StateNotes

Economic / Workforce Development–High Tech / (STEM)

Education Commission of the States • 700 Broadway, Suite 1200 • Denver, CO 80203-3460 • 303.299.3600 • Fax: 303.296.8332 • www.ecs.org

Recent State STEM Initiatives

STEM = Science, Technology, Engineering and Mathematics

By Kyle Zinth

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Introduction

The increasingly globalized economy means that the United States is facing more competition from other nations that are increasing the skills of their citizens in the science, technology, engineering and mathematics (STEM) subjects, areas key to success in a high-tech world. As a result, in recent years much attention in the United States has focused on improving education in the STEM subjects, with initiatives commonly being put forth in the context of workforce development and college readiness, and regularly involving cooperation among the K-12, postsecondary and business sectors.

A recent Educational Testing Service survey illustrates how important both the general public and "opinion leaders" believe education in mathematics and science are key to the future success of this nation. Forty percent of the general public and 61% of opinion leaders identified math, science and technology skills as the most important ingredients in the nation's strategy to compete in the global economy. Underscoring the need to improve STEM education in this country, 71% of Americans believe that "our nation's public high schools are coming up short or falling behind in efforts to put students on the path to compete for highly technical scientific and engineering jobs with their counterparts from other countries."

Although several high-profile reports have called for action at the federal level, many state leaders, perceiving the importance of improved STEM education to their economies, have recently begun to take action. States have responded to this challenge in a number of ways, including raising graduation requirements in mathematics and science. States have also developed and implemented pre-engineering curricula in high schools, as in New Hampshire and 500 high schools in the Southern Regional Education Board (SREB) states. (For more examples of policies aimed at improving mathematics and science education, see ECS' 2006 StateNote on the topic.) Below are some examples of action that 17 states have taken recently that explicitly include all of the STEM subjects in one initiative.

Listed initiatives have diverse origins, and include executive orders, legislation and agreements between national organizations and states. Policies are just as diverse in their scope as they are in their origin. For example:

- Eight states – **Arizona**, **Arkansas**, **Connecticut**, **Kentucky**, **Minnesota**, **Missouri**, **Rhode Island** and **West Virginia** – have convened councils, commissions or roundtables to provide recommendations and guidance on how STEM education can be improved in the state.
- Five states – **Florida**, **Illinois**, **Massachusetts**, **Virginia** and **West Virginia** – have created specialized grant programs to be utilized to improve STEM education in the state. These funds employ a variety of strategies for improving STEM achievement. For example, **Virginia's** program seeks to attract students to pursue degrees and employment in STEM fields by providing grants to students who earn a postsecondary degree in a STEM field and proceed to be employed in a STEM field in the state. Meanwhile, **Florida** is seeking to build its capacity to conduct top level research in STEM subjects by establishing a policy intended to attract world-class scholars to selected institutions of higher education in the state.
- Five states – **Indiana**, **Massachusetts**, **Minnesota**, **Ohio** and **Texas** – intend to improve the skills of teachers in STEM subjects through their initiatives.
- Two states – **Minnesota** and **Ohio** – include opportunities for students to earn college credit while in high school.

This document is not meant to be comprehensive, and additions and corrections are welcome. Links to statutory language are provided when available for the reader's convenience, however, recent amendments may not be reflected.

Summary Table

	Teacher Training	Teacher Recruitment	Dual Enrollment / College Credit for High School Students	Real-World Learning Opportunities	Grants	Council / Commission Recommendations	Workforce / Economic Development Activities	Other
Arizona						X	X	
Arkansas						X		
Connecticut						X		X
Florida					X		X	X
Illinois				X	X		X	
Indiana	X	X					X	X
Kentucky						X		
Massachusetts	X			X	X		X	X
Minnesota	X	X	X			X	X	X
Missouri						X		
Ohio	X	X	X					X
Rhode Island						X		
Texas	X	X		X			X	X
Utah								X
Virginia					X		X	X
Washington							X	X

West Virginia					X	X	X	X

State Profiles

Arizona (2006)

EXECUTIVE ORDER 2006-07

Creates the Governor's Council on Innovation and Technology, replacing the Science and Technology Council. The council's duties will be to: (1) strengthen the innovation and technology infrastructure in the state; (2) enhance university research and education in high technology fields; (3) inspire cooperation between industry and university researchers; and (4) create and retain high-quality jobs in the state.

