Editorial

Learning from Others

All of us can learn a lot when a very effective teacher communicates about teaching. An example is an interview with Eleanor Siegrist, this year's winner of the James Bryant Conant Award in High School Chemistry Teaching, that begins on p 1408. Reading Siegrist's answers to the *Journal*'s questions led me to think further about our roles as teachers. Some of these thoughts follow.

Respect Students; Expect Reciprocal Respect

Siegrist reports that she has high expectations for her students, encourages them not to give up or sell themselves short, and provides support to help them experience the satisfaction that comes from achieving difficult goals. There is considerable research to support the thesis that students who are told that they belong to a group that is below average in a particular area are likely to perform below average in that area *(1)*. Though sometimes it is easy to take a skeptical view of students' willingness to work hard and their aptitude for learning, such skepticism may be a self-fulfilling prophecy. Assuming without evidence that any student, or group of students, will not do well in chemistry is not appropriate and may well be damaging. We should not sell students short by not challenging them. But we should also provide them with every possible opportunity to succeed.

To do this requires hard work. We must devote more time and effort to developing challenging lessons and assessments, and to providing more means for helping students to succeed. If we expect students to work hard to learn chemistry, we ought to expect to work hard to help them do so. Making it clear that we are willing to work hard on students' behalf shows that we respect them; such respect is likely to be reciprocated. Mutual respect provides a strong basis for both teaching and learning—and it may well extend also to the subject being taught, enabling students to reach a more thorough understanding of chemistry that they will retain for years.

Teach for Understanding; Encourage Creativity

Siegrist reports that one important change during her career as a teacher was great improvements in instrumentation and technology. Today's high schools often have instruments and information technology that were not available to college students 40 years ago. Such changes in the tools of the trade are also likely for our students during their careers, and change is accelerating. Therefore it is imperative that our students understand chemistry rather than learning by rote things they expect to be on a test. Without fundamental understanding of the subject and a collection of techniques that can be applied to solving real problems (as opposed to end-of-chapter exercises or fill-in-the-blanks laboratories), how can a student adapt to the many changes that will occur during her or his career?

Understanding can be developed in different ways by different students, so a broad range of learning experiences is important. Siegrist points out that projects often appeal to more creative students—ones who sometimes perform poorly on routine work. At the undergraduate level, some students are not turned on until they get into a research laboratory, but once they begin research their motivation and performance jumps to a high level. Other students learn better through discussions with their peers, and all students learn better when they become fully engaged with the subject matter. Simply presenting good lectures is not enough. Students who could become excellent chemists but learn in different ways may be induced to choose different careers.

Mutual respect provides a strong basis for both teaching and learning

Be True to Yourself; Experiment

I have known many excellent teachers, and each of them has had a personal, unique style. How they taught was based on application of principles derived from experience and from chemical education research, but those principles were interpreted differently in each case. One of the most important aspects of good teaching is that each teacher must develop a style that suits his or her personality and the students being taught. As Siegrist puts it, "find what works for you." "Find" implies a quest, and that's what we all should be on. It is OK initially to follow the lead of an experienced teacher, but finding what works best is a continual process of trying new approaches and evaluating how well they work.

That none of us will ever find a single best way to teach is a given. Because students, teachers, and the society within which they work are in constant flux, it is the quest that counts. Letting students know that we are constantly striving to improve also helps. I recently spoke at a conference of college teachers where two undergraduate go-fers stayed for the presentations. After a spirited discussion among the audience and speakers about the best ways to teach first-year courses, one of the students remarked to me that up to then he had been unaware that teachers were so passionate about improving what we do. He thought it was great that we cared so much. Trying new things every time we teach is guaranteed to keep us fresh, make teaching more interesting, and provide students with an engaged and vital model of a scientist attempting to do the best possible job of getting her or his subject across.

Literature Cited

1. Steele, C. M. *Am. Psychol.* **1997,** *52,* 613; Aronson, J.; Fried, C.; Good, C. J. *Exp. Soc. Psychol.* **2002,** *38,* 113; Beilock, S. L.; Carr, T. H. *Psychological Science* **2005,** *16*(2), 101; Dar-Nimrod, Ilan; Heine, Steven J. *Science* **2006,** *314,* 435.