Microsoft

A National Talent Strategy

Ideas For Securing U.S. Competitiveness and Economic Growth

Executive Summary

The United States faces a growing economic challenge — a substantial and increasing shortage of individuals with the skills needed to fill the jobs the private sector is creating. The country faces the paradox of a crisis in unemployment at the same time that many companies cannot fill the jobs they have to offer. But these problems are not unrelated.

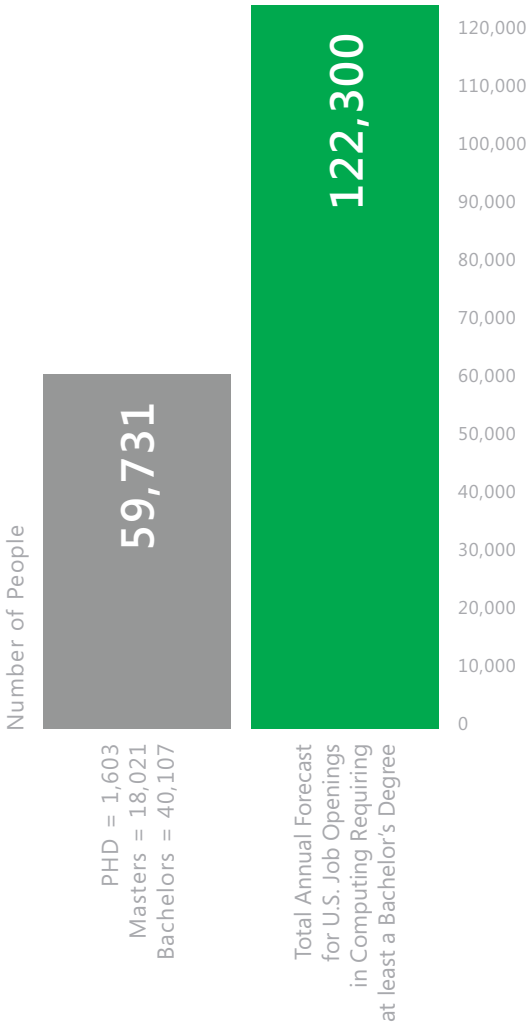
Throughout the nation and in a wide range of industries, there is an urgent demand for workers trained in the STEM fields — science, technology, engineering and mathematics — yet there are not enough people with the necessary skills to meet that demand and help drive innovation. Even more troubling, too few American students are achieving the levels of education required to secure jobs in innovation-based industries, especially students who have historically been underserved and underrepresented. The result compounds our economic problems, as many students fail to achieve their full individual potential and, as a country, we fail to achieve our full national economic potential. Every job in technology that is unfilled also means the loss of as many as five other jobs.[1] It is a problem that ultimately affects everyone across the country.

As the company that spends more on research and development (R&D) than any other in the world, Microsoft sees these problems firsthand. Like companies across the information technology sector, we are opening up new jobs in the United States faster than we can fill them. We now have 6,000 open jobs in the country, an increase of 15 percent over the past year. Over 3,400 of these jobs are for researchers, developers and engineers, and this total has grown by 34 percent over the past 12 months.

We know we are not unique. The U.S. government estimates that there are 3.7 million open jobs in the U.S. economy.[2] Amid this total there is a well-documented national shortage of individuals with engineering and computer science skills. Unemployment in computer-related occupations has fallen to just 3.4 percent, or less than the traditional rate for "full employment."[3] And most available analyses indicate that this shortage is going to get worse. As one recent study predicted, between 2010 and 2020, the American economy will annually produce more than 120,000 additional computing jobs that will require at least a bachelor's degree,[4] but the country's higher education

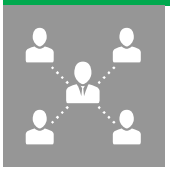
Graduation Rates Not Keeping Up With Job Creation

Number of graduates in computer science versus projected job openings in computing requiring at least a bachelor's.



Source: Graduation numbers from IPEDS 2010 Computer Science Degrees. Forecast job openings based on U.S. Bureau of Labor Statistcs forecast of 1.22 million for 2010 -2020.

Executive Summary



system is currently producing only 40,000 bachelor's degrees in computer science annually.[5]

Microsoft spends 83 percent of its worldwide R&D budget in the United States. But companies across our industry cannot continue to focus R&D jobs in this country if we cannot fill them here. Unless the situation changes, there is a growing probability that unfilled jobs will migrate over time to countries that graduate larger numbers of individuals with the STEM backgrounds that the global economy so clearly needs. In the short-term this represents an unrealized opportunity for American job growth. In the longer term this may spur the development of economic competition in a field that the United States pioneered.

There is an urgent demand for workers trained in the STEM fields, yet there are not enough people with the necessary skills to meet that demand and help drive innovation.

Just as this challenge is not unique to Microsoft, it is not unique to the information technology sector. In a very real way, a large majority of companies across the country have become software companies. Across the manufacturing and services sectors, software plays a vital role in core business processes, from the assembly line to the cash register. This means that companies across the economy increasingly need individuals who can develop and deploy customized software to support their business. The same is true in the public sector as well.

Rather than simply watch these economic forces continue to unfold, we have decided to help. Last week we announced Microsoft YouthSpark.[6] Through YouthSpark, we are reorienting a large portion of corporate philanthropy to focus on these challenges, investing $500 million in a wide range of company resources over the next three years to expand opportunities for education, employment and entrepreneurship for over 50 million young people in the United States and 300 million youth worldwide. We have also decided to speak out, both to draw attention to this problem and to advocate for broader steps to address it. Having spent significant time working with and learning from others and studying the problem ourselves, we are optimistic that the country can take both short- and longer term steps to address these issues. But we need to summon the national will to do so.

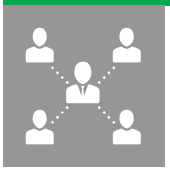
What we need, in short, is a two-pronged approach that will couple long-term improvements in STEM education in the United States with targeted, short-term, high-skilled immigration reforms. If done correctly, the latter can help fund the former. Put together, this approach can create a more effective national talent strategy to keep jobs in the U.S. by providing a supply of skilled employees who can fill these jobs here, both now and in the future.

Although most education policy decisions in the U.S. quite properly are made at the state and local levels, we face a national problem that calls at least in part for a national initiative. Borrowing from what we saw work effectively in many states as part of the recent Race to the Top initiative, we believe the country needs a national Race to the Future initiative that would provide incentives and financial resources for the states to strengthen STEM education. There are a number of focused initiatives that this could address. We believe it should include, among other things, funding for states to:

(1) Strengthen K–12 STEM education by providing additional resources to recruit and train STEM teachers and implement Common Core State Standards and Next Generation Science Standards that will better prepare students for college and work in these disciplines

(2) Broaden access to computer science in high school to ensure that all students have the opportunity to gain this foundational knowledge and explore careers in computing

Executive Summary



(3) Address our national crisis in college completion by helping students who start college to finish it faster and expand higher education capacity to produce more STEM degrees, with a particular focus on computer science

Each of these steps is important. To have an impact, each will also take time. To be effective in keeping jobs in the United States, we also need targeted high-skilled immigration reform. We believe this should take two forms. First, Congress should create a new, supplemental allocation of 20,000 visas annually for STEM skills that are in short supply. Second, it should take advantage of prior unused green cards by making a supplemental allocation of 20,000 new green card slots annually for workers with STEM skills.

Because education and immigration opportunities should go hand-in-hand, we believe it would be appropriate to require employers to make a meaningful financial commitment toward developing the American STEM pipeline in exchange for these new visas and green cards. Those funds would help pay for the STEM education investments across the country that would be part of a Race to the Future initiative. Based on our own analysis, we believe that it would be fair and feasible to require an investment of $10,000 for each of these new STEM visas and $15,000 for each of these new STEM green cards. This would raise up to $500 million per year — or $5 billion over a decade — that the federal government could use to distribute to the states where STEM education investments are needed.

Ultimately we cannot expect to build the economy of the future with only the jobs of the past. We must prepare the next generation for the waves of technological innovation that are on the horizon in every field. We are committed to doing our part and hope business, education and government can come together to pursue this common goal. We know that the proposals in this paper do not have all the answers. But we believe they can help us move in the right direction.

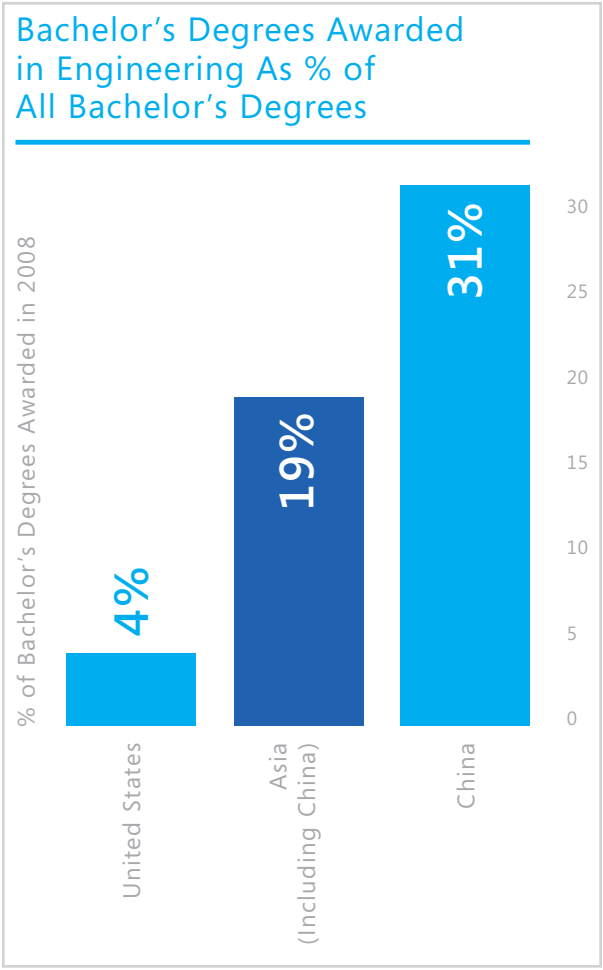
The Challenge and The Consequences

Today's global economy depends increasingly on technological and scientific innovation, leading to the creation of new kinds of jobs, which in turn require new kinds of skills. Other countries have been quick to react to these changes, and some have begun to pull ahead in STEM fields. The United States, however, has been slower in responding.