The council will be composed of appointees of the governor from state universities, the state technology council, technology organizations, corporate executives and venture capital executives. The council will be responsible for:

- Developing and recommending policies and programs that enhance and encourage innovation and technology for Arizona
- Developing and periodically updating a blueprint for technology-based economic development in Arizona through the creation of a long-term strategic plan for innovation and technology
- Providing the framework, and a forum for ideas, to enable Arizona to become a global leader in innovation and technology research, development and product creation
- Monitoring changes in global economic conditions that may justify a re-orientation of Arizona's technology programs
- Identifying future fields of science and technology that offer potential for application in Arizona
- Serving as the principal advisory group to the governor and, if so requested, the state legislature, on innovation and technology issues facing the state
- Stimulating technology transfer among and within higher education institutions and industry, including transfers of information available from federal agencies
- Reporting to the governor quarterly on an informal basis, and electronically submitting an annual written report to the governor no later than the first day of November

Arkansas (2003)

ARK. CODE ANN. § 6-1-301

Creates the Arkansas Commission for the Coordination of Educational Efforts. One of the many duties of the Commission is to make recommendations to improve STEM education for all grade levels K-16.

Connecticut (2005)

In October 2005, the governor hosted the first of a series of forums, collectively called “CONNvene”, in hopes of achieving the following goals:

- Creating a blueprint to focus federal, state and local resources on STEM improvement
- Identifying strategies for consideration by the governor, legislature, state boards of education and higher education, local school districts and communities on how to improve student interest and achievement in STEM education for all students, with specific emphasis placed on eradicating achievement gaps
- Drafting a proposal for a coordinated and comprehensive business and industry support program
- Considering various policy initiatives

- Implementing a statewide public awareness campaign to engage parents and child caregivers to ensure all Connecticut students receive appropriate STEM education opportunities. (Press release text)

Florida (2006)

H.B. 1237

21st Century Technology, Research and Scholarship Enhancement Act

Creates the 21st century technology, research and scholarship enhancement act for the purposes of:

- Investing in programs that attract world class scholars and building centers of excellence as an important means of increasing technology-based business in the state
- Aligning research and development efforts with established, statewide economic-development strategies, including an emphasis on identified economic clusters
- Facilitating value-added job creation through continuous improvement in university research, as well as entrepreneurship and capital-development programs
- Establishing the state as a leader for entrepreneurship and innovation, with continued commitment to university centers of excellence and an expanding base of research and development.

The policy provides for the allocation of matching funds to eligible universities in order to attract world-class scholars. The policy will be implemented by a technology, research and scholarship board that has been established within the state university system's board of governors in order to implement this policy.

State University System Research and Economic Development Investment Program

Creates the Florida university system research and economic development investment program in order to provide matching funds to eligible institutions to construct and acquire state-of-the-art science and engineering research facilities and specialized equipment to support research programs, foster economic development and accelerate the state's innovation economy. The program will be administered by the board of governors of the state's university system.

Establishes criteria for institutions to qualify for one of two funding levels, including the number of doctoral degrees awarded, an existing track record of securing patents and licenses leading to products in the marketplace and four-year undergraduate graduation rates. Funds appropriated under this policy must be used by the board of governors to match funds raised by an eligible university from non-university sources on a one-time dollar-for-dollar basis.

