# Researching Teaching Scientifically

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# Researching Teaching Scientifically

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**While many educators recognize** the importance of "scientific teaching," they are less certain about how to engage in this process. One approach taken by the developers of *Teaching Issues and Experiments in Ecology* (TIEE; *http://tiee.ecoed.net*), a peer-reviewed, Web-based collection of ecological educational materials, was to assemble a team of faculty research practitioners who were interested in using TIEE to study their own teaching. "We tested the hypothesis that the research practitioners will develop a deeper understanding of why inquiry promotes improved student learning and will be more committed to its use," says Charlene D'Avanzo from Hampshire College in Massachusetts, co–principal investigator of the TIEE project along with Bruce Grant at Widener University, Pennsylvania.

TIEE, which is supported by the Ecological Society of America (ESA) and the National Science Foundation, offers college-level experiments and issue-based lecture materials that employ a "student-active," inquiry approach—that is, students discuss, write, ask, and answer questions, or otherwise engage in their own learning. The materials incorporate scientific teaching strategies, outlining ways for faculty to apply scientific research methods in their classrooms to measure student learning and the effectiveness of their own teaching.

During a workshop at the 2005 annual ESA meeting, 15 TIEE research practitioners formed groups with common questions and experimental designs. "We had to figure out how to design our study, which was very challenging because we were at different institutions with different student bodies and taught different classes," says Elizabeth Hane, a biology professor at Rochester Institute of Technology in New York. She decided to use pre- and posttests to measure improvements in students' experimental design skills. To help her students build these skills, Hane gave them progressively more responsibility for the design of each new lab that they conducted in class, culminating with an independent project. "I used to be frustrated that my students didn't have these skills," says Hane, who found that her "scaffolded" approach was successful in helping students develop these skills.

Chris Picone, from Fitchburg State College in Massachusetts, was part of a group that measured students' graphing and analytical skills over a semester. "We were surprised by how much our students struggled with graph design and interpretation," says Picone, adding, "As scientists, we are so immersed in data that we can forget how nonscientists may view graphs and tables with a very different set of 'glasses.'" His group discovered that students' skills improved when they used the "step one, step two" approach to describe and interpret graphs throughout the semester. Picone has benefited from taking a closer look at what the education community has to share. "I now pay attention to the education literature and attend education sessions at the ESA annual meeting, which I never did before being involved in TIEE."

Robert Humston, from the Virginia Military Institute, worked with a group that investigated the impact of TIEE activities on students' environmental attitudes and values. The student survey results revealed that the effectiveness of something as seemingly simple as an in-class discussion could depend on the way an instructor facilitates it. "We realized that if you are using a case study to illustrate an ecological pattern or concept, you can't let students run away with the discussion," says Humston. There needs to be the right balance of structure for in-class discussions to be meaningful learning experiences.

Although the ESA workshop gave the team members the opportunity to outline their research projects face-to-face, it was critical that they communicate with one another throughout the academic year. "My team acted as a sounding board and a clarifier. It provided a time and a place to think carefully about what you're doing," says Alan Griffith from the University of Mary Washington in Virginia. The groups exchanged thoughts and strategies periodically by e-mail and spoke together weekly in teleconferences organized by the TIEE evaluator, Deborah Morris, from Florida Community College. Morris encouraged all of the groups to be introspective and suggested ways for them to analyze their data.

Members of the TIEE research team presented their results during the poster session at the 2006 ESA meeting in Memphis. Their conclusions support the idea that faculty who approach their teaching as they do their scientific research, using carefully constructed experimental designs, become more invested in and more successful at changing their practice for the better. Team members will publish their research in the next volume of TIEE, scheduled for late spring 2007.

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**TIEE Resources**

- Student-active teaching literature: *http://tiee.ecoed.net/teach/teach_links.html#student*
- Step one, step two graph interpretation: *http://tiee.ecoed.net/teach/essays/figs_tables.html*
- Guided class discussion: *www.tiee.ecoed.net/teach/essays/guided_discussion.html*
- Action research: *www.tiee.ecoed.net/teach/teach_glossary.html#action*