

LETTERS

Experience Is Best Teacher for Scientists in the Classroom

Physicists, engineers, and other scientists are being urged to become involved with science school teachers in their classrooms. (See, for example, Ramon E. Lopez and Ted Schultz, *PHYSICS TODAY*, September 2001, page 44, and the Letters department, January 2002, page 10.) Easier said than done.

This letter presents nine relevant lessons extrapolated from retiree volunteer experience in many middle-school science classrooms. We report on a total equivalent of approximately 11 years, at one day a week: 6 years by ourselves (a physicist and an engineer), and the remainder by 12 other academic or professional scientists who participated to varying extents.

We discuss only classroom involvement in which a scientist is working directly with one teacher, one half-day to two full days per week—with the primary goals being to aid and improve mainstream teaching, and perhaps to develop and implement a new curriculum.

Lesson 1: You are much more likely to be useful and successful if your teacher is eager to accept help, to be guided, and to recognize your expertise.

In middle school, science is now regularly taught as a combination of physical, Earth, and life sciences, yet most teachers have been trained only in life sciences. Such teachers may well feel less competent in the physical sciences, and eagerly accept you. Unfortunately we have also found that some poorly qualified teachers do not want any “meddling” or outside observation in their classroom.

However, a skilled or “master” teacher may not want you to aid in mainstream teaching, but rather see

you only as providing “gee-whiz” extras, demos, or enrichments; doing supplemental work with a few advanced students; or tutoring less successful students. Though useful, those activities have less impact. That teacher may not accept you as a full consultant or participant in the day-to-day planning and teaching, and (perhaps subconsciously) may even view your comments and suggestions as critical instead of supportive.

Lesson 2: It is very important that your teacher view and appreciate you as an equal-but-different collaborator and partner in the team.

Lesson 3: Do remember that your teacher is the boss. You must have humility. School teaching is very different from an academic or professional environment. You must have a desire to enhance the students’ learning experience in ways that meet the teacher’s needs and that also fulfill your own aims to aid and improve science learning overall.

Lesson 4: Move slowly and with care. Start with simply observing class and teacher; move on to small, incidental collaborative steps; then finally become a true junior participant in the whole process.

Lesson 5: Choose your teacher carefully—and quickly move to another if the arrangement does not appear to be mutually satisfying.

Lesson 6: You may have more success in a lower socioeconomic neighborhood, with typically less-well-prepared teachers (senior teachers often can choose their schools). And there you may do more societal good. Still, classroom attention and disciplinary problems may be worse. Though those will be the teacher’s sole responsibility, they will impact upon you. It is your choice—the challenge may be greater—yet so may be the personal reward.

In two low-socioeconomic placements—one with an experienced life sciences teacher who admitted to knowing no physical sciences, and another with a first-year teacher—we did very well. But, in two placements in an excellent school and affluent neighborhood, we were

treated like wallpaper.

Lesson 7: Remember that, for the teacher, outside help can also add to the workload, take up valuable time, and require extra coordination and communication. You may need to work to keep yourself in the loop.

Lesson 8: You generally need a “sponsor” for authentication before linking up with an individual teacher within a school system. Simply walking into the school does not work.

Our initial group of volunteers were invited by the science coordinator of our county school system. We were under the auspices of RE-SEED (the national Retirees Enhancing Science Education through Experiment and Demonstration).¹ RE-SEED and the school system jointly provided a 35-hour training course, which wisely included many classroom issues.

At the same time, the school system was implementing a major science curriculum revision. Our sponsor, the science coordinator, had explicitly pressured the master science teachers in those schools, already in curricula throes, to accept our volunteer aid—accept willy-nilly. That perhaps explains the poor response of several teachers, who let us observe but really do nothing more. They did not want an even further perturbation in their now-rocking, yet previously well-oiled, ships, particularly if they were close to retirement.

Lesson 9: In the greater Boston area, RE-SEED and SEED, working jointly, have been very successful over the past 10 years. SEED directly interacts with local school systems and trains willing teachers in weekend and summer workshops. Then RE-SEED places its trained retiree volunteers with the SEED teachers. This double-barreled approach is clearly superior, but it is a much larger endeavor.

Do heed these lessons. We wish you a very successful experience. Good luck.

Reference

1. RE-SEED and SEED were started at Northeastern University by the late
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prising until one notices that the standard deviation is largest for this test. Overall, the scores are so uniformly high that they provide little discrimination.

The situation is somewhat different with the subject matter test: The correlation with first-year graduate grades is 0.27, about the same as for undergraduate grades, where the correlation is 0.28.

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Physics Intentions and the GRE

In the early 1980s, three coauthors and I published a letter (PHYSICS TODAY, April 1984, page 15) stating that the Graduate Record Examination (GRE) aptitude tests showed that those students taking the tests and indicating physics as their intended area of study had the highest combined quantitative and verbal scores of the 98 disciplines listed. In view of evolving trends in graduate education, it seemed of interest to reexamine the quality of students planning to go to graduate school in physics, as measured by the GRE aptitude tests.

The data given here appear in the *GRE Guide to the Use of Scores*, available online at <ftp://ftp.ets.org/pub/gre/992362.pdf>, and are based on exams taken between 1 October 1997 and 30 September 2000. Test takers were grouped into 50 broad fields by intended graduate major, and mean scores are reported for each of the three aptitude tests, verbal, quantitative, and analytical.

For the physics and astronomy category, the mean score ranked first in quantitative aptitude, first in analytical, and tied for sixth in verbal (students who listed philosophy as their intended course of study ranked first in verbal aptitude). When the means are aggregated, students intending to study physics and astronomy easily rank first among the 50 categories.

Physics graduate programs are still getting good students—so good, in fact, that the aptitude tests are of limited value in predicting first-year grades in graduate school, the one outcome for which complete data are published. The correlation of first-year graduate grades with the aggregate aptitude score is only 0.20. Moreover, the best correlation is with the verbal score, which is a little sur-

Turn Down the Lights

While PHYSICS TODAY's April 2002 cover photo of Earth at night is impressive, I would urge readers to note that the lights seen in this image represent billions of dollars per year of energy wasted on upward-directed outdoor lighting. That issue of the magazine, devoted to the energy situation, appears to address only the need for increased energy production, with conservation barely mentioned. Ernest Moniz and Melanie Kenderdine do point out that efficiency improvements "represent the most effective opportunity for meeting energy and environmental goals in the near to intermediate term" (page 45). How effective is it to use light fixtures that waste up to a third of their light by directing it upward?

Physics can help with efforts to increase energy reserves; it can also be applied to conservation. The quality of outdoor lighting techniques and fixtures is generally poor worldwide, the US included. Proper outdoor lighting, with fixtures that direct no light upward and that provide nonglaring illumination at appropriate brightness levels, can provide safe nighttime spaces while conserving energy and preserving the wonders of the starry skies.

Part of California's response to its recent energy crisis (see http://www.energy.ca.gov/outdoor_lighting/index.html) was the creation of an innovative project to examine the nature of existing outdoor lighting. The initial results are not surprising: Most facilities are poorly lighted and often at unnecessarily high levels.¹ Such lighting does little to help with safety or security, or to improve the nighttime ambiance of our communities. It is obtrusive to many and wastes a lot of energy. By reducing