U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HEARING CHARTER

Achieving the Promise of a Diverse STEM Workforce

Thursday, May 9, 2019
10:00 am – 12:00 pm
2318 Rayburn House Office Building

PURPOSE

On Thursday, May 9, 2019 at 10:00 am, the Committee on Science, Space, and Technology will hold a hearing to explore the need for a diverse STEM workforce and assess the lessons learned, model programs, enduring challenges, and future opportunities for expanding access to STEM studies and careers. The Committee will also receive testimony on the *STEM Opportunities Act*.

WITNESSES

- **Dr. Mae Jemison**, Principal, 100 Year Starship
- **Dr. Shirley Malcom**, Senior Advisor and Director of SEA Change, American Association for the Advancement of Science
- **Dr. Lorelle Espinosa**, Vice President for Research, American Council on Education
- **Dr. James L. Moore III**, Vice Provost for Diversity and Inclusion and Chief Diversity Officer, The Ohio State University
- **Ms. Barbara Whye**, Chief Diversity and Inclusion Officer, Vice President of Human Resources, Intel

KEY QUESTIONS

- Why should we strive for a STEM workforce that reflects the diversity of the country?
- What major barriers persist to increasing diversity in STEM studies and careers?
- What are some promising practices for recruitment, retention, and advancement of women and other groups historically underrepresented in STEM?
- Where should future efforts be focused?
- How might the *STEM Opportunities Act* be improved to address some of the challenges to broadening participation in STEM careers?

BACKGROUND

The U.S. science and engineering enterprise is essential to national defense, the public welfare, economic competitiveness, and the capacity to address national challenges.[1,2] While the U.S. continues to lead the world in spending on science research, advanced STEM degrees, high-quality research publications, and Nobel laureates, the nation's long-standing dominance in science and innovation is eroding.[3,4] Other nations are investing heavily in their STEM workforce. In 2014, almost half of all STEM bachelor's degrees were conferred in India (25 percent) and China (22 percent), compared with 10 percent conferred in the U.S. China increased spending on research and development by 18 percent per year between 2000 and 2015, compared with 4 percent in the U.S.[5] China has accelerated its research output in recent years, surpassing the U.S. in the number of research articles published for the first time in 2016.[6] One of the key challenges facing the U.S. science and engineering enterprise is a lack of diversity in the STEM workforce.

THE STEM WORKFORCE

It is difficult to measure the size of the STEM workforce because there is no standard definition of STEM workers. When defined by occupation only, the STEM workforce totals nearly 6.8 million people. By far, the largest STEM occupations are computer and information scientist (46 percent) and engineer (26 percent). While most STEM occupations (64 percent) are in industry, 13 percent are in 4-year colleges and universities and 6 percent are in the Federal government.[7]

Growth of the STEM workforce has historically outpaced growth of the overall workforce. The Bureau of Labor Statistics (BLS) predicts that future growth in STEM employment will be dominated by growth in math and computing jobs. Employment in math occupations will grow by 28 percent (59,400 new jobs) and computing jobs by 13 percent (557,100 new jobs) between 2016 and 2026. According to BLS, growth in these occupations will be driven by "greater emphasis on cloud computing, the collection and storage of big data, and information security."[8]

STEM Skills Gap: The widespread adoption of advanced technologies by the private sector has resulted in a growing demand for STEM skills. While demand is high in sectors traditionally

