Science-education gap between US and other nations?

One of the last science policy reports turned out by the machinery of the Carter administration was a study of the problems confronting science and engineering education in the US. Spurred in part by growing anxiety that the US work force is losing its technical edge over other industrialized nations, such as Japan and West Germany, and by rising concern over the "education gap" between the US and the USSR in mathematics, science and engineering, President Carter charged the Director of the National Science Foundation and the Secretary of Education with the mission of determining the adequacy of the country's science and engineering education for our long-term needs.

The resulting report, *Science and Engineering Education for the 1980's and Beyond*, addresses two basic issues: the number and quality of professional engineers, scientists and technicians being turned out by US universities, and the technical illiteracy of the vast majority of high-school and college graduates today. Because the general population is continually asked to make judgements on research and technology questions, "the current trend toward virtual scientific and technological illiteracy . . . means that important national decisions involving science and technology will be made increasingly on the basis of ignorance and misunderstanding."

NOVOSTI from SOVFOTO

A Moscow elementary school science laboratory. According to a recent US study, Soviet schoolchildren get a more rigorous science education than do their American counterparts.

Manpower. The study found shortages of computer professionals and most types of engineers at all degree levels, but "employers in the industrial sector report that there are more than enough qualified physicists . . . though spot shortages (particularly at the PhD level) are reported in several sub-specialties," notably solid-state physics, plasma physics and optics.

"Several different econometric projections . . . indicate that, with few exceptions, there should be adequate numbers of engineers and scientists at all degree levels to fill available positions in 1990," though the same cannot be said for the shortage of trained computer professionals.

US shortages of engineers and computer scientists are not paralleled in the Soviet Union, Japan and Germany, which are producing much larger proportions of engineers and applied scientists than we are. In Japan, for instance, the number of degrees granted to engineers in recent years has surpassed the number granted in those same years in the US, though its base population is roughly one-half of ours. And about five times as many Soviet students as American students go on to engineering training. According to the report, the Soviets consider engineering to be the standard liberal arts education.

Those three countries are also educating a substantial majority of their secondary-school population to a point of considerable scientific and mathematical literacy, the study found. "In Japan, Germany and the USSR, national policy promotes the comprehensive science and mathematics education of far greater numbers of people than are expected to engage in scientific and engineering pursuits. In both the Soviet Union and Japan, especially, managerial positions in both government and industry are heavily populated by people with engineering degrees."

The large number of Japanese students who enter scientific fields (65% of baccalaureate degrees versus 30% in the US) is made possible by a secondary educational system that has heavy emphasis on science and mathematics. Mathematics instruction has a more rapid pace in Japan than in the US, and a much higher proportion of students take the more advanced courses. "The overall quality of this instruction appears to be high. The International Project for the Evaluation of Education Achievement ranked Japanese 13-year olds highest in mathematical achievement among 12 countries including the US and several European countries."

Part of the impetus for the study of US science education was a report by Izaak Wirszup of the University of Chicago on Soviet mathematics and science education and manpower training. In 1966 the Soviets launched a reform of compulsory education, placing heavy emphasis on science, mathematics and technical vocational training of the entire school population. According to Wirszup's unpublished report, Soviet science and math curricula surpass, in content and scope, that of any other country. By the time a Soviet pupil finishes his ten-year obligatory schooling, Wirszup reported, he

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will have had five years of physics, five years of algebra, ten years of geometry, two years of calculus, four years of chemistry, one year of astronomy and five and one half years of biology.

This is in sharp contrast to the US, where math and science teaching reforms of the 1950's and 60's were designed to reach early those students heading for careers in science and provide them with accelerated programs. The result, as the US study points out, has been a neglect of science education for non-science majors. For example, virtually all five million graduates of Soviet secondary educational institutions in 1978 and 1979 had studied calculus for two years, while less than 5% of US high school students had taken one year of calculus.

The US study found another side to the coin, however: "There is little specific data, but informed US opinion is that there is widespread underemployment of the science and engineering work force in the Soviet Union." And furthermore, "A member of the Soviet science and engineering work force is trained almost for a specific job and usually remains with a particular institution for a whole career. This results in a system that, in the opinion of some, is very slow to rise to new specialties and has a reduced ability to innovate."

