BHEF/ACT Policy Brief

MAY 2014

Now in its 36th year, the Business-Higher Education Forum (BHEF) is the nation's oldest membership organization of Fortune 500 CEOs, prominent college and university presidents, and other leaders dedicated to advancing innovative education and workforce solutions and improving US competitiveness. BHEF's business and academic members collaborate in regions across the country to design and deploy education-workforce solutions in the high-demand and emerging fields that are critical to innovation and national security. BHEF and its members generate insights from research, modeling, and regional projects; work to influence public policy at the national and state levels; and inspire other leaders to act.

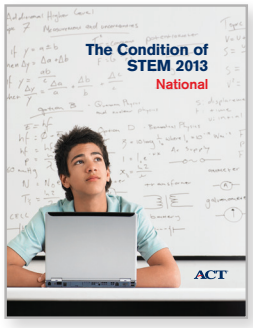
At ACT—a nonprofit organization—we are driven by our mission, our vision, and our values. Best known for the ACT college readiness assessment to help students gain admission to college, but offering much more, ACT gives individuals the information and tools they need to achieve education and workplace success. We value learning, diversity, excellence, sustainability, leadership, and empowerment. We understand the urgency to improve education and workplace skills so people can successfully compete in today's world. We embrace the opportunity to improve lives and to help shape effective policy discussions about how to ensure better educational and career opportunities for individuals throughout their lifetimes.

Building the Talent Pipeline: Policy Recommendations for *The Condition of STEM 2013*

Introduction

ACT has been a leader in measuring college and career readiness trends for decades. Each August, ACT releases *The Condition of College & Career Readiness* (www.act.org/newsroom/data/2013), our annual report on the progress of the ACT-tested graduating class relative to college readiness. Nationally, 54.3% of the 2013 graduating class took the ACT® college readiness assessment. The continued increase of test takers enhances the breadth and depth of the data pool, providing a comprehensive picture of the current college readiness levels of the graduating class as well as offering a glimpse of the emerging national educational pipeline. It also allows us to review various aspects of the ACT-tested 2013 graduating class.

In February 2014, ACT released *The Condition of STEM 2013* (www.act.org/stemcondition/13/), a report series that reviews the graduating class in the context of STEM (Science, Technology, Engineering, Mathematics)-related fields.



This report, *Building the Talent Pipeline: Policy Recommendations for The Condition of STEM 2013*, is a collaboration between ACT and the Business-Higher Education Forum (BHEF). The report was created to offer recommendations relative to the results of *The Condition of STEM 2013*. The recommendations fall into three key markets: higher education, business, and government.

We hope this report starts discussions and creates actionable steps to improve achievement levels in STEM-related fields. As a nation, we need to improve the STEM education pipeline, moving more individuals into the STEM jobs that will drive our economy in the future.

K–12 Policy Recommendations

Education in science, technology, engineering, and mathematics (STEM) is vital to the ability of the United States to maintain its position of global leadership and economic competitiveness. With more than 8.6 million STEM-related jobs anticipated by the year 2018, preparing and encouraging our students to pursue STEM majors and careers becomes even more important. Unfortunately, students on average are struggling to succeed in STEM-related subjects. ACT's *The Condition of College & Career Readiness 2013* national report found that only 44% of ACT-tested high school graduates are ready for credit-bearing first-year college mathematics courses, and only 36% are similarly ready in science.

The Condition of STEM 2013 national report reviews student performance on the ACT in the context of STEM-related fields and examines students' level of interest in these fields via the ACT Interest Inventory. The following policy recommendations are grounded in the report's findings and collectively discuss ways to improve STEM-related student performance and increase student interest in STEM.

1. Support adoption, implementation, and measurement of college- and career-ready mathematics and science standards.

While almost half (48.3%) of the ACT-tested high school graduating class of 2013 indicate some interest (expressed, measured, or both[1]) in STEM majors or occupations, too few students are meeting college and career readiness benchmarks in these subjects. Of those students with an expressed and measured interest in STEM, only 51% met the ACT College Readiness Benchmark for science, while 58% met the mathematics ACT College Readiness Benchmark. Implementation and measurement of STEM standards will better prepare students with interests in STEM majors and careers to meet benchmarks in those areas of interest.

Given the 2.4 million job openings for STEM workers between 2008 and 2018[2] and the rapid rise of STEM jobs compared to non-STEM jobs in the last 10 years,[3] state adoption of college- and career-ready mathematics and science standards is critical to bridging the gaps between students' interests and preparedness and the demands of the present and future economy.

2. Encourage students with expressed and/or measured interests in STEM to pursue STEM-related fields earlier in their educational careers.

