

IS THIS SCIENCE?

Can you be a scientist without a degree in science? I think most of us would think so. But, imagine a scientist who has never taken a course in science methodology. What if this scientist learns the craft by observing other scientists work. After many years of observation, he or she is given the chance to "do some science." At first, they work under the supervision of another scientist, and then eventually this scientist-in-training is given a complete "science job" of his or her own. Will he or she be successful as a scientist? I guess this depends on the nature of the training.

What if the environment does not include scrutiny of science journals, constant and critical reevaluation of the scientific techniques applied, or peer review of the science process? What if the scientist-in-training is exposed only to a limited number of techniques and learns to use whatever "gets the job done" easiest and fastest? What if he or she decides that one experimental design or statistical analysis is the "best" and tries to force any science situation into that format? What if little attempt is made to quantify success and little reward is given for quality? How likely, under this scenario, are we to end up with a successful scientist?

I think the conditions described above do not preclude quality science, but they do little to insure or promote it. Most likely a scientist trained in this manner will be quickly out-of-date and ineffective. Fortunately, this scenario sounds ludicrous. It is unlikely that anyone approaches science in any manner similar to that described above. Now read those first two paragraphs with the word "teaching" in place of "science" and "teacher" in place of "scientist" (and replace "experimental design" with "presentation technique" and "statistical analysis" with "testing procedure"). Now is the scenario out of the ordinary?

Teaching is no less a science than ecology. The science of education has its own philosophical and theoretical structure, its own experimental tech-

niques, its own body of literature to explore. With my degree in ecology, should I expect to be employed as a psychologist, an engineer, an administrator? (That's a different issue!) Yet, as a trained ecologist I am immediately assumed to be competent to teach. Some might argue that no immediate assumption is made and that any prospective faculty member is examined for his or her teaching ability by giving a seminar as part of the interview process. But the assumption that teaching a course and giving a seminar are the same, or even necessarily utilize the same skills or abilities, just highlights the problem.

Of course I cannot be a psychologist if I've never been exposed to the work of a psychologist. This isn't the case for teaching. Everyone experiences the education process for years. We see good teaching and bad teaching, and hope that we can distinguish between them. But I wouldn't want a psychologist whose only claim to expertise was years of experience as a patient. The training for any job includes the study of alternative approaches (some of which may be missed by more haphazard "experience") and methods to evaluate success objectively. As educated students of a subject we possess a knowledge base, but this is only one of the many pieces that lead to successful teaching of that subject. Usually we don't know how to transfer this knowledge and we don't know how to evaluate the success of the transfer.

Let's go back to the original analogy. How do we do quality science and how does this relate to quality teaching? We've passed the first peer review process, we are all funded, i.e., hired. We find ourselves with a teaching job, without clearly defined hypotheses to test or objectives to investigate, and often without a clear idea of the options for achieving them. We have in effect skipped the creative investigation and proposal-writing steps of our process. What would you do as a scientist in that situation? Chances are everyone has an answer to that, relative to their science, because we all spend a lot of

time reading and thinking critically about our research interests. What if we spend a small amount of time and energy critically analyzing our teaching? As teachers, let's start, or continue, to ask, "Why are we doing this?" and "How might it be done differently?" For each class, assignment, test, project, we can ask: "What is it we expect to accomplish?" "Will this activity help us reach that goal?" "Are there alternatives?" "How can we determine if we have succeeded?"

Typically we only have two objective measures of our teaching success: classroom evaluations and the grades that our students achieve. It seems to me the greatest difference between what we do as scientists and what we do as teachers involves the critical input of our colleagues. This also is relatively simple to bring about. Invite a colleague to review your syllabus, the goals and instructions for a specific assignment, or a test. Invite a colleague to spend a few minutes in one of your classes and listen to his or her reactions. Meet with the teaching assistants for your course and solicit their input to the activities offered, before and after the activities are implemented. Sit in on classes and examine them critically. What could work for you? This does not mean a significant shift in time and energy. It is a significant shift in philosophical approach.

When we begin to view teaching as a complex process with many alternatives, to critically evaluate the decisions we make, and to solicit the input of our colleagues, we've taken the largest and most significant steps in changing our teaching from an activity we do by rote to one in which we bring the creativity we utilize in our own particular science to the science of successful teaching. This will have profoundly positive effects on our students' learning, which is, after all, why we are here.

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