BHEF BUSINESS-HIGHER EDUCATION FORUM®

BHEF Policy Brief

November 2011

Meeting the STEM Workforce Challenge: Leveraging Higher Education's Untapped Potential To Prepare Tomorrow's STEM Workforce

Innovations in science and engineering have driven economic growth in the United States over the last five decades. More recently, technology has risen to become a defining driver of productivity in business and industry. In that context, college graduates in science, technology, engineering, and mathematics (STEM) disciplines provide critical talent that fuels America's competitive ability. Unfortunately, the United States is not producing enough STEM specialists, STEM teachers, or STEM-literate citizens to sufficiently drive innovation, spur economic growth, and produce engaged, informed leaders and citizens.

Leaders in business, education, and government have recognized that the United States must develop more home-grown talent in STEM disciplines to meet workforce demand. Today, too few of our students are prepared for and interested in pursuing training, degrees, and careers in STEM-related fields. Moreover, as baby-boomer STEM workers rapidly approach retirement age, their replacements will increasingly be women and minorities, two groups that historically have had low participation rates in these fields.

Projections suggest that STEM-related employment opportunities will grow nearly 17 percent over the next decade, and that more than 90 percent of those jobs will require a college degree or higher.[1] In addition, impeding retirements of workers with STEM skills threaten to exacerbate the shortage of workers in many technology-based sectors.

Even in the face of this intensifying demand, the production of STEM graduates is stagnating. While the number of degrees awarded in STEM fields increased modestly over the last five years, the overall percentage of STEM degrees decreased during the same period. And while nearly a quarter of all undergraduates begin their studies in a STEM major, only half will graduate with a STEM degree. Even fewer women, Hispanics, and African Americans earn a STEM degree.[2]

As the number of American workers who obtain STEM degrees stagnates, American business has had to look abroad for STEM-capable talent. Foreign nationals made up a quarter of STEM workers with a postsecondary degree in 2003.[3] In order to remain globally competitive in the future, the United States will need to increasingly develop more of the talent in its own schools and universities and also reexamine

---

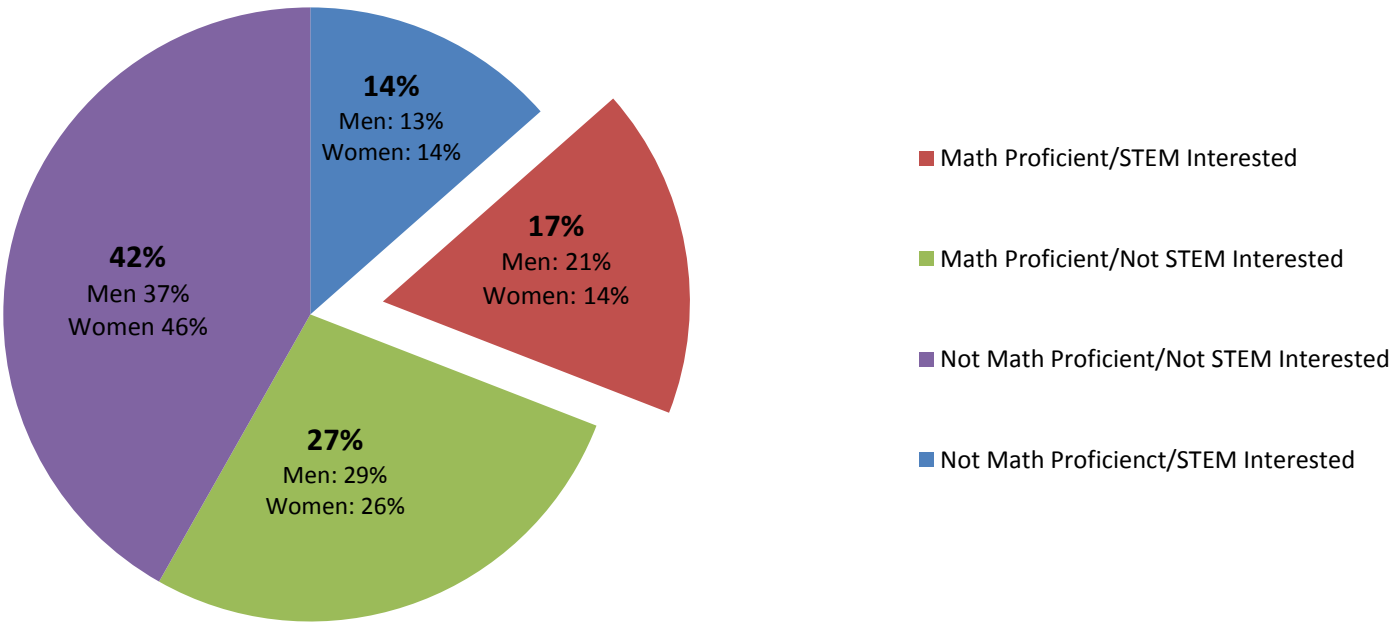
The Business-Higher Education Forum (BHEF) is the nation's oldest organization of senior business and higher education executives dedicated to advancing innovative solutions to U.S. education and workforce challenges. Composed of Fortune 500 CEOs, prominent college and university presidents, and other leaders, BHEF addresses issues fundamental to our global competitiveness. It does so through two initiatives: the College Readiness, Access, and Success Initiative (CRI), and the Securing America's Leadership in Science, Technology, Engineering, and Mathematics (STEM) Initiative. BHEF and its members drive change locally, work to influence public policy at the national and state levels, and inspire other leaders to act. Learn more at www.bhef.com.

