VIEWPOINTS

Good Teaching is Good Science

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Teaching is often placed in contrast with scholarship, research, and science in general, and is sometimes described as an activity that precludes scientific endeavor. The distinction is unfortunate because it limits thinking about teaching and the potential for achievement in instruction and minimizes the scholarly value of teaching. Through the efforts of Lee Shulman and others, we now recognize the *scholarship* of teaching, and pedagogical accomplishments are more likely to be accepted as scholarly accomplishments and reflected in promotion and tenure considerations. Teaching can range from the most basic transmission of factual knowledge to a process that transforms both teacher and student through critical thinking, experimentation, and discovery. Good teaching is and should be good science.

We are all familiar with the scientific method and its application to traditional scientific inquiry. It involves observation to identify gaps in knowledge, statement of a problem and a hypothesis, design of experiments to test the hypothesis, analysis of data from experiments, and subsequent decisions based on the experimental findings. When applied to teaching, the scientific process leads to advancements in methods and even to discovery of new knowledge. The application of the scientific method should be thought of as integral to good teaching rather than an alternative to it. If we accept that teaching methods can advance, then a structured or scientific approach to teaching should be used to identify new directions and validate new teaching methods. How can advances in teaching occur in the absence of the scientific method? Teaching is much too important to leave to the alternative approaches of luck, instinct, or intuition.

The scientific method can be readily applied to teaching and can be observed in the best teachers.

- It begins with thoughtful, well planned observation to identify gaps in knowledge. We refer to this in its most current form in pharmacy education as “assessment” or “evaluation.” What are we doing in teaching that is not effective? What can be improved? A systematic approach should be used to identify these gaps.
- A gap in knowledge can then be expressed as a problem statement. It may be, for example, that

our students are not adequately demonstrating professional behaviors, or are not proficient in the care of patients with diabetes. Multiple gaps need to be prioritized to apply our limited time and to maximize our efforts. Complacency leads to acceptance of the status quo when we do not identify gaps or problems. I once heard a professor state “I have been teaching for 25 years. If there is a better way to teach I would already be doing it.”

- Advances in teaching can be hypothesis driven. Given the current state of teaching, we can predict that certain actions (teaching methods) will have a certain effect, and we can design experiments to determine whether our assumptions hold up. All too often in our teaching, we allow the hypothesis to become the explanation and we move on without full benefit of the scientific validation process.
- The experimental process can be applied to teaching by testing hypotheses. This involves using state-of-the-art study design and methods to measure instructional outcomes. The measures may be quantitative or qualitative, but valid instruments should be used and accepted methods such as controls, randomization, and statistical analysis that maximize validity and minimize bias. Typically, when we test new teaching methods we set out to prove that our new idea is good, that it is an effective teaching strategy. This approach is biased and does not lead to scientific validity.
- Data collected in experiments should be properly analyzed to make a decision about the experimental methods, that the intervention did or did not achieve its intended effects in instruction. The eventual application of new teaching approaches may then depend on resource issues and examined as a risk (costs) versus benefit question.

Even though the scientific method is well accepted in our universities for research, it is not the standard used to achieve progress in teaching. Scientific thinking has been

dissociated from instruction. Applying it to instruction makes the instructor and the scientist one and the same. The scientific approach provides other benefits for faculty members and students as the advances to teaching would be made in a format that could be more readily accepted

by others, have greater validity, and be more likely to be accepted as scholarship by the larger scientific community. Teaching innovations could become more readily recognized as research. Good teaching is and must be good science.