A Business Leader's Guide to

MOBILIZING STATE ACTION ON STEM

CHANGE THE EQUATION™




www.changetheequation.org

Change the Equation (CTEq) is a nonprofit, nonpartisan, CEO-led initiative that is mobilizing the business community to improve the quality of science, technology, engineering and mathematics (STEM) learning in the United States. Since its launch in September 2010, CTEq has helped its more than 100 members connect and align their philanthropic and advocacy efforts so that they add up to much more than the sum of their parts.

OUR MISSION

Through our coalition of CEOs, Change the Equation pledges to foster widespread literacy in science, technology, engineering and mathematics (STEM) that sparks an innovative spirit in students and prepares them for postsecondary options.

OUR GOALS

CTEq offers a broad umbrella under which companies can connect with each other, identify opportunities for jointly leveraging their STEM investments and achieve more together than they can separately.

- **Improving Philanthropy**—Increase the impact of corporate philanthropy by emphasizing high-quality, scalable programs.
- **Inspiring Youth**—Capture the imagination of young people, giving them a solid foundation in STEM and insight into the unlimited postsecondary and career options.
- **Advocating for Change**—Promote proven state policies and research-based practices that enhance student mastery of and interest in STEM disciplines.

TABLE OF CONTENTS

I. Introduction

This guide for business leaders provides information and practical advice about effective strategies to support state actions that promote widespread STEM talent development in all K–12 youth. Although seasoned STEM advocates may find a few new ideas here, the guide is written for business leaders who are committed to STEM but relatively new to engagement and advocacy at the state level. It focuses primarily on K–12 education, because Change the Equation's (CTEq) mission is to improve STEM learning—both in and out of school—during the K–12 years. However, from a state policy perspective, STEM talent development involves a continuum that includes preK, K–12, higher education, as well as economic and workforce development.

II. Why State Action is so Important

The 10th Amendment of the U.S. Constitution states that all "powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people." Since the Constitution does not explicitly discuss education, states are responsible for K–12 public education.

States typically (there are always exceptions) provide the largest share of funding for public K–12 education and are responsible for:

- Academic standards;
- Assessments of student achievement in reading, math and other subjects;
- High school graduation requirements;
- School finance formulas;
- Accountability systems;
- Provisions for creating charter schools;
- Teacher/administration education and professional certification requirements; and
- Special initiatives such as professional development, technology and school choice.

States are also the focal point for making essential improvements in K–12 education. There have always been outstanding programs, effective schools and excellent teachers, but they are not nearly as widespread as they should be. The challenge for state policymakers is to find the mix of funding, regulations, assistance and incentives that spur and support local action to:

- Scale what works;
- Stop doing what's not working; and
- Develop a culture of continuous improvement and innovation that not only routinely raises student achievement, but also ensures that students are college-and career-ready when they graduate from high school.

States also provide a substantial portion of the funding for public higher education, recruit employers to create jobs in the state and run public workforce development programs.

III. Challenges for Business STEM Advocates

From the perspective of most business leaders, the education system is broken. Student achievement in STEM subjects is improving, but not fast enough, and large gaps remain between the United States and top-performing countries on math and science assessments.

Insufficient numbers of U.S. students are majoring in STEM fields to meet the high and growing demand for STEM skills both within and beyond STEM occupations. According to the recent *STEM Help Wanted* report issued by CTEq, even with high rates of unemployment, many jobs remain unfilled because the skills that workers have do not match the skills employers need.[1]

However, many educators who have been working on STEM issues for a long time would appreciate acknowledgment from business for what has been accomplished to date. And although most policymakers welcome business expertise, there are educators (difficult to quantify how many) who fear that business wants to impose a corporate model for organizational change on schools. The blogosphere includes extreme accusations, for example, that business wants to privatize K–12 public education.

The rationale for business involvement is clear: employers are one of the education system's most important customers. Employers have a bird's-eye view of current and future demands for skills and knowledge. Employers compete for talented people who want to live and work in communities with good schools. Employers are taxpayers and citizens who have a stake in the strength of the U.S. economy and democratic institutions.

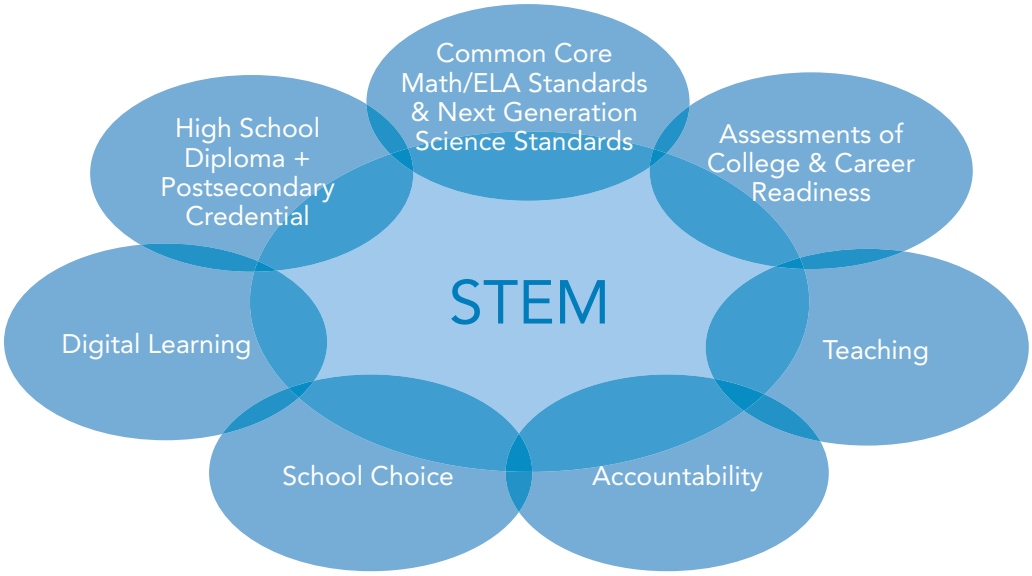
Challenges faced by business advocates for STEM include:

- Patience and urgency: Business leaders' sense of urgency about the crisis in STEM learning—not just for future scientists and engineers, but also for all students—squares off against the time it takes to change state policy and education practice. It's been said that it is easier to change the location of a cemetery than to change the school curriculum.[2] For many in the business community, it can feel like operating in two different universes. Finding the right equilibrium between patience and urgency is an art, not a science, but it is necessary to maintain credibility with the people who are responsible for making the desired changes happen.

