Practical Limits To Growth In ChE

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THE FOCUS IN THE PAST two years on national needs, with particular stimulus from our energy crisis, has excited new thinking about control of chemical change. A result is that ChE is a well-paid profession at entry. High school students in the United States have noticed the difference. Possibly for that reason there has been a boom in enrollment in ChE schools in the 50 states. Some schools report twice as many students enrolled in 1976 in the first class of ChE as in 1975. Perhaps the trend will continue, and perhaps it will not. In any event we do seem to be faced with acute personnel problems. They are problems that are nicer to have than those that relate to shrinkage of enrollments.

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What really will control the growth of ChE enrollments? Should they be controlled? First, universities already have built-in controls by way of budgets that are tighter than ever before in the history of education. Even if a school wanted to double its total program, it probably would have trouble. It might allow an entering class to be twice the size of a previous entering class, but to have the total undergraduate enrollment twice that experienced over a couple of years ago would probably not be possible in terms of staff and supporting functions required. Therefore, the college budget is the first step in the control of ChE enrollment.

What is the second step? Students may be enamored with the idea of opportunities to help and to gain economic strength by way of the engineering profession, and particularly by way of chemical engineering. They may lose sight, however, of the difficulties in various curricula. Certainly ChE is a quantitative curriculum, and students have been known to fail in the program. Particularly students have had trouble with university chemistry. General chemistry, organic chemistry, inorganic chemistry, and physical chemistry are much more demanding and quantitative than ever before. To be a ChE requires that you move through the courses in chemistry. It probably is so that a fair fraction of a diverse group of students in the ChE curriculum will find difficulties with chemistry. So item two in control of ChE enrollments relates to the specter of chemistry. Also chemistry could be made even more stringent as a control point.

Third, one of the items that engineering and science programs have not handled appropriately over the past few years is the matter of quality. Since the end of World War II, we, in general, have been focusing upon quantity not at the total loss of quality but not with the same development of quality that we would have with emphasis on that attribute. So, as universities have large entering classes in ChE, it is incumbent upon the universities to have appropriate standards of performance so that in the subsequent years those students who really are not committed to the development of useful careers in ChE can be dropped. That has been a practice in some large schools for some time anyway. For example, admission standards could be minimal for the freshman year. Then a large number could be weeded out in the first year after knowledge is collected on their abilities. Perhaps more of that control will be invoked in the future in ChE.

FUTURE OPPORTUNITIES

A FOURTH CONTROL on growth of ChE enrollment could be found in careful examination of predicted employment opportunities. No one has yet figured out how to predict employment opportunities. If we ponder the costs for a new engineer in industry and the increasing ability of an engineer to work with effectiveness because of new tools and new computers, maybe the market will need fewer engineers per capita of population.

As part of the future employment opportunities for engineers, note should be made of the roles

of engineering technologists and technicians. Employment interest in them has not been fully developed. As it becomes fully developed, there probably will be an increasing effort to have engineers work in the fullest professional sense as engineers. Engineering technologists would be ready to handle operational functions. If engineering technology does affect our work as suggested, there indeed will be fewer engineers hired but probably at much higher salaries and with much higher professional input to their jobs. That calls for better and even more demanding programs. That more intense professional development in itself could provide a strong governor on enrollment.

No one truly can predict what lies ahead relative to what we have done in the past. Engineering obviously will have to help in meeting all national priorities and in keeping the country moving. Whether it will do its work more efficiently than in the past is our problem, and really that is the total crux of what engineering will be like ten years from now and what enrollment levels will be. □

A fourth control on the growth of ChE enrollment could be found in careful examination of predicted employment opportunities.

Too Many Departments!

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THE CONTINUED HEALTH of our profession demands that the production of baccalaureate graduates in ChE be limited. A natural such limitation results from the acceptance of a simple premise, but it is nonetheless one that educators in ChE somehow still find to be debatable. The premise is simply that education in ChE at whatever academic level must be developed and presented by professors who are themselves active participants in the growing edge of the profession. And this is true for professors in all of the professions. For example, I cannot imagine the apprentice surgeon learning his skill from a master who himself does not practice surgery. Certainly also the young surgeon who aspires to be the creator of new techniques—to invent the heart transplant, as it were—will want to work with the best-known experts of the day. So it is also in ChE.

It is not enough merely to admonish our students to go out and be honest and apply common sense to this or that ethical situation. We must provide intellectually demanding exercises and exposure to the great ideas and thinkers of Western Civilization.

This participation by faculty at the growing edge of the profession is heavily dependent upon graduate students, for the neophytes are an extension of the personality of the major professor. In fact, to a marked degree, the reputation of professors is heavily dependent upon the quality of the graduate students that we have attracted over the years. It appears that our economy can absorb about 400 new PhD level ChE's per year. At a nominal rate of one new PhD per year per faculty member, this implies a total faculty in the universities of the country of about 400. Or, correspondingly, the need of our society for about 1000 MS graduates per year implies a faculty of about 500 if we take a production rate of about two new MS graduates per faculty member per year. Using this larger number, and with a critical density of about 15 faculty per department, this suggests that we need about 35 departments. A faculty of 15 could readily produce a baccalaureate group of 70 per year or a national production of about 2500 BS graduates per year. The numbers in this sort of nominal scenario are approximately the degree production that seems to fit our national requirements for new ChE's. However, the institutional structures for educating these new practitioners of our science and our art have expanded beyond all reason. We compare the above projections with the curent listing of 123 accredited departments in the United States with almost 1500 faculty members—and growing. The academic profession then is functioning as an excellent absorber of ChE talent that could be