The challenge the United States faces in part is one of educational attainment. Our success will depend largely on our capacity to develop critical STEM skills and to cultivate, attract and retain talented individuals in STEM fields. We need more engineers, computer scientists, mathematicians, healthcare professionals, STEM teachers and other highly skilled workers. This is not to suggest that other disciplines, including those in the liberal arts, are any less crucial; we need a better educated and more technologically adept American workforce in all areas, with higher rates of college degrees and high-skilled credentials, so that our citizens are prepared to meet the requirements of today's and tomorrow's jobs. Yet the situation in STEM is especially dire.

Beyond the overall risk to national competitiveness and economic growth, this is a growing personal crisis for our country's younger generation.

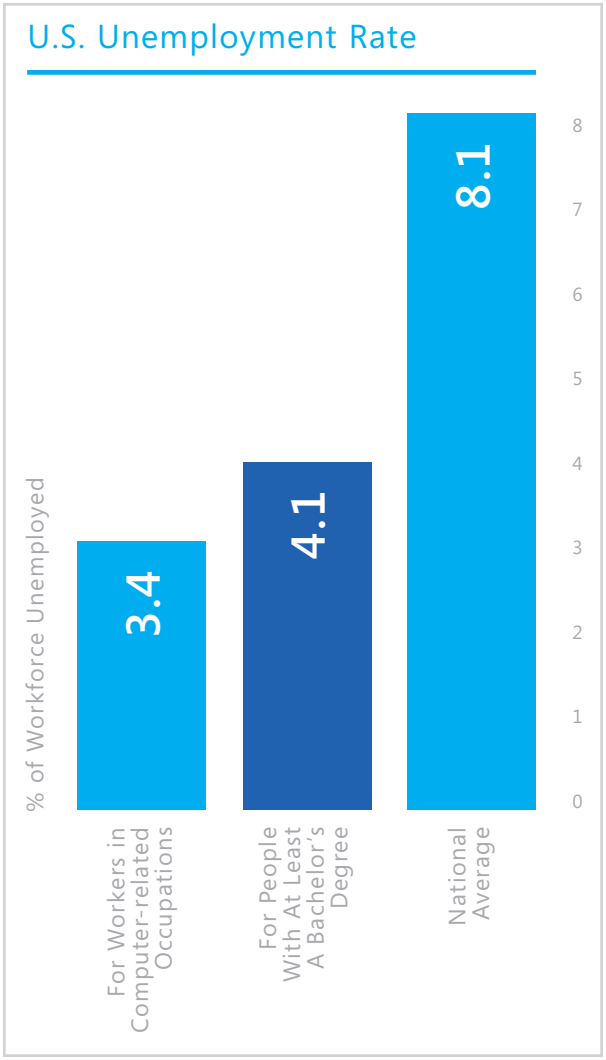
By many measurements, we are falling behind the rest of the world in the STEM disciplines. In the United States, only about 4 percent of all bachelor's degrees awarded in 2008 were in engineering, as compared to approximately 19 percent throughout all of Asia and 31 percent in China in particular.[7] Between 2010 and 2020, there will be at least 1.2 million job openings in computing professions that require at least a bachelor's degree,[8] yet at our current pace we will not produce even half the number of U.S. graduates needed to fill those positions.[9] And the gap is not limited to science and engineering jobs. A June 2011 McKinsey Global Institute report predicts a shortfall of 1.5 million "data-savvy" managers and analysts by 2018.[10] The result is that employers in many industries across the U.S. are unable to fill high-skilled American jobs with high-skilled American workers, a trend that seems all but certain to continue if we fail to act.



Source: National Science Foundation. Science and Engineering Indicators 2012. *Chapter 2: Higher Education in Science and Engineering.

The Challenge and The Consequences

At Microsoft, we have experienced the growing shortfall of high-skilled STEM workers firsthand. In August 2012, Microsoft had more than 3,400 unfilled research, development and engineering positions in the United States, a 34 percent increase in our number of unfilled positions compared to a year ago. This trend is unsurprising, given the dramatic difference between the unemployment rate for high-skilled workers in computer-related occupations (3.4 percent) and the overall unemployment rate (8.1 percent).[11]



Source: U.S. Bureau of Labor Statistics

Beyond the overall risk to national competitiveness and economic growth, this is a growing personal crisis for our country's younger generation. We see an increasing gap between those who are prospering and the growing number of young people being left behind because they lack the education, skills and/or real-world opportunities to succeed. Too many of our country's youth face an opportunity divide.

Demographics are making this divide even more acute. The U.S. population is expected to grow to 400 million by the year 2039, at which point minorities will represent 49 percent of the total population.[12] Yet we know that these students have been historically underserved in our nation's schools, making the challenge we face even greater in these communities. For instance, in 2011, 39 percent of white Americans between the ages of 25 and 29 had at least a bachelor's degree, as opposed to only 20 percent of African-Americans and less than 13 percent of Hispanic Americans in the same age range.[13] In 2008, Hispanic Americans, African-Americans and American Indians — who, together, make up 26 percent of our country's working population —accounted for only 9 percent of U.S. workers in the fields of science and engineering, and only 11 percent of U.S. graduates with science or engineering degrees.[14]

We have seen firsthand some of these challenges in our home state of Washington, especially in the area of STEM education. During the 2010–2011 school year, only 439 students in Washington took the Advanced Placement ("AP") computer science exam, which is itself a serious problem. Even more concerning was that only 12 of these students were Hispanic American, only four were African-American, and only 99 were female.[15] Any solution must include a clear focus on strategies that better encourage and support minority populations and young women to pursue careers in science and engineering. There is a direct nexus between providing economic opportunity for all students and maintaining our country's competitiveness in the global economy. Closing the achievement gap has become an economic imperative.

For the country, the ongoing talent crisis endangers long-term growth and prosperity. For individuals, it in-

The Challenge and The Consequences

creases the threat of unemployment, especially for young people. During the current recession, unemployment rates have been more than twice as high for those with only a high school diploma (8.8 percent) than for those with a bachelor's degree or higher (4.1 percent).[16] And the emerging opportunity divide facing our young people affects everyone in our country, not just those struggling to find work. In the United States, 6.7 million young people are neither working nor in school, representing an estimated aggregate cost to taxpayers of $1.56 trillion and a cost to society of $4.75 trillion.[17] The costs of an underskilled, underemployed workforce, together with the risk of declining competitiveness and stalled economic growth, pose a significant threat to America's future.

A National Talent Strategy

Drawing on our own experience and working with and learning from others, we have identified specific ideas and recommendations that we believe can begin to address the real threats to employment and economic competitiveness our country faces.

Our ideas include:

Part 1

- **Concrete actions to strengthen America's STEM pipeline of skilled and educated workers so that we can meet the future projected workforce needs with American citizens. In essence, we need a national "Race to the Future" initiative.**

Part 2

- **Targeted changes to high-skilled immigration to both bridge the short-term skills gap and help fund some of the investments needed to strengthen the STEM pipeline.**

Taken together, these ideas are a national talent strategy focused on strengthening our competitiveness, creating jobs and growing the American economy.

Race To The Top

The U.S. federal government created the $4.35 billion Race to the Top (RTTT) program in 2009, funding it as part of the American Recovery and Reinvestment Act. The program has proven successful in spurring educational innovation among the states and should serve as a model for future funding initiatives at the U.S. Department of Education.

RTTT created a peer-reviewed grant process in which states could compete for funding to support improvements in one of four areas:

- Development and use of common, high-quality standards and assessments
- Implementation and use of data systems to improve instruction
- Fostering great teachers and leaders
- Turning around the lowest-performing schools

Three initial rounds of state competitions were held to support reforms in these areas. Twenty-one states and the District of Columbia received initial grant awards. A district-level competition is now underway to augment these state-level programs by bringing more funding directly to the local level.

RTTT has been successful in driving a wide range of reforms because it established a common set of objectives for states to pursue, but did not prescribe specific strategies for reaching those goals. Historically, federal education funding policy has taken a top-down, compliance-driven approach, imposing detailed rules, processes and reporting requirements on states in order to receive core federal funding. In contrast, RTTT presented a set of clearly defined strategic outcomes, established clear criteria for evaluating proposals, and allowed each state to develop programs and policies based on the needs of its students, parents and educators. RTTT also provided a strong incentive in the form of additional funding to spur development and implementation of policies with the potential to significantly grow student learning and achievement.

Federal education policymakers should continue to focus on outcome-based policies that provide both flexibility and significant financial incentives. With the skills gap a growing problem nationwide, more emphasis in future RTTT-like funding cycles should be placed on rewarding innovative programs to significantly improve STEM outcomes — at all levels of education.

For more information on RTTT, see www.ed.gov.

Race To The Future: Strengthening America's STEM Pipeline

Part 1: Strengthening America's STEM pipeline

Strengthening America's STEM pipeline will require public-private partnerships as well as collaborations across federal, state and local governments. These partnerships and collaboration will be most effective if they are based on common principles in a Race to the Future that provides incentive financial resources to state and local government to support a common set of objectives, while not prescribing specific strategies for reaching those goals. Strengthening the STEM pipeline requires us to 1) strengthen K–12 STEM education, 2) broaden access to computer science in high schools, 3) increase STEM capacity in higher education, with a special focus on computer science, and 4) help more students obtain post-secondary credentials and degrees by addressing the college completion crisis.

Only 8% of college freshmen in the U.S. end up graduating with a STEM degree.

