

highly talented students and the average bright students and therefore should be encouraged.

Robert David Turoff
Antioch College

ZEMANSKY REPLIES: The suggestion that a conventional course in college physics containing subjects such as statics, geometrical optics, calorimetry (which may be dull to the teacher but not necessarily to the student) might be the reason for part of the drop in college enrollments can hardly be taken seriously. Highly gifted students have always been bored with conventional courses, even to tears, without removing their persons and their wet handkerchiefs from the physics classroom. In the olden days, when, say, Julian Schwinger was a student of elementary physics, highly gifted students like Schwinger were just as unwilling to be bored as similar students are today. Schwinger didn't drop out; he absorbed his assignments in Hausman and Slack quickly and then went on to read the original works of Maxwell, Jeans, Eddington, et al. Nowadays there are first-rate and inexpensive materials prepared for the extra bright student who is bored with college physics. Any teacher who can't interest his few gifted students in many different ways ought to be fired.

I am firmly of the opinion that an adequate course in college physics should not limit itself to "showing the students what physicists regard as interesting today" any more than a first course in college music should limit itself to showing the students what musicians regard as interesting today or a first course in college mathematics should limit itself to showing the students what mathematicians regard as interesting today. By "students" I do not mean the few hundred high-IQ prep-school graduates admitted to Cal Tech. I mean the thousands of students who were graduated from high schools where the physics course was weak, who need a knowledge of physics to prepare for careers in engineering, medicine, chemistry, physics, etc. "Emphasizing the place of physics in the evolution of our culture" is a lux-

ury that can be afforded by the few hundred first-year Amherst students but not the thousands who are entering the big city colleges and state universities. This large group will have to postpone this luxury until their junior or senior year when they will presumably be in a better position to know what our culture is and how it evolved.

Mark W. Zemansky
Executive Secretary, American Association of Physics Teachers

Economics of teaching

Your special issue on introductory education in physics is an excellent presentation of the recent curricular trends and changes.

Bravo to Mark Zemansky for expressing the sentiments of the vast majority of seasoned physics teachers in colleges and universities with a high preponderance of C and B students (PHYSICS TODAY, March, page 71). Though the admission standards at my institution have gone up considerably, the physics staff notes little improvement in the high-school physics backgrounds of students enrolled in our elementary courses. A nation-wide, longitudinal study is urgently needed to assay the effects of the new curricula. Unfortunately, the AAPT Committee on Testing, a natural initiator of such a study, has apparently disbanded.

There are probably many reasons for the decreasing enrollment in high-school physics. However, it is the conviction of many individuals familiar with the conditions in the secondary schools that the shortage of well-trained and enthusiastic physics teachers is one of the important factors. Western Michigan University is the second largest teacher-training institution in the world, but only 7 out of the 47 physics majors accepted jobs as physics teachers between 1962 and 1966. The data are summarized in my table (page 13).

It is a question of economics! Because of the large pay differential between high-school teaching and other employment, we shall continue to lose the battle for the qualified and able instructor. To attract and retain him, the salary and working conditions

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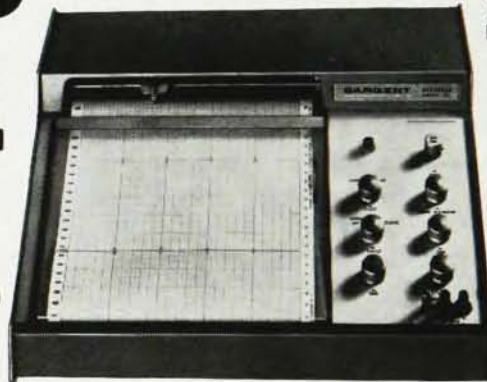
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LETTERS

must be competitive with other opportunities.

It is interesting to note that in all the innovatory curricula the emphasis has been on "hardware" first. Certainly, most of the text materials, teacher's manuals, films and other paraphernalia are needed; these are useful and even exciting, but these are

concluded by suggesting that he might get more help at a prominent institution near his home. Yesterday I got a thank-you note which included the sentence, "Until now I had not been able to get a definition or a straight (answer?) out of _____."

George L. Trigg
Physical Review Letters

Placement of Physics Teachers at Western Michigan University, 1962-1966

Year	Available jobs	Seniors placed	Beginning salary
1961-62	49	1	\$4900
1962-63	83	1	4800
1963-64	98	2	4500
			4800
1964-65	71	1	5400
1965-66	173	1	5300

no more than working tools. Of enormous help to the good teacher, they puzzle and confuse the poor teacher.

Let us have a moratorium on curricula packaging and Madison-Avenue-style promotions. These will not stop or reverse enrollment trends. It is high time to concentrate on the recruitment, training and retention of the most important component of the introductory physics education—the high-school physics teachers.

Haym Kruglak
Western Michigan University

Any time for students?

So we are concerned, are we, about the dropping interest in physics on the part of students? Consider, then, the sequence of events I will now describe.

About two weeks ago, there was posted on the bulletin board of the theory group here at Brookhaven a letter from another part of the country which read in part as follows: "I am a high school student. . . . I have been told that you were the place to write for information on antimatter. Please tell me all you can about it." After about a week, I took the bull by the horns and wrote the boy a letter of slightly over two pages, trying to give him at least some sort of a start on the business but warning him that without any knowledge as to his background I might not do too well. I

Make room for drop-ins

I wish to contribute a brief comment on the feature content of the March issue of *PHYSICS TODAY* and in particular on the article by Susanne Ellis on "Enrollment Trends."

Take the case of a college sophomore with no particular background in physical science who enrolls in the traditional noncalculus arts and sciences general physics course for a two-semester introduction to physics. Some students in this group will always find such a course interesting and stimulating. A dozen years ago such a student could decide near the end of his fourth college semester that he would like to major in physics, and he (or she) could do so, completing the required major courses in the junior and senior years—taking a great deal of math and physics in those two years. This made the physics majors a very heterogeneous group—with a few outstanding students who needed special honors courses or seminars to provide a mechanism for intellectual growth at a rate commensurate with their abilities. The great majority of the physics majors of that time went into industrial or commercial positions of an engineering nature while small numbers went into other fields (such as law, medicine, business) or secondary school teaching and graduate school. The situation has changed—and now a first semester freshman college student may feel that it is already too late for him to consider majoring in physics if he did not have PSSC physics in high school.

It is understandable that engineering students should have physics in their very first three or four college semesters since it is fundamental to all that follows in that curriculum. It is understandable that engineering-oriented students will generally take high-school physics. It is understandable that college physics depart-

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