VITALSIGNS

Reports on the condition of STEM learning in the U.S.

ENGINEERING EMERGENCY

African Americans and Hispanics Lack Pathways to Engineering

Fifty years after Lyndon Johnson declared war on poverty, millions of Americans still lack opportunities to join the middle class. A quality education that leads to good jobs offers a reliable pathway to economic security, yet the first step on that pathway remains inaccessible to far too many Americans, especially Americans of color.

Nowhere is this inequity more apparent than in engineering. On average, people with engineering bachelor's degrees earn higher salaries than people with bachelor's degrees in any other field,[1] and the Bureau of Labor Statistics projects 690,000 engineering job openings by 2022.[2] New CTEq analysis of U.S. Department of Education data finds that African Americans and Hispanics remain much less likely than white Americans to reap these rewards,[3] presenting both a moral and an economic crisis. This disparity deepens income inequality in the U.S. while leaving untapped the creative potential of millions of Americans.

We cannot address these inequities through college programs alone. Instead, we must strengthen the pipeline to engineering and other STEM fields in our elementary and secondary schools by setting high academic expectations for all students while greatly expanding minorities' access to advanced STEM learning opportunities.

We need all hands on deck

Without students of color, our nation cannot supply all the engineering talent it needs to remain at the forefront of innovation. U.S. employers report that engineering positions are among the hardest to fill.[4] Engineers have skills that are in high demand outside of engineering, which exacerbates the shortage.[5] The challenge has become especially acute for defense companies and government agencies that, by law, cannot fill sensitive security positions with foreign nationals. Some foreign policy experts perceive shortages of domestic engineering talent as a threat to national security.[6]

The problem will only intensify as racial and ethnic minorities become the majority of Americans. More than 40 percent of children aged 5 and under are either African American or Hispanic, and they will comprise more than 40 percent of all working-aged adults in just 30 years.[7]

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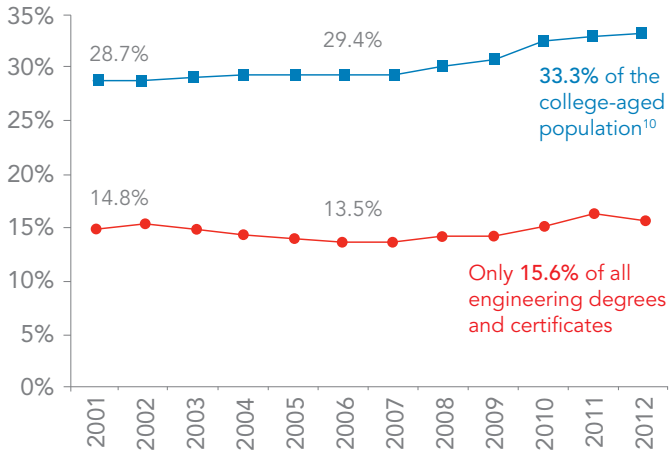
CHANGE THE EQUATION™

Only a small share of engineering degrees and certificates goes to African Americans and Hispanics

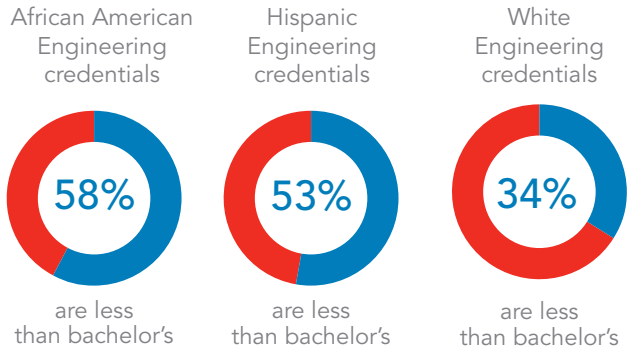
African Americans and Hispanics comprise a third of the college-aged population,[8] yet together they earn less than 16 percent of all engineering degrees and certificates.[9] Though their college-aged population has grown since 2001, their share of degrees and certificates remained mostly flat.

African Americans and Hispanics



The higher the degree, the fewer people of color

A closer look at these data reveals an even more troubling picture. By 2022, 9 in 10 new engineering jobs will require at least a bachelor's degree,[11] yet most of the engineering credentials African American and Hispanics earn are below the bachelor's level. The reverse is true for whites.