Goal No. 1: Strengthen K–12 math and science teaching and learning to better prepare students for college and possible careers in these disciplines

Our K–12 educational system is not producing enough high school graduates who are prepared for success in college — particularly success in STEM fields of study. A lack of preparedness has lasting effects. In 2011, only 45 percent of U.S. high school graduates were prepared for college-level math, and only 30 percent were prepared for college-level science.[18] Only 8 percent of college freshmen

Common Core State Standards

The Common Core State Standards (CCSS) Initiative is a state-led effort coordinated by the National Governors Association (NGA) and the Council of Chief State School Officers (CCSSO). The initial subjects included are English language arts and mathematics in grades K–12. The standards were developed in collaboration with teachers, school administrators and experts to provide a clear and consistent framework to prepare our children for college and the workforce. These standards define the knowledge and skills students should have upon high school graduation in order to succeed in college courses and in workforce training programs. The standards:

- Are aligned with college and work expectations
- Are clear, understandable and consistent
- Include rigorous content and application of knowledge through high-order skills
- Build upon strengths and lessons of current state standards
- Are informed by other top-performing countries, so that all students are prepared to succeed in our global economy and society
- Are evidence-based

Next-Generation Science Standards

Through a collaborative, state-led process managed by Achieve*, new K–12 science standards are being developed across disciplines and grades to provide all students with an internationally benchmarked science education. The NGSS will be based on the Framework for K–12 Science Education developed by the National Research Council and describes a vision of what it means to be proficient in science. These standards are being developed in collaboration with teachers, school administrators and experts. (*Achieve is a bipartisan, nonprofit organization that helps states raise academic standards, improve assessments, and strengthen accountability to prepare all young people for postsecondary education, work and citizenship.)

in the U.S. end up graduating with a STEM degree.[19] The problem is especially acute for girls, low-income students and minorities.

Our students also are falling behind their international peers. One recent study showed that 15-year-old students in the United States scored significantly lower in math literacy than 15-year-old students in 17 other developed countries. Only five developed countries had scores measurably lower than the United States.[20]

There is now a well-researched, widely accepted K–12 education reform agenda that includes adoption of internationally benchmarked standards and assessments, improvements in teaching quality, new ways to teach and experience STEM, and greater accountability and measurement tools to make sure every student is getting access to a high-quality STEM education. It is time to make sure this agenda is properly supported and implemented.

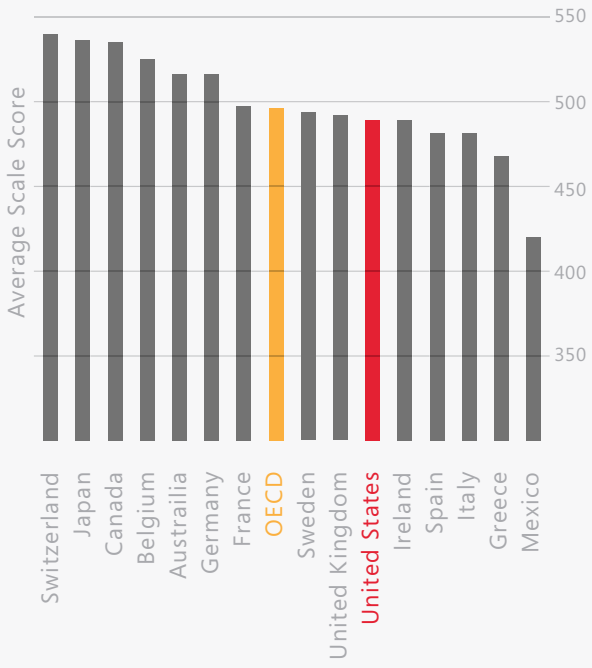
Implement new math and science national standards across the country

To prepare students for college and/or a career after high school, students and teachers need a clear definition of what skills are expected, and teachers need a clear system to assess if their students have learned these skills. In STEM, the Common Core State Standards and the Next Generation Science Standards[21] and their companion assessments — all

RECOMMENDATION 1.1

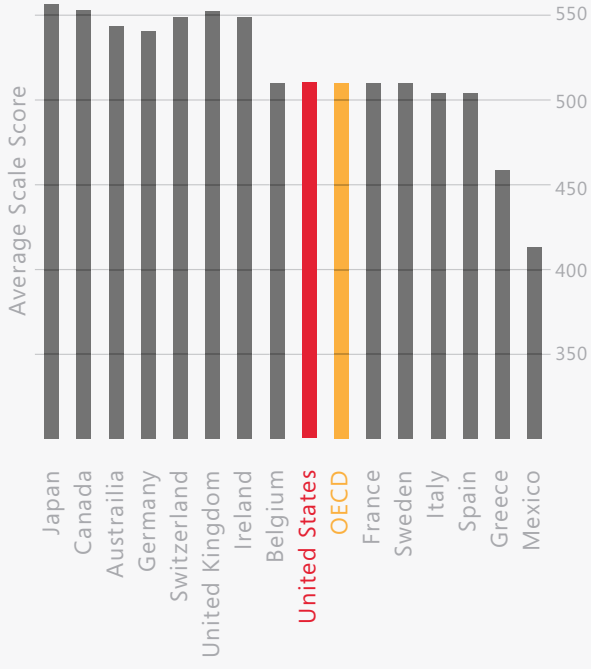
Of 34 OECD Countries, The U.S. Ranks 17th in Math

(Chart Shows Selected Countries Only)



Of 34 OECD Countries, The U.S. Ranks 17th in Science

(Chart Shows Selected Countries Only)



Source: Data Courtesy of Education Trust/OECD

of which are internationally benchmarked — do just that. A Race to the Future initiative would accelerate the adoption of these standards by providing resources and technical assistance to states, districts and schools that want to move to implement these standards and assessments quickly and with fidelity.

RECOMMENDATION 1.2

Recruit more K–12 STEM teachers and invest in training resources for them

A significant barrier to high-quality K–12 STEM education is the shortage of qualified teachers. A Race to the Future initiative should include steps to address this shortage by providing incentives to states that increase their efforts to attract, train, support, retain and reward effective teachers, driving toward a common goal of more K–12 STEM teachers that are fully equipped. A Race to the Future could provide financial incentives to encourage more math and science graduates to consider careers in teaching. It could encourage mid- and end-of-career professionals to pursue opportunities in the classroom through expedited routes to certification. This mechanism should also reward states that provide more support to the professional development of STEM teachers.

The Common Core State Standards and Next Generation Science Standards create an opportunity to build a consistent and high-quality professional development approach and content across the country. These will provide teachers and school principals with consistent and clear direction regarding what their students are expected to learn and what teachers are expected to teach, enabling them to focus more of their professional development time on how their teaching practices can improve.

RECOMMENDATION 1.3

Innovate in STEM delivery and teaching practices

New approaches to STEM curriculum delivery — including leveraging new technology — will help inspire our K–12 students and improve outcomes. Schools need help to increase access to quality programs inside and outside of their schools. A Race to the Future would reward states that invest in these programs and find new ways of working to ensure interested students stay on a STEM pathway. Ideas to pursue include:

- High-quality digital and blended learning models
- STEM-themed schools
- Externships for teachers to work alongside industry professionals
- Hands-on activities, practice and problem-solving
- Advanced learning opportunities such as Advanced Placement and dual-enrollment programs for college credit.
- Internships and mentorships for students
- After-school STEM enrichment programs

Public-private partnerships can play an important role. In Washington state, for example, Microsoft and others founded Washington STEM, a nonprofit organization that invests in and helps scale innovative approaches to STEM education.

These concrete steps are not all that is needed, but they will play an important part in improving STEM outcomes in K–12 and help close the college-ready gap in STEM that is so critical to our long-term success.

Goal No. 2: Broaden access to computer science in high school

Computer science is the foundation for much of today's innovation economy, and many of the new jobs being created — and which employers are looking to fill — are in this field. The need reaches beyond the information technology sector. Many companies across the economy now use computing technology as a core part of their business and their competitive advantage. And beyond the direct application of computer science skills to software development, studying computer science provides students with knowledge and skills useful in a wide range of modern careers, which are increasingly analytical and STEM- based.

Despite its critical and growing importance computer science is taught in only a small minority of U.S. schools.

Despite its critical and growing importance, computer science is taught in only a small minority of U.S. schools. There currently are just over 42,000 high schools in the United States.[22] But only 2,100 of them were certified to teach the AP computer science course in 2011, and in fact only 21,139 students took the AP exam.[23] Ironically, given the growing importance of computer science, the subject accounted for only 0.6 percent of all AP tests taken last year, down from 1.6 percent of all tests in 2000.[24] The challenge is clear: Across the country there simply are not enough teachers qualified to teach rigorous and engaging computer science courses. In addition, students often do not get core graduation credit for taking computer science, creating a significant disincentive even when the opportunity to study computer science exists. Compounding these problems is a

What Is Computer Science?

One of the challenges around expanding access to rigorous and engaging computer science in K–12 is the lack of understanding around what "computer science" education entails. Computer science education encompasses "the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society."[25.1] A few of the topics and activities that might be included in a computer science course[25.2] include:

- Algorithmic problem-solving
- Computing and data analysis (managing, processing, visualizing and interpreting data)
- Human-computer interaction
- Modeling and simulating real-world problems
- Creating and manipulating graphics
- Programming (including game design)
- Security (including cryptography)
- Web design (illustrating principles of programming, human-computer interaction and abstraction)
- Robotics (designing and programming)
- Ethical and social issues in computing

Foundational computer science courses in K–12 teach the fundamental concepts of computing, much like a physics course teaches fundamental concepts around the laws of motion and energy. The new AP computer science course under development[25.3] focuses around seven big ideas at the core of computer science —creativity, abstraction, data, algorithms, programming, Internet and impact — that are fundamental to computer science, but applicable to analysis in many disciplines.

lack of understanding of what computer science is, making it difficult to drive the needed changes.