Illinois (2001)

20 ILL. REV. STAT. § 701/5 - 20 ILL. REV. STAT. § 701/99

The high technology school-to-work program seeks to increase the number of students exiting secondary and postsecondary schools who opt to enter occupations requiring advanced skills in the areas of science, mathematics and advanced technology. A secondary goal of the program is to encourage students exiting secondary schools to pursue advanced educational programs in technical fields and the sciences.

Grants are provided to local partnerships – consortia of high technology businesses and local secondary and postsecondary schools – which are required to provide students with work experience in high technology occupations combined with related classroom instruction. Employers and educators are required to cooperatively adopt or develop skills standards, curricula and assessment tools. Skills standards must be current with high performance workplaces and technology requirements.

Project activities also include:

- Training teachers
- Training work site supervisors and mentors
- Coordinating activities among the partners
- Outreach and recruitment of students
- Providing vocational counseling to student participants.

The program was established and coordinated by the department of commerce and economic opportunity. The department is required to periodically identify high technology industries and occupations for which training programs may be developed.

Indiana (2005)

A recipient of the National Governors Association (NGA) honor states grant program, Indiana's proposal focuses on bolstering high school STEM education. The state has encouraged its communities to consider proposals for effective STEM high school models, and has raised an additional $1 million from a philanthropic source to support planning grants for communities and districts committing to such high school redesigns. A request for interest in participation in a statewide STEM K-12 learning center has been circulated by a collaboration of higher education, business and other interests seeking to deepen the support for STEM models and learning across the state.

The state will push all state public colleges and universities to require future teachers to acquire a major in both education and a subject area (i.e., mathematics). The state will encourage more students to major in STEM-related areas, as a prerequisite to earning a teaching degree in that area. With the help of mathematics departments and schools of education, Indiana will develop a statewide curriculum for bringing math teachers up to subject matter mastery. In addition, the state will track student performance in middle school algebra and high school STEM subjects and link it to the institutions from which teachers graduated. The state will further hold higher education institutions accountable by asking them to guarantee the preparedness of their graduated teachers by providing them with further professional development to them if needed. (From National Governors Association Web site.)

Kentucky (2006)

Established in November 2006, Kentucky's Council on Postsecondary Education STEM Task Force includes leaders in the state's government, business and education sectors. The STEM Task Force was charged by the council with developing a statewide P-20 strategic action plan to accelerate Kentucky's performance within the STEM disciplines. In March 2007, the task force released its final report.

The final report has eight major recommendations for the state:

- Energize and fund a statewide public awareness campaign to help Kentuckians understand the critical importance of STEM to their own economic competitiveness and to that of the state
- Create incentives and a supportive environment for students, teachers and institutions that pursue, succeed and excel in STEM disciplines throughout the P-20 pipeline
- Implement international best practices in professional development programs for P-16 STEM teachers to increase the intensity, duration and rigor of professional development
- Improve teacher preparation programs and encourage people with undergraduate and graduate STEM degrees to enter the teaching profession
- Revolutionize how STEM subjects are taught, learned and assessed and implement a statewide research-based STEM curriculum that is aligned with global workforce and academic standards

- Engage business, industry and civic leaders to improve STEM education and skills in the state and create incentives for Kentucky businesses that employ and invest in STEM educated students
- Develop an ongoing, coordinated, statewide STEM initiative that maximizes the impact of resources among state agencies, schools, colleges and universities, and businesses and is focused on developing and attracting STEM-related jobs to the state
- Target energy sustainability problems and opportunities in the state and the nation as a primary objective of statewide STEM enhancements.

Massachusetts (2003)

MASS. GEN. LAWS CH. 29, § 2MMM
Established the Mathematics, Science, Technology and Engineering grant fund, also known as the pipeline fund. The purpose of the fund is to increase the number of students in Massachusetts who participate in programs that support careers in STEM-related fields.

