UW tackles neglected realm of training for science professors in training

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U.S. science and engineering students emerge from graduate school exquisitely trained to carry out research. Yet when it comes to the other major activity they'll engage in as professors – teaching – they're usually left to their own devices.

That's now beginning to change, thanks to work at the University of Wisconsin-Madison. In the Nov. 28 issue of *Science*, a team led by bacteriology professor Jo Handelsman describes its program of "scientific teaching," in which graduate students and postdoctoral researchers are taught to foster scientific inquiry by their students, accommodate diverse learning styles, and rigorously evaluate their teaching efforts.

True to the approach, they've now assessed whether participants are indeed learning the program's methods and principles, and the study indicates they're getting results.

"We've shown in this paper that training graduate students in teaching is feasible and that it works," says Handelsman, who leads UW-Madison's scientific teaching initiative with funding from the Howard Hughes Medical Institute. "It does have an impact on the way they think about teaching, their philosophy of teaching, and what they actually do in the classroom."

While the findings may sound obvious to some, programs that prepare science graduate students for teaching are still relatively rare, says Handelsman, despite repeated calls by the National Research Council and others for better education training for future professors. What's more, of the programs that do exist, none appear to have been studied as carefully as the UW-Madison initiative, known as the Teaching Fellows Program.

Filling a gaping hole in graduate education is thus one major benefit of well-tested programs like UW-Madison's. But the biggest winners will be the future generations of undergraduates who take science courses, says the paper's lead author Sarah Miller, who co-directs the Wisconsin Program for Scientific Teaching with co-author, Christine Pfund.

"This is all about the classroom of tomorrow," says Miller. "How do we make that classroom a place where every student who comes through the doors has a reason to be there, feels included and isn't just learning facts that you can find using Google? It's about thinking: How do we get our students to think?"

To accomplish this, scientific teaching mimics science itself in several critical ways. First of all, it teaches undergraduates skills like analytical thinking and experimental design, rather than having them simply memorize facts. It employs practices, such as active learning, based on the latest evidence from the education literature. And it strives to reach a diversity of students, "because that's one of the critical aspects of science," says Handelsman, "that we attract and retain people with different backgrounds, ethnicities and ways of thinking."

The approach has been honed over five years by Handelsman and her colleagues, based on both their own evolving knowledge of effective teaching methods and feedback from the program's more than 60 participants. But the team eventually decided this wasn't enough, says Miller. "We realized that we needed to demonstrate how the fellows were putting scientific teaching into practice."

To do so, the researchers collected both quantitative and qualitative data. Teaching units developed by the fellows were scored on criteria such as proof of active learning, methods that fostered discovery and a reflective approach to teaching. Fellows were asked to rate their level of skill as instructors at the end of the program. And

co-author Christine Pribbenow, of the Wisconsin Center for Education Research, helped the group to analyze and compare teaching philosophies written by the participants at the program's beginning and nine months later.

The analyses uncovered ample evidence that the fellows were learning. Their teaching units, for example, were found to devote more than 66 percent of class time on average to active learning exercises. Three-quarters of the units also required students to learn aspects of scientific discovery, such as the scientific method or critical thinking. Moreover, Pribbenow's analysis of the teaching philosophies revealed a significant shift from a teacher-centered perspective at the start, to one more focused on the learner by the end.

The team is now planning a longitudinal study to see how taking part in the program affects the fellows' careers. But Handelsman hopes the current evidence by itself will convince people to invest in this neglected area of graduate education.

"I think it's really important to train graduate students in teaching," she says. "Not only do I think we have a responsibility to the next generation of professors, but also to society: all of the people who will be those professors' students."

Source: University of Wisconsin-Madison