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A math and science problem

States take lead role in addressing K-12 issue seen as vital to nation's success in global, technology-driven economy

by Tim Anderson (tanderson@csg.org)



State legislators have pursued several strategies to improve K-12 math and science education. They include strengthening academic standards and graduation requirements; improving training for math and science teachers; investing in new schools or academies; and encouraging young people to pursue math and science degrees and/or to become K-12 teachers. Details on some state initiatives from the Midwest can be found inside.

The Midwestern Office of the Council of State Governments supports several groups of state officials, including the Midwestern Governors Association and the Midwestern Legislative Conference, an association of all legislators in the region's 11 states. The Canadian provinces of Manitoba, Ontario and Saskatchewan are affiliate members of the MLC.

Late last year, the release of Minnesota students' test scores on math and science proficiency made big news.

And the positive results, education and business leaders said, were good reason for pride and celebration across the state.

This wasn't a high-stakes test — in the sense that results would determine whether a student could get into college or whether a school would face sanctions.

Instead, the Trends in International Mathematics and Science Study assessed Minnesota fourth- and eighth-graders' performance in these two subject areas compared to counterparts around the world.

How these students measure up, state leaders say, is a key indicator of how Minnesota is doing in a global competition where the stakes are indeed high.

This competition is for success in today's economy, one that is increasingly driven by technological innovation, that demands a skilled workforce, and that puts a premium on math and science aptitude. Recognizing this economic reality, Minnesota and other Midwestern states have made improving K-12 math and science education a top policy priority in recent years.

There is another reality at play too: The nation appears to be falling behind other countries in these two core subject areas.

"More work needs to be done," Minnesota

Education Commission Alice Seagren said when announcing results that showed her state's fourth- and eighth-graders outperforming most of their global peers. She was speaking of the need to improve the performance of older students. Only about 30 percent of Minnesota 11th-graders are proficient in math, compared to 64 percent of sixth-graders.

In fact, across the country, students hold their own against international counterparts in the primary grades. But an achievement gap develops and widens as young people get older.

Among the 30 industrialized countries participating in an assessment of 15-year-olds' math and science literacy, the United States ranked 21st in science and 24th in math.

According to the American Society for Engineering Education, fewer than 15 percent of high school graduates have a

strong enough math or science foundation to pursue science or technology degrees. At risk, business leaders say, is the nation's long-held standing as the world leader in science, technology and innovation — a position that has contributed mightily to U.S. economic prosperity.

Losing this edge is a national problem, but at least part of the response must come from the states. Inside, we highlight some of the new, ongoing and proposed state initiatives in the Midwest designed to improve K-12 math and science education. ★

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Formulas for success?

Stronger standards and graduation requirements, enhanced teacher training and recruitment, and new schools part of recent math and science initiatives

by Tim Anderson (tanderson@csg.org)

When they announced the encouraging math and science test results, and the achievement gains that had been made over the past decade, **MINNESOTA** education officials were quick to point to some key policy changes that had coincided with the advances.

Statewide academic standards in the two subject areas had been created and subsequently strengthened. As a result, officials say, students are now getting taught more math and science in the classroom, with a more rigorous curriculum. (A team of scholars from Michigan State University helped Minnesota establish the standards.)

And the state continues to revamp its math and science learning goals for different grade levels of students. According to the Minnesota Department of Education, standards are now being changed to include “a greater emphasis on college and work-readiness and technology use.”

Three years ago, too, the Legislature passed a bill (HF 3179/SF 2994) requiring students to complete Algebra I by the end of eighth grade and Algebra II prior to high school graduation. The legislation also requires high school graduates to have taken a physics or chemistry class.

Minnesota is not alone.

ILLINOIS, INDIANA, MICHIGAN, OHIO and **SOUTH DAKOTA** are among the other states that have strengthened high school graduation requirements in recent years. One common element of these changes is that students are expected take more — and more rigorous — math and science classes.