This policy directs the chancellor of higher education, in consultation with the commissioner of the department of education and the president of the University of Massachusetts, to employ the fund through grants and other disbursements and activities that are calculated to increase the number of qualified STEM teachers in the state and to improve the STEM educational offerings available in public and private schools. Activities may involve the University of Massachusetts, state and community colleges, business and industry partnerships, workforce investment boards, private colleges and universities, public and private schools, and school districts.

Grants and other disbursements and activities may support:

- The development and use of innovative curricula, courses and programs in STEM subjects for teachers that provide appropriate content and instruction in innovative ways to teach STEM subjects, including the use of hands on, experimental learning. At least $360,000 will be allocated to support a collaborative planning effort among six Workforce Investment Boards to develop a pilot high school STEM internship program designed to increase the number of high school students pursuing post-secondary education in STEM careers.
- The development of a STEM network to create, implement, share and broadly disseminate information on best practices and innovative programs related to STEM instruction as well as expanding and maintaining student interest in STEM studies and careers.
- Effective ways to teach STEM subjects.

Priority will be given to grants that provide effective course and curricula in low income schools or school districts.

Minnesota (2005)

Also an NGA Phase I Honor State, Minnesota's proposal focuses on increasing the number of high school courses – and student course taking – in STEM subject areas. The state has initiated efforts designed to:

- Improve high school rigor for students and their transitions to postsecondary education
- Implement a P-16 system of accountability for student success and coordinate a P-16 governance system
- Improve teaching and learning in STEM subjects
- Provide STEM teachers with professional development to enhance teacher induction/mentoring programs
- Build teachers' skills in using digital content in science and math.

The governor established a STEM roundtable of business, civic and education leaders to determine the state's needs in math and science, and evaluate and enhance the rigor of math and science in career and technical education programs. (The roundtable's final report may be accessed here.) Additionally, the

governor's education council – made up of leaders from the workforce and business community, higher education organizations and government agencies – will establish two- and 10-year goals and benchmarks for P-16 student achievement, including progress in STEM disciplines.

A fall 2006 STEM summit is planned to bring together high school students from across the state to encourage them to enroll in more rigorous coursework in the STEM subject areas. Business representatives will also have representation to educate students on how STEM directly relates to the business world. The state is also planning an aggressive communications campaign for 2006 to stress to parents and students the importance of academic achievement and the value of taking rigorous courses including math and science.

Legislation passed in 2005 (H.F. 141) enabled school districts to expand districts' abilities to expand their Advanced Placement or International Baccalaureate programs and required that students be informed of the College Level Examination Program (CLEP) and other rigorous assessments for earning college credit. In addition, S.F. 2994 (2006) raised high school graduation requirements in mathematics and science.

Missouri (2005)

Convened in April 2005, Missouri's Math and Science Summit began a dialogue among education, community, business, government and industry leaders to improve STEM education and address challenges facing the state. In May 2006, Governor Matt Blunt named members to serve on the Math and Science Alliance. The alliance will develop an action plan to improve STEM learning and student achievement in the state. The alliance will use strategies and suggestions generated at the summit as the basis of an action plan for the state to become a global leader in STEM fields. The state chamber of commerce and industry will support the alliance. The action plan was submitted to the governor on August 31, 2006.

Ohio (2006)

H.B. 115 (2006)
Appropriates funds to support the following activities of the Ohio Core program to:

- Support the participation of licensed teachers and mid-career professionals in a 12-month intensive training program leading to teacher licensure in a laboratory-based science or advanced mathematics field at the high school level and employment with an Ohio school district
- Support alternative teacher licensure programs developed by educational service centers, in partnership with institutions of higher education
- Obtain contracted instruction for high school students in science and mathematics from institutions of higher education that result in dual high school and college credit
- Implement and support the *Ohio Students Choosing On-line Resources for Educational Success* initiative to increases the educational options available for students in mathematics and advanced laboratory-based science; the policy directs the eTech Ohio Commission to work collaboratively with the department of education and the board of regents on this initiative
- Support up to 10 regional summer academies that prepare 11th- and 12th-grade students to enroll in college-level STEM courses and encourage them to pursue a teaching career in a STEM discipline. Students successfully completing these courses will earn dual high school and college credits.

