

PRE-COLLEGE EDUCATION

There appears to be a great stir in the land concerning our science education system. Eminent committees have warned us that our nation is at risk. Congress has given extra money to the NSF specifically earmarked for pre-college education. Many school districts and even states are experimenting with drastic revisions of how and when physics is taught in the upper grades. Physicists are taking part in some, but not all, of these projects.

The United States has a long tradition of physicist involvement in school science teaching. My article on page 22 tells of numerous interventions by physicists in the schools during the last 150 years. In each case there were immediate effects followed by a gradual change either back to the previous practices or to an altered and poorer form of the innovation.

The article by Will Pfeifferberger, Ann Marie Zolandz and Lee Jones on page 30, gives statistics concerning the performance of American students on standardized national and international science exams. Getting the facts about education is not trivial. Anecdotal information is apt to reflect local situations and is about as reliable as the common belief that "students are not as good as they used to be." Perhaps they never were. Going beyond anecdotes requires sampling a large and complex population and framing questions that elicit answers whose significance we can interpret. Pfeifferberger and his collaborators have great experience in trying to monitor educational results, and in this article they summarize some of the facts about the results of physics instruction.

On page 38, Gerhard Salinger describes new instructional materials that have been developed in recent years. In many ways the situation in our schools—or at least our awareness of the situation—is more complex than it was 30 years ago, when the previous national curriculum improvement efforts were in full sway. There are now new ideas about the way students learn and a new appreciation of the problems of reaching a broad spectrum of students with different backgrounds and different interests and abilities.

American physics organizations as well as research teams at various national and industrial laboratories are assuming the responsibility of engaging students in science. On page 48 Brian Schwartz and James Wynne describe some of the programs that the societies and labs are sponsoring. The American Physical Society has established a new Forum on Education, providing leadership and support for physicists who want to become involved in school science instruction.

Jose Mestre, in his article on page 56, provides

background information about the latest theories of learning. Some of the points may seem obvious to experienced teachers, but the standard teaching practices in our schools (and in our colleges) ignore the obvious realities. The article underlines the necessity to understand the educational process before plunging into a missionary attempt to change it.

There have always been a few physicists who specialize in preparing new teachers, and many physicists have occasionally given courses or written books for a general audience. Most large research departments, however, do not pay attention to the issue of teacher training. At Ohio State, Ken Wilson is devoting a major fraction of his time to questions of teacher preparation, and he is forming a group within the physics department to specialize in that activity. On page 71 Wilson describes the mission as he sees it and the way in which he and the department are responding.

There are several underlying themes to these articles:

- ▷ Science instruction in our schools is in trouble.
- ▷ Physicists have in the past made major changes in our instructional methods, and they are once again getting involved.
- ▷ For the sake of our common goals and the good of the nation, all physicists ought to be aware of the problems, and more of us ought to help solve them.

Physicists wanting to help must realize that school education is very different from physics research or university life. The schools are a complex system of politics, sociology and the nature of teachers and children. To affect the system, you cannot simply drop into your local school and give a few guest lectures. You need to study learning theories or at least to know about them. You can't have a serious discussion about atoms with third graders—or even with the teachers of third graders. You can't provide a fascinating physics course to high-school students who are hungry or frightened or too immature to understand proportions. You can't move into the school in one year and out the next and hope to leave a lasting effect.

Many great physicists have been fascinated by the challenge of teaching physics to children. We hope that this special issue will provide the necessary caveats to temper the enthusiasm for panaceas while still hinting at the fascination of the work and the professional obligation to help.

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