its visa policies that currently require American trained foreign born students to leave the U.S. after completing STEM degrees.

The STEM Interest/Proficiency Challenge

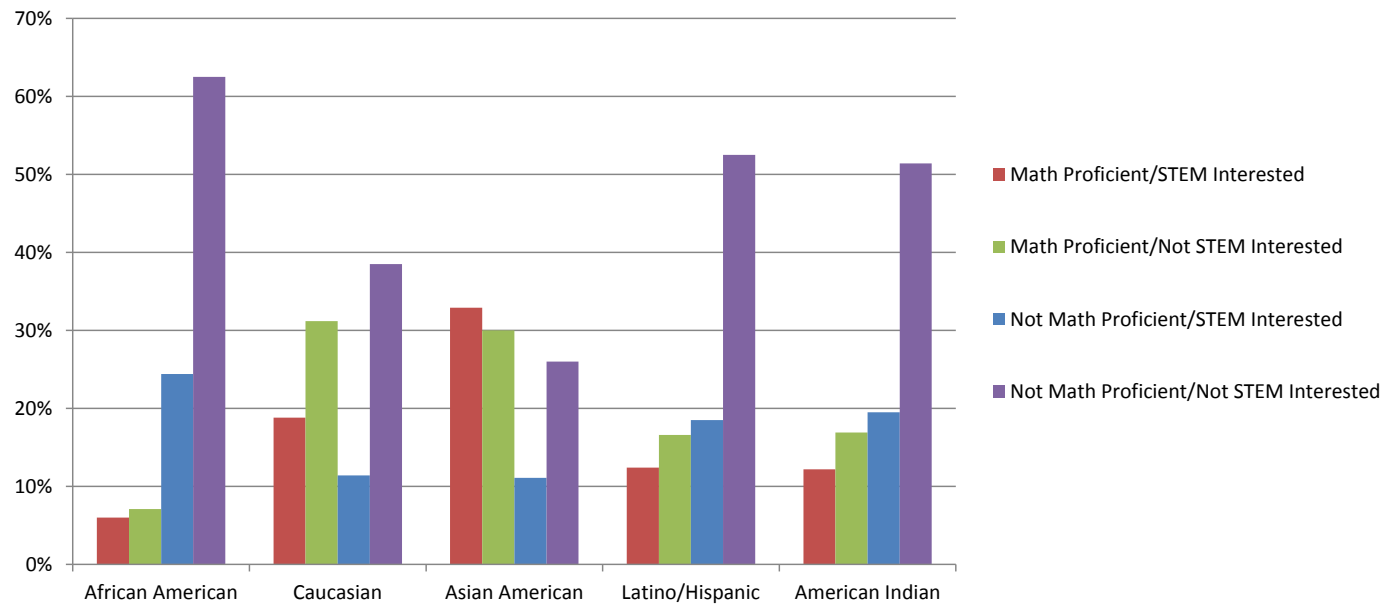
Despite decades of P-12 education reform efforts, we have seen little increase in students' proficiency in mathematics and science. In fact, the most recent results from ACT indicate that fewer than half of all 12th grade test takers met the college readiness benchmarks in math and science.[4] In addition, the level of interest in STEM majors and careers is strikingly low—fewer than one in three college-bound high school seniors is interested in STEM and fewer than one in five is both interested in STEM *and* proficient in mathematics, the critical gatekeeper to STEM courses, majors, and careers (see Figure 1). These low levels of STEM interest and math proficiency stand in stark contrast to the demand for STEM knowledge and skills in the workforce. In a recent survey of 300 U.S. companies, 70 percent of employers said colleges should place more emphasis on learning outcomes related to identifying knowledge of concepts and new developments in science and technology.[5]

Figure 1: 12th grade student STEM interest and math proficiency



SOURCE: Business-Higher Education Forum. (2011). *The STEM interest and proficiency challenge: Creating the workforce of the future.* Washington, DC: Author.