For example, laws in Michigan (SB 1124 and HB 5606 of 2006) and Ohio (SB 311 of 2006) call for students to take four years of math, including Algebra II, and three years of science. The Ohio statute specifies that three years of “inquiry-based laboratory science,” such as physics, chemistry and biology, be completed.

Finding new math and science teachers

Requirements and standards alone are not enough to improve math and science education.

Another critical factor is the quality of the teachers in these subject areas.

According to the National Math and Science Initiative, about one-third of high school math students and two-thirds of those enrolled in physical science have teachers who did not major in the subject or are not certified to teach it. The rates tend to be even higher in schools serving low-income areas.

This dearth of highly qualified teachers is a nationwide concern.

According to the National Math and Science Initiative, about one-third of high school math students and two-thirds of those enrolled in physical science have teachers who did not major in the subject or are not certified to teach it.

The National Academies’ highly publicized 2005 report “Rising Above the Gathering Storm” concluded that the lack of qualified math and science teachers was a serious risk to U.S. competitiveness in the global economy.

It proposed creating a merit-based scholarship program (worth up to \$20,000 for four years) in order to attract 10,000 exceptional students into math and science teaching careers.

Many states, in fact, already have established scholarships, loan-forgiveness programs or other financial incentives in order to recruit math and science teachers.

But the shortage of highly qualified instructors suggests more may need to be done.

In **IOWA**, for example, there were 294 math and science teacher positions open in 2008, but only 250 students majoring in math and science at the state’s Regent institutions.

To try and address this gap, the Legislature appropriated \$4 million for the Board of Regents’ Mathematics and Science Education Collaborative Initiative. Housed at Northern Iowa University, the initiative will focus, in part, on recruiting more young people into math and science teaching careers.

Minnesota Gov. Tim Pawlenty has proposed a new program that aims to bring mid-career professionals into the state’s K-12 schools as math and science teachers. It is modeled after existing initiatives in New York City and Texas.

In South Dakota, a teacher-compensation program provides state dollars for school districts to increase pay in certain subject areas, such as math and science, based on market demand and the districts’ academic goals.

Training current math and science teachers

Recruiting and retaining new math and science instructors is one way to improve teacher quality. Another is to focus on enhancing or updating the skills of existing instructors.

Two years ago, the Minnesota Legislature set aside \$3 million

for nine math and science teacher academies. The goal of the new academies is to offer teachers high-quality professional development, with a focus on the instructional methods that best help young people meet Minnesota's math and science standards. According to the state Department of Education, more than 1,000 teachers are currently involved in these academies.

In South Dakota, a statewide grant program — known as South Dakota Counts — has targeted intensive math-instruction training for elementary-school teachers.

Different students, varying achievement levels

States, though, aren't relying on teacher quality alone. Through other initiatives, they are focusing on the students themselves and on the types of school settings where young people are taught.

For decades now, some states have had math and science academies for gifted students. As a December 2006 *Education Week* article notes, these academies operate in a variety of ways: as stand-alone residential high schools, as part of college campuses, or as part-time schools that allow students to also attend their home high schools.

This fall, **KANSAS** will open its first math and science academy. Established by the Legislature in 2006 (SB 139), the academy is modeled after programs in place in Missouri and Texas. Forty high school juniors are expected to be part of the academy's first class; they will be taught college-level instruction at a university campus. One goal of the academy, legislators say, is to offer some of the state's brightest students a true academic challenge. But leaders also hope it encourages graduates to finish their postsecondary education in Kansas, and to eventually join the state workforce.

Meeting the needs of gifted math and science students is one strategy; another is providing extra help to young people who lack proficiency in math and science.

According to federal statistics, close to 30 percent of the nation's eighth-graders score "below basic" on math achievement tests. About one-third are "at or above proficient" in math.

The pool of students in need of additional instruction, then, is high.