A significant population of students interested in pursuing STEM majors and occupations already exists. Developing innovative approaches to identifying greater numbers of interested students and fostering this interest earlier in their educational experience (i.e., before high school) can help cement interest and accelerate progress in STEM. For example, students need more information about which majors or jobs are in STEM areas. States, communities, and the federal government need to provide students with better information and exploratory opportunities about STEM careers and majors.

3. Improve and support STEM achievement among female students.

Although women currently represent just 24% of those in STEM fields, 46% of ACT-tested female students reported an interest in pursuing STEM majors and occupations in 2013. However, only 51% of those students are meeting the mathematics ACT Benchmark, and just 43% are meeting the science ACT Benchmark. Greater effort needs to be made to encourage and support women's achievement in STEM and their pursuit of STEM majors and careers.

4. Improve STEM achievement among ethnically diverse groups of students.

Among African American, American Indian, and Hispanic students with expressed or measured interests in STEM, only 24%, 32%, and 44%, respectively, met the mathematics ACT Benchmark and just 18%, 25%, and 33% met the science ACT Benchmark. STEM research, program development, and innovation efforts should include a focus on accelerating the college and career readiness of ethnically diverse students, particularly those with an interest in STEM.

5. Support targeted STEM-related professional development for K–12 teachers.

The most recent ACT National Curriculum Survey® suggests a misalignment between K–12 and postsecondary science curricula. For example, middle and high school science teachers rate the importance of science process skills much lower than do college instructors.[4] Such misalignments may hamper students' preparation for college-level STEM courses and careers in STEM-related fields. Better training of teachers to deliver rigorous STEM curricula will improve students' preparation and achievement.

6. Encourage universal adoption of a common definition of STEM.

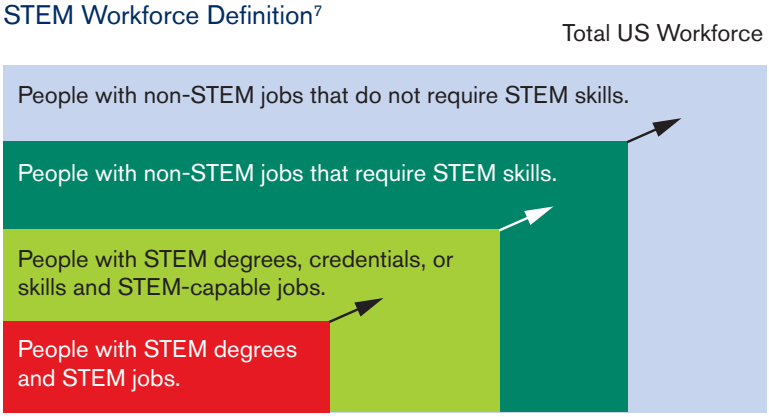
To better assess and track student achievement, a common definition of STEM should be adopted that encompasses four main areas:

- **Science**—Includes majors and occupations in the traditional hard sciences, as well as sciences involving the management of natural resources. Also includes science education.
- **Computer Science and Mathematics**—Includes majors and occupations in the computer sciences, as well as general and applied mathematics. Also includes mathematics education.
- **Medicine and Health**—Includes majors and occupations in the health sciences and medical technologies.
- **Engineering and Technology**—Includes majors and occupations in engineering and engineering technologies.

The demand for STEM skills

STEM skills drive innovation and productivity. The demand for both STEM graduates and STEM skills was documented in the 2012 report *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics* by the President's Council of Advisors on Science and Technology (PCAST).[5] In response to the PCAST report, President Obama set an aggressive goal of adding 1 million STEM graduates in a decade to the US workforce. In addition to the need for STEM graduates, the report also highlighted the demand for STEM skills, such as data analysis and interpretation, complex problem solving, as well as mathematics in non-STEM jobs. Many employers typically fill non-STEM jobs with individuals who possess STEM skills—such as engineers being hired by the financial services industry—thus creating even more of a demand for graduates who possess STEM degrees.[6]

STEM Workforce Definition[7]



Within the US economy, increasing numbers of job categories require various levels of STEM skills. Increasingly, innovation and competitiveness require new types of employees with either a specialist or an enabled competency in STEM-related careers. These employees do not necessarily have to be traditionally trained scientists, possessing years of postgraduate work. They can instead be sufficiently educated to develop STEM skills and apply their expertise to solving the country's most pressing problems while driving innovation.

About half of the students who declare or intend to major in STEM fields ultimately leave STEM undergraduate programs.[8] Thus, there is a need to increase student persistence and to identify non-STEM graduates—particularly those who leave STEM majors or who are math ready but disinterested in a STEM career—as potential talent for non-STEM jobs that require STEM skills.