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[1] Vannevar Bush, "Science, The Endless Frontier," https://www.nsf.gov/about/history/nsf50/vbush1945.jsp
[2] NAS, "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future," https://www.nap.edu/catalog/11463/rising-above-the-gathering-storm-energizing-and-employing-america-for
[3] Nature Index, "Not so fast. Who really leads the world in science?," https://www.natureindex.com/news-blog/not-so-fast-who-really-leads-the-world-in-science
[4] The Economist, "The hierarchy of countries winning Nobels in the sciences is shifting," https://www.economist.com/graphic-detail/2018/05/10/the-hierarchy-of-countries-winning-nobels-in-the-sciences-is-shifting
[5] NSB, "The Rise of China in Science and Engineering," https://nsf.gov/nsb/sei/one-pagers/China-2018.pdf
[6] NSF, "Overview of the State of the U.S. S&E Enterprise in a Global Context," https://www.nsf.gov/statistics/2018/nsb20181/report/sections/overview/research-publications
[7] NSF, "Women, Minorities, and Persons with Disabilities in Science and Engineering 2019," https://ncses.nsf.gov/pubs/nsf19304/
[8] BLS, "Occupational Outlook Handbook," https://www.bls.gov/ooh/

reliant on STEM skills, such as information technology and software development, industries such as manufacturing, transportation, and financial services also need additional STEM talent as they incorporate new technologies into their business models.

High schools, community colleges, and universities have been slow to respond, struggling to adapt their curriculum to keep pace with the rapidly evolving needs of employers. Many companies are having difficulty recruiting and retaining workers with adequate STEM skills for their needs. A 2014 report by The Brookings Institution found that STEM jobs take more than twice as long to fill as job openings in other fields.[9] An analysis conducted by the World Economic Forum found that the skills gap is a significant barrier to the adoption of new technologies by companies in industries spanning a range of sectors.[10]

CHANGING DEMOGRAPHICS

Demographic shifts in the U.S. population are approaching an inflection point. The U.S. Census Bureau projects that by 2045, white Americans will no longer comprise the majority of the population. During that year, non-Hispanic whites will comprise 49.7 percent of the population, while Hispanics will comprise 24.6 percent, African Americans 13.1 percent, Asians 7.9 percent, and multiracial populations 3.8 percent. Although the nation as a whole is diversifying, the STEM workforce has been slow to respond.

Women: Despite accounting for one-half of the college-educated workforce, in 2015 women represented 28 percent of people working in STEM occupations. Women's participation in the STEM workforce varies across STEM fields. While women have made significant gains in fields like biological, agricultural, and environmental sciences (47.9 percent), their proportions are low in engineering (14.5 percent) and computer and mathematical science (26.4).

Low rates of women in the STEM workforce is driven, in part, by their underrepresentation in STEM degree programs. Women's share of bachelor's degrees fell between 2006 and 2016 in computer science (from 20.7 to 18.7 percent) and physics (from 20.7 to 19.3 percent) and women earned only 20.9 percent of bachelor's degrees in engineering.[11]

For women of color, the disparity is more pronounced. In 2016, Hispanic women comprised 10.6 percent of the college-age population[12], yet earned just 1.9 percent of bachelor's degrees in computer science and 2.3 percent of bachelor's degrees in engineering. The share of STEM bachelor's degrees awarded to Hispanic women increased across all fields between 2006 and 2016.

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[9] The Brookings Institution, "Still Searching: Job Vacancies and STEM Skills," https://www.brookings.edu/interactives/still-searching-job-vacancies-and-stem-skills/

[10] World Economic Forum, "The Future of Jobs Report 2018," https://www.weforum.org/reports/the-future-of-jobs-report-2018