A Race to the Future initiative should set a new national goal to give all high school students in the U.S. access to computer science. This would ensure that all young Americans would have the opportunity to develop an interest and acquire initial knowledge and skills in this important subject. To be clear, we are not advocating that every high school student in the country should have to take the course. But every student in every school should have the option and the opportunity to make this choice.

Computer science is the foundation for much of today's innovation economy, and many of the new jobs being created are in this field.

RECOMMENDATION 2.1

Recruit and prepare more high school computer science teachers and provide them with the resources they need to succeed

A Race to the Future initiative should provide incentives and funding for the states to address the high school computer science shortage by investing in teacher recruitment, preparation and retention. And because computer science is a rapidly changing field, this will require networks for support among new and experienced teachers and ongoing professional development. Federal and state STEM educational programs should direct funding and provide professional development for these purposes, and they should continue to support research on computer science pedagogy.

Computer Science – It's Not Just About Working for IT Companies

In the 21st century, information technology is permeating many aspects of daily life and big data, software, and the Internet are being integrated into businesses and products throughout society. The knowledge and skills learned from studying computer science prepare students for careers in a variety of sectors. Examples include:

In information technology — designing security software and hardware systems or developing mobile communication devices, networks and applications

- In manufacturing — designing and using simulations to improve products
- In healthcare — exploring the vast quantities of data produced by new DNA sequencing techniques, developing new remote monitoring systems for patients, or designing security and privacy for medical records
- In retail — analyzing data to predict trends and improve inventory management
- In weather forecasting — developing and interpreting models that predict the behavior of hurricanes.
- In the arts — designing new special effects for movies or composing digital music.
- In financial services — designing and overseeing automated trading services.

It is also important that a Race to the Future rewards states for taking the steps needed to ensure that qualified computer science teachers are recognized for their skills. This requires improvements in the process for teaching certifications in this field. Unlike some disciplines, there is often no clear path for current or prospective teachers to learn to teach computer science. Most states do not offer a certification or even an endorsement for teaching computer science, and when states do have a certification program, it is often either not applied consistently or not grounded in appropriate computer science content.[25] As a result, there is a need to develop new pathways for computer science teachers to become certified, and these should include alternative and flexible routes to certification that ease the transition for teachers currently trained in other areas.

These changes will also require support from other institutions. Colleges and universities should expand their development programs for pre-service and in-service teachers to prepare them to offer rigorous computer science courses, as well as provide ongoing professional development and support. Technology can be used to facilitate communities of teachers, the dissemination of materials, and the development and deployment of high-quality blended and online learning environments.

We also believe that companies in the private sector and the philanthropic community also have a positive role to play in supporting and enabling the expansion of access to computer science. As but one example, the Technology Education And Literacy in Schools (TEALS) program[26] recruits, mentors and places high-tech professionals as part-time teachers in high schools unable to offer computer science courses on their own. Since its founding by a Microsoft employee in 2009, TEALS is responsible for bringing more than 75 sections of computer science into schools that did not previously have them, including 20 new AP computer science classes, and has "graduated" three schools to be able to provide computer science offerings on their own.[27] TEALS will continue to expand for the 2012–2013 school year, with more than 120 TEALS volunteers working with teachers in 37 high schools in eight states to teach computer science to more than 2,000 students.

Computer Science Prepares Students for a Wide Range of Careers

The breadth of ways in which computing knowledge prepares people for multiple careers is borne out by looking at the people working in computing occupations by sector: 9 percent are in information services, 12 percent are in financial services, 36 percent are in professional and business services, 7 percent are in government and public education services, and 12 percent are in manufacturing.[25.4] Conversely, even those whose majors were not in computing often move later into occupations focused in these areas; of the 2.2 million workers in computer and math occupations in 2009, 35 percent had computing or math-related degrees, 27 percent had degrees in other STEM fields, and 39 percent had non-STEM degrees.[25.5]

RECOMMENDATION 2.2

Ensure core credit for computer science and include computer science in accountability measures

Today, only nine states allow computer science courses to count as either "core" math or science courses. This means, in short, students that take computer science only receive elective credits for their effort and get no credit toward either math or science requirements.

We need to reward states for making computer science courses count as part of a student's core graduation and college-entrance requirements, either as mathematics, science or a similarly-required computer science credit. This will remove a current disincentive for high schools to offer and for students to take computer science.

Nine States that Count Computer Science Toward "Core" Graduation Requirements

(Area in which Computer Science Credit is Counted)

Georgia	Science	—
Missouri	—	Math
New York	—	Math
North Carolina	—	Math
Oklahoma	—	Math
Oregon	—	Math
Rhode Island	—	Math
Texas	—	Math
Virginia	—	Math

Source: Source: Running On Empty: The Failure to Teach K–12 Computer Science in the Digital Age. CSTA, ACM (2010)

Rigorous computer science knowledge should be incorporated into educational accountability standards and assessments.[28] This includes the Next Generation Science Standards, which are currently being developed. Unfortunately, the draft of these standards, released this past spring, currently does not do enough to integrate fundamental computer science concepts.[29] Currently, more than two-thirds of states have few or zero upper-level standards for computer science instruction.[30] Strong standards will ensure that computer science education becomes a priority for schools around the country and that educators know what is required to teach and learn computer science at the high school level. States or school districts quite properly set graduation requirements and standards. However, a Race to the Future initiative should incentivize and help fund the changes that are needed to ensure strong standards and assessment in this important field.

RECOMMENDATION 2.3

Raise awareness of what computer science is and why it matters

Currently, schools will not invest time or resources into offering computer science if principals, parents, policymakers and students do not understand its importance. There continues to be confusion about what computer science education is, what it is not, and why it matters. For example many people still confuse computer science with learning to use a computer or software applications.

It is important to raise awareness of the nature of computer science education, which includes teaching deeper computing and computational concepts — how to tease insight out of massive quantities of "big data," for example, or how to integrate security into the design of a computer network or system. It is also important for all stakeholders to have ready access to information about the ways in which computer science education teaches skills that are useful beyond the computing and software sectors.

Goal No. 3: Help Americans get the degrees and credentials that 21st century jobs require

The "dual unemployment rate" and the nature of newly created, high-skilled jobs together make clear that that the workforce needs more people with post-secondary qualifications and experience, and that these qualifications and experience greatly improve prospects in the job market. Indeed, recent studies predict that by the year 2018 nearly two-thirds of all new jobs created in the United States will require a post-secondary credential, such as a technical certificate, or a community college or four-year degree.[31]

Ironically, the principal problem today is not persuading young people to start college. The problem is helping them to complete it. In short, students are not completing college at nearly the rate they are entering college, and this is rapidly emerging as a crisis that deserves the nation's attention.

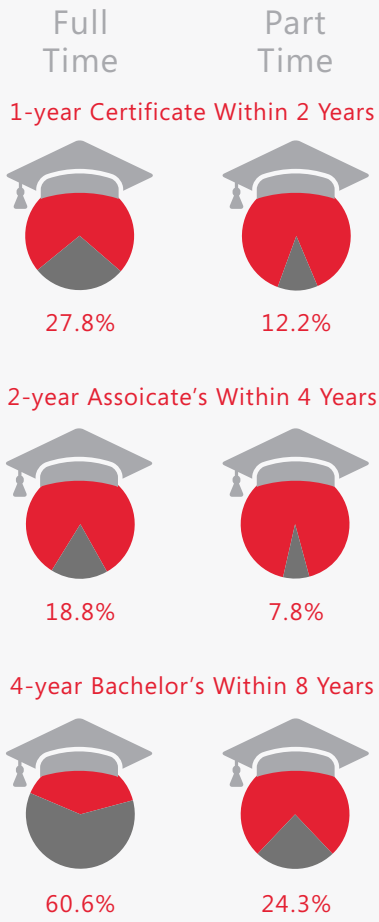
The numbers tell the story. More than 70 percent of high school graduates now enter some form of advanced training or education within two years of receiving their high school diploma.[32] And these types of high figures hold true across racial and ethnic groups.[33] But only a little more than half of U.S. students who enter a four-year, full-time bachelor's program actually graduate — within six years.[34] And in the nation's community colleges, less than 30 percent of the students who enroll in a two-year certificate program actually complete this program within three years.[35] As a result, the United States now ranks only 15th in the world in terms of the percentage of 25-to-34-year-olds who achieve post-high school degrees.[36]

College completion rates are even worse for minority students. For example, only 49 percent of Hispanic students and 42 percent of African-American students attending four-year colleges full time ultimately complete their degrees within six years, compared with 60 percent of white students.[37]

At this rate, the current generation of college-age Americans is in danger of being less educated than their parents' generation, a first in our nation's history.[38] The need for improvement is especially acute in the STEM fields, as fewer than 40 percent of students who enter college intend-