- Collaboration and agitation: Business leaders are building or joining national, state and local partnerships that include a wide range of STEM stakeholders. Just as there is tension between patience and urgency, there is tension between the need for collaboration among all stakeholders and the frequent need for external pressure to shake up the status quo. The role of partner is just as important as that of outside agitator (or put more kindly, critical friend), but finding the right balance is challenging.
- Realistic expectations: Though some may view business with suspicion, others may welcome it with too much enthusiasm. It's best for business leaders to make it clear from the start that they don't necessarily come with a checkbook, and that they also have full-time jobs.
- State politics: Companies may be in discussions with governors or state legislators about business-related state policy issues. Such discussions may provide opportunities to mention STEM learning. They also may mean that the timing isn't right for a particular company to take the lead on STEM issues with elected officials.
- Company branding: Frequently companies' desires to brand their own philanthropic and other corporate responsibility activities may be in tension with their desire to join broad business coalitions with shared goals. Clearly there are multiple ways for companies to advocate effectively for STEM that include opportunities for both individual company recognition and collective recognition of the larger group.

IV. Current State Policy Landscape

STEM is at the nexus of major education policy initiatives that are getting attention from policymakers. Effort on any one of these issues often has a ripple effect on others. Moreover, STEM advocacy does not occur in a vacuum; it is both a piece of overall education reform and, in many states, a driver of the changes needed for states' economic development and job growth. The following Venn diagram highlights seven interrelated policy issues that influence STEM teaching and learning.



STEM advocates need to understand why each of the issues in the outer circle of the diagram is now on state policymakers' radars. These seven are *not* the only critical education reform issues, but they are the ones that are most relevant to STEM learning at this point in time:

- Common Core State Mathematics and English Language Arts Standards (CCSS) and Next Generation Science Standards (NGSS);
- Assessments of college and career readiness;
- Teaching;
- Accountability;
- School choice;
- Digital learning; and
- High school diploma plus postsecondary credential.

Appendix A includes a brief discussion of each issue, and its relationship to STEM.

V. Who is in Charge?

It's byzantine. Four key players at the state level are involved in governance of K–12 public schools: governor, legislature, chief state school officer (often called state commissioner of education or state superintendent of schools) and state board of education. States use various permutations of who appoints whom and which positions are elected or appointed. (Details on the model in each state are available in Education Commission of the States' brief on State Education Governance Models[3].)

Add to this mix the players in governance at the local level—board of education, mayor (in a few cities), district superintendent, union or other teacher organization involved in contract negotiations and principal. There also may be county-level involvement. A few states have passed legislation (referred to as "parent trigger") that enables a vote by a majority of parents to fire the principal in a low-performing school.

So who's in charge? The answer often appears to be no one and everyone. But that just means it's difficult—not impossible—for companies to make a difference in the labyrinth of state education policy and politics. Importantly, the business community can help provide "cover" for elected officials who want to do the right thing in educational decision making but know that such decisions may be politically unpopular. As an organization, CTEq has signaled to governors that member company CEOs would publicly support the raising of expectations of proficiency on state assessments, despite the anticipated initial uptick of unsatisfactory performance.

Elected and appointed officials come and go, but the business community provides the continuity necessary to sustain the state's STEM and education reform agenda. Companies do not need to figure out each state's education system on their own. State STEM coalitions, working closely with state business groups, provide opportunities for business leaders to work with like-minded public- and private-sector partners to mobilize state, and in many cases local, action. The next section provides examples of different strategies companies and coalitions are using.

VI. Effective Roles and Actions for Companies

This guide focuses on effective roles for business engagement and advocacy on state policy, but many of the recommendations and examples are also applicable to national and local STEM policies and programs.

Be strategic.

Companies committed to accelerating STEM learning and widespread talent development can have the greatest impact when they strategically align and involve their philanthropic, government relations, employee involvement and other business activities with their STEM objectives.

> Washington Roundtable, which represents the state's largest employers, works with its education arm, Partnership for Learning, to set business' policy agenda for K–12 education reform. With the policy direction in place but insufficient support for change on the ground, Boeing, McKinstry, Microsoft and other companies and foundations provided funding to create Washington STEM,[4] a notable example of pooled company resources advancing state goals while also maintaining recognition for individual company contributions. The organization partners with business, education and community groups to make strategic local investments, generate breakthrough ideas, build political will and advocate effective STEM policies and practices. STEM professionals and employee volunteers are involved as mentors and advisors in both in- and out-of-school programs that receive statewide, regional and local grants from Washington STEM.

Show strength in numbers and speak with one voice.

The business community is most effective when companies and business groups speak with one voice on an issue—this is as true for STEM as it is for other public policy issues. Business leaders should be on the same page about what the state needs to do for STEM talent development. Also, individual companies frequently are more comfortable signing letters to the governor and members of the state legislature when they know that other companies are involved.

> The Ohio STEM Learning Network, managed by Battelle, worked closely with the Ohio Business Roundtable to develop its successful advocacy strategy to secure additional state funding for STEM.5 Business leaders were poised to step up on the issue because of an earlier initiative that rallied the business community around a common STEM agenda, Tapping Ohio's Potential. The Ohio STEM Learning Network continues to focus stakeholders on the connection between Ohio's economy and STEM education with the message, "… Ohio is using STEM education as a talent development tool to unleash creativity and innovation in all our students."

Participate in a broad-based coalition.

The coalition should include the right players at the table to build consensus on a state STEM agenda and, most important, a strategic plan with measurable benchmarks for advancing that agenda. If a coalition is already in place, ask questions about the process for updating the plan and how milestones are monitored. CTEq's State STEM *Vital Signs* and *State Self-Assessment of Capacity for Advancing STEM Initiatives* are tools to help inform states' development and implementation of states' strategic plans.

