US science education

Will Reagan foot the $830 million bill?

Washington

THE steep decline in the quality of pre-college education in mathematics and science in the United States requires that the federal government should reach deep into its pocket. That is the unwelcome message for the Reagan Administration contained in the final report* this week of a commission set up by the National Science Board — the policy-making body of the National Science Foundation (NSF).

After 17 months of work, the commission has put together an ambitious 12-year plan designed to make American science education the best in the world by 1995. It would entail retraining more than a million teachers, modernizing the school curriculum and changing school timetables so that children receive more mathematics and science from an earlier age. At the heart of the scheme would be the creation of 2,000 exemplary mathematics and science schools as "landmarks of excellence".

The commission says that none of this will be achieved without the creation of new planning machinery at the federal level and a massive increase in federal spending on education. Although states and local districts would continue to be responsible for the bulk of education spending, the commission wants President Reagan to set up a national education council to oversee the spending of an extra $955 million in each of the first three years of the scheme, $680 million for the next two years and $331 million for each year thereafter.

Under the scheme, school timetables would be changed to ensure that every child, from the beginning of elementary school, is taught at least an hour of mathematics and half an hour of science a day. By 1985, no student would be allowed to graduate from high school without having completed three years of high school mathematics, including a year of algebra, and at least three years of science and technology including a term of computer science.

Students going on to higher education would eventually be expected to have completed four years of high school science including physics, chemistry and a year of computer science, and four years of mathematics including a second year of algebra and courses on probability and statistics.

The commission is sharply critical of many existing school mathematics and science courses, which, it says, teach children to be technicians rather than problem-solvers. It wants NSF to set up a curriculum council to devise new courses and encourage school districts to drop components of the secondary mathematics curriculum which have little importance with the widespread availability of calculators and computers.

Like previous reports on American schools, the commission describes the shortage of good teachers as education's most pressing problem, one that can only be solved by raising teachers' pay and status. A dwindling number of college students are entering teaching and a growing number of experienced mathematics and science teachers are leaving the profession. The commission proposes retraining more than a million mathematics and science teachers, at an average cost of $3,000 each. The programme would be spread over five years, with the federal government meeting half the annual cost of $698 million.

The report, with its call for vastly increased federal spending, is unlikely to be given a sympathetic reception by the Reagan Administration, which maintains that it has already been generous towards mathematics and science education. In its 1984 budget request the administration has restored the cuts it inflicted on the NSF education budget in 1982 and proposed an increase of $9 million over the $30 million appropriation which Congress insisted on in 1983. But it is not expected to support legislation before Congress which would authorize an extra $400 million for mathematics and science education across all government agencies.

What all high school graduates should know according to the National Science Board report:

Mathematics

Algebra: Ability to solve quadratic equations; familiarity with permutations, combinations and simple counting problems.

Geometry: Ability to use the Pythagorean theorem and special right-angle relationships, understanding analytic geometry and vector algebra in three dimensions.

Other mathematics: Basic combinatorics; graph theory and discrete probability. Computer science, including programming and introduction to algorithms and iteration; the philosophical basis of calculus.

Physics

Understanding of the conservation of mass and momentum, of energy, the kinetic theory of gases and wave phenomena. Understanding the concepts of motion from particles to celestial bodies; understanding light and electromagnetism. Appreciation of atomic and nuclear physics, and of relativity.

Computer competence

How computers work and their uses; familiarity with one high-level computer language; use of a computer language to solve problems; the social problems and issues raised by computer technology.

In the past, the administration has shown particular hostility to suggestions that the federal government should take over from states and districts the main business of running and funding schools. It is hardly likely to welcome the commission's proposal that the lion's share of the cost of setting up 2,000 exemplary schools — some $830 million — should be met from federal funds. **Peter David**

**Educating Americans for the 21st Century.*

French science

Papon in print

PIERRE Papon, the director-general of the French Centre National de la Recherche Scientifique (CNRS), has done an unusual thing: he has written a book outlining the future of science and technology in France*. Not only may the reader boggle at how he possibly found the time to write a book — before his present post, he was full-time science policy adviser to the midnight oil-burning science and technology minister, Jean-Pierre Chevènement — but its publication is a bold move for someone still closely involved in policy decisions.

However, the book is consonant with Papon's belief in open government. Also, Papon has hedged his bets. He sketches three scenarios, distinguished by the degree of "institutional viscosity" (his term) which might be facing present policy. So if the policy fails, it can be put down to high viscosity.

Nevertheless, the book is a generous and fascinating effort at outlining current Paponesque (French) thinking, and at analysing the strengths and failures of French institutions. It also defines Papon's belief in a "neocolbertist" France. This term derives from the Colbert who founded the French Academy of Sciences in 1666. Colbert believed — like Francis Bacon — in a positive role for science in the state and society. If science and the state are not intimately linked *à la* Colbert, France is due to be eclipsed in the "economic war" that will befall the West after 1985, Papon believes.

On a longer time scale, Papon sees Japan losing steam by the year 2000, for lack of basic science, to be challenged in the East by China; in the West he sees the United States reasserting itself. Present French science policies would make France the third strongest technological power by that date, he says, but they require continuous and strong political will lasting for two decades. Whether that will be forthcoming is another question, for on that time scale it will certainly have to be a will that crosses party lines. **Robert Walgate**

**Pour une Prospective de la Science* by Pierre Papon (Seghers, Paris, 1983); to be fully reviewed in a forthcoming issue of *Nature*.

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