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Engineering Education

The technological superiority of the United States is fast vanishing. The country is experiencing enormous trade deficits, has become a debtor nation, and is probably sliding toward a crisis a few years hence. One hope for minimizing future economic problems is high technology. Scientific competence is a useful ingredient in technology, but it is overshadowed in importance by engineering skill.

For several years, industrial employers have found it difficult to meet their needs for engineers. There has been a bulge in engineering enrollments and a corresponding shortage of professors. The universities have been unable to attract enough native-born graduate students. These problems led to an in-depth study by a committee organized by the National Research Council (NRC). The study is nearing completion, and a summary has been released.*

The tone of the report seems unusually objective. If anything, the tenor may be on the optimistic side. For example, while noting the shortage of qualified professors, the report points to the high quality of students and to the satisfaction expressed by employers regarding new holders of baccalaureate degrees. Nevertheless, there are problems. One of these is the scarcity of expensive new equipment. Instrumentation for science and engineering has been improving rapidly for decades. When available, sensors and transducers coupled with chips make it possible to follow in detail fast-changing and complex phenomena. A related problem is computerization. Few universities have the resources to obtain state-of-the-art equipment.

All university educators face difficult decisions in choice of curricula for undergraduates. Four years seem too short a time to provide both breadth and depth. In engineering a tiny fraction of students take advanced degrees. The main employer, industry, places little monetary value on holding an advanced degree. The average bachelor of engineering in 1984 could expect an annual entry salary of almost $26,000. There was little incentive to take a low-paying graduate fellowship to work 4 years with inferior equipment. One consequence is that 40 percent of graduate students in engineering are foreigners. The NRC report recommends increasing graduate stipends for native-born students to a level half that of entry-level salaries.

Science and engineering share a problem in the fact that there are two tiers of universities. The prominent research universities are well equipped, and their professors have time to engage in or direct research. Young professors at the second-tier schools find it difficult to maintain competence at the cutting edge of science or engineering. The NRC report recommends that special provision be made for these professors through new engineering research centers funded by the National Science Foundation. Another recommendation is the fostering of co-op or intern programs in which undergraduates receive some of their training at industrial sites.

One of the concerns expressed in the NRC report is the need for continuing education. With science and technology evolving rapidly, there is danger of obsolescence for the engineer. Effective international competition requires familiarity with other cultures and tastes. Advancement into management is facilitated by knowledge of financial matters, marketing, and ability to communicate. At present, few universities participate in continuing education of engineers.

Our problems in international balance of payments include high labor costs, a nonsymmetrical trading relation with Japan, strong dollars, and a tardiness in adopting robotics and quality control. Excellence in high technology cannot be expected to overcome all these handicaps. But unless the United States finds ways of achieving such excellence, its economic problems will surely go from bad to worse.—PHILIP H. ABELSON

*Committee on the Education and Utilization of the Engineer, *Engineering Education and Practice in the United States* (National Academy Press, Washington, D.C., 1985).