The Tennessee STEM Advisory Council provides advice and counsel to guide Tennessee's STEM Innovation Network.6 Companies represented on the council, state experts and opinion leaders recently developed a statewide STEM plan in consultation with state agencies and private and public organizations. The council also is charged with providing guidance for those Tennessee STEM investments that were made possible by the $36 million grant from the federal Race to the Top state grant competition. Similarly, in May 2012, North Carolina launched its NC STEM Learning Network. The state network is currently pursuing partnerships with nonprofits, businesses, foundations and others who interested in connecting with other STEM stakeholders from the across the state and beyond.

Focus on data and evidence.

Businesses are well positioned to insist on data driven decision making in education. CTEq's State STEM *Vital Signs* and other state and local data provide insights to initiate or continue conversations about next steps to advocate to improve STEM learning.

Representatives from EMC, Intel, University of Massachusetts Medical Center and other companies participate in the Central Massachusetts Regional STEM Network. They advocated for a regional breakdown of statewide STEM data reports so the network could plan programs and policies to meet the region's needs which, in some cases, were different than the state's priorities. This strategy helped regional councils focus their STEM plans to address trends faced by their students.

Communicate with employees.

Employees, of course, also are parents and grandparents, neighbors, coaches and leaders in their communities. Companies can use internal communications, provide links on websites to get more information and host opportunities for employees to learn more about STEM *Vital Signs* and new STEM-related education developments in states and schools.

GE has begun to hold "brown bag" lunches with employees at company locations around the United States to discuss not only the significance of Common Core math and English language arts standards and Next Generation Science Standards, but also how the shift to higher standards will affect their states and communities. GE has also invited other companies to participate in separate discussions on the same issue. These activities will help prepare the public for implementation of the Common Core.

Build on core competencies.

No one expects business leaders to be education experts or to get "in the weeds" on state STEM policies. Companies are most effective when they use their core competencies, including business leaders' analytic and problem-solving skills, to address real state and local STEM issues. Examples include: human resources strategies to attract and retain talented employees and develop managers' leadership skills, marketing and public relations expertise and curriculum development and training.

Based on P-Tech, a six-year school for grades 9–14 developed in New York City in a partnership with IBM, Chicago plans to open five grades 9–14 high school/college schools with IBM, Cisco, Microsoft, Motorola and Verizon as partners. The companies will help develop curricula focusing on science, technology and math. In addition to their high school diplomas, students will be able to earn certificates and associate's degrees. Students who want to go directly into the workforce are guaranteed a "first in line" interview with the partner companies.

Leverage partnerships and sponsorships.

Companies often have partnerships and sponsorships with other organizations that can be tapped to focus attention on STEM issues. These relationships can be very useful for public engagement and expanding support for state STEM policies.

As a sponsor of the Masters Golf Tournament, ExxonMobil runs ads about STEM during the Masters television broadcast, which boasts millions of viewers. This year's ads7 featured ExxonMobil's support for math and science programs and the Common Core State Standards initiative. The creative ads frame STEM issues in ways that the general public can understand.

Inspire students.

To complement state policy changes, states should have a strategy to spark student interest in STEM. If students never meet a scientist or an engineer, are not told which courses they need to take to keep their future career options open, or experience negative peer pressure for their interest in math and science, it's unlikely they will pursue STEM learning. However, classroom visits by company scientists and engineers will not make a significant difference unless they are closely coordinated with the expectations in state Common Core Math and Next Generation Science Standards and employees know how to craft age-appropriate messages. It's also important to involve students, especially girls and underrepresented minorities in STEM, in out-of-school activities that engage and inspire students with real-world scientific and technological problems.

Maryland Business Roundtable for Education is developing a STEMnet Teachers Hub[8] in response to one of the recommendations made by the Governor's STEM Task Force to secure the state's future as a global leader in STEM-based learning, research and economic development. Teachers will be able to link with private sector STEM professionals and call on them to augment curriculum-based learning, and inform and inspire students about real-world STEM work.

Make the case for STEM.

There never are too many times to remind people why STEM is important and why business is involved. Business leaders have opportunities to bring up STEM when they give speeches, meet with editorial boards, play golf or attend sports, arts or fundraiser events with prominent state officials. Companies help make the case by supporting public engagement campaigns, writing to and meeting with state policymakers and doing any of the suggested roles and actions discussed in this section of the guide.

A few examples:

- Xerox Chairman and CEO Ursula Burns' speech to the Detroit Economic Club[9]
- IBM Chairman and former CEO Sam Palmisano's remarks at a panel convened by the Federal Reserve[10]
- Raytheon Chairman and CEO William Swanson's speech at Massachusetts' STEM Summit[11]
- Senior executives from Agilent, Bechtel Group, Chevron, DuPont, Lockheed Martin, Northrop Grumman, Rockwell Collins and other companies make the case for STEM[12]

VII. Conclusion

Although there has been progress in improving STEM learning at the K–12 level, it has been incremental and often not commensurate with the effort and investments that have gone into it. This has to change. Our economic, civic and democratic future depends on the STEM skills and knowledge of our youth: Competitors are passing us by.

The business community has a special role to play in accelerating progress toward the goal of widespread STEM talent development. But, the question remains: How can we speed our progress? CTEq believes that coordinated action based on data will be a critical strategy.

Change the Equation's State STEM *Vital Signs*, state data and information on schools from sources such as GreatSchools[13] provide business leaders with data to engage in meaningful conversations with policymakers and practitioners about strategies to improve STEM learning and accelerate STEM talent development.

We urge the business community to take advantage of this growing body of data and the growing commitment to make lasting change now. Remember: "Without data, you are just another person with an opinion."[14]

Appendix A

Current State Policy Landscape: Key Issues and Players

The seven issues introduced in the Venn diagram on page 6 are briefly discussed in this Appendix.

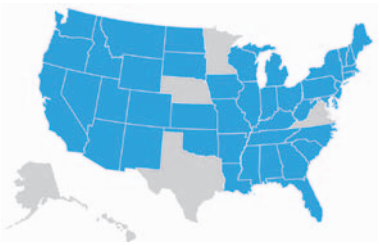
Common Core Standards in Mathematics and English Language Arts; Next Generation State Science Standards. In what could be a game changer for United States education, for the first time, states are collaborating on common standards in math, science and English.