Figure 2: STEM interest and math proficiency differ by race/ethnicity



SOURCE: Business-Higher Education Forum. (2011). *The STEM interest and proficiency challenge: Creating the workforce of the future.* Washington, DC: Author.

The STEM Higher Education and Workforce Supply Chain

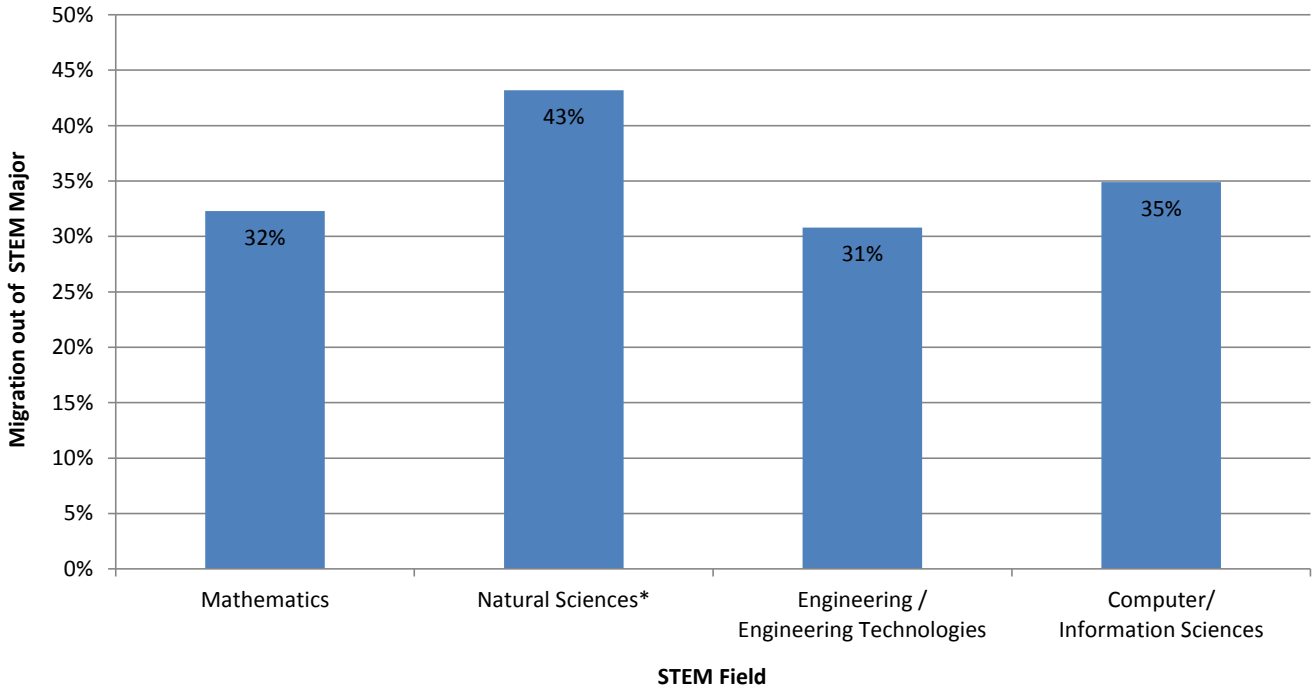
To date, the national dialogue regarding STEM education has largely focused on K-12 education. However, significant challenges must be addressed in higher education in order to increase the number of students who obtain baccalaureate degrees and advanced training in STEM fields to meet workforce demand. Key disruptions exist at every point in the STEM human capital supply chain: In preparation for college; persistence in STEM majors; inadequate development of high-demand skills in undergraduate education; poor linkage between employers' needs and graduate training; and the diversion of nearly half of STEM graduates into non-STEM jobs.

- Almost half of the STEM-interested 12th grade students do not possess the requisite foundational skills in mathematics or science, and require remediation to succeed in postsecondary institutions. Math proficiency is particularly low for under-represented minorities (see Figure 2).
- A high percentage of students migrate *out* of STEM to graduate from non-STEM majors (see Figure 3). Moreover less than half the students intending to major in STEM fields graduate with a STEM degree, and more than a third leave between freshman and sophomore year.[6] This trend is particularly striking among women and minority students, who leave these fields in greater numbers, even when they have similar preparation and performance compared to their non-minority and male counterparts.
- The picture for students starting at community colleges is especially grim. Only 7.3 percent of students who start undergraduate education in STEM at a community college earn a STEM baccalaureate degree within six years.[7]
- Despite a preeminent U.S. graduate education system, particularly in STEM fields, these programs also face challenges, including low numbers of U.S. born students, low degree completion rates, and lack of training that specifically meets the evolving needs of employers. Today, business, industry, and the public sector require

professionals with a combination of scientific, technical, and managerial skills—the so-called "T-shaped professional—which is not the type of skill-set necessarily cultivated in graduate education.