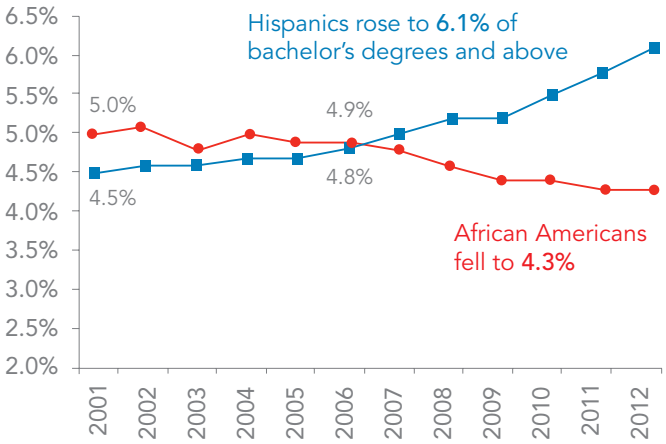
In fact, the higher the engineering degree, the smaller the percentage earned by African Americans and Hispanics. They comprise 33.3 percent of the college-aged population, and they earn:

- 34.8 percent of certificates
- 21.1 percent of associate's degrees
- 12.5 percent of bachelor's degrees
- 7.2 percent of master's degrees
- 4.0 percent of doctoral degrees

These disparities put African Americans and Hispanics at a big disadvantage. The annual mean salary for engineering jobs that require mostly a bachelor's degree or higher was more than $90,000 in 2012, and such jobs are projected to grow 8.6 percent by 2022. "Engineering technology" jobs, most of which require less than a bachelor's degree, paid a mean salary of less than $54,000 and are projected to grow by just 2.1 percent.[12]

Hispanics make gains in bachelor's degrees and higher while African Americans lose ground

While Hispanic and African Americans face hurdles in engineering, they are not on the same trajectory. Since 2001, Hispanics have been making strides in engineering degrees at the bachelor's level and higher while African Americans have fallen back.



Between 2001 and 2012, Hispanics almost doubled the number of bachelor's degrees and higher that they earn each year. Among African Americans, by contrast, the number grew a meager 26 percent, much slower than the overall growth of engineering degrees. The end result is that African Americans' piece of the engineering "pie" is shrinking.

Can we rest assured that Hispanics are well on their way to earning a proportional share of engineering degrees at the bachelor's level and higher? Hardly. Even if other groups remained static, Hispanics would need to triple the number of engineering degrees they earn to reach their proportional share.

The inequities start early

We sow the seeds of these inequitable outcomes in our elementary and secondary schools, which all too often limit, rather than expand, the horizons of African American and Hispanic students.

Hispanic and especially African American students lack access to resources in math and science. Forty-seven percent of Hispanic eighth-graders, and fully half of African Americans at that grade level, have science teachers who say they lack materials and resources to teach science. Twenty-seven percent of Hispanic and 35 percent of African American eighth-graders have math teachers who report lacking resources. (Twenty-five percent of white eighth-graders fall into that category.)[13]

African Americans, and to a lesser degree Hispanics, also lack access to challenging math and science courses that are gateways to engineering careers. Many attend schools that do not even offer physics or calculus every year.[14]

Because of the limited access to challenging coursework, we are squandering the potential of students of color. Only 3 in 10 African American and Hispanic students who have the potential to succeed in Advanced Placement math classes actually take those classes. Of those who do not take AP classes, half report that the classes are not available, and the other half report lacking the confidence to take them.[15]

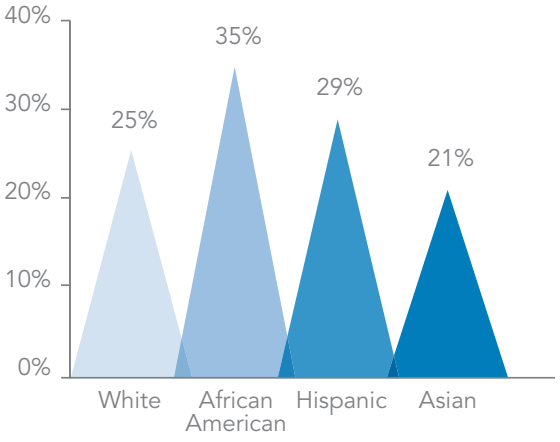
This problem extends to the elementary and middle grades. While 63 percent of high-achieving white fifth-graders enroll in algebra in eighth grade, only 35 percent of high-achieving African American fifth-graders do.[16] Those who do not may never find the pathway to engineering or other rewarding STEM careers.

Turning the tide

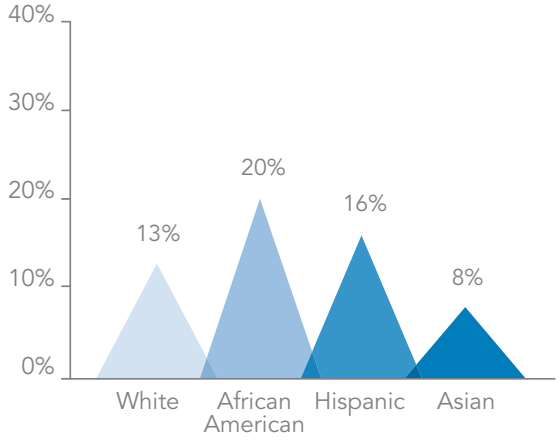
How can we accelerate progress for Hispanic students and turn the tide for African Americans in engineering?