Interest in raising academic standards is nothing new; the modern focus on standards-based education reform dates back to the 1983 report, *A Nation at Risk*.[15] There have been many efforts by national organizations to develop national standards in core subjects, and some received federal support in the 1990s. Individual states also raised their standards, both before and after they were required to have standards in core subjects by the No Child Left Behind (NCLB) Act of 2001.

However, until now, each state developed its own standards for what students need to know and be able to do in K–12 math, science and reading (English language arts). As a result, state standards differ significantly in terms of content, expectations at each grade level and rigor. There is widespread agreement that most states had far too many standards, that standards lacked coherence from grade to grade and that they focused disproportionately on lower-level skills compared to higher-level problem solving, analytic and communications skills. Business leaders also worried that individual state standards were not internationally benchmarked.

It is politically unacceptable for the federal government to take the lead in common standards efforts, but governors and state commissioners of education, who have responsibility for education in the United States, stepped up and launched the movement to develop, adopt and implement internationally benchmarked common state standards. In doing so, they recognized that what is important to learn in Minnesota does not differ from what is important to learn in Mississippi, Montana, Maryland or Massachusetts. Progress to date follows:

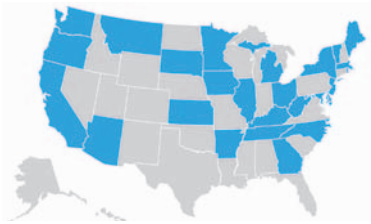
Common Core State Standards in Mathematics and English Language Arts:[16]
As of June 2012, 45 states and the District of Columbia have adopted and agreed to implement Common Core State Standards in Mathematics and English Language Arts, following the initiative led by the National Governors Association (NGA) and the Council of Chief State School Officers (CCSSO) to develop common, internationally



45 States and DC adopted Common Core Standards in both subjects 2010 and 2011.
*Minnesota only adopted the English Language Arts standards.

benchmarked K–12 grade-by-grade expectations. The states that have not adopted the standards plan to demonstrate that their own state standards are as rigorous as the Common Core.

Next Generation Science Standards:[17]
Business leaders and other STEM advocates also called for common state science standards. Twenty-six states are leading the development of Next Generation Science Standards (NGSS) based on the National Research Council's Framework for *K–12 Science Education*. The 26 states volunteered to take the lead; other states have the opportunity to review the standards and decide whether they are interested in implementing them as well. A revised draft based on an initial round of comments will be released for public review in Fall 2012—with additional opportunities for business leaders, scientists, engineers, educators, policymakers and anyone else who is interested—to provide feedback before the standards are finalized. Business leaders can anticipate being asked to help make the case for why states should adopt the new science standards.



26 states are leading development of NGSS.

However, Common Core Mathematics and English Language Arts Standards and Next Generation Science Standards will not make a difference unless they are aligned with new and better assessments, accountability for high student achievement, time and support for students who need additional help to meet the higher standards and, most important, the training and tools teachers need to teach the higher standards. Business leaders know from experience that great ideas can fail because of poor execution. A quotation often attributed to Thomas Edison perfectly captures the challenge for successful implementation of the new standards: "Vision without execution is hallucination."[18]

Assessments of College and Career Readiness. Current state math and reading assessments required by NCLB are inadequate as measures of the rigorous content and 21st century skills included in the Common Core Math and English Language Arts Standards. Since it would be costly and redundant for each state to create its own tests, two national consortia—the Partnership for Assessment of Readiness for College and Careers (PARCC)[19] Consortium and the Smarter Balanced Assessment Consortium[20]—are developing multi-state assessment systems aligned to the Common Core standards. The assessments are being designed to measure individual student growth, gauge progress toward college or career readiness and create a feedback loop to improve teaching, learning and programs. New assessments in math and English language arts should be ready for the 2014–15 school year. Because the Next Generation Science Standards have not been finalized or adopted by the states, the development of new science assessments has not started. In the interim, states will continue to use existing science tests.

State policymakers and educators in participating states expect that students' scores will drop dramatically when they are assessed on new measures of their progress toward college and career readiness. However, parents and the public may not be prepared for the change. Support from the business community will be critical to maintain the political courage to stay the course, as painful as that may be in the short run.

States that opted not to join the Common Core effort will continue using their own state-generated standards and assessments, although the opportunity to join the common effort will remain open. The business community will want to make certain that states going it alone have standards and assessments of comparable high quality.

Teaching. Research on the importance of teacher effectiveness in improving student achievement, plus the recession's impact on many states' budgets, are focusing laser-like attention on teachers. There are heated debates in many states and communities over teacher evaluation, tenure, compensation and unions. One of the most contentious issues is "LIFO"—last in first out, the policy for using seniority to determine which teachers are laid off when there is a reduction in force. LIFO may have resulted in the loss of new teachers who were more effective than veterans, but unions view it as the only fair option for ensuring that older teachers aren't dismissed simply because they are more expensive. This may begin to change as states develop and implement new approaches to evaluating teachers, including measures that take growth in student achievement into account. Such efforts are under way in states that won grants in 2010 and 2011 from Race to the Top, a new federal grant competition for states.

Less on the political radar, but no less important, is the recognition that implementation of Common Core standards depends on making sure teachers get the training and the instructional materials they need. With a potential game changer in the wings, the players must learn a new set of rules and skills.

Accountability. Since passage of NCLB a decade ago, states, districts and schools are accountable for ensuring that all students, including subgroups of students (economically disadvantaged, racial and ethnic minorities, and students with disabilities or limited English proficiency) are proficient in reading and math by 2014. Schools that miss annual targets for multiple years face serious consequences.

The process for Congress to revisit and improve NCLB—called reauthorization—has been overdue since 2007. For political reasons, it probably will not occur until 2013 at the earliest. NCLB's accountability requirements continue, creating a potential for policy disconnect as 2014 approaches. Schools will have to demonstrate 100 percent proficiency just as they begin to implement higher Common Core standards in math and English language arts. To address the problem, the Administration is offering states waivers from NCLB's accountability provisions if they agree to specific education reforms.