Part-Time Students Face Greater Challenges Graduating

% of Students Achieving The Qualification in Given Time Frame

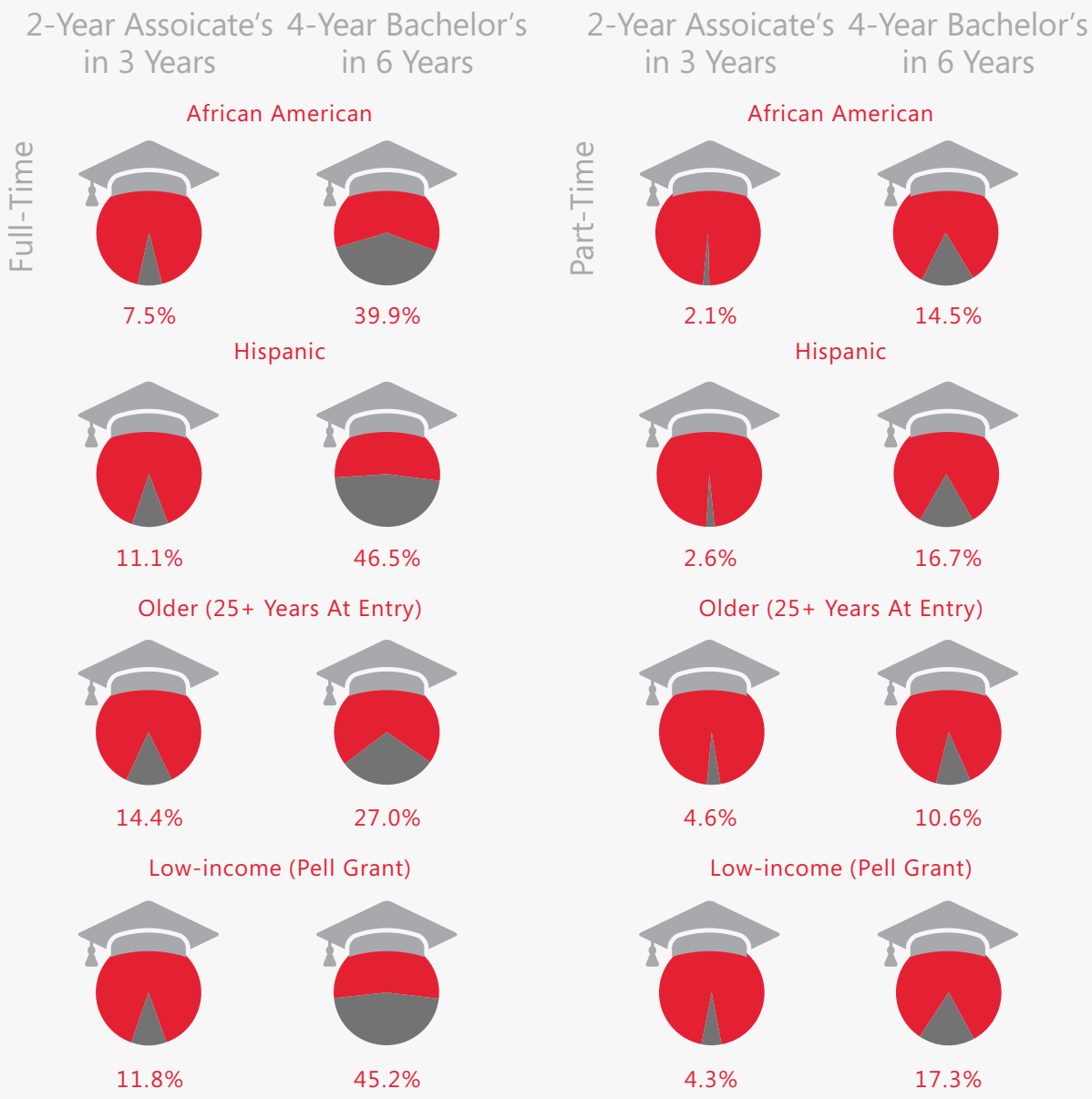


Source: Complete College America – "Time is the Enemy," September, 2011

Race To The Future: Strengthening America's STEM Pipeline

Minority and Low Income Students Face Even Bigger Challenges

% of Students Achieving The Qualification in Given Time Frame



Source: Complete College America – "Time is the Enemy," September, 2011

ing to major in a STEM field end up completing a STEM degree.[39]

In short, we need to take new steps as a country to help more students, especially in STEM fields, not just go to college but successfully complete it.

RECOMMENDATION 3.1

Incentivize and fund strategies that recognize the realities of today's student body

The solution to current college-completion problems lies in an understanding of their nature and origins. The demographics of the country and its college age population have changed. Today's reality is that only 25 percent of U.S. college students attend school full-time and live on campus, while the other 75 percent are juggling families, jobs and commuting to class in addition to their studies.[40] Nearly 40 percent of college students today are only able to attend part time.[41] In the nation's community colleges, this juggling is even more widespread. At these colleges, 60 percent of the students hold jobs that involve working more than 20 hours a week, and 25 percent of students are currently working more than 35 hours per week.[42]

Students juggling commutes, families and jobs are often referred to as "nontraditional students" — but in fact they are the new majority. The nation's college system has not adjusted sufficiently to the needs of this new majority, and as a result students are spending longer than ever in college. The longer students spend in college, the more debt they accrue, and the harder it is for them to graduate. As it has been aptly described, for these students "time is the enemy" of college completion.[43]

College completion and credential attainment need to become a more realistic goal for the vast majority of our students and workers. Achieving this goal requires a significant shared responsibility from colleges, businesses and government to help American higher education meet the needs of today's students.

A Race to the Future initiative should prioritize money to help colleges and universities implement strategies that help students get degrees on time while balancing the demands of work and family.[44] It should reward colleges that restructure their academic schedule to support the more complicated needs of nontraditional students. One example of a possible reform would be holding classes within the same block of time every day to allow students to hold down jobs while they study. This would represent a big step forward compared, for example, to a schedule that requires a student to attend one class from 9:00 to 10:00 in the morning and another from 2:00 to 3:00 in the afternoon.

Another strategy that could help would be offering more academic terms year round to provide students the opportunity to complete their degrees in less time. This concentration of class time would also create a cohort of students interacting more frequently with each other and with their professors. Schools should also be rewarded for creating peer support and learning networks that connect students to others in their program, strategies that have been shown to improve the retention of students. Finally, some classes can be taught more efficiently by using hybrid approaches that mix online and classroom learning to reduce classroom time.

RECOMMENDATION 3.2

Make degree programs easier to navigate from start to finish

At most colleges and universities, students have to sign up every term for individual and unconnected courses, with too few safeguards in place to keep students on track to earn the credits they need to graduate on time. Successful, large-scale programs and systems around the country have proved that by utilizing informed choice and structured delivery, students can successfully balance jobs and school — and are much more likely to graduate.[45]

A Race to the Future initiative should reward universities and colleges that come up with strategies to simplify course registration, making it easier for students to enroll in a single, coherent program, and creating on-time degree plans for all their students. These "guided pathways" can keep better track of how students are doing in their majors by flagging required courses, alerting them when they are falling behind in their requirements, and generally making it simpler to get information about how likely they are to complete their degree on time.

Guided pathways can also help colleges plan their course offerings at any given time to meet student demand

RECOMMENDATION 3.3

and ensure students are able to stay on track. These pathways can also be a valuable tool to help match students' aspirations with the needs of the job market, especially in STEM-related fields.

Incentivize colleges to focus on completion rates and ensure transparency

States have a significant stake in helping their public colleges and universities successfully graduate more work-ready students. To be successful, states must hold themselves, their students and their educational institutions accountable. State governments could incentivize colleges to improve their graduation rates, by distributing at least some of their funding to colleges based on the number of degrees completed — not the number of students enrolled — as well as the number of students successfully transferring from two-year to four-year colleges, and the number of courses have completed on time.[46]

While we need to focus on overall college completion rates across the board, the problem is particularly acute in STEM fields, and most acute in computer science. In the Race to the Future, state governments should be rewarded for showing that their colleges have increased their capacity for science, math, engineering, and computer science degrees, and rewarded for the attainment of degrees in those fields by U.S. citizens.

States also have an important role to play in ensuring accountability and transparency. Improved and more complete data on annual graduation rates, transfer rates, and total number of degrees awarded are important measures to help identify what is working. States should share and publish the data needed to drive reform and a focus on completion. They should also serve as a clearinghouse of best practices that allow the rapid scaling of successful reforms. And states can provide students with online access to important information on college graduation and job-placement rates when they are first deciding where to enroll.

At the federal level, a Race to the Future initiative should reward states that make progress in college completion rates in general, and in the number of students graduating with STEM degrees in particular. At the same time, the federal accountability programs need to better track all students, not just those attending college full time and living on campus. The federal government's Integrated Postsecondary Education Data System (IPEDS) currently does not count what happens to part-time students — who make up about 40 percent of all post-secondary students in the U.S.[47] — or track the success of transfer, low-income, or remedial students. The National Governors' Association/Complete College America Common College Completion Metrics can serve as a strong starting point to enhance accountability.

RECOMMENDATION 3.4

Increase capacity for STEM degrees in higher education, with a particular focus on computer science

As noted above, there is an urgent demand for workers trained in the STEM fields. In particular, we face a significant gap between the number of new jobs being created that require a computer science degree, and the number of students graduating in computer science. Colleges and universities need to begin to assess their capacity and capability to provide computing education to a larger number and wider variety of students.

