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Science at the Four-Year and Master's Universities

The system of higher education in this country has gradually undergone a profound change from what existed a generation ago. Schools that were small teachers' colleges have metamorphosed into large comprehensive universities. They now offer broad curricula that include science and engineering. In general, they have few or no Ph.D. programs, but their faculties consist largely of professors who received their doctorates from research universities. The 601 comprehensive universities grant the majority of masters' degrees and about half of the baccalaureate degrees in this country. Their alumni are an expanding fraction of the students who complete the doctorate at research universities. They are increasingly active in cooperating with industry and in public service. They have important roles in the education of minorities, the economically disadvantaged, and late bloomers. If the scientific illiteracy of this country is to be ameliorated, they will be important partners in the effort.

The comprehensive universities vary in sponsorship and size. Some are private, but most (427) are state schools. The largest enrollment (35,000) is at San Diego State University. A minor fraction of the schools have succeeded in obtaining substantial funds for research through contracts and grants from industry, states, and the federal government. But most of the comprehensive universities, and especially the state schools, are handicapped in their functions of educating scientists and engineers. Typical teaching responsibilities average around 12 units. There are limited institutional funds for equipment, supplies, or travel. A relatively small number of their professors obtain federal grants. A National Science Board report* outlining deficiencies in undergraduate education contained comments particularly applicable to many of the state schools:

Laboratory instruction, which is at the heart of science and engineering education, has deteriorated to the point where it is often uninspired, tedious, and dull. Too frequently it is conducted in facilities and with instruments that are obsolete and inadequate. . . .

Faculty members are often unable to update their disciplinary knowledge continuously or maintain their pedagogical skills. . . .

Courses and curricula are frequently out-of-date in content, unimaginative, poorly organized for students with different interests, and fail to reflect advances in the understanding of teaching and learning.

Lack of equipment and inability to update their disciplinary knowledge are particularly frustrating to individuals who were indoctrinated in ways of the research universities. A substantial number of them have become deans, provosts, and presidents of comprehensive universities. In late January of this year, some of them from 27 states participated in a 3-day conference held in Long Beach, CA, and entitled "Science Research in the Comprehensive University," organized by the Chancellor's Office of California State University.

The conference included plenary talks and working sessions designed to lead to a document stating the case for enhanced support of research for these institutions. Among the speakers was Representative George E. Brown, Jr. (D-CA), who is an influential member of many of the top science-related committees. In a lecture he said, "All parts of the educational system should not have identical roles, but research should not be confined to the research universities. Research is an integral part of education. Mere assimilation from authorities is sterile. Education that does not build on natural curiosity can never be education of the highest kind."

The National Science Foundation has established a number of programs, such as matching instrumentation grants, designed to help undergraduate science. But the sums allocated to them are small. The National Science Board report recommended substantial support for improvement of teaching of undergraduate science and engineering, and that should be implemented. The states also have responsibilities. The quality of education of their scientists and engineers will be enhanced if professors are provided with the circumstances that enable them to lead a life of learning. In pursuing their goal to integrate research and teaching more effectively, the comprehensive universities are on the right track. Their cause merits support.—PHILIP H. ABELSON

*National Science Board, "Undergraduate Science, Mathematics and Engineering Education" (Washington, DC, March 1986).

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