School Choice. School choice takes many forms, but the basic concept is this: parents have the opportunity to send their children to a school other than the one they are assigned by the school district. In most cases, the choice provided is at other public schools—charter schools, magnet schools, STEM schools or, as one of the consequences for persistent low performance under NCLB, higher performing schools. Frequently, the availability of school choice is determined by school districts, but state policies are influential. The National Alliance for Public Charter Schools provides an overview on charter schools and ranks state charter laws.[21] A few states and cities also include private and parochial schools among the choices available to low-income families, a much more controversial option often referred to as vouchers or scholarships.

Digital Learning. Technology holds great promise, but to date it has not provided schools the kind of cost savings and productivity improvements experienced by companies. Entrepreneurs (both great thinkers and snake oil salespeople) are entering the field, and virtual schools and online courses are growing rapidly. While skeptics remain, there is growing interest in the power of digital technology to engage students in individualized instruction that enables them to work at their own pace using technology that can be tailored to different learning styles. Information on what states are doing is available at Digital Learning Now.[22]

High School Diploma plus Postsecondary Credential. Twenty-five percent of high school students do not graduate four years after they enter ninth grade.[23] An overarching goal for K–12 education reform is to make sure that all students graduate from high school prepared to enter postsecondary programs that lead to credentials employers value, including two-year degrees, four-year degrees and employer-recognized workforce certifications. A high school diploma plus a postsecondary credential helps ensure that students gain the STEM knowledge and skills they need for many of the well-paying jobs in our changing economy. More than 70 percent of students now go on to two- or four-year colleges or some kind of advanced training within two years of getting their high school diplomas[24] but an enormous share of those students never receive a credential. College completion, not just access, is a goal more states and institutions are embracing. Complete College America[25] is a valuable source of information about what states are doing to address the problem. The Business Higher Education Forum[26] provides a STEM-specific analysis of degree retention and completion.

The Venn diagram on page 6 illustrates the connections between STEM and each of the issues discussed in this Appendix. While the amount of attention each issue is getting differs across states, STEM advocates are more likely to influence state policy with a strategy that works in concert with other state education reform priorities.

Appendix B

Basic Facts about Public Prekindergarten (PK)–12 Education in the United States

Size of the Enterprise (projections for 2011–12 school year)

- 49.4 million students[27] (including 1.1 million in public PK[28])
  - 5.96 million[29] additional students in private schools
- 98,817 schools[30] (including 4,952 charter schools[31])
- 13,629 school districts[32]
- 3.4 million teachers (2007)[33]
- 419,000 taught mathematics or science at public middle and high schools (2007)[34]

Cost and Funding

- $524.8 billion total expenditures (projections for 2011–12 school year)[35]
  - $10,591 per pupil[36]
- Source of funding by level of government (2008–09 school year)[37]
  - 46.7% state
  - 43.7% local
  - 9.6% federal
- Source of state and local revenues to fund PK–12 public schools:
  - Sales, income, property, cigarette and other taxes (wide variations in the type of taxes used and in the degree of reliance on local property taxes)
  - State lotteries
- International comparisons of spending on elementary and secondary education (2008 data)
  - 35% higher total expenditures in the United States on elementary and secondary education than the Organization for Economic Co-operation and Development (OECD) average. Luxembourg, Norway and Switzerland were the only OECD countries that had higher per-student expenditures compared to the United States.[38]
  - 4.1% of GDP spent on elementary and secondary education, higher than the OECD average of 3.8%. Ten OECD countries spent more on elementary and secondary education as a percentage of GDP than the United States: Belgium (4.4), Chile (4.2), Denmark (4.3), Iceland (5.1), Israel (4.2), South Korea (4.2), New Zealand (4.5), Norway (5.0), Switzerland (4.3) and United Kingdom (4.2). Ireland spent 4.1% as a percentage of GDP, the same as the United States.[39]

Achievement Outcomes

- Reading

4th grade: 34% proficient or above; 33% below basic[40]

8th grade: 34% proficient or above; 24% below basic[41]

12th grade: 38% proficient or above; 26% below basic[42]

International comparisons (age 15): United States is at OECD average; top performers: Shanghai, Korea, Finland, Hong Kong, Singapore, New Zealand, Canada, Japan and Australia[43]

- Math

4th grade: 40% proficient or above; 18% below basic[44]

8th grade: 35% proficient or above; 27% below basic[45]

12th grade: 26% proficient or above; 36% below basic[46]

International comparisons (age 15): United States is below OECD average; top performers: Shanghai, Singapore, Hong Kong, Korea, Taipei, Finland, Liechtenstein, Switzerland, Japan and Canada[47]

- Science

4th grade: 34% proficient or above; 28% below basic[48]

8th grade: 32% proficient or above; 35% below basic[49]

12th grade: 21% proficient or above; 40% below basic[50]

International comparisons (age 15): United States is at OECD average; top performers: Shanghai, Finland, Hong Kong, Singapore, Japan, Korea, New Zealand, Canada, Estonia, Australia and Netherlands[51]

Attainment Outcomes

- 75% high school graduation rate[52]
  African American: 64%, Latino: 66%, Native American: 65%, White: 82%
- 68% of high school students go to a two- or four-year college the fall after they graduate[53]
- 36% of first-year college undergraduates take at least one remedial course[54]

Appendix C

Glossary

A few of the most frequently used acronyms, organizations and terminology related to education policy are defined briefly below. They are adapted from more comprehensive online glossaries provided by *Education Week*,[55] EdSource,[56] School Wise Press[57] and organization and program websites.

Achieve: Independent, bipartisan nonprofit organization led by a board of governors and business leaders that supports standards-based education reform across the states.

Achievement gap: The disparity in academic performance between low-income and minority children compared with their peers.

AYP (Adequate Yearly Progress): The measure for holding schools, districts and states accountable for student performance under the No Child Left Behind Act that requires states to use a single accountability system to determine whether students on average, as well as subgroups of students, are making annual progress toward meeting state standards for reading and math proficiency by 2014.

AP (Advanced Placement): Courses and tests administered by the College Board high school students can take to earn college credit.

ADP (American Diploma Project): Network of 35 states, managed by Achieve, which is aligning high school standards, graduation requirements and assessment and accountability systems with the demands of college and careers.

Blended learning: Combination of face-to-face and online learning.

College- and career-ready: Phrase used to describe students graduating from high school prepared to succeed in college and workforce training programs without the need for remediation (college is defined broadly as postsecondary education and training that results in a two- or four-year degree or an employer-recognized workforce certification).