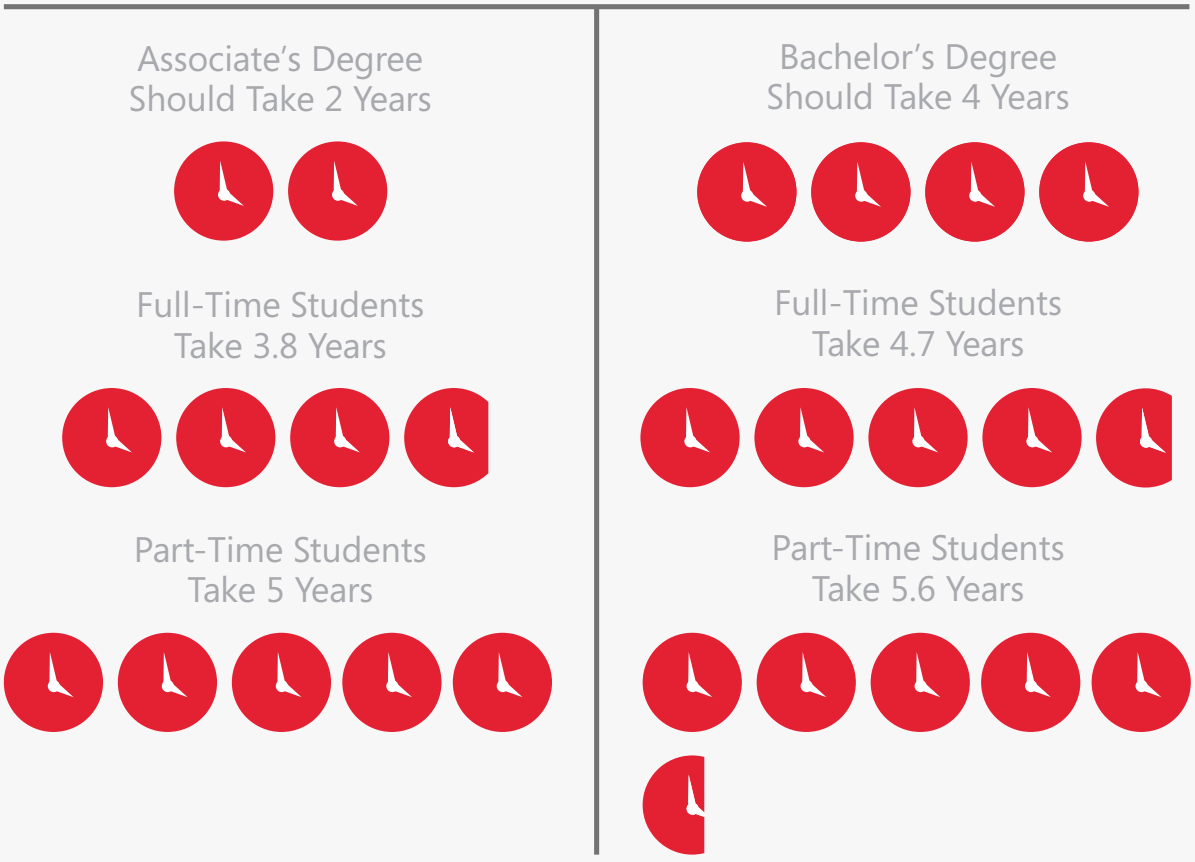
The scale and impact of the change could be significant. As highlighted in the introduction, in 2010, U.S. institutes of higher education awarded about 40,000 bachelor's degrees in computer science. Matching the predicted demand for new and replacement people in computing would require more than doubling the output — a significant challenge at a time when anecdotal evidence suggests that some research universities are already being constrained by faculty or infrastructure limitations into turning away qualified and interested students.[48] Attracting computer scientists to academia and investing in lab facilities does require colleges to invest. But this investment will drive states, and our national economy, to greater levels of competitiveness when the need for qualified high-tech workers, across a broad spectrum of industries, is so high.

As but one example, in Microsoft's home state, the University of Washington had been turning away three-quarters of students applying to major in computer science because the department lacked enough funding. To address

Race To The Future: Strengthening America's STEM Pipeline

Students Are Taking Too Long To Earn A Degree

Average Time Take To Earn Qualification.



Source: Complete College America – "Time is the Enemy," September, 2011

this problem, the University of Washington recently agreed to increase the budget of the computer science department, which will allow the program to grant a third more degrees in the coming years.[49] These graduates are feeding the continued growth of a high-tech cluster in Washington state that is fueling our economy, attracting new investment and creating jobs.

A national Race to the Future should provide new incentives and funding to address this shortfall, incentivizing public colleges and universities to make the investments and changes needed to increase the capacity for STEM degrees and especially computer science degrees.

The private sector can also help play an important role in helping grow the number of STEM college degrees. For example, Microsoft and Boeing were instrumental in the formation of the Washington State Opportunity Scholarship, a program that helps low- and middle-income Washington residents earn bachelor's degrees in science, technology, engineering, mathematics and health care. The program was created by the Washington state legislature in 2011 to address rising tuition at Washington colleges and universities and was funded initially with $25 million each from Microsoft and Boeing and $5 million from the state of Washington. It has the potential to change thousands of lives and help secure the state's economic future by enabling and encouraging Washington students to graduate from Washington colleges and universities, prepared for the jobs being created by Washington employers.

Bridging The Gap With High-Skilled Immigration Reform

Part 2: Bridging the gap with high-skilled immigration reform

We believe the country's primary focus should be on strengthening America's STEM pipeline, so the nation can close the skills gap and meet projected domestic workforce needs. But building this capacity will take time, and it will require significant levels of new funding. To succeed, we need not only a means of generating new funding to invest in our future, but a plan to ensure that employers have access today to the critical high-skilled talent they need to innovate and compete. As work is done to strengthen America's STEM pipeline, there needs to be a path for the best and the brightest innovators in the world to participate in growing U.S. businesses, creating new jobs and strengthening our economy.

To meet both of these needs — a new source of substantial new funding for American STEM programs and immediate access to high skilled STEM talent — private-sector businesses which are the primary source of demand for STEM talent must take on a new leadership role. Companies in industries that rely on STEM talent are uniquely well positioned to bring together resources and industry-relevant ideas for education strategies to complement existing government programs. Through a new two-part high-skilled immigration program that incentivizes private-sector investment, it is possible to create a substantial new source of funding to build the country's STEM pipeline while also ensuring employers' access to essential high-skilled talent today.

RECOMMENDATION 1

Establish a new and supplemental allocation of 20,000 H-1B STEM visas to meet employers' hiring needs and generate up to $200 million for new investments in the American STEM pipeline

Currently, U.S. immigration regulations provide an annual limit, or "cap," of 65,000 H-1B visas, with an additional 20,000 "cap-exempt" H-1B visas for foreign nationals who graduate with an advanced degree from a U.S. uni-

What Causes Green Cards To Go Unused?

Each year, 140,000 green cards are made available for all categories of employment-based applications combined. The Department of State releases these green card numbers monthly based on estimates of the demand in each category. When these green cards are not used during the year they are authorized, they are lost and are not available for future use without special legislation.

In FY 2006, for example, over 10,000 employment-based visas were left unused as a result of a lack of interagency coordination between the Department of State and the U.S. Citizenship and Immigration Service, even though there were an estimated 100,000 to 150,000 pending applications for employment-based green cards, according to the Citizenship and Immigration Services Ombudsman's Annual Report to Congress in June 2007.

Unused Employment-Based Green Card Numbers, FY 1992-2009

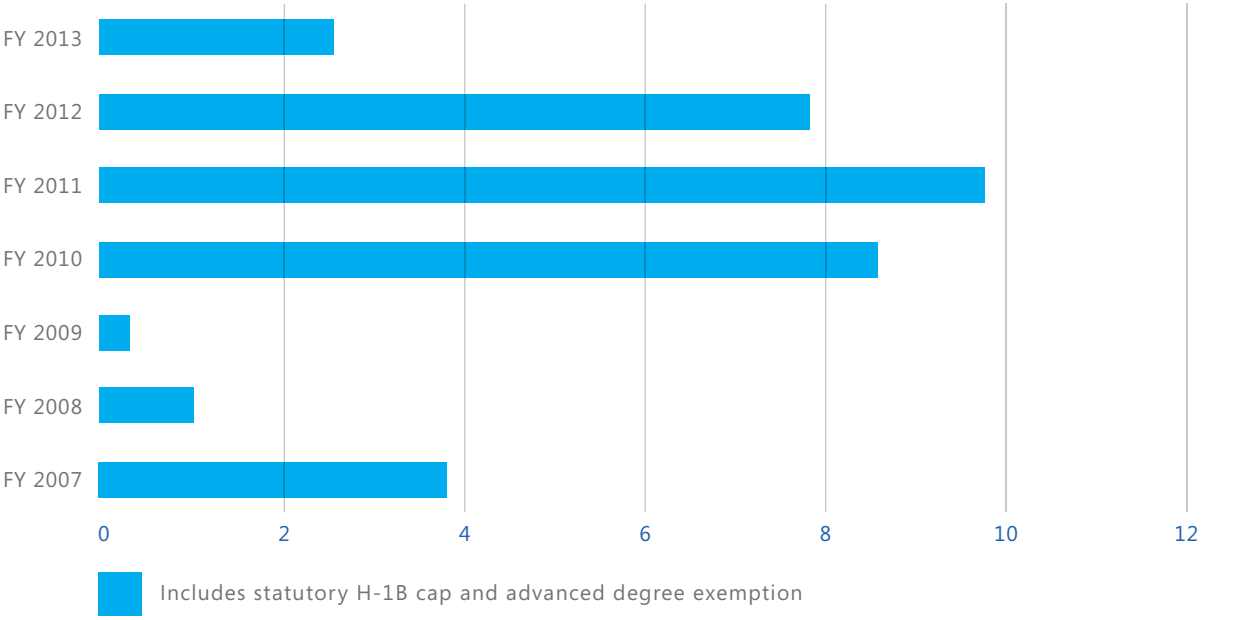
1992	21,207	2002	0
1993	0	2003	88,482
1994	29,430	2004	47,305
1995	58,694	2005	0
1996	21,173	2006	10,288
1997	40,710	2007	0
1998	53,571	2008	0
1999	98,941	2009	0
2000	31,098		
2001	5,511	**Total**	**506,410**

As of June 2010, 180,039 of the unused employment-based green cards numbers had already been recaptured by special legislation.

Source: Citizenship and Immigration Services Ombudsman, Department of Homeland Security, Annual Report to Congress, June 2010, p. 35.

Bridging The Gap With High-Skilled Immigration Reform

Number of months to reach the H-1B cap



versity. Simply put, the H-1B cap — first established by the Immigration Act of 1990 — has not kept pace with the workforce needs of today's modern technological economy. The demand for H-1B visas first exceeded the annual supply in September 1997, and the H-1B cap has been exhausted every year since 2004, even with the introduction of the additional cap-exempt advanced degree H-1Bs in 2004. In fact, the only time the H-1B cap was not reached in the past decade was from 2001 through 2003, when the annual H-1B cap was temporarily tripled to 195,000. In 2008, H-1B applications were subjected to a lottery, with the U.S. Citizenship and Immigration Services receiving approximately 135,000 H-1B visa applications on the first two days of filing. A lottery was similarly required for 2009 filings. The H-1B cap was reached even at the height of the most recent economic downturn, and for 2013, all of the available H-1B visas for the year were exhausted in only 10 weeks. Most experts currently expect that the H-1B cap for 2014 will be used up even more quickly. Once the H-1B cap is reached each year, employers are left unable to hire high skilled STEM workers from abroad to fill the gap that exists due to the shortage of available high-skilled U.S. STEM workers with the right education and training.[50] These impediments to hiring critically needed talent fundamentally threaten the innovative capabilities and competitive strength of U.S. companies.

