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A New Approach to Improving Science, Technology, Engineering, and Math Education

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On February 17, 2009, President Barack Obama signed into law the American Recovery and Reinvestment Act of 2009—the $787 billion legislative package hailed as an "economic stimulus." The legislation includes $2.5 billion in additional federal funding for the National Science Foundation, including new funding for science, technology, engineering, and math (STEM) education programs.[1] This legislation continues recent federal efforts, including the America COMPETES Act of 2007, to increase federal support for STEM education initiatives.

Unfortunately, experience of the past 50 years suggests that such federal initiatives are unlikely to solve the fundamental problem of American underperformance in STEM education—the limited number of students who complete elementary and secondary school with the skills and knowledge to pursue STEM coursework in higher education and succeed in many parts of the workforce. The American education system is supposed to be a pipeline that prepares children in elementary and secondary school to pursue opportunities in post-secondary education and in the workforce. It is well known that this pipeline is leaky—that millions of children pass through their K–12 years without receiving a quality education. Too many students drop out and, all too often, those who do earn a high school degree lack the academic qualifications to succeed in STEM fields in college or in the workforce.

Improving learning in STEM education should remain a priority for American policymakers. For stu-

Talking Points

- For more than 50 years, American political, business, military, and academic leaders have emphasized the need to improve performance in science, technology, engineering, and math (STEM) education. Despite increasing federal spending on STEM education programs, U.S. students continue to underperform in these subjects.
- An urgent priority for improving STEM education in America is to focus on strategies that will fix the leaky pipeline in elementary and secondary education, since many American students are simply not being prepared to succeed in science, technology, engineering, or math.
- Instead of focusing on federal solutions and increasing federal spending policymakers and the private sector should refocus attention on systemic education reforms at the state, local, and school levels to fix the broken pipeline and dramatically increase the number of students who succeed in STEM fields at school and in the workforce.

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dents, succeeding in K–12 STEM classes will open the door to future opportunities in higher education, and in the workforce. Also, ensuring that the next generation of American workers has adequate skills and training in critical areas is vital to America's national security and economic competitiveness. If the United States lacks the tools to combat aggressors, America's future is at risk. Wars are won partly with superior technologies—and America's survival depends on its ability to maintain an advantage over its enemies. U.S. scientists and engineers work every day to develop new tools to protect Americans from terrorism, such as lasers and explosives-detection devices. Tackling pressing global problems—from energy security to vulnerable cyber infrastructure—will require the intellectual curiosity and creativity of STEM-educated individuals.

Given the importance of addressing these needs, policymakers should recognize the need for a new approach to STEM education in America. Instead of continuing to pursue elusive federal solutions, national and state policymakers should recognize the need for systemic K–12 education reforms at the state and local levels. Aggressive reform is the most promising strategy for fixing the leaky pipeline in STEM education and for increasing the population of American students prepared to pursue these fields in college and beyond. State policymakers and the private sector should support reforms that allow greater innovation to improve STEM education, including new school models, providing incentives for teacher excellence, and supporting other initiatives to promote learning in STEM fields.

The Broken Pipeline

The systemic problems in U.S. public elementary and secondary schools are well known.[2] Millions of children continue to pass through American public schools without basic math and reading skills. Long-term measurements, such as national test scores and graduation rates, have remained flat despite significant increases in government spending. In many large cities, fewer than half of all students even graduate from high school. On the 2005 National Assessment of Educational Progress science test, 46 percent of 12th-graders scored "below basic."[3] On the NAEP math exam, 39 percent of 12th-graders scored below basic—suggesting that nearly half of all high school seniors cannot answer basic algebra and geometry questions.[4] These evaluations found that few students were excelling. In science, only 29 percent of 12th-graders scored "proficient" and only 3 percent scored "advanced." The performance in math was similarly dismal: 35 percent "proficient"; 5 percent "advanced."