Remedies. The report outlines a number of strategies that it says can help the educational system, starting at the primary level, including the development of curricula for students who are not interested in professional scientific and engineering careers and which make some attempt to bring modern electronics into the classroom, the establishment of more effective science-career counselling in the high schools, and provision of opportunities for young students with special talent for science and math to develop their interest in these areas. The study also proposes the creation of a President's Council on Excellence in Science and Technology Education akin to the President's Council on Physical Fitness and Sports. It emphasizes, however, that primary and secondary education must remain primarily the responsibility of state and local government.

Frank Press, President Carter's science adviser, had planned before the election to hold a series of regional consultations among educators, scientists and state and local officials to reflect on the report and to plan appropriate actions. What use the Reagan administration, which has proposed eliminating the year-old Department of Education, will make of the document is as yet undetermined.

Copies of the report are available from the Forms and Publications Office, Room 235, National Science Foundation, 1800 G Street, NW, Washington, D.C. 20550. —MEJ

Three scientists elected to House

Of the six Congressional candidates in November's elections who had backgrounds in physical science (PHYSICS TODAY, October, page 52), only three won election or reelection. James Martin (R-N.C.), a chemist, and Don Ritter (R-Pa.), a metallurgist, were reelected to fifth and second terms, respectively. Jim Coyne, president of a chemical and an energy technology corporation in Pennsylvania, was elected to his first term in the House.

In what will surely be a loss to the physics community, Rep. Mike McCormack (D-Wash.), a ten-year veteran of the House, was defeated by his Republican opponent. As chairman of the House subcommittee on energy research and production, McCormack was a strong supporter of nuclear and fusion energy research, and was a prime mover behind the Magnetic Fusion Energy Act that was passed this Fall by Congress (PHYSICS TODAY, November, page 61).

Coyne took over the Coyne Chemical Corp, a family business, in 1971. Coyne is also founder and president of ReChem, which promotes renewable-resource energy technologies, and Energy Management Services, Inc., an energy-conservation consulting firm. He has testified on energy before the Environmental Protection Agency, the Senate and the House of Representatives. He has also served as an energy specialist with the House Committee on Science and Technology.

Before the election, Coyne told us that if the US does not make "a commitment to research and development as we made in the decade of the '60's ...we will find that we as a country will quickly become uncompetitive in a world where there are no rewards for second place." —MEJ

DOD encourages industry to subcontract research

Universities will soon have more industrial contracts for basic research, if a new Defense Department initiative is successful. The DOD is now working out the details of how to implement a June memorandum from William J. Perry, the Under Secretary of Defense for Research and Engineering, directing the research heads of the Army, Navy, Air Force and the Defense Advanced Research Projects Agency to encourage industrial contractors to subcontract basic research projects to the academic community. The directive is presumably related to President Carter's promise last year to encourage university–industry ties to stimulate industrial innovation.

Perry would have industries using part of their independent research and development funds (which are normally included in overhead charges in DOD contracts and spent on R&D activities not necessarily related to the contract they are charged to) to finance the university subcontracts. "Sub-contracting IR&D funds in this fashion should provide substantial benefits in terms of a strengthened industry/university interface and the enhancement of basic science in areas where contractors have a vested interest but lack the facilities and skills to conduct their own research," according to the memorandum.

The DOD research office, headed by George Gamota, has the responsibility of implementing the initiative.

Vacuum congress moved to three circus tents

More than one scientific conference has been likened to a three-ring circus, but the analogy could never be taken as literally as at the 8th International Vacuum Congress, held in Cannes, France, 22–26 September in conjunction with the International Conference on Solid Surfaces and the European Conference on Surface Science. (All three were sponsored by the International Union for Vacuum Science, Techniques and Applications).

On their arrival at the Palais des Festivals in Cannes (which had been booked three years in advance to house the meeting and its accompanying vacuum product exhibition) on 15 September, the local organizers, members of the French Vacuum Society, were told by the mayor of Cannes that the Palais des Festivals was not available for their use. The mayor said that because they could not cancel the conference, the city would erect three circus tents in the parking lot of an athletic stadium some 8 km from the Palais, as a substitute accommodation. Apparently another group had reserved the Palais for a videocommunications exhibition the following week, and required the week of the 22nd to set up their equipment.

The local organizers were understandably distraught. In five days, 1500 vacuum scientists and equipment exhibitors from 37 countries would arrive expecting to participate in a conference that only takes place once every three