The Business-Higher Education Forum's (BHEF) National Higher Education and Workforce Initiative—in partnership with BHEF members' academic institutions and companies in high-demand industry sectors—creates regional, cross-disciplinary projects in emerging fields including data science and analytics, cybersecurity, engineering, and materials science. In the private sector, for example, broad demand

exists for data analytics–enabled professionals in core management functions, marketing, communications, visual arts, and health care delivery. In the nonprofit sector, significant demand exists among cultural institutions for analytics-enabled professionals. These fields require a cadre of professionals with STEM skills, and undergraduates in non-STEM majors (economics and sociology, for example) can be a valuable new source of talent if they possess the necessary knowledge. They can also provide a new talent strategy for meeting businesses' demands for STEM skills. But undergraduates, particularly those in non-STEM majors, have limited exposure to courses in these emerging fields early in their college experience. Frequently, postsecondary institutions do not integrate these courses into undergraduate programs for non-STEM majors.

By collaborating, business and higher education can accomplish two important goals: create new educational programs and integrate learning opportunities not only in emerging fields but also into the broader higher education curriculum. Such strategic partnerships will result in a more diverse talent pool entering the specialist and enabled workforces. Further, the federal government should weigh in at key junctures to incentivize the work underway and foster the development of more aligned education and workforce systems.

The following policy recommendations discuss how higher education, business, and government can improve the talent pipeline for STEM and STEM-related careers.

Recommendations for higher education

1. Improve access to and persistence in STEM majors, especially for women and underrepresented minorities.

Academic achievement gaps continue to exist among underrepresented minorities and women. In addition, interest in STEM is low for African Americans, Hispanics, and women.[9] Research conducted when developing BHEF's US STEM Undergraduate Model and its National Higher Education and Workforce Initiative identified several evidence-based strategies for increasing access and persistence of students in completing degrees, achieving better grades and higher satisfaction with school, and learning how to apply knowledge in real-world settings. One way to help improve access is to implement bridge programs. These programs provide a cohort-style series of courses, activities, and learning experiences to help students make a smooth transition from high school to college.

To improve persistence, higher education institutions should consider implementing some or all of the following evidence-based practices: introductory course redesign; research internships earlier in the academic experience; freshman research experiences; cognitive tutors; multiple mentors; and student learning communities. Implementing multiple interventions simultaneously can have a significant impact on the retention and academic success of undergraduates, particularly women and underrepresented minorities.[10]

2. Develop more opportunities for non-STEM majors to explore STEM-related fields and prepare for STEM-related careers earlier in their higher education experience.

Nearly 41% of 2013 ACT-tested high school graduates attained the ACT College Readiness Benchmark in mathematics, and 37% attained the science Benchmark. Yet most did not express interest in STEM majors or careers.[11] To attract these students into STEM-enabled careers, higher education institutions can redesign freshman-level and introductory courses to expose these students to STEM-related fields earlier in their postsecondary education experience. Introductory courses should be redesigned by moving away from traditional lectures and the lecture-homework-exam format to a student-centered active learning format. A more student-centered format will engage students through active learning with business partners who provide business-relevant, real-world projects, guest lectures, or course codevelopment. By implementing these practices, the classroom experience is more closely aligned to the professional setting, thereby motivating students to apply what they learned in the classroom. Redesigned curricula have been found to improve student performance and satisfaction, strengthen professional competencies, and enhance instructor confidence.

3. Integrate analytical and quantitative skills into required courses in non-STEM majors as a way to expand the talent pipeline of STEM-enabled graduates.

To increase the talent pipeline of STEM-enabled graduates, higher education institutions can integrate quantitative and qualitative skills in non-STEM majors. These skills can be incorporated in a variety of ways: integrating them into existing courses, creating new courses, or developing new certificates or minors. For example, a student could major in anthropology and also earn a certificate in data science. The student would have the skills necessary to enter the STEM-enabled workforce, and businesses would have access to a more diverse talent pool of STEM-enabled graduates.

4. Create and define career pathways, especially those from community colleges to four-year higher education institutions that lead to bachelor's degrees in STEM-related and emerging fields.

Community colleges are a critical gateway into four-year baccalaureate programs, with between 50–80% of all incoming community college students seeking to transfer and earn a bachelor's degree.[12] Nationally, 47% of community college students are members of minority groups and 36% are the first in their families to enroll in postsecondary education.[13] Four-year institutions must strengthen or create new career pathways that allow students to transition from community colleges to four-year institutions more easily. Community colleges play an important role in preparing science and engineering degree holders.[14]