The performance of American students in science and mathematics compared to students in other countries is also concerning. The percentage of American college students earning degrees in STEM fields lags behind students in China, India, Japan, Russia, Mexico, and even the Middle East.[5] The 2007 Trends in International Mathematics and Science Study (TIMSS) report revealed that students in a number of developed countries and economic competitors were outperforming U.S. students, particularly in the percentage of students excelling in science.[6]

The End of the STEM Pipeline. Policymakers and analysts concerned about American students'

1. American Recovery and Reinvestment Act of 2009, Public Law No. 111-16 (February 17, 2009), at *http://www.thomas.gov/home/h1/Recovery_Bill_Div_A.pdf* (March 24, 2009).
2. Dan Lips, "A Nation Still at Risk: The Case for Federalism and School Choice," Heritage Foundation *Backgrounder* No. 2125, April 21, 2008, at *http://www.heritage.org/Research/education/bg2125.cfm*.
3. "The Nation's Report Card: Science Results for Grades 4, 8, and 12," U.S. Department of Education, 2005, at *http://nationsreportcard.gov/science_2005/s0101.asp* (March 24, 2009).
4. "The Nation's Report Card: Mathematics Report Card," U.S. Department of Education, 2007, at *http://nationsreportcard.gov/math_2007/m0001.asp* (March 24, 2009).
5. Marcus Winters, "Stemming the Tide," *City Journal*, January 16, 2009.
6. Patrick Gonzalez, "Highlights from the TIMSS 2007: Mathematics and Science Achievement of U.S. Fourth- and Eighth-Grade Students in an International Context," U.S. Department of Education, National Center for Education Statistics, Institute of Education Sciences, NCES 2009-001, December 2008.

low achievement in STEM fields often focus on the end of the pipeline—the percentage of American college students earning degrees in STEM fields and the population of the workforce prepared for science, technology, engineering, and math professions. But the situation does not look much better as students continue to higher education. The Government Accountability Office (GAO) reported in 2006 that the percentage of U.S. post-secondary students earning degrees in STEM fields has fallen over the past decade—from 32 percent in 1995 to 27 percent in 2004.[7] A closer examination of the statistics shows that the number of degrees earned by college students in STEM fields has essentially remained flat during this period, since the college-student population as a whole increased during that period. In addition, an estimated one-third of these STEM degrees were awarded to students from abroad.

Moreover, the declining percentage of STEM degrees earned has occurred during a period when the number of jobs in STEM fields has grown. The GAO reports that overall employment in STEM fields grew by 23 percent between 1993 and 2004, compared to growth of 17 percent in non-STEM fields. If these trends continue, American students may be less prepared to compete for jobs in STEM fields than students with degrees from other countries. As the National Science Foundation reports, the percentage of students earning STEM degrees in other countries is already higher than in the United States.[8]

STEM: A National Security and Economic Priority

The bleak outlook for America's collective STEM abilities is a cause for concern. A STEM-educated workforce can help America gain a competitive edge in the global markets. For instance, America's ascent to economic superpower status began during the Industrial Revolution. The new products and processes that came out of this period of innovation significantly expanded America's economy, created jobs, and gave the U.S. an advantage against foreign competitors. The value of a STEM-educated workforce does not diminish in hard economic times. In fact, in the current economic climate, it is increasingly more important that the U.S. produce new and innovative technologies that will expand and create new markets and add more jobs.

Not Just Economics. The shortage of STEM workers is not only an economic problem. America's ability to produce a STEM-educated workforce has a direct effect on national security. The U.S. has enjoyed its status as the dominant scientific power for many decades. But as the economies of China and India have expanded, this position has fallen dramatically. A 2005 study by the National Bureau of Economic Research indicated that China will produce more "scientific and engineering doctorates than the U.S. by 2010."[9] The decrease in America's STEM expertise was stressed in a Defense Science Board report in 2008, which addressed the coming shortage of nuclear-deterrence know-how. The report cited the importance of this knowledge, noting that "no threat can put the nation's existence at risk as quickly and chillingly as nuclear weapons." The report also emphasized that "a significant part of the workforce in the national laboratories and production facilities are at or near retirement age"—and that there simply are not enough students going into STEM fields to fill the void.[10]

Those who underestimate the impact of a STEM-educated work force on a nation's security need only look at America's cyber security problem. Foreign intelligence efforts increasingly rely on cyber tools to collect sensitive U.S. technology and eco-

