

degrees—46 percent—was reported by teachers from the Northeastern states, while teachers in the South reported the lowest proportion—32 percent.

One interesting finding was that a substantial majority of the teachers of science and mathematics in secondary schools are men. "Men predominate among these high school teachers," says the report, "particularly in the subjects other than mathematics. Of the entire sample, 69 percent were men. Of the teachers who taught mathematics but no other science, 63 percent were men. Of those who taught sciences other than mathematics, 75 percent were men. The ratio of men to women was lowest in the South (59 percent), highest in the West (78 percent)."

This preponderance of men appears to be a natural consequence of the disinclination, which Conant noted and lamented, on the part of able girls in high school to study chemistry, physics, or the more difficult forms of mathematics.

In the conclusions of the survey, two points are stressed: (i) the limitations on opportunities for full-time science teaching, and (ii) the inadequate preparation, in terms of formal course work, of many science and math teachers.

Applying the "guidelines" set up by NASDTEC-AAAS recommendations on the preparation of secondary school science and mathematics teachers [*Science* 131, 1024 (1960)], the report had this to say about teacher education.

"It would be ideal to have every high school science class taught by a teacher who has a substantial education in the subject and who can keep his knowledge reasonably up to date. Any estimate of how far the nation's high schools are from this goal must depend upon somewhat arbitrary standards of measurement; but it seems moderate enough to say that a teacher who has less than 18 semester hours of college work in a science does not have a substantial education in it, and we have seen that two-thirds of the physics classes, a third of the chemistry classes and more than a fifth of the biology classes and the upper-level mathematics classes are taught by such teachers. Many physics classes, and in fact large numbers (if small percentages) of the classes in every high school subject are taught by teachers who have had only a single 1-year college course in the subject—or even none at all."

What the NSF study cannot show is

how well, rather than how much, these teachers have been trained and how good or bad their performances are. And a demand for improved teaching in science and math has come from the critics of the schools and from the public, who have grasped the idea of competition with the Soviet Union in science and technology.

Professional educators are certainly aware of this demand, but they face other demands as well, and it is fair to say that their major response has been indirect—that is, to rely on general efforts to raise teacher certification standards and to strengthen programs for teacher education and thereby improve teaching generally.

The main movement in teacher education in the past generation has been toward the requirement of 4 years of college for both elementary and secondary school teachers, and recently a year of graduate study has been added as a requisite for "professional" standing.

This movement had an expansionary, some say inflationary, effect on institutions where teachers were educated. Normal schools grew into state colleges, and these later instituted graduate programs, at least in education. During this growth period, education students came to take a substantial portion of their work in courses in teaching methods and other professional education subjects, a portion that critics of teacher training regard as excessive.

Many institutions emphasizing teacher training did not develop strong departments in mathematics and the natural sciences, and students preparing to teach science and mathematics often took denatured courses—for example, how to teach physics, rather than physics itself.

Certification a Weapon

The most effective of the instruments employed to bring about the leveling up in the education of teachers has been the teacher certification authority, which is centralized in the state departments of education. This certification power has grown as state payments of funds for education to local school districts have been linked to salary schedules based on certification levels. In this way, approved academic achievement—notably, credits in education courses—became, along with longevity, a determinant of salary. In the same way, graduate study, in the eyes of some, became less a way to gain learning than

a means of winning the next pay increment.

Certainly, stout efforts are being made, in teacher education, to resolve the "methodology versus content" conflict and to give better preparation to future teachers of science and math, but the main emphasis in teacher preparation appears still to be on the battle to eliminate or upgrade the "unqualified" and "substandard" teachers, to certify the teacher and accredit the teacher-education program.

It is probably true that many teachers who qualify on paper are not satisfactorily prepared to teach in these fast-moving fields. On the other hand, the person with solid college training in science or math may be discouraged from teaching because of certification requirements.

Whether the machinery of accreditation has created special problems in science and math teaching, however, is an open question. But if secondary schools are the seedbeds of scientists, mathematicians, and engineers, as is generally assumed, then this is one of a number of important questions which the useful NSF study makes only a start at answering.—JOHN WALSH

House Armed Services Committee Forms R&D Subcommittee to Oversee Rising Research Funds

Further evidence that Congress is serious about looking over federally supported research activities that it overlooked before is to be found in the appearance of a new House Armed Services subcommittee on research and development.

House Armed Services is the authorizing committee for the nation's \$50 billion-plus annual military program, and the R&D portion of the defense budget has been climbing and this year amounts to an estimated \$7 billion.

Armed Services Committee chairman Carl Vinson (D-Ga.) is said to have felt that military R&D expenditures simply had reached a level that made a separate subcommittee necessary; he named as chairman Congressman Melvin Price (D-Ill.), who reportedly has been interested in the post since the possibility of an R&D panel came up a year or two ago.

Price is a member of the Joint Committee on Atomic Energy and heads the JCAE subcommittee on research, development, and radiation, which

corresponds to the Armed Services R&D panel. With this new second edge to his sword, Price is likely to become even more a man to be reckoned with in this increasingly controversial area, where government, industry, and science all have vital interests.