Emerging fields such as data science and cybersecurity offer opportunities to build new career pathways beyond the traditional STEM majors. While sub-baccalaureate certificates and degrees are vital, many jobs in these emerging fields require a bachelor's degree. For example, 84% of cybersecurity job postings specify at least a bachelor's degree.[15] The good news is that there are many pathways for students to earn bachelor's degrees and reach their career goals. "On-ramps" can be built from many levels—high school diploma plus work experience, sub-baccalaureate certificates, military experience, or an associate's degree. Students can also enter through a four-year baccalaureate program. The career pathway design has to be flexible and careful about creating overly prescribed or narrow occupational paths that are either unresponsive to an evolving field or obstruct talent from entering the field. Further, it must simultaneously offer industries a way to identify and cultivate talent while recognizing students' various pathways to success.[16]

Recommendations for business

1. Create strong demand signals for high-skill, high-demand STEM and STEM-enabled career opportunities.

Business leaders should inform higher education faculty and administrators about the knowledge, skills, and abilities required in high-skill, high-demand careers. In addition, business leaders must emphasize the necessary work experience and certifications required for entry-level jobs—and they must improve how they convey this information. If conveyed effectively, higher education will respond by creating curricula and learning opportunities that will build robust undergraduate pathways and produce both STEM experts and STEM-enabled graduates across all industry sectors.

2. Build and sustain business and higher education partnerships that support the acquisition of STEM skills for all undergraduates.

Businesses must move from transactional relationships to strategic partnerships with higher education institutions. By implementing the following five strategies, businesses can use their expertise to align undergraduate education with workforce needs.

- **Engage corporate leadership.** C-suite executives provide "grass-top" engagement to (a) shape internal and external messaging to raise community awareness of workforce requirements and the academic response to those requirements; (b) build a critical mass of peers focused on undergraduate education in support of workforce development goals; and (c) guide corporate and academic policy development to ensure that both sectors align with shared strategic education and workforce development goals.

- **Strategically focus corporate philanthropy on undergraduate education**. When undertaken in concert with college or university strategic planning and regional workforce assessment, philanthropy can serve as a vital catalyst for positive, lasting, and high-impact change in higher education and workforce alignment.
- **Identify and tap core competencies and expertise**. Managers, engineers, and other subject matter experts represent expertise in business. They bring intellectual resources, field experience, skills, and competencies to bear on strengthening the education-to-workforce pipeline through efforts such as codevelopment of new courses focused on active learning, student research opportunities, and other learning experiences.
- **Facilitate and encourage employee and staff engagement.** Partnerships can organize the hundreds or thousands of employees within an organization to support strategic educational goals. This human capital can be mobilized to act both inside and outside the corporation or higher education institution, providing grassroots support and advocacy in the planning and implementation of educational reform.
- **Expand the focus of funded research to undergraduate education.** Research conducted in college and university laboratories can serve as platforms for early research experiences for freshmen and sophomores, which has been shown to increase student persistence. Corporate laboratories and research centers can provide unique real-world learning opportunities for undergraduates and can expand the capacity of higher education institutions to offer such experiences to students.

Recommendations for government

1. Fund the redesign of freshman-level introductory courses across all STEM majors.

President Obama should instruct federal agencies that oversee STEM education programs, particularly the National Science Foundation, to support the redesign of introductory undergraduate courses across all STEM majors. Strategic engagement between business and higher education can support the development of freshman-level introductory courses that expose students to emerging fields, such as data science and cybersecurity. Introductory courses could include information that would explain how these fields might impact majors and courses of study. Having this knowledge at the beginning of their undergraduate experience, and with the support of business, including mentors and internships, students are more likely to complete their degree and thus boost the STEM talent pipeline.

For example, as part of the Association of American Universities' STEM Education Initiative, the University of Arizona is redesigning introductory STEM courses to improve information and quantitative literacy by incorporating the use of real-life applications in problem solving. The university is also expanding its use of hands-on demonstrations and experiments in introductory courses, helping to develop conceptual understandings of central theories in biology and engineering.[17]

2. Provide support to higher education institutions to embed STEM skills in non-STEM majors.

The need for employees to possess high levels of STEM skills has increased by nearly 60% since 1980.[18] As the demand for STEM skills increases, STEM graduates have more opportunities to pursue careers in both STEM and non-STEM jobs. The increase in demand for STEM skills creates challenges for businesses with STEM jobs to attract graduates with STEM degrees. To address this demand for STEM skills outside of STEM occupations, the National Science Foundation should provide grants to higher education institutions. The grants would be used to develop new courses for non-STEM majors that embed the analytical and quantitative skills many businesses want. By integrating STEM skills in non-STEM majors, the need for STEM skills in non-STEM jobs could be filled by non-STEM majors who acquire the analytical and quantitative STEM skills in their programs of study. ■

Endnotes

1 An "expressed" interest is choosing a major or occupation that corresponds with STEM fields. A "measured" interest is a response on the ACT Interest Inventory that indicates an interest in a STEM-related major or occupation.

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4 *ACT National Curriculum Survey 2012*: Science.

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