

Pathways to scientific teaching

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The call to reform undergraduate science education continues to appear in journals (eg Powell 2003), national committee reports (eg NRC 1999), and funded projects throughout the country. Many authors agree that this reform should be founded on “scientific teaching” (Handelsman *et al.* 2004; D’Avanzo 2003; Ebert-May *et al.* 2003), derived from the notion that science should be taught with the same rigor that it is practiced (AAAS 1990). The Ecological Society of America’s (ESA) 21st Century Vision and Action Plan (Palmer *et al.* 2004) also calls for programs that provide ecologists with “access to best practices in teaching and learning”. Currently, several forums in ESA exist to provide such access, including education workshops at annual meetings, NSF-funded web resources such as Teaching Issues and Experiments in Ecology (TIEE 2004), and professional development opportunities such as Faculty Institutes for Reforming Science Teaching (FIRST II 2004).

The primary goal of the new education section in *Frontiers* is to build on these ESA education programs and introduce ecologists and educators to a variety of teaching, learning, and assessment strategies with which to adapt papers from the journal into instructional materials. The focus will be on development of explicit learning goals, instructional strategies wherein students are actively engaged in the process of science, and assessments aligned with those goals. A focus on assessment and research-based scientific teaching can assist faculty in determining not only whether undergraduates understand key scientific principles, can demonstrate basic scientific skills, and are able to exercise logical thought in applying these principles and skills, but also why they can (or cannot) do so. As such, “scientific teaching” can help us understand students’ thinking and determine the effectiveness of various instructional approaches in promoting these goals, based on evidence about students’ understanding.

The first article in the series will focus on three components: learning goals, a “learning cycle model” of instruction, and assessment of student learning (BSCS 1993). Thereafter, articles will focus on a variety of instructional strategies and goals, and on assessing student learning to assist scientists representing a variety of backgrounds, experiences, and needs in scientific teaching. The articles will also provide ideas for implementing instructional material in large (easily scaled down to small) enrollment courses, using active,

inquiry-based pedagogy, including tested cooperative learning strategies. They will also highlight new instructional materials based on current scientific research and emerging evidence about how people learn, especially for concepts that are particularly difficult and challenging for students to understand.

Our goals for this new series are to help improve undergraduate science education, assist faculty, and prepare graduate students (an important audience) to engage in scientific teaching and to apply research strategies used in science when conducting research on student learning. Ultimately, the process of scientific teaching has the potential to provide pathways for scientists to conduct research in ecology/science education that addresses questions about students’ understanding of science. As scientists’ thinking about teaching and learning evolves within the context of our existing research, the concept of “teaching as research” will take on meaning, leading to increased innovation and publications in ecology education research and practice.

We look forward to feedback about your successes with, and adaptation of, the teaching, learning, and assessment strategies presented in this new series of articles. We also encourage readers to communicate results from scientific teaching through TIEE and other ESA publications, to continually provide our readership and membership with access to the “best practices (and research) in ecology teaching and learning”.

References

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