Research Request

Higher Education and STEM

Focus on:
Trends and Best Practices
Women & Ethnic Minorities Entering STEM Fields

January, 2017
The following report provides an overview of trends and outcomes for women and racial/ethnic minorities interested in pursuing a STEM career and advancement in the profession. The report also looks at high school to undergraduate and graduate majors best able to ensure a successful STEM (science, technology, engineering and mathematics) careers and the higher education institutions and company programs supporting the growth of the pipeline. An overview of job outlooks and college capabilities is also covered.

Content overview:

1. Statistics on girls studying STEM in high school followed by majoring in STEM in college  
   a. Specific focus on underrepresented groups – African American, Hispanic and students from the lower end of the socio-economic spectrum
2. Do STEM focused companies want to hire women and racial/ethnic minorities?  
   a. What STEM area of focus is most valuable for women to study to ensure a position following graduation in the field?  
   b. Where are women most highly valued and/or wanted?  
   c. Is there value in advanced degrees, master’s degree or MBA in the STEM careers?
3. Information on specific jobs available on BLS
4. What are other colleges/universities doing in this space?  
   a. Ivy Leagues that have specific STEM programs for women
TECH, FINANCE, LIFE SCIENCES
Stepped-up efforts to advance Women in STEM

In the past two years, there has been a significant increase in the focus on women and diversity in STEM. The technology, finance and sciences industries have publically stepped up their efforts to increase their gender representation.

Tech companies were under significant public scrutiny for their lack of gender representation. In response, several companies, led by Intel, publically shared their statistics, challenges and goals to achieve greater gender and ethnic diversity. Pinterest, Salesforce, Twitter and others followed suit. Intel invested a portion of their $300million diversity budget to achieve a 40% female hire rate- a goal that they had never been close to achieving. Intel recently announced a 43.1 percent achievement rate.2

As recently as Jan 11, 2017, a coalition of 100 Bio pharm companies aligned during their annual conference to sign an open letter committing to greater gender parity and representation at their companies. This effort was largely a result of findings from an EY study on gender in life sciences and some pressure at last year’s Bio Pharm conference regarding the dismal results of female representation, despite commitments to diversity.3

The UN Women initiative HeforShe campaign and the Thirty Percent Coalition have been primarily led and championed by financial institutions such as JPMorganChase, Bloomberg, EY, Thomson Reuters and others.

Additional examples of STEM Companies with Hiring Initiatives for Minorities:

● **Intel** is allocating $300M to a new diversity initiative. According to a 2015 Fortune.com article, “That includes funding programs that teach STEM to young people in underserved areas, collaborating with higher education institutions, investing in women and minority-owned companies and creating bolder hiring and retention incentives and programs to encourage diversity within Intel. The goal? To achieve “full representation” of women and minorities by 2020—a.k.a. employ a workforce that is more representative of actual demographics.”

● **eBay**: The tech company is partnering with Year-Up, “which takes young adults in lower social economic status and train them for 6 months before placing them at top Silicon Valley companies. There, they learn how to do entry level tech jobs and, if they’re successful at it, they hire them. It’s a nontraditional way to fill the STEM pipeline and lift people out of poverty at the same time...” says, Kelly Minton, head of CIO communications and CIO engagement strategy at eBay.
The DATA: Racial/Ethnic Minorities and Women in STEM from high school to workplace.

U.S. Census data from February 2016 shows that women make up 14 percent of engineers, around 45 percent of mathematicians and statisticians and 47 percent of life scientists. But, the number of women in STEM is slowly trending upwards. Data shows that the STEM workforce was comprised of 26 percent women in 2011, compared to 23 percent in 1990.

A 2012 report by MyCollegeOptions, STEMconnector and funded by Cisco, highlights several compelling statistics. Below are excerpts of the executive summary.†

Since the graduating class of 2004, overall interest in STEM majors and careers among high school seniors has increased by over 20 percent. Arguably the most concerning trend with students interested in STEM is the increasing gender-gap. Female students express STEM interest at 14.5 percent compared to 39.6 percent for their male counterparts. Since 2011, interest in STEM has grown and is projected to continue rising for Asian, Hispanic, American Indian and White students. The Southern region of the US has the highest concentration (36%) of students interested in STEM.

In 2012, Mechanical Engineering (20.4%) was the most popular major or career choice among STEM-interested students, while Biology was second at 11.9 percent. American Indian students are the most likely to be interested in Engineering, compared to students of other ethnic groups. Female students are significantly more likely to be interested in the STEM majors/careers of Biology, Chemistry, Marine Biology and Science. Engineering and Technology interests are on the rise, while interest in Science and Mathematics has decreased over the past few years.

In 2012, the US STEM workforce surpassed 7.4 million workers and it is expected to grow significantly through 2018, to an estimated 8.65 million workers. In 2012, accountants and auditors comprised the largest number of STEM-related jobs in the US with over 1.66 million, a number that was projected to increase to 1.78 million by 2016. Currently the manufacturing sector faces a large shortage of employees with STEM skills. Alarmingly, 600,000 manufacturing jobs are going unfilled in spite of current economic conditions. It was estimated that between 2011 and 2015, 1.7 million jobs were to be created in cloud computing in North America. Another noteworthy increase in STEM jobs has come courtesy of mobile application (“apps”) technology, which has fostered 311,000 jobs in the “app economy.” By 2018, the bulk of STEM jobs will be in Computing (71%) followed by Traditional Engineering (16%), Physical Sciences (7%), Life Sciences (4%) and Mathematics (2%).

