed in their science self-concept (as defined for this study, the self-evaluation of one's ability to meet the predicted demands of a career and of potential personal benefits of that career) in different national cultures, educational systems, and economies; 4) whether observed gaps favored boys; 5) to what extent models that reduce gender differences in science self-concept would result in more similar career expectations of girls and boys; and 6) whether country and school characteristics could be used to predict preferences for CEM and BAH careers. The study design controlled for academic science performance, students' economic and sociocultural status, and other school- and country-level variables.

Their analyses revealed that across all 50 countries represented in the PISA data set, BAH careers appealed to fewer boys than girls, and fewer science-oriented girls than boys were attracted by the prospect of a CEM career; countries differed only with respect to the magnitude of the gap between the number of boys and girls attracted to BAH and CEM careers. For BAH career expectations, the gap was larger in advanced industrial than in developing countries. For CEM expectations, the gender gap was similar in postindustrial and developing countries. For the majority of countries, girls were found to have a lower science self-concept than boys, even when data from boys and girls were matched by academic performance. The researchers utilized their results to generate a model to test a hypothetical scenario of "no gender difference in science self-concept." In other words, if there were no gender difference in science self-concept, would girls and boys have similar science career expectations? They found that, with respect to the appeal of both CEM and BAH careers, the difference between boys' and girls' preferences changed very little when science self-concept was removed.

The authors concluded that the patterns in their data are consistent with the self-segregating tendencies predicted by gender essentialist beliefs, which are culturally embedded assumptions that men are innately more competent than women in analytical tasks and complex and abstract reasoning, and women are innately more adept at nurturance, service, and social interactions (Charles and Grusky, 2004). They argue that, although efforts designed to eliminate gender bias in science self-concept may be useful in stimulating girls' overall interest in science careers, they may not be effective in addressing gender segregation in the types of science careers that boys and girls favor.

2. Matz RL, Rothman ED, Krajcik JS, Banaszak Holl MM (2012). Concurrent enrollment in lecture and laboratory enhances student performance and retention. *J Res Sci Teach 49*, 659–682.

[Abstract available: http://onlinelibrary.wiley.com/doi/10.1002/tea.21016/abstract]

In this study, the researchers explored how the timing of laboratory experiences influence science learning.

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Specifically, they asked whether concurrent enrollment in a laboratory course affects lecture withdrawal rates and final grades in a chemistry course at a large, public, midwestern university. The researchers analyzed data from a 6-yr period during which nearly 9500 undergraduates completed a semester-long general chemistry lecture course. In this course, students had the option of concurrent or nonconcurrent enrollment in a separate laboratory course. Three lecture-course formats were available to the students. First, students could enroll in a traditional three-times-a-week course accompanied by a 50-min discussion led by a graduate teaching assistant; 63% of these students concurrently enrolled in lab. Second, students could enroll in an "extra support" version of the course, which met four times per week and also included a discussion session; 50% of these students concurrently enrolled in lab. For both of these options, the lab course utilized an inquiry- and team-based format, and the lab course content was not intentionally aligned with that of the lecture course. Finally, students could enroll in a five-credit studio course that combined lecture and laboratory. In this option, the topics were aligned between lecture and lab, and the course made use of team-based learning strategies.

The effect of concurrent versus noncurrent enrollment in the laboratory course on lecture course withdrawal rates and final lecture grades were examined using multiple linear and binary regression analyses. Regressions were performed using variables such as high school GPA and SAT score as covariates. For the traditional course (format 1), concurrent laboratory course enrollment had a positive effect on students' lecture course grades, resulting in an improvement of up to 0.19 points on the GPA scale. Concurrent enrollment also had a positive impact on retention in the course of up to 2.2 times higher. In format 2, which was designed to provide additional academic support, there was no significant effect of concurrent enrollment on final lecture course grade or retention in the course. Because the third format integrated the lecture and laboratory, the impact of concurrent enrollment was not explored. The researchers note that students might have self-selected into particular course formats, which could have biased the results. They also note that "time on task" may have influenced the study outcomes, but because learning gains on such cognitive tasks as problem-solving can stabilize after several performances of a task, they posit that there are additional contributing factors. They suggest that one of the most important of these was the design of the laboratory to be a knowledge- and community-centered learning environment (with multiple exposures to inquiry approaches and peer interaction)—a design they think could have positively influenced performance in the lecture class if taken at the same time.

3. Quinnell R, May E, Peat M (2012). Conceptions of biology and approaches to learning of first year biology students: introducing a technique for tracking changes in learner profiles over time. *Int J Sci Educ 34*, 1053–1074.

This article describes the development and testing of a methodology for tracking changes in the ideas and habits of first-year biology students. Specifically, the researchers designed a survey using a series of existing measures in order to create "Learner Profiles." The survey combined measures of students' abilities to identify fragmented versus cohesive conceptions of biology (the Conceptions of Biology Questionnaire; Quinnell *et al.*, 2005) and whether students utilized "surface" or "deep" approaches to studying (the Study Process Questionnaire; Biggs, 1987). The researchers administered the survey to 285 students enrolled in an introductory biology course at a large Australian research university at the beginning and end of the course. They then conducted a hierarchical cluster analysis of the data to develop "initial" and "final" Learner Profiles for students based on the clustering patterns in the survey results. Students were classified as having disengaged, surface, deep, or dissonant Learner Profiles. Deep and surface profiles corresponded to students' approaches to studying. Students fit the disengaged profile if they did not identify as having deep or surface studying approaches. Students fit the dissonant profile if they used both deep and surface approaches.

The researchers then explored whether students shifted their Learner Profiles during the semester, and found that the proportion of students in the disengaged category increased, while the proportion of those in the deep category decreased. Further analysis of individual student patterns revealed that students who were initially categorized as disengaged often fit this classification at the end of the semester, while students who fit the surface category either shifted to disengaged or remained surface. Students who initially fit the deep category either remained in this category or displayed less cohesive conceptions. Students in the dissonant category either remained in that category or moved to a less surface profile. In the population as a whole, there was a statistically significant movement to surface approaches to learning. The authors conclude by noting the potential utility of their technique in identifying the need for and evaluating the effectiveness of targeted changes in the curriculum.

I invite readers to suggest current themes or articles of interest in life sciences 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 Deborah Allen (deallen@udel.edu).

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