(Funds were also allocated to meet foreign language education needs.)

Rhode Island (2005)

EXECUTIVE ORDER 05-08
Creates the statewide PK-16 council, which is chaired by the governor. Among the council's responsibilities are to support the recommendations of the governor's Blue Ribbon Panel on Math-Science Achievement and track the state's progress. The panel released a report with recommendations for actions to be taken in the areas of: (1) governance and culture, (2) teacher recruitment, (3) teacher quality and (4) learning opportunities, to meet four goals:

- Coordinate and sustain reforms in STEM education across K-12 and higher education systems with employer involvement
- Attract more individuals to teach STEM subjects in which teacher shortages exist
- Improve mathematics and science teacher prep programs, especially for elementary school teachers
- Provide opportunities for all students to engage in rigorous STEM education.

Texas (2005)

EXECUTIVE ORDER RP53
Texas Governor Rick Perry directed the Texas Education Agency (TEA) and the Texas Higher Education Coordinating Board to work together to enhance college readiness standards and programs for Texas public schools.

Components include:
- The creation of STEM academies throughout the state, to improve student college readiness
- The creation of a system of college readiness indicators, including the reporting of higher education remediation rates on public high school report cards
- The development of a series of voluntary end-of-course assessments in science, mathematics and other subjects currently assessed by the 11th grade Texas Assessment of Knowledge and Skills (TAKS), to measure student performance; and provide for a potential alternative to the 11th grade TAKS.

In December 2005, the Texas High School Project – an initiative involving the governor's office, the TEA and several national organizations – announced the launch of the Texas Science, Technology, Engineering and Math (TSTEM) Initiative. The $80 million public-private partnership will establish 35 small schools that offer focused teaching and learning opportunities in STEM subject areas and five to six STEM Centers to develop high-quality teachers and schools.

The 35 academies are expected to include a mixture of charter schools, traditional public schools and schools operated in conjunction with an institution of higher education. All academies will begin at 6th grade and focus on the most challenged school districts and the most disadvantaged students across the state. The academies are intended to develop successful practices that can then be implemented throughout the state. Academies will also include partnerships with employers to expose students to careers in STEM fields.

Virginia (2006)

H.B. 1244
Creates the mathematics, science and technology education grant program to provide grants to state residents. Students must maintain at least a 2.5 grade point average or its equivalent and maintain enrollment in a qualified degree program to be eligible under the grant program.

Prior to being awarded a grant, students are required to sign a promissory note agreeing to:
- Begin employment in the state in a STEM-related position within six months of receiving an undergraduate or graduate degree in a STEM field
- Continue such employment in the state for at least four years.

Washington (2006)

HB 2817
Establishes a state priority to encourage an increase in the number of students who enroll and earn degrees in engineering, technology, biotechnology, sciences, computer sciences and mathematics. The legislation directs institutions to determine local student demand for programs in these fields and submit findings and proposed alternatives to meet demand to the higher education coordinating board and the legislature by November 1, 2008.

Examples of the types of institutional programs that may help achieve these objectives include establishment of institutes of technology, new polytechnic-based institutions, new divisions of existing institutions and an array of flexible delivery models, such as face-to-face learning, interactive courses, internet-based offerings and instruction on main campuses, branch campuses and other educational centers.

Further, the measure strongly urges higher education institutions to consider science, engineering and technology program growth in areas of the state that exhibit a high concentration of aerospace, biotechnology and technology industrial presence. "Expanded science and technology programs can gain from the proximity of experienced and knowledgeable industry leaders, while industry can benefit from access to new sources of highly trained and educated graduates."