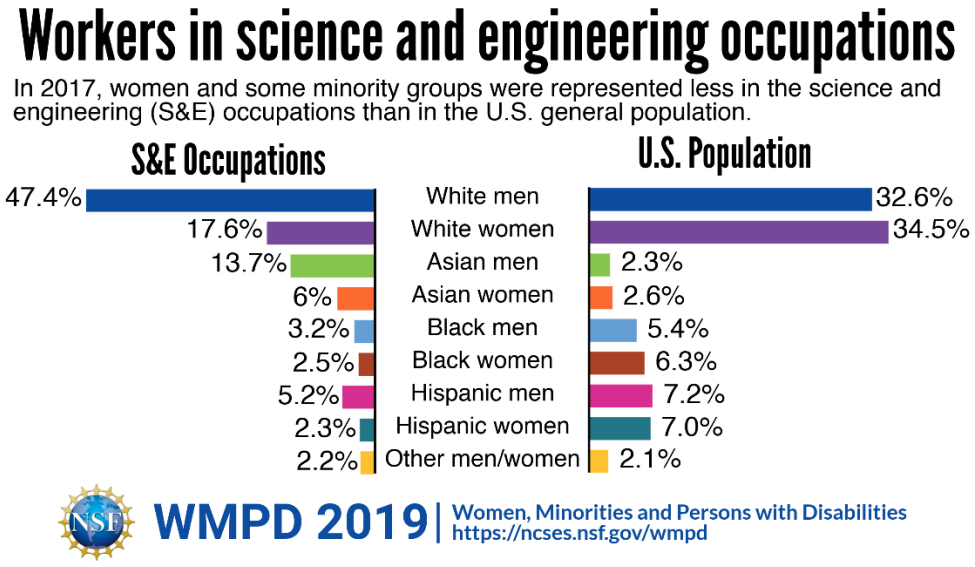
[11] NSF, "Women, Minorities, and Persons with Disabilities in Science and Engineering 2019," https://ncses.nsf.gov/pubs/nsf19304/

[12] U.S Census Bureau, "National Population by Characteristics: 2010-2017," https://www.census.gov/data/tables/2017/demo/popest/nation-detail.html

While the share of bachelor's degrees earned by black women (7.6 percent of the college-age population) increased slowly in psychology and social science, their share of bachelor's degrees in all other STEM fields stayed constant or declined. Black women earned just 1 percent of engineering bachelor's degrees in 2016, down from 1.5 percent in 2006. The sharpest decline was in computer science, which fell from 4.4 percent to 2.2 percent.

The women who do succeed in obtaining STEM degrees earn less than men. According to data collected by NSF, full-time employed women with a doctorate degree in a STEM field earn 20 percent less than men with STEM doctorates.[13] In addition to the STEM education pipeline and pay disparities, women in STEM occupations face a number of barriers to access and advancement in STEM careers. These barriers include discrimination, implicit bias, arbitrary and subjective career evaluation criteria, and organizational structure and rules that lead to differential treatment when compared with men.[14]

The National Academies of Science has a study underway to examine "the evidence behind the most successful policies, practices, and strategies that have demonstrated effectiveness in opening doors to women's participation and success" in STEM.[15] Dr. Mae Jemison, the first African American woman in space, is a panelist for the hearing. She is serving as Chair of the committee conducting this study and can discuss the motivation for and scope of the project.



Racial and Ethnic Minorities: Compared with their proportions in the U.S. population, members of racial and ethnic minority groups are significantly underrepresented in the STEM workforce. Asians and whites are overrepresented. While the representation of American Indians in STEM

[13] NSF, "Science and Engineering Indicators 2018," https://nsf.gov/statistics/2018/nsb20181/
[14] NAS, "Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering," https://www.nap.edu/catalog/11741/beyond-bias-and-barriers-fulfilling-the-potential-of-women-in
[15] NAS, "Addressing the Underrepresentation of Women in Science, Engineering, and Medicine," https://www8.nationalacademies.org/pa/projectview.aspx?key=51113

occupations increased from 1993 (0.2 percent) to 2006 (0.4 percent), that progress was reversed and only 0.2 percent of STEM occupations were held by American Indians in 2015. While Hispanic employment in STEM occupations has steadily increased (from 2.9 to 6 percent) from 1993 to 2015, progress for African Americans has been much slower (from 3.6 to 4.8 percent).[16]

Similar to women, the low rate of underrepresented minorities[17] in the STEM workforce is due, in part, to the pipeline of minority STEM graduates. Almost a quarter of all bachelor's degrees in STEM were earned by underrepresented minority students in 2016. At all degree levels, underrepresented minority men earned lower shares of STEM degrees than underrepresented minority women.[18]

