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Noah Finkelstein

Education Research: A New (Tenure) Track for Scientists

Sarah Webb
United States
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While working on his PhD in molecular biology at Stanford University in Palo Alto, California, Brian White found himself frustrated by laboratory research. So after finishing his degree, he pursued an interest in teaching, accepting an instructor position at the Massachusetts Institute of Technology in Cambridge. Teaching courses and working with undergraduate students "got [him] interested in students' wrong answers," he says. "There were a couple times that I realized that what they had was just a different view of things. It wasn't right but wasn't unreasonable." White was bitten by a different research bug: in science education.

For decades, science-education research resided almost exclusively in schools of education. But starting some 25 years ago, physics-education researchers led a trend toward discipline-based science-education research in science departments. As interest in the quality of K-12 and

undergraduate science education grew, some science departments began hiring faculty who could teach science and education courses, assist with curriculum development and educational outreach, and carry out education research.

NOT ABOUT BEING A BETTER TEACHER

Education researchers often enter the field due to their interest in teaching science. But earning a degree in science education is not about learning how to teach, notes Dawn Del Carlo, a chemistry professor at the University of Northern Iowa in Cedar Falls, who earned a Ph.D. in chemical education at Purdue University in West Lafayette, Indiana. A science-education Ph.D. is a research degree with all the challenges of acquiring, analyzing, and publishing data, she notes. "In chemical education, they're teaching you how to do educational research rather than in a lab, with a mass spec or an NMR." Most science-education researchers aim to assess, quantitatively, the effectiveness of particular problem-solving strategies, laboratory environments, or teaching styles. Others work to develop new pedagogies.

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Brian White



Dawn Del Carlo

Education-focused grad students seeking admission to science departments must meet the same admissions standards as students pursuing a traditional research degree in a science department. Large physics-education research groups such as the one at the University of Colorado, Boulder, admit students via their standard department admissions process, says Noah Finkelstein, a professor in the group. You need a solid background in physics, good grades, and the same test scores as straight research students. "We can't take people who are weak in chemistry," says Diane Bunce, a chemistry professor at Catholic University of America in Washington, D.C., "It's mostly a question of orientation and interest." Programs that provide undergraduates with experience in physics education, such as Colorado's Research Experiences for Undergraduates program, can strengthen a graduate application, Finkelstein says.

Once in, education students take science coursework to the equivalent of a master's degree, then pursue Ph.D. research on an education topic. In addition to science coursework, science-education researchers usually study cognitive psychology, statistics, and social-science research methods.

ENTERING LATER

Although there are many opportunities to train as a science-education researcher in graduate school, scientists can also enter at the postdoc stage, or later. Traditionally, science-education professors on science faculties moved into the field after gaining tenure on the strength of their teaching and conventional research. But it isn't necessary to wait that long.



Andrew Elby



Diane Bunce

Finkelstein chose to complete a Ph.D. in a "traditionally vetted area," studying laser physics at Princeton University, even though he already knew he wanted to study education. A traditional science background, he wagered, would help him get the type of job at the type of institution he wanted. With a standard degree, "people would recognize that you are a

member of this [physics] community," Finkelstein says. A postdoctoral fellowship from the National Science Foundation (NSF) gave him his start in science education. "I'm certain I wouldn't have gotten a tenure line if I hadn't had a Ph.D. that was recognizable by the department." However, "I believe these things are starting to change," he says.

When making a switch at a later point in a science career, says Andrew Elby of the University of Maryland Physics Education Research Group, "there's no substitute for getting your hands dirty in a more apprenticeship-like context." Switching to an education-research focus is no different from changing focus within biology, chemistry, or physics, he says. Collaboration, or a sabbatical with an established science-education researcher, can help a more senior scientist learn the best practices in the field.

CAREER OUTLOOK AND OPPORTUNITIES



Diane Ebert-May

Informal research by *Science Careers* indicates that although job opportunities in this field aren't numerous, the number of people competing also isn't large. A census of physics-education researchers yielded more than 100 faculty members in that field at 80 institutions. About 9 of 10 are members of physics departments. And some chemistry departments are now hiring education researchers at the senior level, Bunce says, showing a greater commitment to the field.

Different scientific fields are creating space for science education at different rates. Physics still leads, researchers say, followed by chemistry. Comparatively few biology faculty focus full time on education research. White, now a tenured professor at the University of Massachusetts, Boston, is an exception. At Michigan State

University in East Lansing, Diane Ebert-May has placed a greater emphasis on education research but maintains a research program in arctic ecology. Her 35-year study doesn't demand yearly fieldwork, so she's gradually skewed her research time toward education. She mentors mostly postdocs interested in biology-education research and will soon take on her first Ph.D. student in that area.

BRIDGING CULTURAL DIVIDES

One tension within the field, Elby says, is reaching agreement on what a science-education researcher based in a science department ought to do. The lack of standardization--and familiarity--means researchers have flexibility, but there's also risk. "Think for yourself which of these kinds of positions that you would like," Elby says. "And make sure that institution that you're going to wants that because there are some horror stories of bad mismatches." Del Carlo moved to the University of Northern Iowa after 3 years in the chemistry department at an eastern university because she was concerned that her colleagues in the chemistry department didn't understand what she did. "Trying to get tenure in that department, I perceived, was going to be a battle."

"A lot of chemistry departments who are hiring chem-ed people don't have a very good feel for how to adequately assess and evaluate how those faculty are doing," Del Carlo adds. Her institution is trying out a solution: a science-education department composed of all the discipline-based science-education researchers. That structure allows faculty familiar with education research to give advice on promotion and tenure criteria and decisions. "It's not for the faint-hearted," Bunce says. "You really have to be able to explain your research. You have to be good, and you have to be published."

According to Elby, getting published isn't easy when the other work starts to pile up. Many departments have only one education expert, and administrators have been known to throw everything education-related--including some of the more onerous teaching duties--their way. "It's so easy for a department to start piling on their education expert all the education-related duties that no one else really wants to do. For some science-education folks that's just fine. But "others don't want that situation at all. They want their job to be the same as anyone else's and want time to do their research."

NSF funding has been strong in education research, and legislation such as the recently signed America COMPETES Act make science education--and science-education research--a priority. "As this field is becoming acknowledged and accepted and actually demanded, more and more places are developing programs," Finkelstein says. "So I think there are bright prospects."

Resources on research in science education

[Research on Learning in Formal and Informal Settings](#) (DRL) is a division of the National Science Foundation that funds a wide range of research in the learning process of scientific and technical knowledge. One recent funding announcement from DRL (as of October 2007) addresses research on [education in science and engineering](#), with letters of intent due on 5 November 2008.

The [Institute of Education Sciences](#), part of the U.S. Department of Education, funds research in mathematics and science education, as well as learning processes across disciplines. However, the requests for proposals for fiscal year 2008 that started on 1 October 2007 have not yet been announced. The institute does accept unsolicited research proposals.

NSF supports training opportunities, including a new graduate fellowship program at the [University of Maryland](#).

[Purdue University](#) has an active group of chemical education researchers.

The University of Washington's [Physics Education Group](#) is one of the oldest in the country.

The [Division of Chemical Education](#) of the American Chemical Society provides resources for chemical education researchers and others interested in chemical education.

[PERcentral.com](#) is a Web site of the American Association of Physics Teachers with links to news in the field, the leading journals, and other information for physics-education researchers.

The [National Association for Research in Science Teaching](#) is a professional organization in the field that publishes a research journal.

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