To provide employers with immediate access to the highly talented STEM professionals that their businesses need, a new allocation of 20,000 H-1B visas for foreign nationals with a U.S. bachelor's degree or equivalent foreign degree in a STEM discipline should be established. To qualify for these visas, employers would be required to make an investment of $10,000 toward the development of future American STEM workers for each visa sought from the new allocation. This level of investment per visa is sizeable by design: It is large enough to represent a material commitment to building America's STEM pipeline, and to ensure that the visas will only be used to fill immediate, critical needs for a particular STEM worker's skills. Yet investing $10,000 to secure immediate talent is still within reach for

Bridging The Gap With High-Skilled Immigration Reform

most employers — from large, established companies to startups just beginning to build their teams — if they have a serious need for a particular skill set. This proposal will not solve the broad shortage of H-1B visas overall, given the stark disparity between the current supply of H-1B visas and the demand for skilled workers — particularly during periods of economic growth. But it will make an appreciable impact in addressing the talent crisis many businesses face today due to the shortage of high skilled STEM workers.

In addition to improving the ability of private-sector employers to meet their STEM-based workforce needs, full utilization of this new allocation of visas would generate $200 million in investments for the American STEM pipeline annually. The incentive of immediate visa availability for STEM professionals would also connect participating employers' staffing strategies today directly to the effort to rebuild the American STEM pipeline for tomorrow.

This new allocation fits easily into the existing immigration system, and would incorporate all of the wage requirements, working condition mandates and other workforce protections that have been carefully built into the H-1B program.[51] This new funding would complement, not replace, existing general scholarship and job-training programs administered by the Department of Labor and the National Science Foundation through current H-1B filing fees. H-1B dependent employers — those whose U.S. workforce is made up by 15 percent or more of H-1B workers — would not be eligible to seek these additional visas.

RECOMMENDATION 2

Recapture 20,000 unused employment based green card numbers annually to reduce the green card backlog and generate up to $300 million for new investments in the american STEM pipeline

As part of a strategy to draw the world's best minds into our economy, the massive employment-based green card backlog, which for many current applicants can extend a decade or longer, needs to be cleared. The backlog exists primarily because the number of employment-based green cards each year — also established over two decades ago by the Immigration Act of 1990 — has not kept pace with the number of high skilled professionals sponsored for green cards by employers over the years. The effects of the backlog are worsened by "per country limits," which restrict the number of green cards that can be issued to any country to just 7 percent of the total number of available green cards. The backlog has also been exacerbated by underutilization of hundreds of thousands of congressionally authorized green card numbers from prior years. This underutilization was the result of inefficient government processing procedures that allowed the green card numbers to expire before they could be given to qualified applicants.

These extraordinary delays in the permanent-residence process hinder our country's ability to attract high-skilled immigrants in STEM and other disciplines, and to retain high-skilled foreign STEM talent already employed by companies in the United States. This is especially true as other countries around the world offer competing economic and intellectual opportunities with shorter and more predicable paths to permanent residence. Once these talented, high-skilled immigrants come to our country, those confronted with the green card backlog must forego professional advancement opportunities, endure years of uncertainty, and face tremendous obstacles to such basic endeavors as buying a home. These challenges create a powerful disincentive to investing in the U.S. over the long term, and the resulting loss of existing and future talent in our country only adds to the overall deficit of STEM talent.

To help address this backlog and enable employers to retain targeted high-skilled foreign workers and attract the best and brightest from around the world, the program would authorize recapture of up to 20,000 unused green card numbers annually. To qualify for these green card numbers, employers would invest $15,000 for the development of future American STEM workers for each green card number made available through recapture. The green card numbers would be assignable only to employees who already have an approved PERM labor certification and/or I-140 immigrant visa petition, making them eligible for immediate processing of their green card applications.[52] Dependent family members would also be eligible for immediate green card processing without requiring additional green card numbers.

Bridging The Gap With High-Skilled Immigration Reform

Full utilization of this strategy for the recapture of green cards would generate $300 million in investments for the STEM pipeline annually. Given the finite number of green card numbers available for recapture, this provision would sunset after 10 years. Ultimately, this strategy would effectively reduce the severity of the green card backlog and convert the wasted opportunity of unused green cards into newly realized opportunities for the American STEM pipeline.[53]

This proposal is not simply a request for additional H-1B visas or green card numbers. It is also a call to action for employers to engage directly in efforts to solve the crisis in the American STEM pipeline.

RECOMMENDATION 3

Direct employers' investments from these new, targeted immigration benefits to fund initiatives that strengthen the American STEM pipeline

Together, the program's allocation of additional STEM-specific H-1Bs and recaptured green card numbers has the potential to generate up to $500 million annually — or $5 billion over 10 years — for STEM investments. This level of funding, when applied to the right programs, will have a real and measurable impact on the country's STEM pipeline and the resulting opportunities created for American workers.

The United States needs to keep its doors open to the world's best and brightest, who have been and will always be an important part of our social and economic fabric. Throughout this country's history, the U.S. has led the world in attracting people with ideas and drive, and we have provided them with an environment in which they can flourish. By keeping the channels of immigration open, we have welcomed innovators from around the world who have helped to build and grow our country: Albert Einstein, who revolutionized our thinking about physics; David Ho, who pioneered the fight against AIDS; Tim Berners-Lee, who was one of the inventors of the World Wide Web; and countless others who have contributed important innovations in STEM fields and across the spectrum of human endeavor. Without access to this talent today, private employers face a critical impediment to their ability to innovate and create.

This new approach for these STEM H-1B visas and recaptured green card numbers offers a new way to fund essential efforts to build the STEM pipeline. This proposal is not simply a request for additional H-1B visas or green card numbers. It is also a call to action for employers to engage directly in efforts to solve the crisis in the American STEM pipeline. It is a set of immigration reforms that are specifically reserved for securing critical STEM expertise, for today and for the future. It provides an important new source of funding for the STEM pipeline without placing a new burden on existing government revenue streams at the federal, state or local level. At the same time, it ensures that employers who are high-level investors in STEM talent can maintain a solid foundation to innovate, compete and create jobs. And most important, it establishes a common sense but vital conceptual nexus between employers' access to crucial STEM talent today with the preparation of future American STEM talent for tomorrow.

A National Talent Strategy: Summary

The United States faces a growing economic challenge — a substantial and increasing shortage of individuals with the skills needed to fill the jobs the private sector is creating. Microsoft spends more on research and development than any other company in the world, and spends 83 percent of its R&D budget in the U.S. We are opening jobs faster than we can fill them and so see these problems firsthand. We know we are not unique. The U.S. government estimates that there are 3.7 million open jobs in the U.S. economy. Amid this total there is a well-documented national shortage of individuals with engineering and computer science skills. Unless the situation changes, there is a growing probability that unfilled jobs will migrate over time to countries that graduate larger numbers of individuals with STEM (science, technology, engineering and mathematics) backgrounds.

Rather than simply watch these economic forces continue to unfold, we have decided to help. In addition to our own programs and initiatives that help tackle these issues, we have also decided to speak out to bring attention to key policy ideas and recommendations. We believe we need a two-pronged approach that will couple long-term improvements in STEM education in the United States with targeted, short-term, high-skilled immigration reforms. If done correctly, the latter can help fund the former. Put together, this approach can create a more effective national talent strategy to keep jobs in the U.S. by providing skilled employees who can fill these jobs, here, both now and in the future.

We are committed to doing our part and hope business, education and government can come together to pursue this common goal. The recommendations in this document will require coordinated commitment and action by federal, state and local governments, by K–12 schools and higher education, and by foundations and companies. Through policy advances, programmatic investments and incentives, we can achieve systemic change and make strides toward overcoming the opportunity divide and maintaining U.S. leadership in the innovation economy.

Part 1:
Race To The Future: Strengthening America's STEM Pipeline

Concrete actions to strengthen America's STEM pipeline of skilled and educated workers so that we can meet the future projected workforce needs with American citizens. In essence, a national "Race to the Future" initiative.

Goal #1:

Strengthen K-12 math and science teaching and learning to better prepare students for college and possible careers in these disciplines.

Recommendations:

1. Implement the new math and science national standards across the country.
2. Recruit more K-12 STEM teachers and invest in training resources for them.
3. Innovate in STEM delivery and teaching practices.

Goal #2:

Broaden Access to Computer Science in High School.

Recommendations:

1. Recruit and prepare more high school computer science teachers and provide them with the resources they need to succeed.
2. Ensure core credit for computer science and include computer science in accountability measures.
3. Raise awareness of what computer science is and why it matters.

Part 1,Cont'd.

Goal #3:
Help Americans Get the Degrees and Credentials That Twenty-First Century Jobs Require.

Recommendations:
1. Incentivize and fund strategies that recognize the realities of today's student body.
2. Make degree programs easier to navigate from start to finish.
3. Incentivize colleges to focus on completion rates and ensure transparency.
4. Increase Capacity for STEM Degrees in Higher Education, with a Particular Focus on Computer Science.

Part 2:
Bridging The Gap With High-skilled Immigration Reform
Targeted changes to high-skilled immigration to both bridge the short-term skills gap and help fund some of the investments in strengthening the STEM pipeline

Recommendation #1:
Establish a new and supplemental allocation of 20,000 H-1B STEM visas to meet employers' hiring needs and generate up to $200 million for new investments in the American STEM pipeline.

Recommendation #2:
Recapture 20,000 unused employment-based green card numbers annually to reduce the green card backlog and generate up to $300 million for new investments in the American STEM pipeline.

