EDITORIAL

Is Physics Too Tough?

STATISTICIANS tell us that, at least in schools and colleges, physics is losing its appeal. Physics enrollments are growing much more slowly than those of other subjects. On a per-capita basis they are declining. Perhaps we need not worry about this state of affairs. If physicists are in long supply and physics has little to contribute to the nonphysicist, all is well. But if the world needs physics and physicists, we should ask ourselves some questions.

Why people do not study physics is not hard to discover. In high school the student hears from his counselor that physics is difficult. Records show him that if he needs an A to help him into college, other courses are more likely to provide it. If, despite all, he takes the introductory course, he finds the advice was good; the course is invariably hard (and frequently dull).

The same kind of discouragement—and more—faces him in college. Not only is the physics course difficult; it also involves lengthy laboratory work and a heavy requirement of mathematics. The nonphysics student who wished to round out his education by taking courses outside his specialty probably turns not to physics but to biology or the modern American novel.

TRADITIONALLY physics is a tough course, and most experts probably think it must be and should be so. You can't do physics without numbers, they say. You have to have laboratories. And making courses difficult shakes out the weak ones who wouldn't contribute anything anyway. All of these ideas are probably true, but they deserve scrutiny.

What about numbers? Someone has said that largely by accident has mathematics developed quantitatively. We think that the same thing may be said of physics. Granted that in certain aspects our science, like most other activities, requires computations, it does not follow that no one can understand any physics without them. When we recently helped a high-school friend with his homework, we found his textbook and his teacher so involved with plugging numbers into formulas that neither time nor space was left for any true understanding of what was going on. An overindulgence in mathematics, especially in an introductory course, can be a barrier to progress just as proper application is a road to comprehension.

What about laboratories? Are they really essential? Is there no learning without them? Are they somehow peculiar to the natural sciences and not to other matters? In fact we think that any good Shakespeare course would benefit, as does physics, from a good laboratory one afternoon a week. We would ask the student to compose a sonnet, write newspaper stories in metaphor-filled blank verse and create writing with proper balance among humor, suspense and character development. He would surely get more out of Shakespeare, but it might not be worth his time.

What about eliminating the weaklings by making things tough? Is it obvious that patience and fortitude are particularly applicable to physics? Do we favor the long suffering but uninspired drudge? Is there a risk that a lazy but imaginative student, who might have something to contribute to physics, will be unwisely diverted to a career in cigarette advertising? And what about the weaklings? Does physics have less obligation than other parts of our culture to develop them as much as possible?

IN OUR VIEW the statement that any subject is *intrinsically* difficult is questionable. Surely any subject, physics, Shakespeare or economics, can be *made* difficult by teaching it too fast or too badly. Such procedures may serve the worthy purposes of causing the student to learn rapidly and eliminating the ones who don't belong in the course. But they also introduce distortions and injustices.

An injustice to a student may occur if he has to work six hours to get three hours' credit. The profession may suffer an injustice if a student who ought to study physics is deterred before he gives it a try. Society may suffer an injustice if physics ought to be part of every man's education but it is taught so that only the totally committed professional can afford to attempt it. We would hardly tolerate the teaching of English, history or arithmetic in such a manner that only the future novelist, history teacher or mathematician benefited from the courses.

The challenge, we think, is to recognize the needs of all students and offer a program that will serve all needs. Introductory courses should not bore with detail or frighten with difficulty. Primarily they should inspire curiosity. The student who is properly inspired in his early years will do enough later to make up for a lot of confusing number work that is left out of the introduction.

We offer these questions for speculation without certainty that they need answers or have any. But we think professional physicists and teachers would not waste their time if now and then they asked, "Is physics too tough?"

—*R. Hobart Ellis Jr*