WHY NOT TEACH 'PHYSICS FOR THE FUN OF IT'?

Instead of asking why few students take physics, suppose we ask our best physicists why they are physicists. My guess is that most will speak of the enjoyment of thinking about observations, forming and testing hypotheses, and the excitement of seeing it all fit together. Contrary to the suggestions made by some correspondents in the April issue (page 112), they aren't physicists because physics relates to space travel and energy resources, nor because everybody was required to take physics. They're in it for the fun of it.

Marlys Stapelbroek's letter spoke of the difficulties of "thinking experimentally." It seems to me that the time to start showing our future physicists the fun of thinking experimentally is when they are children in the early grades of school, before their natural curiosity and penchant for experimenting have been beaten out of them with "Don't touch!" and "Listen to the teacher for the right answer."

I have been involved as an author in two different science curriculum projects. In both the central purpose was to show the enjoyment of finding out about the world around us. For one of these projects I wrote a "module" called "Evidence of Invisible Systems." The first thing the students were asked to do was to look out the window and figure out how we know whether the wind is blowing. This awareness of how deductions are drawn from observations was eventually extended to the discovery of crystal structures by x-ray diffraction studies. Even the most sophisticated experiments must ultimately produce results that our senses can detect.

In the other project, a text for college freshmen who did not plan to go further in science (*Physical Science for Non-Science Students*, the PSNS project), the approach was to have the students do a simple experiment with a puzzling result and to encourage them to think about possible explanations. This is better science than to use the experiment to demonstrate a law that has been expounded in the textbook. If Stapelbroek had learned to think experimentally through such approaches, from fourth grade on up, she might have been able to enjoy applying her excellent math skills to physics.

To increase our supply of physicists and others sympathetic to the physics community, we must share with everyone, at an early age, the nature of the enjoyment of physics.

ELIZABETH A. WOOD
Red Bank, New Jersey

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Training Students for Future Flexibility

I am continually amused by the discussion of science education in high schools. My own unique experience appears to be a counterexample.

I had an excellent high school education at Washington High School in Rochester, New York. The science courses were minimal, and I did not even take advantage of those mathematics courses offered. In my senior year I chose not to take the fourth-year courses in trigonometry and solid geometry and instead took voice training and choir. The musical training has enriched my life by enabling me to participate in choral groups.

During the summer after my high school graduation, I picked up the trigonometry and solid geometry textbooks, read them and easily passed the Cornell entrance examinations. I took calculus during my first year at Cornell, and also learned all the physics and chemistry I needed. I never felt I had missed anything by not having learned this in high school. After graduating in electrical engineering from Cornell, I eventually switched to physics and did a PhD in experimental physics at Princeton. Formal course work was not stressed. The student was expected to pass a general examination in physics when he felt he was ready for it. Nobody cared whether he learned the material from formal courses or by sitting in the library.

After finishing my PhD I traveled to Europe and Israel and worked for a while in electronics, nuclear engineering and experimental physics be-

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