CCSS (Common Core State Standards): Initiative led by governors and chief state school officers to develop and adopt common, internationally benchmarked, grade-by-grade K–12 state math and English language arts standards that reflect the knowledge and skills necessary for students to graduate from high school prepared for college and careers without the need for remediation.

CCSSO (Council of Chief State School Officers): National membership organization for state commissioners of education and state superintendents of public instruction.

DQC (Data Quality Campaign): National initiative led by a nonprofit organization and national and state partners that encourages and supports state policymakers to improve the availability and use of high-quality education data to improve student achievement.

Digital divide: The gap between technological haves and have-nots both in quality of, and access to, the use of technology to improve learning.

Disaggregated data: Data on student achievement, graduation and other education outcomes reported by groups of students who are economically disadvantaged, from racial and ethnic minority groups, have disabilities or have limited English proficiency.

ELL (English language learners): Students who speak a language other than English and have not yet mastered English, also referred to as limited English-proficient (LEP) students.

ESEA (Elementary and Secondary Education Act): Principal federal law affecting K–12 education, originally passed in 1965 to support the education of children from high-poverty communities and students at risk of academic failure. The No Child Left Behind Act of 2001 is the most recent update (called a reauthorization) of ESEA.

ESL (English as a Second Language): Non-native, English-speaking students or programs for teaching non-native English-speaking students.

Highly qualified teachers: Requirement from the federal No Child Left Behind Act that by the end of the 2005–06 school year, every teacher working in a public school must be "highly qualified"—meaning that a teacher is certified and has demonstrated subject-matter proficiency, by majoring in the subject, passing a subject-knowledge test or obtaining advanced certification in the subject.

High-stakes test: Any test that results in some kind of consequence for those who score low, some kind of reward for those who score high or both (e.g., tests used to determine grade promotion or high school graduation).

IDEA (Individuals with Disabilities Education Act): Federal law renamed in 1997, but originally passed in 1975 that, in exchange for federal money, schools must guarantee that all children with disabilities receive a "free, appropriate public education."

LIFO (last in, first out): Acronym used for the policy negotiated in teacher contracts for using seniority to determine who is let go when there are layoffs.

LEP (Limited English-Proficient): See ELL (English language learners).

NAEP (National Assessment of Educational Progress): National test, also referred to as "The Nation's Report Card," currently given to national and state samples of 4th- and 8th-grade students in reading and math every other year, and in 12th grade and other subjects less frequently. A different form of NAEP provides long-term national trends in the reading and math achievement of 9-, 13-, and 17-year-old students going back to the early 1970s.

NASBE (National Association of State Boards of Education): National membership organization for members of state boards of education.

NCSL (National Conference of State Legislatures): National membership organization for state legislators.

NGA (National Governors Association): National membership organization for governors.

NSBA (National School Boards Association): National membership organization for local school board members.

NCLB (No Child Left Behind Act): Passed in December 2001 and signed into law in January 2002 as the most recent reauthorization of the Elementary and Secondary Education Act (ESEA); increased federal focus on holding schools accountable for the achievement of all groups of students (low-income, racial and ethnic minorities, disabled and English language learners), including reading and math proficiency by 2014.

NGSS (Next Generation State Science Standards): New science standards, developed by 26 states in a process managed by Achieve (see above), are undergoing several rounds of state and public reviews before they are finalized and states begin to consider adoption.

PARCC (Partnership for Assessment of Readiness for College and Careers): One of two multi-state consortia developing assessments for Common Core State Standards in Mathematics and English Language Arts.

PISA (Program for International Student Assessment): Assessment administered by the Organization for Economic Co-operation and Development (OECD) at three-year intervals since 2000, of 15-year-old students' reading, math and science literacy.

RTT, RTTT or R2T (Race to the Top): Federal competitive grants program for states that specified selection criteria intended to spur innovation and reform in K–12 education (grants awarded in 2010 and 2011).

Reauthorization: Legislative process for Congress to make changes, additions and deletions in the reapproval and extension of a current law. Some laws terminate if they are not reauthorized, but the Elementary and Secondary Education Act (ESEA), currently known as No Child Left Behind (NCLB), continues as is until reauthorized.

Smarter Balanced (Smarter Balanced Assessment Consortium): One of two multi-state consortia developing assessments for Common Core State Standards in Mathematics and English Language Arts.

SES (Socioeconomic status): A combined measure of family income, education and occupation.

SES (Supplemental Educational Services): Additional learning opportunities, such as tutoring, that must be provided to students from low-income families who attend schools that have not met annual performance goals for two years in a row under the No Child Left Behind Act (NCLB).

Standardized test: A test that is in the same format for all who take it and the testing conditions—including instructions, time limits and scoring—are the same for all students.

TIMSS (Trends in International Mathematics and Science Study): Data on the mathematics and science achievement of U.S. 4th- and 8th-grade students compared to that of students in other countries, most recently released in 2008, with new data from more than 60 countries expected in 2012.

Unique student identifier: An identification number for each student that maintains privacy while providing the opportunity to track student progress and longitudinal data on transitions from K–12 to higher education and the workforce.

WIA (Workforce Investment Act): Federal program passed in 1998 to reform federal job training programs.

VAM (Value-added measures): Models to measure the value added by an individual teacher or school to students' performance over time, usually done through data analysis comparing a student's test scores to the same student's scores from the previous year (also called growth models).

Vouchers: Proposals/programs for states to pay (full or partial) tuition for (usually low-income) children to attend private or religious schools of their choice.

Endnotes

[1] Change the Equation. (2012). STEM help wanted (2012). Washington, DC: Author. Retrieved from http://www.changetheequation.org/site.s/default/files/CTEq_VitalSigns_Supply %282%29.pdf

[2] The statement that it is easier to move a cemetery than to change the school curriculum, or variations on that theme, frequently is attributed to Woodrow Wilson, but without the original source for the comment.