- Nearly half of all STEM degree holders are diverted into non-STEM fields, including investment banking, law, and business, which pay a significant dividend for STEM skills.[8]

Figure 3: Undergraduate student migration out of STEM majors



* Includes Physical Sciences and Biological/Agricultural Sciences

SOURCE: Chen, X., & Weko, T. (2009). *Stats in brief: Students who study science, technology, engineering, and mathematics (STEM) in postsecondary education*. Washington, DC: US Department of Education NCES.

Leveraging Higher Education's Untapped STEM Potential

New strategies, tactics, and tools are necessary to address the complex STEM workforce demand. In particular, the nation needs new forms of collaboration among business and industry, higher education, and government to transform STEM higher education and boost the number of scientists, mathematicians, and engineers graduating from our colleges and universities.

The Business-Higher Education Forum (BHEF) has launched the **STEM Higher Education and Workforce Project** to address these challenges and align higher education with national and regional STEM workforce needs. This effort is predicated on a fundamental assumption that strong skills in the STEM fields will continue to be vital drivers of American innovation and competitiveness, and that it is therefore necessary to invest our workforce with those skills, both in the numbers and competencies necessary to fully meet the demands of the 21st century.

BHEF's project goals include:

- Increasing the number of undergraduates, particularly women and underrepresented minorities, who persist and graduate in high-need, STEM disciplines.
- Deepening the relevance and content of undergraduate STEM education, particularly in the freshman and sophomore years, to augment workforce preparation and skills of STEM students.
- Increasing the alignment of undergraduate STEM education and degree production with workforce needs, particularly at the regional level, with a focus on high-demand STEM fields.
- Demonstrating effective approaches to collaboration between business and higher education, incorporating data analysis and modeling to simulate the impact at scale of STEM interventions piloted in the project.

Project goals will be achieved through four interrelated strategies. **Regional demonstration pilots** will be a key component of the BHEF project. BHEF member corporations and universities will develop new forms of collaborations in regional efforts achieve project goals. Strategies the project will explore include research-based courses for first-year students; internships in corporate and government facilities for students in the initial two years of college; redesigned courses and new methods of teaching STEM; and early career advising, mentoring, and academic support.

BHEF STEM Higher Education and Workforce Project Strategy

The **national strategy** envisions linking government, university, and industry associations, including the Association of American Universities, Association of Public and Land-grant Universities, the Aerospace Industries Association, and others to develop and advance a national STEM workforce development strategy and influence national policy.

BHEF also will launch a **new series of policy and research briefs** using unique longitudinal data sets that capture student career interest and student proficiency in four core areas. These briefs are designed to deepen our understanding of the STEM challenges and provide new insights for fashioning solutions. These **solutions will be modeled** using the BHEF STEM Education Model® and the results of the modeling, as well as regional pilots, will be disseminated through BHEF's resource center StrategicEdSolutions.org®.

More information about the project can be found at www.bhef.com/solutions/stem/hewp.asp.

END NOTES

1. Carnevale, A.P., Smith, N., & Strohl, J. (2010). *Help wanted: Projections of jobs and education requirements through 2018*. Washington, DC: The Center on Education and the Workforce.

2. National Science Board. (2010). *Science and engineering indicators 2010*. Arlington, VA: National Science Foundation.

3. Aerospace Industries Association. (2008). *A special report: Launching the 21st century american aerospace workforce*. Arlington, VA: Author.

4. ACT. (2011). *The condition of college and career readiness*. Iowa City, IA: Author.

5. Hart Research Associates. (2010). *Raising the bar: Employers' views on college learning in the wake of the economic downturn*. Washington, DC: Author.

6. Atkinson, R., & Mayo, M. (2010). *Refueling the U.S. innovation economy: fresh approaches to science, technology, engineering and mathematics (STEM) education*. Washington, DC: The Information Technology & Innovation Foundation.

7. Horn, L., & Wecko, T. (2009). *On track to complete? A taxonomy of beginning community college students and their outcomes 3 years after enrolling: 2003–04 through 2006*. Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

8. Carnevale, A.P., Smith, N., & Melton, M. (2011). *STEM*. Washington, DC: Center on Education and the Workforce.