7. Cornelia M. Ashby, director of education, workforce, and income security issues at the U.S. Government Accountability Office, testimony before the Committee on Education and the Workforce, U.S. House of Representatives, GAO-06-702T, May 3, 2006, at *http://www.gao.gov/new.items/d06702t.pdf* (March 24, 2009).
8. Winters, "Stemming the Tide."
9. John Aloysius Farrell, "Signs America's Scientific Edge is Slipping," *The Denver Post*, March 26, 2006, p. E-01.
10. "Report of the Defense Science Board Task Force on Nuclear Deterrence Skills," Office of the Undersecretary of Defense for Acquisition, Technology and Logistics," September 2008, at *http://www.acq.osd.mil/dsb/reports/2008-09-NDS.pdf* (March 25, 2009).

nomic information.[11] One of the major culprits is China—a country that has made cyber warfare one of its major espionage tools. China's People's Liberation Army (PLA) organized its first cyber warfare unit in 2003. Its mission: to target foreign computer network operations. In 2006, Chinese intelligence agencies covertly attacked at least four separate U.S. government computer networks. In June 2007, 150 computers in the $1.75 billion computer network at the U.S. Department of Homeland Security were quietly penetrated by programs that sent an unknown quantity of information to a Chinese-language Web site. In the same month of June 2007, Chinese military hackers circumvented one of the Defense Department's computer networks. The skills necessary for China to engage in this type of cyber warfare are a direct result of the ingenuity of STEM-educated Chinese citizens. The new technologies and techniques America needs to combat these types of attacks depend on America's ability to produce citizens with superior STEM skills.

The STEM Education Crisis: Fifty Years and Counting

The most recent alarm highlighting the crisis in STEM education sounded in 2007 with the publication of *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*—a report by the Committee on Prospering in the Global Economy of the 21st Century, a distinguished group of national leaders including Defense Secretary Robert Gates.[12] The report examined the changing trends in the world's labor force and highlighted the need to implement a series of reforms to improve the nation's economic competitiveness. The committee's first recommendation was to implement a new strategy for improving K–12 science and math education.

Rising Above the Gathering Storm energized support for the Bush Administration's American Competitiveness Initiative, aimed at strengthening U.S. education by improving math, science, and foreign language education, and spurred support for new congressional action, including the 2007 America COMPETES Act—legislation that authorized new programs and funding for federal STEM programs.[13] The U.S. Department of Education's involvement in STEM fields was greatly expanded, including a new federal program to train 70,000 new teachers to teach Advanced Placement or International Baccalaureate courses. The act also authorized the U.S. Education Department to provide additional teacher training in STEM fields and to encourage students pursuing STEM majors to obtain teaching certification. The department and other federal agencies are also charged with providing additional funds and resources to help schools develop and implement new programs and strategies to promote learning in STEM fields.

But those with a historical perspective on the STEM education crisis recognize the *Gathering Storm* report as only the latest in a series of national warnings about the crisis in STEM education and the continuing failure of Washington-centric educational policies that have done little to address the rampant under-education of America's children. In fact, the language of the report was similar to the words of President Dwight Eisenhower in 1958 as he signed into law the National Defense Education Act (NDEA), which was passed in part as a response to the growing concern about American security and competitiveness in the wake of the Soviet Union's launch of the Sputnik satellite.[14] Eisenhower called the legislation "an emergency undertaking" for a temporary federal initiative to "strengthen our American system of education so

11. John J. Tkacik, Jr., "Trojan Dragon: China's Cyber Threat," Heritage Foundation *Backgrounder* No. 2106, February 8, 2008, at *http://www.heritage.org/Research/AsiaandthePacific/bg2106.cfm*.
12. *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, National Academies Press, 2007, at *http://www.nap.edu/catalog/11463.html* (April 2, 2009).
13. President George W. Bush, "Fact Sheet: America COMPETES Act of 2007," August 9, 2007.
14. Derek Leebaert, *The Fifty-Year Wound: How America's Cold War Victory Shapes Our World* (New York: Little, Brown, and Company, 2002), p. 219.

that it can meet the broad and increasing demands imposed upon it by considerations of basic national security."[15]

The NDEA included new benefits for college students and federal support for elementary and secondary schools to improve science, math, and foreign language instruction. It also provided a foundation for future federal support of post-secondary and K–12 education. During the 1960s, the federal education budget grew, including the creation of the U.S. Department of Education. But the crisis in America's schools persisted.