[3] Fulton, M. (2011). State governance models. ECS State Notes. Denver, CO: Education Commission of the States. Retrieved from http://www.ecs.org/clearinghouse/77/78/7778.pdf

[4] Washington STEM website, http://www.washingtonstem.org

[5] Ohio State Learning Network's STEM advocacy materials are available at http://www.osln.org/state-stem-landscape/resources/stem-advocacy.php

[6] Tennessee STEM Innovation Network website, http://tsin.battelle.org/

[7] See ExxonMobil's ads at http://www.exxonmobil.com/Corporate/community_math.aspx

[8] Maryland Business Roundtable for Education website, http://mbrt.org/maryland-business roundtable-for-education-mbrt/stem/

[9] See Ursula Burns' remarks at Detroit Economic Club, Sept. 8, 2010. Retrieved from http://news.xerox.com/pr/xerox/document/UMB_Detroit_Economic_Club_-_09_08_10.pdf#http://news.xerox.com/pr/xerox/document/UMB_Detroit_Economic_Club_-_09_08_10.pdf

[10] See summary of Sam Palmisano's remarks on panel sponsored by Federal Reserve Bank of Cleveland, Nov. 30, 2010. Retrieved from http://www.ibm.com/smarterplanet/us/en/economic_stimulus/article/palmisano_fedpanel.html#http://www.ibm.com/smarterplanet/us/en/economic_stimulus/article/palmisano_fedpanel.html

[11] See reprint of William Swanson's remarks prepared for delivery to Massachusetts' STEM Summit, Oct. 18, 2011. Retrieved from http://www.raytheon.com/newsroom/rtnwcm/groups/public/documents/content/rtn11_stemsummit_whs.pdf

[12] See National Engineers Week 60th anniversary in 2011, *Corporate Leaders Weigh in on Role of Outreach in STEM Education*. Retrieved from http://www.eweek.org/NewsStory.aspx?ContentID=249

[13] GreatSchools website, http://www.greatschools.org/

[14] The quote, "Without data, you are just another person with an opinion," has been used by Andreas Schleicher, Deputy Director for Education at OECD; Tom Luce, founder of the National Math and Science Initiative and longtime advocate for education reform in Texas and across the nation, and others. The original author of the quote is unknown.

[15] National Commission on Excellence in Education. (1983). *A nation at risk*, Washington, DC: U.S. Department of Education.

[16] Common Core State Standards Initiative website, http://www.corestandards.org

[17] Next Generation Science Standards website, http://www.nextgenscience.org

[18] Although the quote often is attributed to Thomas Edison, it also has been attributed to Henry Ford and others. There is no definitive source.

[19] Partnership for Assessment of Readiness for College and Careers (PARCC) website, http://www.parcconline.org

[20] Smarter Balanced Assessment Consortium website, http://www.smarterbalanced.org

[21] See National Alliance of Public Charter Schools ranking of state laws at http://www.publiccharters.org/law/

[22] Digital Learning Now website, http://digitallearningnow.com

[23] Balfanz, R., Bridgeland, J.M., Bruce, M., & Fox, J.H. (2012). *Building a grad nation: Progress and challenge in ending the high school dropout crisis*. Washington, DC: America's Promise Alliance.

[24] National Center for Education Statistics. (2012). Percentage of high school completers who were enrolled in 2- or 4-year colleges the October immediately following high school completion, by family income: 1975–2010 (Table A-34-1). *Condition of Education 2012*. Retrieved from http://nces.ed.gov/programs/coe/tables/table-trc-1.asp

[25] Complete College America website, http://www.completecollege.org/

[26] Business-Higher Education Forum website, http://www.bhef.com/

[27] National Center for Education Statistics. (2012). Actual and projected public school enrollment in grades prekindergarten (preK) through 12, by grade level and region: Selected school years, 1970–71 through 2021–22 (Table A-3-1). *Condition of Education 2012*. Retrieved from http://nces.ed.gov/programs/coe/tables/table-enl-1.asp

[28] National Center for Education Statistics. (2010). Actual and projected numbers for enrollment in public elementary and secondary schools, by grade: Fall 1994 through fall 2019 (Table 2). *Projections of Education Statistics to 2019*. Retrieved from http://nces.ed.gov/programs/projections/projections2019/tables/table_02.asp?referrer=list

[29] National Center for Education Statistics. (2010). Actual and projected numbers for enrollment in grades PK–12, PK–8, and 9–12 in elementary and secondary schools, by control of school: Fall 1994 through fall 2019 (Table 1). Retrieved from http://nces.ed.gov/programs/projections/projections2019/tables/table_01.asp

[30] National Center for Education Statistics. (2010). Number of operating public elementary and secondary schools, by school type, charter, magnet, Title I, and Title I schoolwide status, and state or jurisdiction: School year 2009–10 (Table 2). Common Core of Data. Retrieved from http://nces.ed.gov/pubs2011/pesschools09/tables/table_02.asp

[31] Ibid.

[32] National Center for Education Statistics. (2010). Operational and student membership status of public elementary and secondary local education agencies in the United States, by agency type: School year 2009–10 (Table 1). Common Core of Data. Retrieved from http://nces.ed.gov/pubs2011/pesagencies09/tables/table_01.asp

[33] National Science Foundation. (2012). Public middle and high school mathematics and science teachers, by minority enrollment and school poverty level: Academic year 2007–08 (Table 1-10). *Science and Engineering Indicators 2012*. Retrieved from http://www.nsf.gov/statistics/seind12/c1/c1s3.htm

[34] Ibid.

[35] National Center for Education Statistics. (2010). Actual and projected numbers for current expenditures and current expenditures per pupil in fall enrollment for public elementary and secondary education: 1994–95 through 2019–20 (Table18). *Projections of Education Statistics to 2019*. Retrieved from http://nces.ed.gov/programs/projections/projections2019/tables/table_18.asp

[36] Ibid.

[37] National Center for Education Statistics. (2011). Revenues and percentage distribution of revenues for public elementary and secondary education, by source and state or jurisdiction: Fiscal year 2009 (Table 1). Revenues and expenditures for public elementary and secondary education: School year 2008-09 (fiscal year 2009). Retrieved from http://nces.ed.gov/pubs2011/expenditures/tables/table_01.asp?referrer=report

[38] National Center for Education Statistics. (2012). Education expenditures by country (Indicator 22). *Condition of Education 2012*. Retrieved from http://nces.ed.gov/programs/coe/pdf/coe_ifn.pdf

[39] Ibid.

