FRAGMENTATION of SUBJECT MATTER

THERE WAS A TIME, in the good old days, when a professor taught his students, no matter what their major interests, what he believed would be best for them. He chose carefully, from the field he knew well, the topics of fundamental or current value that he considered to be of the greatest importance. What he taught had a logical continuity. Today, a professor is more like a cog in a machine; he may be tossed about and buffeted by experts in curriculum construction, by planning and policy committees, by agencies of accreditation, and by financial, or even political pressures. It is small wonder that he finds difficulty in retaining his native enthusiasm for teaching a student what he thinks the student should know.

We live in a scientific age beset by a curious educational paradox. As our college and graduate school enrollments increase, postponing till a later and later date the age at which an intelligent young person begins full-time work on a responsible job, the incidence of specialization in education occurs earlier and earlier. It comes about, however, not by plan but in a variety of insidious ways—by an accumulation of tiny pressures rather than by a bold change of educational pattern.

One of the characteristics of this trend is the fragmentation of subject matter. As one looks through a university catalog, one finds courses entitled physics for premedical students, physics for liberal arts students, physics for home economics students, physics for students of architecture, physics for students of engineering. The same kind of specialization can be found in nearly all fields of knowledge that are eagerly sought by students. It is the first stage in the fragmentation process. In emergencies, such as a period of national danger, a first-stage fragmentation of this kind is not only justifiable but necessary. A superficial but temporary competence can then be achieved quickly in narrowly limited ranges of subject matter. As a long-term policy, the trend is to be deplored. Its products are individuals who are well trained but who have not been educated. It overemphasizes the present popular beliefs in the importance of know-how; it ignores the long-term necessity of developing people who have the know-why; it fails to recognize that know-how is based on know-why, and that know-how is not self-generating in a vacuum.

The second stage in the fragmentation process begins when specialists belonging to one field cease to have confidence in the ability of specialists in supporting fields to teach appropriately the basic material that is needed. It has its roots in the traditional belief that a college course should last four years, but not more. Teachers and students alike suffer from an oppressive sense of urgency. As an illustration, one may find (though one hopes such activities are merely incidental) chemists teaching arithmetic, physicists teaching mathematics, 'educators' teaching statistics, or engineers teaching physics. If the consequences of this second stage of fragmentation and specialization are followed to the ultimate limit, the complexity of the country's educational problems will be increased rather than diminished. This is not to say that unfortunate results are inevitable, for the disease, being yet in its infancy, may be arrested.

Of particular importance to readers of *Physics Today* is the suggestion, made by a member of a reputable department of engineering, that physics should not be taught to students of engineering by physicists but by engineers. Fortunately, physics and engineering are so closely interlinked that some engineers are at the same time good physicists, while a few physicists are also competent engineers. But it would be unrealistic to apply the statement to all physicists or to all engineers.

That physicists would be unhappy to see this suggestion carried into effect on a wide scale would be a grave understatement. That it was made at all, however, must be taken as an indication that physicists have not, in some instances, succeeded in presenting the fundamentals of physics to students of engineering in an acceptable way. It is at the same time a blow to pride and a challenge to accomplishment. Where dissatisfaction with physics courses for engineering students now exists, it is to be hoped that some compromise solution may be given a fair trial before radical changes are made which might jeopardize the educational well-being of a whole college generation of students.

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