

For example, Used Numbers, a project being developed by the Technical Education Research Centers and Lesley College in Cambridge, Mass., will make statistical thinking accessible to elementary school students.

At the secondary level, there are several projects showing the way toward a new curriculum. As at the lower-school level, the major projects do not diverge much in their visions of math education.

For example, the University of Chicago School Mathematics Project (UCSMP), with primary funding from Amoco and further support from several other foundations, is producing a complete curriculum for grades 7-12, with a target population of the middle 80 percent of students. Among its striking variations with the status quo: the learning of algebra is moved earlier (for most students, in grades seven or eight); geometry is woven throughout; the calculator is used regularly in all grades; and the computer is an integral part of students' development of statistical thinking and an understanding of functions.

While UCSMP has been developing its

curriculum, the North Carolina School of Science and Mathematics, with funding from the Carnegie Corporation, has begun an innovative and computer-rich fourth-year course for high schools. It is comprised of six modular units, each of which provides students with a setting filled with up-to-date math.

Finally, the College Board's Project EQuality has brought together representatives of both high school and college math to produce a set of recommendations for the kind of curriculum that will best serve students who are preparing for college math.¹³

The Bridge to Change

With history as guide, one can safely bet that none of the above projects will become widely adopted without resistance. The basic conservatism of textbook publishers will slow down change, but so will several other factors.

For one thing, schools as well as publishers will require firm and concise statements of math learning objectives for

each grade level, and test makers will require time and guidance to learn how to evaluate these new and challenging learning objectives. It is one thing to evaluate whether students can solve a certain type of algebraic equation; it is quite another to evaluate how well students are inventing, generalizing, abstracting, or otherwise **doing** math.

Similarly, if the "underachieving curriculum" is to move significantly away from the current model, then the paradigm of teaching math also must change significantly. Class periods dominated by lecture and silent student practice can no longer be the rule.

New models of teacher training also are needed to match the changed paradigm of teaching. Whatever their design, the new models must make it possible for teachers to step back and transform their basic beliefs about what goes into the teaching and learning of math. They must be able to do for teachers, on a large scale, what Eleanor Duckworth and colleagues at the Massachusetts Institute of Technology were able to do for twenty elementary-school

Exemplary Programs Spur Student Interest

The following schools were selected from a number of case studies profiled in *Stories of Excellence*. The Study of Exemplary Mathematics Programs, from which the profiles were drawn, was funded by the U.S. Department of Education and continued from 1982-84.

Lawton Elementary School, Ann Arbor, Mich.

Lawton's math program is distinguished by a liveliness that extends beyond the classroom walls. Students participate in activities such as a math club and newsletter; teachers share materials and ideas; and the principal clearly communicates the commitment to a central role for non-traditional math problem solving. The school uses the Comprehensive School Mathematics Program, and teachers adapt and supplement it when they see fit. The result is a curriculum in which all students receive at least 55 minutes of math each day. Staff collegiality, at least in the sense of sharing, is exceptionally strong. Leadership from the district is supportive, and complements the principal's leadership at the school level.

Franklin Middle School, Nutley, N.J.

Franklin Middle School (grades 7-8) is distinguished by a math program in which nationally standardized test scores have vaulted from mediocre to excellent in the past decade. The superintendent has been

the catalyst and overall architect; the principal infuses the school with a serious, yet supportive, tone and high expectations; the guidance staff carefully monitors student placement and parent communication; and teachers are active participants in the redesign of the curriculum while, in the classroom, they maintain an effective blend of support and high expectations.

Huron High School, Ann Arbor, Mich.

A spirit of staff teamwork at Huron High School has led to a multifaceted approach to excellence in the math program. Students in the lowest-level courses receive careful attention and innovative course materials; minority students benefit from a vibrant supplementary pre-engineering program; and the staff makes a conscious effort to keep girls from dropping math courses. The overall percentage of students taking four years of math is exceptionally high. Computers and teacher-developed software are used extensively.

Rufus King High School, Milwaukee, Wis.

Rufus King High School is an urban magnet school for college-bound students. Its math program has incorporated the International Baccalaureate Program for the top courses, and is distinguished by a cohesive, sharing staff of teachers who commit considerable time. Leadership is strong throughout—the department head

acts consistently in support of teachers, and the principal and higher administrators give the program the underpinnings it needs. With more than 50 feeder schools, the program faces considerable challenges to respond to student needs, and from the staff's desire to keep expectations high.

Stuyvesant High School, New York, N.Y.

Stuyvesant is a specialized public high school for talented students. Student interest in math extends far outside the classroom, with daily meetings of math clubs and numerous extracurricular research projects. Teachers consistently communicate their expectations of clarity in students' mathematical arguments. Teachers also use coaching techniques in classes. The department head supports teachers in obtaining necessary resources, often in the face of a daunting lack of bureaucratic response.

North Carolina School of Science and Mathematics, Durham, N.C.

The North Carolina School of Science and Mathematics is a statewide boarding school for students in grades 11 and 12 who are talented in these fields. The math curriculum ranges from second-year algebra to second-year calculus, and students are carefully placed in appropriate courses. Teachers regularly observe and consult each other. Department members carefully nurture a "teacher-as-learner" environment and work to develop innovative curriculums.