In 1983, the National Commission on Excellence in Education published the seminal report *A Nation at Risk*, highlighting the calamity that exists in the nation's education system:

> Our nation is at risk. Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world. This report is concerned with only one of the many causes and dimensions of the problem, but it is the one that undergirds American prosperity, security, and civility…. What was unimaginable a generation ago has begun to occur—others are matching and surpassing our educational attainments. If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war.[16]

The report highlighted American students' poor performance in math and science. It also called for aggressive education reforms and a greater focus on standards and testing.[17] But despite ever more spending by the federal and state governments, little has changed.

The deteriorating quality of American education—particularly in STEM fields—continued to be a priority under subsequent Administrations. In 1989, President George H. W. Bush convened a national summit of governors, including then-Governor Bill Clinton, designed to forge a national consensus on the need for education reform. The summit was premised on the belief that improving education was a key to ensuring American economic competitiveness. Among the goals established at the summit was that "U.S. students will be first in the world in mathematics and science achievement."[18] President Clinton would also highlight the need to improve STEM education.

Recent Federal STEM Initiatives. Since 2005, Congress has enacted legislation that has changed and expanded the federal government's intervention in STEM education. The Deficit Reduction Act of 2005 included provisions to provide new college scholarships for qualifying students who pursue coursework in mathematics, technology, engineering, critical foreign languages, and in physical, life, and computer sciences.

But in 2006, the GAO reported that that the federal government has provided little information about the effectiveness of these programs and urged more evaluation and coordination.[19] The GAO emphasized that the federal government had spent nearly $4 billion on more than 200 STEM programs in 2004.[20] It also stated that: "Although evaluations had been done or were underway for about half of these programs, little is known about the extent to which most STEM programs are achieving their

15. President Dwight D. Eisenhower, "Statement by the President Upon Signing the National Defense Education Act," September 2, 1958.
16. *A Nation at Risk: The Imperative of Education Reform*, National Commission on Excellence in Education, April 1983, at *http://www.ed.gov/pubs/NatAtRisk/risk.html* (March 25, 2009).
17. Dan Lips, "A Nation Still at Risk: The Case for Federalism and School Choice," Heritage Foundation *Backgrounder* No. 2125, April 21, 2008, at *http://www.heritage.org/Research/Education/bg2125.cfm*.
18. Maris A. Vinovskis, "The Road to Charlottesville: The 1989 Education Summit," National Education Goals Panel, September 1999.
19. *Ibid.*
20. Ashby, "High Education: Science, Technology, and Mathematics Trends and the Role of Federal Programs."

desired results."[21] The GAO's conclusion in congressional testimony was that it was "important to know the extent to which existing STEM education programs are appropriately targeted and making the best use of available federal resources—in other words, these programs must be evaluated—and a comprehensive evaluation of federal programs is currently nonexistent."[22] Despite this recommendation for reform, the federal government continues to expand federal STEM programs.

In fact, President Barack Obama has signaled an interest in continuing the focus on STEM education. As a Senator, he sponsored the Enhancing Science, Technology, Engineering, and Mathematics Education Act of 2008—legislation that would have reformed federal STEM education programs and encouraged new STEM initiatives at the state level (it was never enacted into law).[23] At the time, Senator Obama said: "We must ensure our nation remains a global leader in scientific advancement and technology innovation, and that begins with strengthening America's schools. Our students deserve the education and skills they need to compete in today's global economy and to understand the increasingly complex issues that face our democracy, and we must do everything we can to provide them with the resources and curriculum they need to succeed."