NOTE: The student data used in this report is drawn primarily from My College Options’ annual survey of 5.5 million high school students, which covers 95 percent of U.S. high
schools. The data for the STEM employment outlook and projections comes from the Bureau of Labor Statistics (BLS) and the Economic Modeling Specialists International (EMSI). According to a 2013 US Dept. of Education statistical analysis report on STEM attrition, “Students’ experiences or perceptions of institution and workplace context/climate may be related to STEM attrition as well. Such factors include inadequate academic advising, career counseling, and institution support...” This discouragement is systemic and normalized, however, there are many pipeline efforts from women and underrepresented minorities to excel and remain in the STEM field. The visibility of women and members of underrepresented communities are crucial to innovation, competition, and the fostering of creativity.

**Early STEM Gender and Ethnicity Gaps**

Math skills are considered essential to success in STEM fields. Historically, boys have outperformed girls in math, but in the past few decades the gender gap has narrowed, and in 2008 girls were doing as well as boys in math on average (Hyde et al., 2008). Girls are earning high school math and science credits at the same rate as boys and are earning slightly higher grades in these classes (U.S. Department of Education, National Center for Education Statistics, see figures 1 and 2). In 2008, on high-stakes math tests, however, boys continue to outscore girls, albeit by a small margin. A small gender gap persists on the mathematics section of the SAT and the ACT examinations (Halpern, Benbow, et al., 2007; AAUW, 2008). Fewer girls than boys take advanced placement (AP) exams in STEM-related subjects such as calculus, physics, computer science, and chemistry.\(^5\)

In 2016, female students’ achievement in mathematics and science is still on par with their male peers and female students participate in high level mathematics and science courses at similar rates as their male peers, with the exception of computer science and engineering.\(^6\) Larger gaps exist between students of different racial and ethnic backgrounds or family income, with white and Asian/Pacific Islander students and those from higher income families scoring higher than their counterparts who are black, Hispanic, or American Indian/Alaska Native or who are from lower income families.

**Other stats to consider:**

In 2005, 31 percent of Asian American and 16 percent of white high school graduates completed calculus, compared with 6 percent and 7 percent of African American and Hispanic high school graduates, respectively. Additionally, one-quarter of Asian American and one-tenth of white high school graduates took either the AP or International Baccalaureate exam in calculus, compared with just 3.2 percent of African American and 5.6 percent of Hispanic graduates\(^7\)
Figure 1. High School Credits Earned in Mathematics and Science, by Gender, 1990–2005


Figure 2. Grade Point Average in High School Mathematics and Science (Combined), by Gender, 1990–2005

Transitioning from High School to Higher Education

The rates of science and engineering course taking for girls/women shift at the undergraduate level and gender disparities begin to emerge, especially for minority women.  

- Women earned 57.3 percent of bachelor’s degrees in all fields in 2013 and 50.3 percent of science and engineering bachelor’s degrees. However, women’s participation in science and engineering at the undergraduate level significantly differs by specific field of study. While women receive over half of bachelor’s degrees awarded in the biological sciences, they receive far fewer in the computer sciences (17.9%), engineering (19.3%), physical sciences (39%) and mathematics (43.1%).
- In 2012, 11.2 percent of bachelor’s degrees in science and engineering, 8.2 percent of master’s degrees in science and engineering, and 4.1 percent of doctorate degrees in science and engineering were awarded to minority women.  
- In 2012, 3.1 percent of bachelor’s degrees in engineering, 6.5 percent of bachelor’s degrees in physical sciences, 5.4 percent of bachelor’s degrees in mathematics and statistics, 4.8 percent of bachelor’s degrees in computer sciences, 9.7 percent of bachelor’s degrees in biological sciences, and 14.2 percent of bachelor’s degrees in social sciences were awarded to minority women.
Figure 5. Intent of First-Year College Students to Major in STEM Fields, by Race-Ethnicity and Gender, 2006

 Ivy Leagues, Colleges and Universities: Setting Precedent in support of Women/Ethnic Minorities in STEM:

While research shows that many recruiters are paying less attention to higher education background, the exceptions are in STEM and finance. These areas still rely on higher education pedigree in addition to the transferable skills experience candidates are able to demonstrate. Many colleges and universities are increasingly focused on closing the gender gap in STEM.

Forbes recently compiled a list of the top 13 schools for women in Stem, Best Value for STEM Careers.

- Cornell University: 51 percent female enrollment, 30 percent in STEM
- Princeton University: According to an Article, “the student chapter of Engineers Without Borders has an executive board that is nearly 70 percent female, reflecting the overall club composition. Seventy percent of the university’s student-run Sustainable Engineering and Development Scholars program is also female.”