[40] National Center for Education Statistics. (2011). Trend in fourth-grade NAEP reading achievement-level results. *The Nation's Report Card: Reading 2011*. Washington, DC: U.S. Department of Education. Retrieved from http://nces.ed.gov/nationsreportcard/pubs/main2011/2012457.asp - section2

[41] National Center for Education Statistics. (2011). Trend in eighth-grade NAEP reading achievement-level results. Retrieved from http://nces.ed.gov/nationsreportcard/pubs/main2011/2012457.asp - section2

[42] National Center for Education Statistics. (2010). (Chart showing achievement levels for 12th grade reading). *The Nation's Report Card: Grade 12 Reading and Mathematics 2009 National and Pilot State Results*. Retrieved from http://nationsreportcard.gov/reading_2009/gr12_national.asp?tab_id=tab2&subtab_id=Tab_1 - tabsContainer

[43] OECD. (2010). *PISA 2009 results: What students know and can do – student performance in reading, mathematics and science* (Volume 1). Retrieved from www.oecd.org/edu/pisa/2009

[44] National Center for Education Statistics. (2011). Trend in fourth-grade NAEP mathematics achievement-level results. *The Nation's Report Card: Mathematics 2011*. Washington, DC: U.S. Department of Education. Retrieved from http://nces.ed.gov/nationsreportcard/pubs/main2011/2012458.asp

[45] National Center for Education Statistics. (2011). Trend in eighth-grade NAEP mathematics achievement-level results. *The Nation's Report Card: Mathematics 2011*. Retrieved from http://nces.ed.gov/nationsreportcard/pubs/main2011/2012458.asp

[46] National Center for Education Statistics. (2010). (Chart showing achievement levels for 12th grade mathematics). *The Nation's Report Card: Grade 12 Reading and Mathematics 2009 National and Pilot State Results*. Retrieved from http://nationsreportcard.gov/math_2009/gr12_national.asp?tab_id=tab2&subtab_id=Tab_1 - tabsContainer

[47] OECD. (2010). PISA 2009 results: *What students know and can do – student performance in reading, mathematics and science* (Volume 1). Retrieved from www.oecd.org/edu/pisa/2009

[48] National Center for Education Statistics. (2011). (Chart showing achievement levels for fourth-grade science). *The Nation's Report Card: Science 2009*. Retrieved from http://nationsreportcard.gov/science_2009/g4_nat.asp?tab_id=tab2&subtab_id=Tab_1 - tabsContainer

[49] National Center for Education Statistics. (2012). (Chart showing achievement levels for eighth-grade science). *The Nation's Report Card: Science 2011*. Retrieved from http://nationsreportcard.gov/science_2011/g8_nat.asp?tab_id=tab2&subtab_id=Tab_1#chart

[50] National Center for Education Statistics. (2011). (Chart showing achievement levels for twelfth-grade science). *The Nation's Report Card: Science 2009*. Retrieved from http://nationsreportcard.gov/science_2009/g12_nat.asp?tab_id=tab2&subtab_id=Tab_1#tabsContainer

[51] OECD. (2010). PISA 2009 results: *What students know and can do – student performance in reading, mathematics and science* (Volume 1). Retrieved from www.oecd.org/edu/pisa/2009

[52] Balfanz, Bridgeland, Bruce & Fox, 2012.

[53] National Center for Education Statistics (2011). Percentage of high school completers who were enrolled in 2- or 4-year colleges the October immediately following high school completion, by family income: 1975–2010 (Table A-34-1). *Condition of Education 2011*. Retrieved from http://nces.ed.gov/programs/coe/tables/table-trc-1.asp

[54] National Center for Education Statistics. (2010). Percentage of first-year undergraduate students who took remedial education courses, by selected characteristics: 2003-04 and 2007-08 (Table 241). *Digest of Education Statistics: 2010*. Retrieved from http://nces.ed.gov/programs/digest/d10/tables/dt10_241.asp

[55] Education Week Glossary. Retrieved from http://www.edweek.org/rc/glossary/a.html#http://www.edweek.org/rc/glossary/a.html

[56] EdSource Glossary. Retrieved from http://www.edsource.org/glossary.html#http://www.edsource.org/glossary.html

[57] School Wise Press Glossary. Retrieved from http://www.schoolwisepress.com/smart/dict/dict.html

PRINCIPLES FOR STEM POLICY ADVOCACY

Change the Equation (CTEq) is leading private sector initiatives to help improve STEM teaching and learning in the U.S.—both in school and out of school. CTEq member companies are committed to working with states and local communities, which provide over 90 percent of public funding for education, to improve STEM learning.

It is a national priority for U.S. students, K-12, to have a solid foundation in mathematics and science—whether they go on to STEM-specific careers or not. And it is critical that public and private policies and investments adhere to the following set of principles:

1. Support adoption and implementation of Common Core Math Standards and Next Generation Science Standards (or standards as rigorous).
2. Urge all states to use a common high cut score to pass state assessments aligned to Common Core Math Standards and Next Generation Science Standards.
3. Weight science equally with other subjects in state accountability systems.
4. Recognize that standards, assessments and accountability are necessary but not sufficient.
5. Align curriculum, learning resources, technology, teaching and management to help all students meet or exceed the standards.
6. Use data and research, including CTEq's State Vital Signs, to inform STEM policy development and implementation.
7. STEM teachers must be properly prepared, evaluated and compensated. Recruitment and retention of high-performing students to the STEM teaching profession is critical.
8. Incentivize effective STEM teachers to teach in high-poverty, high-minority schools.
9. Scale what works in STEM.

Change the Equation (CTEq) is a nonprofit, nonpartisan, CEO-led initiative that is mobilizing the business community to improve the quality of science, technology, engineering and mathematics (STEM) learning in the United States. Since its launch in September 2010, CTEq has helped its more than 100 members connect and align their philanthropic and advocacy efforts so that they add up to much more than the sum of their parts. CTEq's coalition of members strives to sustain a national movement to improve PreK-12 STEM learning by leveraging and expanding its work focusing on three goals: improving philanthropy, inspiring youth and advocating for change.

www.changetheequation.org

CHANGE THE EQUATION™

1101 K STREET, NW · SUITE 610 · WASHINGTON, DC 20005 · 202 626 5740