Career Series: V. Becoming a Science Educator

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Abstract

Christopher Dobson is Assistant Professor in the Biology Department at Grand Valley State University (Allendale, Michigan) where he teaches biology, ecology, and integrated life science for K–8 teachers. As a biologist and science educator, he is interested in the purposeful improvement of the teaching and learning of science at all levels, specifically the learning of science through scientific inquiry.

Article

I currently work and am well received as a science educator in a traditional biology department at a state university, but what a long strange trip it's been! I debated over titling this article, "Forging a Career as a Teaching Scholar" or "Imposter Stumbles onto Science Education Gig." The truth is probably somewhere in between, but with a tenure decision looming in my not too distant future, I want to err on the side of caution. So now I have a title sounding something like a back-to-school essay topic. My apologies.

My love for teaching was born during my first undergraduate biology course, in which I helped several of my classmates understand cellular respiration. "Why didn't the teacher just say that?" was the response I will never forget. "Maybe I have something here," I thought, and explored the possibility more formally by becoming a tutor. I felt a rush every time I saw the light bulb go off in a student's eyes—I was hooked, hopped up on learning. Of course, I really dove into the pedagogical waters as a graduate student, teaching labs during my master's program in biology. It was sink or swim, and I struggled at first, but eventually learned to dog paddle.

It was not until I entered the Doctor of Arts Program in Biology at Idaho State University (http://www.isu.edu/departments/bios/DA/index.html), however, that I truly began to develop as a professional educator. Like other "teaching doctorates," such as the doctorate in education in biology (Ed.D.) or the doctor of philosophy in biological education (Ph.D.), the doctor of arts degree (D.A.) prepares graduates as broadly trained biologists capable of both effective college-level teaching and research methods appropriate to biology and to education.

Degree requirements allowed me the flexibility to design my program, to some extent, and conduct educational research. With an eye toward my future teaching, I investigated the development of critical thinking skills in anatomy and physiology students (2). The program also required successful completion of supervised teaching internships. I taught several lecture courses, in which I was responsible for curriculum development and student assessment. Evaluation of my teaching

was an integral component of these experiences, with substantive feedback coming through regular attendance by the supervising faculty as well as videotapes of my lectures. I never realized how much I talked with my hands!

During my first internship, I vividly remember my initial attempt to use a "minute paper," one of the classroom assessment techniques outlined in Angelo and Cross (1). I had just completed the world's best lecture on meiosis—I know because I was a graduate student with all the time I needed to prepare, a luxury I have not experienced since. I had students anonymously answer a couple of questions, on "3x5" index cards, that I had designed to gauge their understanding of the lecture's content. That night, as I read through the cards, I realized that 44% of the class had what I considered to be at least one major misconception about the process of meiosis.

My first thought was, "If this is the result of my best effort as a teacher, maybe I should go back to Oregon and take up plumbing with my cousin after all." My second thought was that I could correct these misconceptions at the beginning of the next lecture, before the upcoming exam. My heart raced as if narrowly missing a head-on collision. I realized that had I not conducted the assessment, I would not have discovered the widespread lack of understanding until grading the exams. At the risk of overstating the moment, it was **my** epiphany.

From that moment, I began to adopt a more scholarly approach to teaching. I now feel compelled to continually explore my effectiveness as an educator. In other words, I have become a researcher in my classroom. I use various assessment techniques as a microscope to examine my teaching more closely. I have learned to couple personal reflection with the results of this assessment to make informed modifications to my methodologies. The power of this mechanism lies in my ability to reach conclusions about my teaching and student learning based on the collection and analysis of data. As a scientist, this approach is not new to me. I have just begun to apply the same investigative mindset to my classroom, rather than to rely on gut feelings about how things are going.

The application of an investigative approach towards one's teaching is necessarily what transforms a bench-science scholar into a teaching scholar. A thirst for rigorous inquiry, underlying the scientific method, drives an authentic assessment of student learning. Specific research experiences can facilitate the teaching of science as well. National standards for the teaching of science (3) exist and state that students should learn science by doing science. That is, they should engage in the process of science. The goal of this approach is that, in addition to learning science content, students learn about the nature and methods of science. Who better to help them understand the process of science than a veteran researcher with colorful war stories that make the science come alive?

Becoming a teaching scholar, however, does not necessarily limit one's opportunities for doing science. Through my involvement in teacher preparation, I guide students through extended scientific investigations, in which they ask their own questions, practice experimental design, conduct data collection and analysis, and present and defend their conclusions. Mentoring these

students and watching them develop is not unlike supervising graduate students in a laboratory setting and is more fulfilling than I would have ever imagined. Because their investigations address their own questions and are unrelated to my personal research interests, the experience is authentic and the excitement for science is contagious. Less concerned with publication, I feel free to let my students make their own mistakes and learn from them—a more accurate representation of the scientific process.

Another primary responsibility of my position, as a science educator, involves K–12 outreach. Through state and federally funded projects, I interact with elementary and middle school teachers at local school districts to impact their students directly. This includes presentations and workshops to update the teachers' science content, as well as to highlight best practices for the teaching of science. I have also mentored several middle school teachers and their students in research projects that resulted in presentations at various Michigan teaching conferences. Grants are available to support this type of work, and the *No Child Left Behind Act* of 2001 specifically calls for the engagement of science and mathematics faculty toward this end. The successful grant-writing skills of an accomplished researcher, who is making the transition from bench-science scholar to teaching scholar, are an invaluable asset in securing money for these activities in public schools that are in desperate need of funding.

I feel extremely fortunate to be in my position. I am paid to teach undergraduate biology, my first love. I also impact science education at the K–12 level through my individual research, involvement in teacher preparation, and outreach to the teachers and students in local school districts. If you're interested in exploring a career in science education, one easily accessible inroad is through outreach. Volunteer at one of your local informal science institutions that conduct educational outreach, such as zoos, museums, or nature centers. If you have children, visit their schools and speak with their teachers. If not, contact the curriculum director for the school district in which you live to see where your expertise fits into the curriculum and get involved.

References.

1. **Angelo, T., and K. Cross.** 1993. Classroom assessment techniques: a handbook for college teachers. Jossey-Bass Publishers, San Francisco, Calif.

2. **Dobson, C.** 2005. Implications from a study on critical thinking. Focus on Microbiol. Educ. **12**(1)**:**2–5.

3. **National Research Council.** 1996. National science education standards. [Online.] http://www.nap.edu/readingroom/books/nses/html/.