STEM Funding in the American Recovery and Reinvestment Act of 2009. During his short time in office, President Obama has already approved legislation that would extend federal funding for STEM education programs. The American Recovery and Reinvestment Act continues on the same path: providing even more federal funding for STEM education programs. The act features $2.5 billion in new funding for the National Science Foundation (NSF), including initiatives for STEM education and requires that $100 million of that $2.5 billion be used for the NSF's Education and Human Resources Department, whose stated mission is to "achieve excellence in U.S. science, technology, engineering and mathematics (STEM) education."[24] These funds will likely be used to support teacher training and research to improve math and science instruction. The additional funding for NSF can be used on other projects, some of which may include support for STEM education, such as by funding STEM programs at higher education institutions. Unfortunately, years of federal support for STEM education programs have failed to prepare American students to enter STEM fields.

A New Way Forward

Even though the government has spent billions of dollars on massive federal programs aimed at tackling the STEM problem over the past 50 years, the problem persists. Experience has shown that the most recent federal STEM initiatives, including the funding increases in the American Recovery and Reinvestment Act, are unlikely to be the solution. The importance of improving STEM education for national security and economic competitiveness should force federal policymakers to evaluate whether the current policies are likely to solve the problem and fix the leaky pipeline. A candid assessment of the current approach would find that it has failed to do so.

The solution to the STEM problem will not be found in the halls of Congress. Success will not be found in a litany of federal policy initiatives or increased spending. What is needed is a major transformation in this country's approach to education, beginning at the state and local level:

- **State leaders should embrace systemic education reforms to improve student learning**. Fixing the broken pipeline in STEM education will require fixing the overall quality of public educa-

21. *Ibid.*
22. *Ibid.*
23. Press release, Office of Congressman Mike Honda, "Sen. Barack Obama and Rep. Mike Honda Introduce Bill to Make American Students More Competitive in Science Fields," May 22, 2008, at *http://www.house.gov/list/press/ca15_honda/STEMbillintroduction.html* (March 27, 2009).
24. "About Education and Human Resources," National Science Foundation, July 10, 2008, at *http://www.nsf.gov/ehr/about.jsp* (March 25, 2009).

tion in America. States and localities are best positioned to implement the kinds of sweeping education reforms that change public school governance to encourage improvement.

The state of Florida offers a blueprint for systemic education reform that is improving student learning. Over the past decade, Florida has gone further than most states in reforming the governance of its public school systems. Before the No Child Left Behind Act created federal requirements for state testing, Florida was holding schools accountable for results by testing students annually and grading public schools based on their performance on state tests. Florida has also gone further than other states in offering parents public- and private-school choice. In addition, Florida has implemented other education reforms, such as ending social promotion by requiring students to master reading before advancing to the fourth grade, improving reading instruction, and reforming how teachers are hired and compensated.

This aggressive approach to reform has led to significant improvement in student achievement. Since these reforms began in 1999, Florida's students have made dramatic progress on the annual National Assessment of Educational Progress, a reliable indicator of student learning.[25] States across the country should implement similar aggressive reforms to improve the public education. Strengthening the overall quality of public schools through these types of reforms is the most important step to fix the broken pipeline to ensure that more children are able to succeed in STEM classes.

- **State and local policymakers and school leaders should enact new policies to improve teacher quality in STEM fields**. One focus of systemic reform to improve STEM education should be to strengthen teacher quality and effectiveness. Teacher quality is an important factor in determining students' classroom performance.[26]

  Public schools in the United States traditionally pay teachers based on seniority and academic credentials—an approach that does not account for the significant differences between STEM coursework and labor market demands. The first action that policymakers should perform, therefore, is to implement policies to reform teacher compensation, such as allowing STEM teachers to receive higher salaries than teachers of other subjects.[27] This is particularly necessary since those who are qualified to be STEM teachers may be in greater demand in professional fields beyond education than other teachers.[28]

  Second, states and school systems should open up new pathways for qualified professionals to become school teachers, which would be particularly beneficial for increasing the pool of effective STEM teachers. Policymakers are increasingly enacting alternative teacher certification programs, which allow qualified professionals to train to become school teachers without completing traditional teacher certification require-

