

## How Not to Improve Engineering Education

Most of us connected with the American Institute of Chemical Engineers are concerned with seeking improvements in engineering education in its broad aspects, and those of us who are directly concerned are constantly seeking means of improving the teaching of engineering. Many fine studies have been and are being made. One of the outstanding ones is that part of the Institute's "Dynamic Objectives for Chemical Engineering" which is devoted to education.

We should welcome sound proposals, and, indeed, most of us have been considering carefully many suggestions. It is, therefore, all the more disheartening to see an article such as "Engineering the Teaching of Engineering,"\* published by a society wholly devoted to engineering education, which seems to have been written without regard to the careful work going on in this field. This paper establishes some sort of a record in the grand cliché derby and offers a few suggestions which are for the most part lacking in novelty. The use of "engineering" in the title is not flattering to our profession. When we "engineer" something we don't do it with clichés, old ideas, or tape recordings.

The author of the article sets forth the following clichés:

"First, everything a student learns he must learn for himself; no teacher can learn for him.

"Second, regardless of how a teacher paces the instruction, each student will learn at his own rate.

"Third, students learn more when each step is immediately reinforced.

"Fourth, full rather than partial mastery of each step makes total learning more meaningful.

"Fifth, when given the responsibility for his own learning, the student is more highly motivated, learns and retains more".

I submit that all but one of these propositions are fully known and fully understood by all experienced college teachers, not only those in engineering. The third item is the reason that we assign problems for our students to do. The fourth is clearly wrong. If we waited for undergraduates to have complete mastery of entropy before going on, the teaching of thermodynamics would stop right there and remain there for some time.

The article also includes the following suggestions for changes to be made in engineering programs:

1. Better qualified engineering students should be admitted to college before completion of high school.

2. There should be less reliance on the number of years spent in engineering school and more on the actual achievement of the student.

3. Independent study and honors courses should be used more extensively.

4. More extensive use of laboratory work should be made, including programmed learning, tapes, and motion pictures.

5. A more flexible curriculum should be provided to permit a student to go at his own pace.

6. More reliance should be put on complete mastery of the subject.

The first three suggestions are certainly not novel. The problems which may arise, particularly with the second, are not easy. The fifth point has some merit, although a much better reason would be to permit a student to follow his own interests rather than to go at his own pace which could well be a very leisurely one indeed. The sixth is highly dubious: attaining complete mastery of a subject is a matter of maturity and lifelong study, not collegiate education.

It is the fourth suggestion for change that is particularly disturbing. Most of us would endorse more laboratory work, but including the use of motion pictures and tapes under this heading is another matter. The author cites the use of tapes for teaching basic circuits to sophomore electrical engineers. In the opinion of this observer any part of engineering which can be taught with tapes should be taught with tapes—at home, in the summer, in vacation periods, but not as a part of university teaching. The interplay between teacher and student is vital in all college education; it would thus be completely lost.

Engineering education, as well as other areas of education, can be improved, but this is not the way to do it. Surely our sister society can assist the problems of improving engineering education in better ways than this.

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\* Eurich, A. C., *J. Eng. Education*, 53, No. 5, p. 273 (1963).