Creation of the new military R&D panel further fragments authority within Congress over research, but it does serve to set up in the House a checkpoint on defense R&D, which until now has received some separate attention only in appropriations hearings.

Price says that his new subcommittee will not begin meeting seriously until after the full Armed Services Committee completes work on major authorization bills—probably in June—and that a period of stocktaking will then be in order. He says that no decision has been made on whether the subcommittee will have technically trained persons on its staff, as JCAE and a few other congressional committees have.

Members of Price's new subcommittee are Democrats Jeffery Cohelan of California, Otis G. Pike of New York, and Samuel S. Stratton of New York, and Republicans Frank J. Becker of New York, Durward G. Hall of Missouri, and Robert T. Stafford of Vermont.—J.W.

Conflict of Interest: New Law Eases Restrictions on Part-Time Expert Consultants to Government

One of the effects of the meshing of government, science, and industry has been to make it more difficult to follow the Biblical injunction against serving two masters. Taking into account the growing numbers of scientists and other experts who serve the government on a part-time basis, President Kennedy, in February 1962, issued a memorandum modifying the injunction to read, in effect, that a man could not serve two masters on the same day, but recognizing that part-time government consultants also had full-time jobs elsewhere. A comprehensive conflict of interest law passed by Congress last October has just been supplemented by a new Presidential memorandum, and taken together, the two go a long way toward salvaging what is sensible, and scrapping what is not, of the old principle.

Comprehensive as it is, the law is not

comprehensive enough to include its congressional authors. Congress has always been more sensitive to the ethical shortcomings of the Executive branch than to its own, although several senators and representatives are now pushing energetically for congressional self-regulation as well.

Among the most serious ways in which the old conflict of interest laws were out of date is that they failed to distinguish between different ways of serving the government. The regular government employee, the political appointee, and the occasional consultant were treated alike under the old laws—criminal statutes passed after the Civil War mainly to prevent government employees from prosecuting claims against the government. The employees against whom the laws were initially directed were the mass of low-ranking political beneficiaries of the spoils system that then passed for a civil service. It is, in fact, today's technical descendants of the spoilers—the 1100 or so high-level political appointees who serve for the duration of an administration—who have gotten into the most trouble under the old conflict of interest laws, partly just because they are political appointees. The other categories of government employees—regular civil servants and part-time consultants—have been less troubled. In the case of civil servants the law was clear; in the case of consultants it was too ambiguous to be applied. But their legal liability under the old statutes left consultants at least potentially in jeopardy, and is thought to have discouraged many people from serving the government part-time.

The new legislation strikes a better balance between the government's need for ethical integrity and its need for expert advice. The growing body of scientific and technical personnel who serve as advisors and consultants while maintaining jobs in universities or industries are now defined as "special government employees," provided they work for the government no more than 130 out of 365 days. The law's main effect is to liberate the part-time employee from the potential application of an irrelevant series of laws he may inadvertently have been violating in the past; it does not affect the actual relationship between the government and its advisors except by lessening the danger of political attack, and thus making them safer. Although the new law is thus a good deal less remote from current practice than the old ones, in focusing on the advisor relationship

it leaves some of the even more complex forms of the science-industry-government tangle untouched. All the provisions of the law, in other words, are relevant to certain current practices, but there are other practices that are not covered by them.

The specific provisions of the law codify what has been administrative practice in many agencies for several years. The key requirements are: (i) a consultant may not act for a private interest in negotiating a grant or contract with any government agency if he has "personally and substantially" participated in government policy making with regard to that particular contract or grant; (ii) a consultant may not negotiate a grant or contract on any subject with an agency he has served more than 60 days out of a 365-day period; (iii) although the consultant may not act as a negotiator in the above cases, a waiver may be obtained permitting him to work on the performance of such a grant or contract, if the director of the agency thinks that the national interest so requires; and (iv) a consultant must disqualify himself from advising the government on any subject that is likely to have a direct, predictable (and substantial) effect on the financial interest of himself, his spouse, or his minor child.

On most other questions, such as post-employment activities, the consultant is affected much the same way that the regular employee is, although the advisory nature of his job is likely to mitigate the general restrictions to a certain extent. The penalties for most of the violations specified are a \$10,000 fine, or 2 years' imprisonment, or both. Agencies using consultants have been directed to send explanatory material to them.

The new law, like the old, encourages a narrowly pecuniary view of conflict of interest, not because greater subtleties are not recognized but because they are impossible to regulate. The case of the Eisenhower cabinet officer who signed a hotel register as the representative of a private firm in which he previously held large holdings illustrates the limits of the financial angle. The case of the present Deputy Secretary of Defense, Roswell Gilpatric, who is currently under Senate scrutiny because of the remote possible link between the controversial TFX award to General Dynamics and the fact that General Dynamics is a client of the New York law firm to which Gilpatric is soon returning, illustrates how pervasive and thorough the