25. For more information, see Matthew Ladner and Dan Lips, "How 'No Child Left Behind' Threatens Florida's Successful Education Reforms," Heritage Foundation *Backgrounder* No. 2226, January 7, 2009, at *http://www.heritage.org/Research/Education/bg2226.cfm*. The percentage of students who scored "basic" or above on the fourth-grade reading exam increased by 32 percent between 1998 and 2007, and these gains did not come at the expense of high-achieving students. The percentage of Florida fourth-graders who scored "proficient" or better improved by 54 percent, and the number who scored "advanced" (the highest level) increased by 100 percent. The greatest gains have been made by Hispanic and black children. After a decade of strong progress, Florida's Hispanic students now outscore the statewide averages for *all students* in Alaska, Arizona, California, Hawaii, Louisiana, Nevada, New Mexico, Oklahoma, Oregon, South Carolina, Tennessee, and West Virginia on the 2007 fourth-grade reading test.
26. See, for example, Eric A. Hanushek and Steven G. Rivkin, "How to Improve the Supply of High Quality Teachers," Brookings Papers on Education Policy, May 2003, at *http://edpro.stanford.edu/Hanushek/admin/pages/files/uploads/Teacher%20quality.Brookings.pdf* (March 25, 2009).
27. Winters, "Stemming the Tide."
28. *Ibid.*

ments.[29] States and school districts should facilitate alternative teacher certification to encourage talented professionals to pursue teaching with a particular focus on teachers prepared for STEM fields.

Third, policymakers and school leaders should implement policies like performance-based pay to create new incentives to promote excellence in teaching and student learning. An attractive alternative approach to encouraging greater participation in "Advanced Placement" (AP) coursework would be to provide incentives and bonuses to encourage more students to take—and pass—AP exams. Since 1996, the Dallas school system has been providing financial incentives to students who take and pass AP exams. Their teachers, too, can receive financial bonuses when their students pass these exams. The program has led to a dramatic increase in the number of students who pass AP exams, especially among minorities.[30] A similar statewide program in Florida has also led to dramatic increases in students who pass the AP exams.[31] This incentive-based approach to achieving quality teaching and learning should be applied to STEM education.

- **States and localities should encourage new school models**. Another focus of state-level systemic reforms should be to facilitate school-wide innovation and the creation of new schools that focus on STEM education. One promising education reform trend in recent decades has been the growth of charter schools. Charter schools are public schools that are free of many of the traditional regulations governing traditional public schools—including the aspect that parents can choose these schools even if they are not in the designated school district. Today, there are more than 1.4 million students attending more than 4,500 public charter schools in 40 states and the District of Columbia.[32] A key difference between charter schools and traditional schools is that charters grant school leaders the authority and autonomy to define a school's instructional mission and to use the school's resources for that mission. Heads of charter schools, for instance, have the authority to hire and fire their teachers.

  Charter school success stories highlight how innovation and effective leadership in schools can improve opportunities for students and help fix the broken pipeline in STEM education. KIPP Academy public schools are widely recognized as one of the most successful charter school models. There are currently 66 KIPP schools serving 16,000 students across the country.[33] KIPP schools traditionally serve low-income students, and have a track record of lifting students' academic achievement. The KIPP 2009 Report Card shows that students who entered KIPP schools in fifth grade scored only in the 40th percentile on the national math test. After four years, these same students scored in the 82nd percentile.[34]

- **The private sector should support and foster innovative solutions to improving STEM education.** The private and non-profit sector can support STEM education by implementing partnerships with schools and other initiatives. One promising private initiative is Project Lead the Way—a non-profit organization that is working to give middle and high school students instruction and experience in science and engineering. The purpose of this instruction is to increase the number of students who pursue engineering or

29. Paul E. Peterson and Daniel Nadler, "What Happens When States Have Genuine Alternative Certification?" *Education Next*, Winter 2009.
30. "AP Training & Incentive Program," National Math and Science Initiative, 2009, at *http://www.nationalmathandscience.org/index.php/ap-training-incentive-programs/ap-training-aamp-incentive-programs.html* (March 25, 2009).
31. Ladner and Lips, "How 'No Child Left Behind' Threatens Florida's Successful Education Reforms."
32. "National Charter School Data: 2008–09 New School Estimates," Center for Education Reform, at *http://www.edreform.com/_upload/CER_charter_numbers.pdf* (April 7, 2009).
33. For more information, see KIPP, 2009, at *http://www.kipp.org* (March 25, 2009).
34. "KIPP Annual Report Card," KIPP, 2009, at *http://www.kipp.org/01/reportcard.cfm* (March 25, 2009).