Pawlenty has proposed a summer of "intense remediation" (between four and eight hours of teaching a day) for students not proficient in math and/or reading. The pilot program would be overseen by the state Department of Education rather than local school districts.

Ohio's \$200 million investment in STEM

Few states have been more aggressive in the area of math and science education than Ohio. In its last biennial budget, the General Assembly set aside \$200 million for various initiatives related to STEM (science, technology, engineering and math) education.

Part of that money is being used to open five regional math and science schools in areas with high levels of low-income and

Math, science education focus of MLC in 2009

Under the leadership of Kansas Sen. Jay Emler, the Midwestern Legislative Conference will focus over the next year on state efforts to improve math and science education in K-12 schools.



Sen. Jay Emler

The MLC, a nonpartisan association of all state legislators from this region, plans to issue a special report this summer on math and science education as well as hold policy sessions on this subject at its Annual Meeting in Overland Park, Kan. Its goal is to foster regional information-sharing and networking on how states can strengthen student learning and outcomes.

Emler has made math and science education the focus of his chair's initiative. He is serving as MLC chair in 2009. The MLC Annual Meeting will be held Aug. 9-12 in Overland Park, Kan. CSG Midwest provides staffing services to the MLC. More information is available at www.csamidwest.org.

minority students. These schools are being financed with help from the Gates Foundation.

Public dollars also are going toward

- recruiting STEM teachers,
- offering more after-school instruction in STEM disciplines and improving professional-development training in subject areas such as math and science, and
- providing technology-based scholarships for Ohio students to attend state universities.

One overriding goal of the Ohio STEM Learning Network is to promote the value of math, science and technology education in young people. That, too, is one of the many objectives of Indiana's public-private I-STEM Resource Network. Also in that state, Gov. Mitch Daniels has unveiled a new awards program to "emphasize the decisive importance that ability in math and science will play in Indiana's future."

Every year, the state will name a Mr. or Miss Math and a Mr. or Miss Science (the name comes from the prestigious, highly publicized Mr. and Miss Basketball awards given to Indiana's best high school basketball players).

States also have established scholarship programs for students to pursue fields in science, technology, engineering and math, and **NORTH DAKOTA** could become the latest state to do so this year. Gov. John Hoeven has asked the Legislature to appropriate money for STEM grants, a merit-based program that would provide eligible students with up to \$10,000. ★

Percentage of students who are at or above proficient in math and science*

| State | Fourth-graders | | Eighth-graders | |
|--------------|----------------|---------|----------------|---------|
| | Math | Science | Math | Science |
| Illinois | 36% | 27% | 31% | 27% |
| Indiana | 46% | 27% | 35% | 29% |
| Iowa | 43% | 36%* | 35% | 36%* |
| Kansas | 51% | -- | 40% | -- |
| Michigan | 37% | 30% | 29% | 35% |
| Minnesota | 51% | 33% | 43% | 39% |
| Nebraska | 38% | 26%* | 35% | 36%* |
| North Dakota | 46% | 36% | 41% | 43% |
| Ohio | 46% | 35% | 35%* | 35% |
| South Dakota | 41% | 35% | 39% | 41% |
| Wisconsin | 47% | 35% | 37% | 39% |

*All math scores are from 2007. All science scores are from 2005, except Nebraska (2000) and Iowa (2000 for fourth-graders and 1996 for eighth-graders). Data on science scores in Kansas were not available

Source: National Assessment of Educational Progress

SOURCE GUIDE

For more information on math and science education, please visit the following Web sites:

Achieve
www.achieve.org

Education Commission of the States
www.ecs.org

National Math and Science Initiative
www.nationalmathandscience.org

Ohio STEM Learning Network
www.osln.org

"STEM Education: Bolstering Future American Competitiveness" (a report of the CSG Trends in America series)
www.csg.org/pubs/pubs_tia.aspx

Tapping America's Potential
www.tap2015.org

Trends in International Mathematics and Science Study
<http://nces.ed.gov/timss/>



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