

# Mathematics in the U.S. and the Soviet Union

Youngsters in the two nations receive far different messages from the types of mathematics tests they are given—and we can learn much about testing from the Soviet Union.

**M**ikhail Gorbachev's visit to the United States provided an occasion for Americans to learn quite a bit about the Soviet Union. We know that their economy is deteriorating, that national strife is increasing, and that their military empire is crumbling.

One thing America did not learn from news coverage of recent U.S.-Soviet relations is how a nation shackled for decades with the weight of a centrally planned economy could have bested the U.S. in science and engineering in the early years of the space age. The answer lies in one of the best kept secrets of the Soviet Union: a system of mathematics education that has produced a tradition of excellence in mathematical research that is as good as any produced in Western countries.

Even as Gorbachev was touring the United States, a small delegation of U.S. mathematicians visited Moscow at the invitation of Gorbachev's science advisor, Evgeni Velikhov, to explore means of cooperation in mathematics education. Velikhov's invitation was especially timely, coming during a period when mathematics and science education in the United States is under siege.

## How We're Alike, How We Differ

Many parallels between mathematics education in the two countries can be seen, but the differences are more striking. We can learn much both from the similarities and the differences.

Just as President Bush has laid out national goals for mathematics and science education in the United States, so Gorbachev, acting through Velikhov, has established a commission to improve mathematics education in the Soviet Union, where the emphasis



*During their sojourn in the Soviet Union—at the invitation of Mikhail Gorbachev's science advisor—a group of U.S. mathematicians learned that the more formal Soviet mathematics curriculum encompasses open-ended assessments requiring higher-order thinking and creative problem solving.*

*Photograph of St. Basil's Cathedral at Red Square by Kenneth Hoffman*

is on increasing the role of computers in education at all levels.

In the Soviet Union, just as in the U.S., there is great unevenness from school to school—and from teacher to teacher—in the quality of mathematics education. Both nations have responded with similar interventions: special high schools for mathematics and science and university-based enrichment programs for students who can benefit from greater challenges.

Further, both countries debate how best to deploy limited resources for mathematics education. Conservatives—mostly university professors—prefer programs that nurture highly talented students, wherever they can be found; reformers seek to “raise the water table” by improving mathematics education for everybody. In one important area—testing—there is a striking contrast between U.S. practice and the tradition in the USSR. U.S. students go through 16 years of short-answer, multiple-choice tests in mathematics, beginning with number facts in primary school and continuing right through a multiple-choice Graduate Record Exam administered to college seniors. In the USSR, tests are often given in oral or written (essay) form, emulating the type of environment in which mathematical ideas are used in the world of work.

Bite-sized test items eviscerate education as surely as TV sound bites devitalize politics. In contrast, open-ended tests requiring holistic responses encourage higher-order thinking and creative problem solving.

### The Tests We Need

From their experience with school tests, children in the USSR learn to think before answering. U.S. students instead train for rapid response, learning how to take tests rather than how to solve problems. In Soviet schools, tests are an intrinsic part of the curriculum, with teacher responses focused on each individual child in order to prevent failure.

The mathematics curriculum in the USSR is, for the most part, more formal and traditional than that which is becoming common in the United

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States. In the USSR, the mathematical tools of academe predominate; those of the state or business (for example, statistics, discrete mathematics) are almost invisible. So in terms of curricu-

lum—or at least curricular directions—U.S. schools appear better attuned to the real needs of society.

But from tests—which are certain to become more serious not just for students, but for teachers and school districts as well—we have a lot to learn from the USSR. Tests should be part of the curriculum—an opportunity to learn and to be taught—not separate from it. They should enable students to reveal what they can do, not merely seek to reveal what they don't know or can't quickly recall.

If we are to be number one in mathematics and science, as President Bush has urged, we need tests that measure what's most important, not just what's cheap and easy to grade. □

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