Representation of Hispanics and black students varies across STEM fields. The share of STEM bachelor's degrees earned by Hispanic students has increased in all fields over time. Hispanics earn bachelor's degrees in psychology (17.1 percent) and social science (15.3) at rates similar to their proportion of the population but are significantly underrepresented among graduates in mathematics (8.9 percent) and physics (9.3 percent).[19]

The picture is more discouraging for black students. In nearly all STEM fields, the proportion of STEM bachelor's degrees earned by black students has either stagnated or declined since 1996. Black students earned only 4.8 percent of bachelor's degrees in engineering in 1996. Today, that share is 3.9 percent. In the past two decades, representation of black students among bachelor's degree earners in computer science has fallen from 9.9 percent to 8.7 percent.[20]

Black and Hispanic STEM degree earners are paid less than whites and Asians with STEM degrees – 14.3 percent less for doctorate degree earners and 24 percent less for those with a STEM bachelor's degree.[21] Many of the barriers facing women in STEM also affect underrepresented minority students. In addition, minority students are more likely to come from low-income families and have less access to academic resources to prepare them for STEM degree programs.

The National Academy of Sciences released a report in 2018 highlighting the outsized contributions to the STEM workforce made by minority serving institutions (MSIs). MSIs include Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), and Tribal Colleges and Universities (TCUs). For instance, HBCUs make up only 3 percent of the nation's colleges and universities, but graduate 28 percent of African American students earning bachelor's degrees in the physical sciences, 26 percent in mathematics, and 25

[16] NSF, "Science and Engineering Indicators 2018," https://nsf.gov/statistics/2018/nsb20181/
[17] Underrepresented minorities, as used in this charter, refers to African Americans, Hispanic or Latino Americans, Native Americans and Alaska Natives, and Native Hawaiians and Pacific Islanders. Asians, while a minority group in the U.S. population, are typically overrepresented in STEM fields.
[18] NSF, "Women, Minorities, and Persons with Disabilities in Science and Engineering 2019," https://ncses.nsf.gov/pubs/nsf19304/
[19] Ibid.
[20] Ibid.
[21] NSF, "Science and Engineering Indicators 2018," https://nsf.gov/statistics/2018/nsb20181/

percent in the biological sciences.[22] Included in the Committee's recommendations was a call for funding agencies to "continue to develop and expand grant competition programs that serve the nation's MSIs."[23] One of the committee Co-Chairs, Dr. Lorelle Espinosa, is a panelists at the hearing. She can discuss the committee's findings and recommendations in more detail.

BROADENING PARTICIPATION

In light of the STEM skills shortage, women and racial and ethnic minorities represent a much needed, but underutilized, pool of talent. In addition to helping narrow the skills gap, research indicates that diversity produces better results. A 2015 McKinsey & Company study found that "companies in the top quartile for gender or racial and ethnic diversity are more likely to have financial returns above their national industry medians."[24] A 2011 National Academies study compiled diverse views among researchers, economists, and others about the costs and benefits of racial and ethnic diversity and found, "a preponderance of research suggests that benefits outweigh the various objections to diversity raised in the literature."[25]

Promising efforts are underway in the Federal government, at universities, and in the private sector to identify and lower barriers to access, retention, and success in STEM studies and careers for women and other underrepresented groups.

Federal Government: A key initiative focused on increasing diversity in STEM is the NSF INCLUDES program. Launched in 2016, the goal of the program is "to achieve significant impact at the national scale within the next ten years in transforming STEM so that it is fully and widely inclusive."[26] NSF Director, Dr. France Córdova, has said the agency is interested in expanding INCLUDES into a government-wide effort.[27]

Universities: The American Association for the Advancement of Science (AAAS) made the first round of awards as part of its STEM Equity Achievement (SEA) Change initiative in February 2019.[28] Under the initiative, "educational institutions commit to removing barriers to STEM achievement for women, minorities and people with disabilities through participating in a

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[22] NSF, "Women, Minorities, and Persons with Disabilities in Science and Engineering," https://ncses.nsf.gov/pubs/nsf19304/

