Editorial

Willing Retention of Misbelief

Readers of mysteries and science fiction are often credited with willing suspension of disbelief—an unscientific approach but one that is personally satisfying. It seems to me that many of us approach teaching chemistry not only with willing suspension of disbelief, but also with willing retention of misbelief. Not only do we fail to question whether what we are doing is effective and appropriate, but also we persist perversely in believing things that have been contradicted by simple observation or by research into teaching and learning.

What are some of our persistent misbeliefs?

- Most of the students in our classes are chemistry majors.
- We do not have time to discuss applications and implications of chemical science, because we have to concentrate on the basics.
- The latest research results are too complicated and require too much background for our students to appreciate and understand them.
- Chemistry is so hard that we need to provide algorithms by which students can obtain correct answers without understanding why the algorithm works.
- Students can learn directly from what we say, without processing information and constructing understanding.
- Students who can answer numeric questions on exams therefore understand the principles of chemistry.

Teaching and learning would benefit substantially if our actions were influenced less by these misbeliefs, and if we designed course content and pedagogy more realistically.

It is abundantly clear at my university, which produces about 50 chemistry majors per year and has about 3000 students in first-semester, first-year chemistry courses every fall, that most of the students in first-year courses are not going to become chemistry majors. The same is true at many, if not most, colleges and universities. Yet first-year courses include many topics, such as details of orbital hybridization or molecular orbital theory, that are of limited use to students who will major in biological sciences or in engineering, and that can be learned much more effectively in advanced courses that students who need to know them can take. Allocating time and effort to such topics means that we often fail to tell students about exciting new developments that chemistry has brought, or about how chemistry affects the major concerns and problems of the world.

In an essay titled "Cloning the Teacher", Arnold Weinstein, a professor of comparative literature at Brown University, contends that "our entire model of instruction is held hostage to a disciplinary paradigm that reflects the research agenda of the professoriate" *(1)*. Weinstein's title reflects his inference that we are trying to replicate ourselves, continuing "to display the bag of tricks that we have acquired professionally, and to measure our students according to how they stack up". Weinstein argues persuasively that instead we ought to instill in students a sense of the pleasure inherent in learning and count on students thus empowered to be able to learn what they need and desire to know throughout the rest of their lives. I particularly liked his vignette from Brecht's play about Galileo in which Galileo says that learning is innately seductive (and therefore potentially dangerous). Would that more of our students gained enough insight into chemistry's way of viewing the world to be hooked on learning chemistry forever. To assume that all students in our introductory courses already have this insight and motivation is a sure-fire way to prevent most of them from ever attaining it. Displaying the fact that we love what we do and care passionately about the field of chemistry is much more likely to persuade students that chemistry is for them, and this is probably the major part of what many students will remember long after the course is over.

Both learning and the unknown are powerful challenges that can motivate students to put forth their best efforts. We ought to make better use of them.

Students also ought to get a better picture of how useful chemistry is and what insights it can provide regarding crucial problems that face society. A student who has completed a general chemistry course ought to have some understanding of how chemists are addressing major problems involving energy resources, adequate supplies of pure food and water, degradation of the environment, poverty, disease, and terrorism. Even better, the student should be aware that these problems are intertwined and solving one of them at the expense of any or all of the others is not a true solution. Better yet, the student should realize that with appropriate education and experience, the student could contribute significantly to society's efforts to solve these problems. Former ACS President Ronald Breslow has suggested on numerous occasions that students are more likely to be attracted to a field in which the student can participate in solving important problems, but we persist in teaching chemistry as if it is a dead science, where everything is already known. Both learning and the unknown are powerful challenges that can motivate students to put forth their best efforts. We ought to make better use of them.

Literature Cited

1. Weinstein, Arnold. Cloning the Teacher. *Brown Alumni Magazine* September/October 2002, p 29. Available at *http://www.brownalumnimagazine.com/storydetail.cfm?ID=1652* (accessed Oct 2003).