Recommendation #3:
Direct employers' investments from these new, targeted immigration benefits to fund initiatives that strengthen the American STEM pipeline

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7 National Science Foundation. Science and Engineering Indicators 2012. "Chapter 2: Higher Education in Science and Engineering." Available at http://www.nsf.gov/statistics/seind12/c2/c2h.htm.
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16 Bureau of Labor Statistic. Economic News Release (Table A-4). Available at http://www.bls.gov/news.release/empsit.t04.htm.
17 Belfield, Levin, and Rosen (2012). The Economic Value of Opportunity Youth. Available at http://www.serve.gov/new-images/council/pdf/econ_value_opportunity_youth.pdf.
18 ACT Inc. The Condition of College & Career Readiness 2011. Available at http://www.act.org/research/policymakers/cccr11/readiness1.html.
19 Only 8.1 percent of students who entered postsecondary education in 2004/5 had attained a STEM degree by 2009. Source: President's Council of Advisors on Science and Technology. Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics. Table C-7. Available at http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-engage-to-excel-final_2-25-12.pdf. Derived from: Preliminary Estimate — U.S. Department of Education, National Center for Education Statistics, 2003–04 Beginning Postsecondary Students Longitudinal Study, Second Follow-up (BPS:04/09).
20 Fleishman, Hopstock, Pelczar, and Shelley (2010). Highlights from PISA 2009: Performance of U.S. 15-Year-Old Students in Reading, Mathematics, and Science Literacy in an International Context (NCES 2011–004). U.S. Department of Education, National Center for Education Statistics. Available at http://nces.ed.gov/pubs2011/2011004.pdf.
21 Unfortunately, the draft of these Standards, released this past spring, currently does not do enough to integrate fundamental computer science concepts. This must be corrected if these standards are to have the desired impact of providing students with the full STEM knowledge and understanding they require in the 21st century.
22 According to the National Center for Education Statistics, there were 30,381 public schools and 11,941 private schools with secondary grades in the 2009–2010 school year. Source: http://nces.ed.gov/programs/digest/d11/tables/dt11_091.asp
23 The College Board's database of AP Course Audits. Available at https://apcourseaudit.epiconline.org/ledger/search.php
24 College Board. AP Exam Grades, Summary Reports: 2011. Available at http://www.collegeboard.com/student/testing/ap/exgrd_sum/2011.html.
25 Ibid
25.1 From the Computer Science Teachers Association K-12 Computer Science Standards; see http://csta.acm.org/Curriculum/sub/K12Standards.html.
25.2 One example that includes many of these topics is Exploring Computer Science curriculum; see http://www.exploringcs.org/curriculum.
25.3 Information about the development of a new AP computer science course, CS Principles, is available at http://www.collegeboard.com/html/computerscience/index.html.
25.4 Georgetown University Center for Education and the Workforce report on STEM (October 2011), by Anthony P. Carnevale, Nicole Smith, and Michelle Melton, available at http://cew.georgetown.edu/stem/.
25.5 Based on Table 2 of the U.S. Department of Commerce's Economics and Statistics Administration report on STEM workforce; available at http://www.esa.doc.gov/sites/default/filesnews/documents/stemfinalyjuly14.pdf
26 Computer Science Teachers Association. Ensuring Exemplary Teaching in an Essential Discipline: Addressing the Crisis in Computer Science Teacher Certification. Available at http://csta.acm.org/Communications/sub/DocsPresentationFiles/CertificationFinal.pdf.
27 More information about TEALS is available at http://tealsk12.org/.
28 A core set of learning standards designed to provide the foundation for a complete computer science curriculum and its implementation at the K–12 level have been developed and are maintained by the Computer Science Teachers Association. Available at http://csta.acm.org/Curriculum/sub/K12Standards.html.
29 Letter from Industry and Academic Leaders Raising Concerns about the Development of NGSS. Available at http://www.computinginthecore.org/newsroom/computing-and information-technology-community-concerned-about-the-dev/.
30 Association for Computing Machinery & Computer Science Teachers Association (2010). Running On Empty: The Failure to Teach K–12 Computer Science in the Digital Age. Available at http://www.acm.org/runningonempty/. This report found that only 14 states have adopted more than 50 percent of ACM and CSTA's national model computer science standards in their secondary state education standards for computer science instruction. Further, it found 14 states (and the District of Columbia) that did not have even one upper-level standard for computer science instruction as part of their secondary education standards.
31 Carnevale, Anthony, Smith, Nicole, & Strohl, Jeff. Help Wanted: Projections of Jobs and Education Requirements Through 2018. Georgetown Center on Education and the Workforce (2010). Available at http://cew.georgetown.edu/jobs2018/.
32 Complete College America. The Completion Shortfall. Available at http://www.completecollege.org/completion_shortfall/.
33 Stan Jones, President of Complete College America, Testimony before the United States House of Representatives, Subcommittee on Higher Education and Workforce Training, July 18, 2012. http://dl.dropbox.com/u/28697036/Stan%20Jones%20Testimony%20to%20House%20Ed%20-%207-18-12.pdf.
34 National Center for Education Statistics. Integrated Postsecondary Education Data System (IPEDS) Graduation Rate Survey. Available at http://www.higheredinfo.org/dbrowser index.php?submeasure=27&year=2009&level=nation&mode=data&state=0.
35 National Center for Education Statistics. Integrated Postsecondary Education Data System (IPEDS) Graduation Rate Survey. Available at http://www.higheredinfo.org/dbrowser/ ?level=nation&mode=data&state=0&submeasure=24.
36 Organization for Economic Co-operation and Development (OECD). Education at a Glance 2011: United States Country Note. Available at http://www.oecd.org/education/ highereducationandadultlearning/48678896.pdf.
37 Complete College America. The Completion Shortfall. http://www.completecollege.org/completion_shortfall/. Originally sourced from U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), 2007.

38 College Complete America. The Completion Shortfall. http://www.completecollege.org/completion_shortfall/. Originally sourced from National Center for Higher Education Management Systems (NCHEMS). ACS Educational Attainment by Degree-Level and Age Group. Available at: http://www.higheredinfo.org/dbrowser/?level=nation&mode=data&state=0&submeasure=240.

39 President's Council of Advisors on Science and Technology. Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics. http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-engage-to-excel-final_2-25-12.pdf. This report derived the number from U.S. Department of Education, National Center for Education Statistics, 2003-04 Beginning Postsecondary Students Longitudinal Study, Second Follow-up (BPS:04/09), See Appendix C of PCAST Report.

40 Attewell and Lavin. "The Other 75%: College Education Beyond the Elite." Weinberg Seminar Remarks. April 15, 2008.

41 Stan Jones, President, Complete College America, Testimony before the United States House of Representatives Subcommittee on Higher Education and Workforce Training, July 18, 2012.

42 Testimony before the United States House of Representatives, Subcommittee on Higher Education and Workforce Training, by Stan Jones, President of Complete College America, July 18, 2012. http://dl.dropbox.com/u/28697036/Stan%20Jones%20Testimony%20to%20House%20Ed%20-%207-18-12.pdf.

43 Ibid

44 College Complete America. Time Is the Enemy: The surprising truth about why today's college students aren't graduating . . . and what needs to change. Available at http://www.completecollege.org/docs/CCA_national_EMBARGO.pdf.

45 One example of a successful implementation of this approach is the Tennessee Technology Centers, which help direct students' choices and structure academic delivery. Three-quarters or more of their students earn career certificates in twelve to eighteen months going full-time, five days a week, from 8am – 2pm. Every year over 12,000 students move through the multiple Technology Center campuses and nearly all of them head straight into jobs. The City University of New York (CUNY) also has a highly successful program (ASAP) for accelerated completion of associate degrees which graduates its students on time at more than twice the rate of their peers. That program has been so successful the system will soon open an entire campus designed to utilize block scheduling, student cohorts, directed choice, embedded remediation and reinvented supports. (Stan Jones, President, Complete College America, Testimony before the United States House of Representatives Subcommittee on Higher Education and Workforce Training, July 18, 2012.)

46 Complete College America. Essential Steps for States: Shift to Performance Funding. Available at http://www.completecollege.org/docs/CCA%20Essential%20Steps%20Shift%2to%20Performance%20Funding.pdf.

47 Stan Jones, President, Complete College America, Testimony before the United States House of Representatives Subcommittee on Higher Education and Workforce Training, July 18, 2012.

48 Computing Degree and Enrollment Trends, from the 2010-2011 CRA Taulbee Survey, Computing Research Association, by Stuart Zweben, http://cra.org/uploads/documents/resources/taulbee/CS_Degree_and_Enrollment_Trends_2010-11.pdf.

49 Nick Wingfield. "A Northwest Pipeline to Silicon Valley." The New York Times. July 7, 2012. Available at http://www.nytimes.com/2012/07/08/technology/u-of-washington-a northwest-pipeline-to-silicon-valley.html.

50 At Microsoft, our search for qualified workers extends nationwide. Our challenge in finding sufficient numbers of qualified high skilled STEM professionals persists, even with total compensation for the typical research or engineering role at Microsoft exceeding $100,000 annually.

51 The new allocation of H-1B visas would still be subject to the U.S. worker protections and employer obligations of the underlying labor condition applications certified by the Department of Labor for H-1B petitions.

52 By reserving the usage of recaptured green card numbers only for those employees for whom PERM labor certifications and/or I-140 immigrant visa petitions have been approved, the underlying protections for U.S. workers are sustained.

53 Although our proposal would improve waiting times for green cards generally, the greatest impact would be experienced by the individual employees who would be assigned to the immediately available green card numbers. To address broader green card backlog and distribution issues, a combination of strategies is required, including the elimination of "per country limits" and additional sources of green cards. For this reason, we fully support the passage of the Fairness for High Skilled Immigrants Act, and favorably view proposals to streamline the green card process for advanced degree STEM graduates of U.S. universities. These types of strategies are fundamentally compatible and synergistic with our proposal.