[23] NAS, "Minority Serving Institutions: America's Underutilized Resource for Strengthening the STEM Workforce," https://www.nap.edu/catalog/25257/minority-serving-institutions-americas-underutilized-resource-for-strengthening-the-stem

[24] McKinsey & Company, "Why Diversity Matters," https://www.mckinsey.com/business-functions/organization/our-insights/why-diversity-matters

[25] NAS, "Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads," https://www.nap.edu/catalog/12984/expanding-underrepresented-minority-participation-americas-science-and-technology-talent-at

[26] NSF, "Dear Colleague Letter: NSF INCLUDES (Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science)," https://www.nsf.gov/pubs/2016/nsf16048/nsf16048.jsp

[27] AIP, "NSF Scaling Up STEM Diversity Efforts with INCLUDES Network," https://www.aip.org/fyi/2018/nsf-scaling-stem-diversity-efforts-includes-network

[28] https://seachange.aaas.org/

program of voluntary self-assessment."[29,30] Dr. Shirley Malcom, a life-long researcher and advocate for STEM diversity, is a panelist for the hearing. Dr. Malcom is the Director of SEA Change and she can describe this initiative and other AAAS activities in support of increasing diversity in STEM.

Dr. James Moore, Vice Provost for Diversity and Inclusion and Chief Diversity Officer at The Ohio State University, is also a panelist at the hearing. He can discuss ongoing efforts at his institution to address the issue of diversity and the role that public and land-grant universities play in broadening participation in STEM.

Private Sector: Over the last several years, technology companies have faced increasing criticism about the lack of diversity of their workforces, which are dominated by white and Asian men. Some tech companies are making strides to improve the diversity of their workforce. In an effort to be more transparent, Silicon Valley giants including Facebook[31], Google[32], Microsoft[33], Apple[34], and Intel[35] have started releasing annual diversity reports.

A growing number of employers have begun taking a hard look at their recruitment and hiring practices and investing in partnerships with institutions that serve underrepresented minority students. In 2015, Intel announced a $300 million effort to diversify its workforce by 2020.[36] Since then, the company launched a $4.5 million program to support STEM students at HBCUs.[37] Ms. Barbara Whye, Chief Diversity and Inclusion Officer at Intel, is a panelist at the hearing. She can discuss the efforts underway at Intel to increase the diversity of its workforce.

STEM OPPORTUNITIES ACT

The *STEM Opportunities Act* directs (1) OSTP to develop policy guidance on best practices for supporting caregivers, reducing the impact of implicit bias, and identifying cultural and institutional barriers at science agencies and Federal labs, (2) science agencies to collect demographic data on grant proposals and awards and research faculty, (3) NSF to support research, development, and implementation of reforms for increasing the recruitment, retention, and advancement of women and other underrepresented groups in STEM degree programs and research careers, and (4) NSF to support computer science education through the existing Tribal Colleges and Universities program.

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[29] AAAS, "SEA Change Program Aims to Transform Diversity Efforts in STEM," https://www.aaas.org/news/sea-change-program-aims-transform-diversity-efforts-stem

[30] The awardees were Boston University, the University of California, Davis and the University of Massachusetts Lowell.

[31] https://newsroom.fb.com/news/2018/07/diversity-report/

[32] https://diversity.google/annual-report/

[33] https://www.microsoft.com/en-us/diversity/default.aspx

[34] https://www.apple.com/diversity/

[35] https://www.intel.com/content/www/us/en/diversity/diversity-at-intel.html

[36] Intel, "Intel Allocates $300 Million for Workplace Diversity," https://www.nytimes.com/2015/01/07/technology/intel-budgets-300-million-for-diversity.html

[37] Intel, "New Intel Grant Program Invests $4.5 Million to Support STEM Pathways for HBCU Students," https://blogs.intel.com/csr/2017/06/new-intel-grant-program-for-hbcu-students/#gs.90l2o2