West Virginia

H.B. 4690 (2006)
Establishes the West Virginia Consortium for Undergraduate Research and Engineering (West Virginia CURE) as a 13-member collaborative planning group to:

- Increase the state's capacity for high-quality engineering instruction and research
- Improve access to high quality instruction and research opportunities in STEM subjects throughout the state
- Stimulate economic development by increasing the number of professional engineers available to business and industry throughout the state.

West Virginia CURE will develop a strategic plan to address the above needs by using the complementary strengths of West Virginia University Institute of Technology, Marshall University and West Virginia University. The strategic plan may address faculty, library and technology resources, research collaboration and coordination with K-12 education. The consortium will present an interim report to the governor and the legislative oversight commission on education accountability by December 1, 2006, and a final report containing the collaborative engineering strategic plan, with recommendations for implementation, by July 1, 2007.

W. VA. CODE § 18B-14-11 (2005)
The Governor's Commission on Graduate Study in Science, Technology, Engineering and Mathematics – also referred to as the STEM Commission – was created to address issues that include:

- Promoting coordination between higher education and K-12 education to create a seamless system of science and mathematics education and to improve science and mathematics education at all levels
- Increasing the number of graduate students and post-doctoral students in STEM fields, including the number of women and minority graduate students
- Increasing the number of undergraduate and graduate students who receive nationally competitive scholarships and fellowships in STEM fields
- Improving the quality of graduate faculty and programs in STEM fields
- Aligning graduate STEM programs with the goals and objectives of the state experimental program to stimulate competitive research (EPSCoR) program, the state science and technology advisory council, the state development office and the doctoral scholars program of the Southern Regional Education Board
- Increasing the quantity and enhancing the quality of academic research, as measured by federal and external expenditures for research and development.

The commission was directed to report its findings, conclusions and recommendations – together with drafts of any legislation necessary to effectuate the recommendations – to the legislative oversight commission on education accountability, the higher education policy commission and the state EPSCoR advisory council.

W. VA. CODE § 18B-1B-12 (2004)

The research challenge fund – to be administered by the higher education policy commission – is a component of the state's strategic plan for economic development. The policy commission was directed to use the recommendations of the EPSCoR state advisory council in its allocation of funds.

Research challenge objectives are to:

- Increase the research capacity of institutions of higher education and the competitiveness of these institutions to apply for external funding
- Stimulate the development of research and research products that are directly applicable in improving the economic competitiveness of existing state industries and the development of new business and jobs in the state
- Leverage limited state resources with private and federal funds to support projects and activities directly related to economic development by requiring matching funds and cooperative agreements with external partners
- Increase the production of undergraduate and graduate degrees of programs in STEM fields, with special attention to emerging disciplines
- Hold institutions more accountable for the success of research projects funded under this program with the expectation that state support will be phased out and the project or activity will be terminated if it is unable to generate ongoing external support.

Priorities for the research challenge will be:

- Research on energy generation, distribution and utilization that builds on the state's existing energy research strengths, related research products and technology transfer programs
- Research, education and outreach conducted by the EPSCoR program
- Research projects that are related to the economic development of the state and that have significant potential to attract participation and funding from industrial, federal or foundation partners
- Collaborative projects between higher education and public education to improve science and mathematics education
- Graduate education in science (including medical education), technology, engineering and mathematics; the allocation will be used for the increase in doctoral students and programs at West Virginia university and Marshall university in these fields
- Recruitment of eminent scholars to strengthen research capacity and competitiveness for external funding.

Conclusion

The coming years will likely see continued focus on improving education in the STEM subjects. This focus will be driven by states' growing awareness of competition – not only from other states but from nations around the world – fueled by a high tech economy that highly values workers proficient in STEM subjects and bestows numerous economic advantages upon those areas where these workers live and work. The policies outlined in this report provide a variety of approaches that policymakers may consider as they design policies for their own states.

Kyle Zinth, policy analyst in the ECS Information Clearinghouse*, compiled this report. Email: kzinth@ecs.org*

Helping State Leaders Shape Education Policy