- **Stay the course on high academic standards.** Forty-five states have adopted Common Core State Standards for what every student should know and be able to do at each grade level in math. These standards are clearer and more challenging than most states' previous standards,[17] and therefore they chart a clearer course toward STEM literacy for every young person. In addition, nine states have adopted common Next Generation Science Standards that explicitly include practices engineers use. As states do the hard work of putting these standards into practice, they should pay special attention to giving teachers, especially those who teach students of color, the support and resources they need.

Percent of students in high schools that did not offer Calculus in 2010



Percent of students in high schools that did not offer Physics in 2010



- **Support meaningful high school graduation requirements.** Every high school graduate should take four years of math and science, including challenging courses such as Algebra II. Currently, only 11 states require four years of math and science.[18] Meaningful graduation requirements are among the strongest defenses we have against the persistent tendency to track low-income and minority students into less advanced classes. Students who satisfy only the minimum requirements in most states find themselves out of the running for an engineering career long before they are old enough to make that choice for themselves.
- **Improve access to challenging and inspiring math and science education in K-12.** Programs like Engineering is Elementary, which integrates engineering into elementary school science classes, and Project Lead the Way, which offers an engaging engineering curriculum and teacher training in middle and high school, are proven to boost student performance and promote interest in engineering careers. The National Math and Science Initiative's College Readiness Program has dramatically raised the number of African American and Hispanic students who take and pass AP exams in math, science, and English.[19] Programs like these can expand opportunity to communities that have long lacked STEM learning options.

Of course, not every student is destined to become an engineer, but every high school graduate should master enough STEM skills to pursue engineering if she wants to. Equal opportunity is not only a moral promise we make to every child, it is the foundation of U.S. prosperity. We cannot thrive as a nation if we do not draw on the talents of all Americans.

1 Anthony Carnevale, Jeff Strohl, and Michelle Melton, *What's It Worth? The Economic Value of College Majors* (Washington, DC: Georgetown University Center on Education and the Workforce, 2011).

2 United States Bureau of Labor Statistics, Economic and Employment Projections to 2022.

3 Change the Equation worked with the American Institutes for Research to analyze data from the U.S. Department of Education's Integrated Post-Secondary Education Data System (IPEDS). IPEDS collects data from the roughly 7,500 U.S. post-secondary institutions that participate in federal student aid programs. These institutions include public and private colleges and universities, community and technical colleges, non-degree-granting institutions, for-profit institutions, and others. Data are for credentials in Engineering and Engineering Technology.

4 Manpower Group, *2013 Talent Shortage Survey*, 2013.

5 Anthony Carnevale, Michelle Melton, Nicole Smith, *STEM* (Washington, DC: Georgetown University Center on Education and the Workforce, 2011).

6 Council on Foreign Relations, *U.S. Education Reform and National Security* (New York, 2012).

7 U.S. Census Bureau Population Estimates and Population Projections, 2012.

8 The "college-aged population" refers to the population aged 18 to 24. Population data originate from the U.S. Department of Commerce, Census Bureau, American Community Survey Estimates and Summary Files.

9 For long-term trend data on engineering degrees in the United States, with a focus on women and minorities, see the National Action Council for Minorities in Engineering (NACME)'s research page: http://www.nacme.org/research-publications.

10 College-aged population data for the years 2001-2004 have been interpolated. African American and Hispanic students comprised 28.4 percent of the college-aged population in 2000 and 29.6 percent of the college-aged population in 2005.

11 Emily Richards and Dave Terkanian, "Occupational Employment Projections to 2022" (United States Bureau of Labor Statistics, December 2013).

12 Richards and Terkanian, 2013.

13 Change the Equation national *Vital Signs* report. http://vitalsigns.changetheequation.org/#us-United_States-Overview. Change the Equation analysis of data from the National Assessment of Educational Progress, 2013 (mathematics) and 2011 (science).

14 Change the Equation national *Vital Signs* report. http://vitalsigns.changetheequation.org/#us-United_States-Overview. Change the Equation/American Institutes for Research analysis of data from the Civil Rights Data Collection from the Office of Civil Rights, U.S. Department of Education, 2009.

15 The College Board, *The 9th Annual AP Report to the Nation*, February 13, 2012.

16 Jill Walston and Jill Carlivati McCarroll, *Eighth-Grade Algebra: Findings from the Eighth-Grade Round of the Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999* (Washington, DC: National Center for Education Statistics, October 2010).

17 Sheila Byrd Carmichael, W. Stephen Wilson, Kathleen Porter-Magee, Gabrielle Martino, *The State of State Standards—and the Common Core—in 2010* (Washington, DC: Thomas B. Fordham Institute, 2010).

18 Change the Equation, "Out of Sync: Many Common Core States Have Yet to. Define a Common Core-worthy Diploma" (Washington, DC: Change the Equation, 2013).

19 For more information on these and other STEM programs that have undergone rigorous review by third-party reviewers, see Change the Equation's STEMworks database: http://changetheequation.org/improving-philanthropy/stemworks.

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