Scientific elite or outcast?

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There is no doubt that since the beginning of this century the United States ranks first in generating outstanding scientists. It is therefore ironic that as a whole, the population of the United States does not rank first in Science and Mathematics. One only need turn to the media to see that society does not value science and science education as it did just a few decades ago. In spite of all the advances in science and the many contributions of related technological developments to society, science illiteracy is rampant. The average person has little faith in scientists and there are more pressing problems than science education on the agenda of most people. These are worrisome developments because it is in the interest of society that everyone understands at least what science is about. No one can deny the formidable advances that have been achieved in science and their impact on the quality of life — advances that would not have been made without the outstanding quality of American scientists. What happens now in the classrooms across the United States will directly affect the health and well being of this country in the next century. We must act now to prevent losing our edge in science and technology.

At the college level, the introductory science course often is one of the biggest hurdles in the academic career of a student. For a sizable number of students the course leaves a permanent sense of frustration. I only have to tell people I am a physicist to hear grumbling about high school or college physics — almost to the point of making me feel embarrassed about being a physicist. This general sense of frustration with introductory science is widespread among non-science majors required to take science courses. Even science majors are frequently dissatisfied with their introductory courses, and a large fraction of students initially interested in science end up majoring in a different field. What have we done to make it that way, and can we do something about it?

I believe science education has been focused much too long on competitively generating a steady supply of future scientists. We must direct our science education not just at students going on to a scientific career but also at those majoring in other fields. It is time to realize that the demand for scientists is determined to a large extent by people for whom the introductory science course is the only direct exposure to science and who remember science only by the frustration it has caused them. It is time to realize that those who become successful scientists do so in spite of the current educational system, not because of it. It is time to realize that better science education for all will ultimately lead to a higher standard of living.

Broadening and improving science education will require a major change in attitude. The current mode of instruction is self-perpetuating: post-secondary faculty educate both their own successors and future secondary teachers; secondary teachers, in turn, prepare the next generation for a new cycle. At all levels one can find excellent teachers, but for the most part instruction in science is geared at the scientist, not the general public.

Recommendations:

1. Teacher enhancement

To restore public opinion of and support for science I suggest making an all-out and systematic effort to place the nation's best, most innovative and most dedicated instructors at all levels of education. This will require a new reward structure — currently successful research is rewarded much more highly than successful teaching. A new role model — that of the 'teacher-scholar' — must replace the current role model of the hard-core researcher in a white coat who prefers not to deal with students.

2. Innovating Pedagogy

The science education literature abounds with innovative ideas, but unlike innovations in science and technology, few of these ideas are adopted by anyone besides the innovator. Even techniques that have been demonstrated to work have not found widespread acceptance. Overcoming this inertia is becoming an urgent problem. I therefore recommend rewarding not just the developers of successful innovations, but also those who adopt these innovations.

3. Using Technology

New advances in information technology must be used to increase and accelerate dissemination of new ideas and materials in education. Widespread availability of materials will lower the threshold for adopting innovative ideas in science education.

I firmly believe science has done more for society than it is generally credited for — a view which unfortunately is not widely held outside the science community. It is therefore more important than ever that we direct some of our energy at educating the public about science — energy that has been directed almost exclusively at research and at educating and training future scientists. It is time for science educators and researchers to become more pragmatic, to step down from their ivory towers, and to reach out to society not only through scientific accomplishments, but also through better education and information.