

Returning to higher standards in education

As I was reading the manuscripts prepared for this issue on the crisis in high-school physics teaching (see page 25), questions came to mind. Why are we, after decades, *still* talking, writing and lobbying about a crisis in science education? Is the present situation worse than the past? Different? Or just a continuation of a long trend? Is the situation worse in science education than in English? in history? in literature? in foreign languages? Can the crisis in science education be cured independently? Supposing it could be, would it be responsible to do so?

One approach to questions like these is that there really is only one question: Why is there a crisis in education? Here is a question for *all* citizens. For years, the nation has been allowing a once unassailable proposition—education is a fundamental good—to be eroded by qualifications.

Time has brought many changes since the days when only a small fraction of the population attended high school and when graduation signified a considerable achievement. Note, in figure 3 of John Layman's article (page 29), that until 1920 enrollment in physics amounted to 15% or more of the high-school total, implying that most of any given graduating class has studied physics. Physics still enjoyed a role in the background of educated people. Realize, too, that it came on top of a grounding in mathematics and English taught as disciplines, along with other basic subjects so treated. During the 1920s and 1930s, high-school attendance spread to a broader segment and the curriculum accommodated itself accordingly. Note, in Layman's graph, the introduction of "general science," which apparently supplanted physics for many students, while analogous dilutions were replacing other subjects whose titles disappeared completely from the curriculum. In the 1950s and 1960s, we opened the system more, offered an even wider choice of electives, replaced "high" by "secondary" and in effect legislated graduation for all.

By the 1970s and now, we find the situation so debased that we can no longer depend upon the talents and dedication of sufficient number of persons to staff our schools, persons who in an earlier time had been educated to understand what it means to master a discipline and who found in high-school teaching an acceptable outlet for their abilities. As we broadened educational opportunity we elected a path that led to standards we do not respect. And we have failed miserably to provide for teachers the tangible and intangible rewards that would procure for us the quality of service we once had.

As citizens, physicists ought to be joining vigorously in rebuilding secondary education to make it worthy of a nation that professes world leadership. But what should we be doing as physicists? Our professional societies are attempting to influence Federal policy

concerning science education at the secondary level. For smaller groups and individuals the targets are state legislatures, school boards and principals. At each of these levels there are cases to be made: Teaching physics competently requires a background in physics; laboratory work lies at the heart of physics; physics teachers need time and full credit for preparing experiments and for the care of equipment; the budget for equipment and supplies must be reasonable; schools must enter the competition for persons competent to teach physics.

Our concern for the teaching of our own subject might not be regarded as self-interest if we were to stress simultaneously some other points: to do well in physics, students must be able to use not only mathematics but also oral and written language; high-school physics belongs in the background of everyone, not only of those aiming at technical careers; students should receive a cultural and historical context in which to set physics.

There is an even more difficult task to improve science teaching in the elementary grades. Here, now, *all* of our children are being exposed for a few minutes each week to something called "science." It would be unseemly and incorrect to assert that the time so allocated is uniformly a waste, but colleagues of ours who have observed elementary science teaching have generally found much to deplore. Even a small improvement, if felt by so many children, would in effect be amplified. We would have to help improve teacher preparation and would have to learn more about how youngsters learn. Some of us have been adding to the state of knowledge about learning and have been working with elementary teachers; we could turn to these colleagues for guidance. Because teacher training takes place in our colleges and universities, those of us in academe have an inescapable responsibility for doing it better.

The articles in this issue suggest, but do not exhaust, ways in which physicists can act to improve physics teaching and, indeed, all teaching. Idealistic, yes, but in hindsight we see evidence of the effects of an excess of a kind of pragmatism. There are indications that the people of the nation are interested in a return to earlier standards and will provide resources for this purpose. We should encourage such a move; we must do all we can to see that the public is not let down. Physicists should feel this obligation keenly and choose to act on it. They will have to remember that they will be working with a cumbersome system peopled with sensitive, well-intentioned individuals, many of whom are eager for change. Tact and patience will be needed in abundance.

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