technology programs in college. During the 2008–2009 school year, 500,000 students will take part in Project Lead the Way instruction. Project Lead the Way is an example of a private-sector initiative that has evolved from the need to fix the broken pipeline of STEM education. The private sector does not need to wait for federal and state government action to address the STEM education crisis.

- **Congress should increase the number of H-1B visas to close the education gap**. Currently, the law permits only 65,000 H-1B visas to be granted each fiscal year. H-1B visas are reserved for those foreigners who have a specialized skill and at least a college degree. Many of these applicants are highly skilled in STEM fields. Admitting such a low number of these highly qualified workers contributes to America's STEM problem and hurts high-tech industries by pushing the smartest people around the world to work in competing countries like China. In fact, some U.S. companies are so desperate for workers, that they have moved certain branches to Canada and Mexico where immigration laws are friendlier. This was the case for Microsoft, which in 2008 decided to open a branch in Vancouver in order to hire 150 engineers who were not fortunate enough to obtain an H-1B visa to work in the U.S.[35] A survey by the National Foundation for American Policy found that 65 percent of high-tech companies employed people outside the United States because workers were unable to obtain an H-1B visa.[36]

  Congress should return the cap to its previous amount of 195,000.[37] The cap should also be flexible enough to respond to the needs of the marketplace. By increasing the H-1B cap, Congress would allow companies to fill vital positions and to expand within the United States—keeping companies from outsourcing work or moving overseas. This would also allow companies to engage in more innovation and produce better and new technologies, contributing to a brighter and more secure economic future for all Americans.

- **Congress should resist new efforts to expand federal programs, including those that support STEM education, and instead focus on reforming existing federal programs to encourage state and local innovation.** Federal policymakers should review the effectiveness of current STEM education programs and terminate those programs they find to be ineffective or unnecessary. Moreover, federal policymakers should reform major federal education programs like No Child Left Behind to facilitate reform and innovation at the state level.[38]

Conclusion

For more than 50 years, American political, business, military, and academic leaders have emphasized the economic and national security reasons for improving STEM education. Yet after a half century, American students continue to underperform in science, technology, engineering, and math. Instead of focusing on federal solutions and increased spending for national STEM programs, policymakers and the private sector should refocus attention on systemic education reforms at the state, local, and school levels to fix the broken pipeline and dramatically increase the number of students who are able to succeed in STEM fields at school and in the workforce.

These reforms should include a full spectrum of education reforms—from more choice and autonomy for parents and school leaders to encouraging new school innovation and changing how teachers are hired and compensated. These reforms must

35. Peter Whoriskey, "Skilled-Worker Visa Demand Expected to Far Exceed Supply," *The Washington Post*, April 1, 2008, at *http://www.washingtonpost.com/wp-dyn/content/article/2008/03/31/AR2008033102581.html* (April 6, 2009).
36. National Foundation for American Policy, "H-1B Visas and Job Creation," *Policy Brief*, March 2008, p. 8, at *http://www.nfap.com/pdf/080311h1b.pdf* (April 6, 2009).
37. *Ibid.*
38. Dan Lips, "Reforming No Child Left Behind by Allowing States to Opt Out: An A-PLUS for Federalism," Heritage Foundation *Backgrounder* No. 2044, June 19, 2007, at *http://www.heritage.org/research/education/bg2044.cfm.*

include initiatives aimed at improving teacher quality—from changes in compensation structures to alternative certification programs. Finally, America must begin to involve the private sector in education and seek out new and innovative school models that will allow for greater specialization in STEM coursework.

In the meantime, the U.S. can bridge the workforce gap by increasing the number of H-1B visas available to STEM-educated individuals from abroad. Finding a real solution to the STEM problem is not just a matter of economics—the safety and security of all Americans depends on it.

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