



## Low-Tech Teaching Blues

Monday, Dec. 27, 1982 By ELLIE MCGRATH.

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### **Crisis in the math and science classrooms**

Numbers define the story of how poorly math and science are taught in U.S. high schools. Fewer than 240,000 U.S. high school students take any calculus at all, while at least 20 times as many teen-agers in the Soviet Union study the subject for two years. American youngsters take eight or nine years of basic arithmetic; in most European countries, the same material is covered in two-thirds the time. One-third of the math and science teachers in California high schools did not graduate with even a college minor in either subject.

Last week a commission of the National Science Foundation met with 150 administrators and teachers at the Fernbank Science Center outside Atlanta to add up the implications of those doleful figures. "There is a crisis in precollege math and science education," said N.S.F. Director Edward Knapp, a physicist by training. "Our universities are not getting enough adequately prepared persons to ensure our continued technological achievements." More than 40 states reported a shortage of math and physics teachers last year. One reason: the 10% who pursue college math or science degrees can easily better the typical teacher's \$13,000 starting salary by going into industry. The lack of young faculty replacements for math and science teachers is causing what some call an "age time bomb"; the average age of a science teacher in Minnesota was 34 a decade ago and is 40 now. "In most school districts when math teachers retire, there is no money to hire another one," explains Elois Irvin, a high school math teacher in Richmond, Calif. "So they just send in the physical education teacher."

Tightened budgets also affect the purchase of up-to-date equipment and training in up-to-date techniques. One result, according to University of Chicago Mathematics Professor Izaak Wirszup, is "the drill and boredom of arithmetic taught by elementary school teachers not trained to teach modern mathematics." In Japan and East Germany, by contrast, specialized study in math begins in the sixth grade, as does study of biology and physics. Most American children still get only a year of biology in secondary school and few take any physics. Many U.S. high schools ask students to take only two years of math and one of science. Few students elect to go beyond the minimum. Says Harvard Microbiologist Roger Nichols, who is also director of the Boston Museum of Science: "Our third-and fourth-grade kids are natural little scientists, but after eighth grade, only 20% are still interested in math and science."

There are some noteworthy efforts to turn the interest back on. The N.S.F. conference last week took place at the site of one model program. Set in 145 rolling acres in Decatur, Ga., the Fernbank Science Center boasts a 65-acre nature forest, a 500-seat planetarium, a collection of dinosaurs and a 36-in. reflector telescope that has been used to track Apollo space missions. Students from all over the surrounding DeKalb County school district use the facility. Each quarter, for example, 60 ninth-graders are bused in for a nine-week program in which they study math, physics, seismology, meteorology and chemistry for five hours a day.

The Philadelphia Regional Introduction for Minorities to Engineering (PRIME) is a collaborative program involving 33 engineering and technological companies, 14 universities and government agencies, and 1,800 students in Philadelphia and Camden schools. It has succeeded in sending nearly two-thirds of its graduates on to math-or science-related college

programs. In California, MESA (Mathematics, Engineering, Science Achievement), based at the Lawrence Hall of Science on the Berkeley campus, is also designed to encourage minority students with weekly study groups and summer enrichment programs. So far, it has sent 90% of its students to college.

Some MESA students in the classes of Jaime Escalante know that one teacher rather than grand programs can make the biggest difference. Escalante, 51, a Bolivian immigrant who arrived in the U.S. speaking no English, is chairman of the math department at Garfield High School in the east Los Angeles barrio. With his support, 18 students decided to take the advanced placement calculus test, given to only 2.7% of college-bound seniors by the Educational Testing Service. Drilling them two hours a day after school and assigning four hours' worth of problems for every Saturday, Escalante mounted a 35-week effort that paid off when all 18 passed. Escalante and his class had some unwanted recognition, however, when the ETS questioned the results for 14 of the students. Says ETS President Gregory Anrig:

"The pattern was of similar answers, and they happened to be wrong answers." When twelve of the students retook the test, they all passed again. The similarities were "very simple," explained Escalante. "They had the same teacher."

But while special teachers and special programs may reach the most talented and fortunate students, the U.S. is rapidly becoming a high-tech society with low-tech education. Worried businesses have begun to share personnel and equipment with school systems, but such programs do not amount to national reform. As for the N.S.F, it has had its precollege education budget cut from \$80 million to \$15 million by the Reagan Administration. At last week's conference, N.S.F. Chief Knapp said that the Administration will continue to cut down programs aimed at students, but will soon begin supporting efforts to improve the competence and motivation of math and science teachers. Professor Wirszup hopes that it will not be too little, too late. "This Administration has given its fullest attention to the Soviet arms buildup," he says. "But the Soviets also now have the manpower for a military-industrial complex at a very high level. We need an education effort of mammoth proportions, for our economic survival and for our defense. ' ' — By Ellie McGrath. Reported by J. Madeleine Nash/Chicago and Roger Witherspoon/Atlanta  
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