On the Nature of Scholarship of Teaching and Learning: Comparing Disciplinary Research and Educational Research

Alix G. Darden

When I started my teaching career I taught using the traditional lecture, the predominant way I had been taught in college and graduate school. One semester, after failing a genetics test, a student with a learning disability came to me to discuss what he needed to do to improve. Together we went to the special services program director and discussed his learning style, my teaching style, and what needed to be accomplished in a genetics course. I came away from that meeting realizing that many of my students are visual learners and it would be useful if I could be more visual in my teaching. That semester the first modeling activity appeared in my genetics class and I started a self-education program trying to understand how people learn, what teaching techniques allow that learning to occur, and how to assess that learning. ("Learn" as it is used in this text refers to the ability to remember, understand, apply, analyze, evaluate, and create.)

Genetics is a course in which very abstract concepts are taught. Students have difficulty visualizing interactions between molecules they cannot see, such as DNA, RNA, and proteins. The ability to think and create abstractly is one of the last developmental stages of the brain, and in some individuals it never occurs. Alternatively, some students can think abstractly in one situation, but not in another. Therefore, many students, both traditional and nontraditional, enrolled in college genetics courses, may not be abstract thinkers and need to develop this thought process to successfully learn and apply the material. Merely presenting them with the information does not necessarily promote abstract thinking and success in the course. A search of the literature showed that while learning specialists recognized that this was true, there was not much information showing what were effective teaching techniques for genetics topics that promoted the learning that I wanted to occur.

Alix G. Darden is Assistant Professor of Biology, The Citadel, Charleston, S.C. (dardena@citadel.edu).

I began to realize that designing and teaching college courses was very similar to designing and carrying out scientific experiments. My course design and the teaching techniques I use could be hypothesis-driven and theory-based. When I use a teaching technique applied to certain information, I should be able to predict what I expect the students to have learned and then assess whether or not the learning I predicted has occurred, proving or disproving my hypothesis.

The Nature of Scholarly Work

Throughout our academic careers we are constantly evaluated on the basis of our scholarly work. This occurs when we receive our Ph.D., get hired, get evaluated for promotion and tenure, submit grants, and submit work for publication. Scholarship, according to Carnegie Foundation for the Advancement of Teaching President Lee Shulman, is an act of intelligence or of artistic creation that becomes public, an object of critical review and evaluation that others begin to use and build upon. Glassick, Huber, and Maeroff looked for common threads in the evaluation of scholarly work by different bodies, such as granting agencies, journal editors, and promotion and tenure committees (C. E. Glassick, M. T. Huber, and G. I. Maeroff, *Scholarship assessed: evaluation of the professoriate*, Jossey-Bass, San Francisco, 1997). They write, "We have found that when people praise a work of scholarship, they usually mean that the project in question shows that it has been guided by these qualitative standards: (1)

clear goals, (2) adequate preparation, (3) appropriate methods, (4) significant results, (5) effective presentation, (6) reflective critique."

Why Scientists Should Be Involved in Science Education Research

We are learners. The literature shows that people learn and retain information best when they are engaged in and explore a subject before receiving the explanation. We have been experiencing and exploring learning all our lives. We have been exposed to the teaching tools and have probably taught many others, albeit informally, as we helped classmates, passed along laboratory techniques, and presented our work to colleagues. We have evaluated and refined our own learning techniques, some more consciously than others. We are therefore in a good position to conduct research on how to promote learning in our disciplines.

We are qualified to do the research. Scholarly work requires constant growth in knowledge and methodology. I have gleaned most of the knowledge and methods that I use in both my disciplinary research and my educational research since leaving graduate school, but for both I use the same logical process to achieve my goals. In my disciplinary research, I may want to isolate a gene from a particular organism; in my classroom research, I want to assess the ability of a particular teaching technique to promote abstract thinking. In both cases, I will prepare by reading the literature in the field, talking with colleagues, and ensuring that this work has not already been done. I will then apply the appropriate molecular biology techniques to isolate the gene in my disciplinary research and apply learning assessment techniques to measure abstract thinking in my educational research. In both cases, if I do not have satisfactory data to answer the hypothesis, I may need to use different techniques until I have achieved my goal. This may involve reading more literature and discussions with colleagues. Significant findings of both research projects will be presented at appropriate meetings and submitted to peer-reviewed scholarly journals. In both cases, there is reflection of the significance of the data as well as its relevance with respect to the current body of knowledge. The process outlined above mirrors the scholarly process outlined by Glassick et al.

We know what we want our students to learn. The education literature can provide us with theories of how people learn and what educational techniques work in what situations, but we want to know what works best for our courses and our students. Having a deep working knowledge of the material we want our students to learn and how they will continue to use this information makes us prime candidates to research how to promote learning in our disciplines.

We have a vested interest in the next generation. The students we teach fall into three broad categories. (i) A small number will go onto graduate school and become our graduate students and future colleagues, doctors, dentists, etc. We would like to encourage the best and the brightest to pursue these careers. (ii) A larger percentage will become the teachers of all future students that we, as faculty, receive. We would like to receive well-educated students. (iii) The vast majority will become voters and biological consumers. How they react to biological warfare, human cloning, genetically modified foods, new vaccines, etc., may depend heavily upon how they learned and understood science either in college science classrooms, or in the classrooms of those science teachers we provided content for. We would like these people to make sound decisions.

Scientists should regard science education research as one more facet of their discipline that they apply to their work where appropriate. They should actively support this research as scholarly work in hiring, promotion, and tenure decisions. ASM has taken a lead in this initiative by having a division in education, which is active at national meetings, and by launching a new peer-reviewed journal, *Microbiology Education.*