- Rice University DREAM. DREAM seeks to increase the number of underrepresented minority students in STEM degree programs, particularly engineering. DREAM is structured on a foundation of long-term mentoring. The program sends a team of Rice STEM undergraduates to mentor and teach students in Houston area high schools to encourage them to pursue college degrees in STEM fields.

- The MIT Women's Technology Program (WTP) is a rigorous four-week summer academic and residential experience where female high school students explore engineering through hands-on classes, labs, and team-based projects in the summer after 11th grade. Students attend WTP in either Electrical Engineering and Computer Science (EECS) or Mechanical Engineering (ME)

- The RAND report did an extensive study on diversity in STEM in response and support of the Department of Defense Diversity Summit. This report highlights cost, impact and metrics supporting the building of diverse pipelines, several programs of which are in collaboration with universities and Higher Education.11

- Through the previously mentioned United Nations created He for She initiative, women in STEM has been bolstered as well. Universities such as Mexico’s National Autonomous University of Mexico (UNAM) have created strong women in engineering pipelines out of Mexico.
Global University Programs Supporting Gender/Ethnicity in STEM

UNAM (National Autonomous University of Mexico) male professors working to include more women in computer engineering by creating civic technology together.

In Mexico, the National Autonomous University of Mexico (UNAM) supports the campaign HeForShe. UNAM has historically organized several events and programs to empower women, so this campaign was well aligned with the university's principles, which facilitated the university's participation. Within the HeForShe campaign, the university has organized events where women and men collaborate and innovate together. UNAM has also opened forums where women and men share their experiences regarding discrimination, and best practices to overcome it. HeForShe has particularly offered a platform where UNAM could continue to include women, especially in tech fields. UNAM's efforts, as well as that of other organizations in the region, have helped to position Mexico as a country with a high number of women engineers.

Around the world, Vice Chancellors and Presidents of universities are participants in the initiative.

- Brazil: University of São Paulo
- Canada: University of Waterloo
- France: Sciences Po (Institut d'études politiques de Paris)
- Hong Kong: University of Hong Kong
- Japan: Nagoya University
- South Africa: University of the Witwatersrand
- United Kingdom: University of Leicester and University of Oxford
  https://www.womeninscience.ox.ac.uk/topics
- United States of America: Georgetown University Regent Scholars Program and Stony Brook University
**Other stats to consider:**

All other factors being equal, bachelor’s degree STEM entrants who first attended public 4-year institutions had a higher probability of leaving STEM by switching majors than those who started at private nonprofit 4-year institutions. Bachelor’s degree STEM entrants who were male or who came from low-income backgrounds had a higher probability of leaving STEM by dropping out of college than their peers who were female or came from high-income backgrounds, net of other factors. Similarly, bachelor’s degree STEM entrants who first attended institutions that were among the least selective had a higher probability of leaving STEM due to dropping out than students who first attended highly selective institutions.12

**STEM Women in the Workplace:**

In transitioning from college to the workplace, MBAs are serving less importance to STEM positions occupied by men, but this is not true for women.

| Table 1. Total and STEM Employment by Gender and Educational Attainment, 2000 and 2009 |
|-----------------------------------------|------------------|------------------|------------------|------------------|
| All workers                             | 69,098   | 73,580   | 60,619   | 67,058   | 47%                  | 48%                  |
| College-educated                       | 18,995   | 22,167   | 16,415   | 21,433   | 46%                  | 49%                  |
| STEM workers                            | 5,321    | 5,640    | 1,680    | 1,790    | 24%                  | 24%                  |
| College-educated                       | 3,259    | 3,738    | 1,002    | 1,199    | 24%                  | 24%                  |

Source: ESA calculations from Census 2000 and 2009 American Community Survey public-use microdata
Note: Estimates are for employed persons age 16 and over.

- Engineers are the second largest STEM occupational group, but only about one out of every seven engineers is female.
- For every dollar earned by a man in STEM, a woman earns 14 cents less, smaller than the 21 percent gender wage gap in non-STEM occupations, but a clear gender disparity nonetheless.

**STEM Workforce 2016**

- According to a 2016 Forbes.com article, women comprise 48 percent of the U.S. workforce but just 24 percent of STEM workers and 29 percent of the science and engineering workforce. “U.S. Census data from February 2016 shows that women make up 14 percent of engineers, around 45 percent of mathematicians and statisticians and 47 percent of life scientists.
- Data shows, the number of women in STEM had been slowly trending upwards prior to 2016. The STEM workforce was comprised of 26 percent women in 2011, 24 percent in 2009, compared to 23 percent in 1990.”
● Women remain underrepresented in the science and engineering workforce, with the greatest disparities occurring in engineering, computer science, and the physical sciences.\textsuperscript{13}  
● Female scientists and engineers are concentrated in different occupations than are men, with relatively high shares of women in the social sciences (62%) and biological, agricultural, and environmental life sciences (48%) and relatively low shares in engineering (15%) and computer and mathematical sciences (25%).

For example:

○ 35.2% of chemists are women;  
○ 11.1% of physicists and astronomers are women;  
○ 33.8% of environmental engineers are women;  
○ 22.7% of chemical engineers are women;  
○ 17.5% of civil, architectural, and sanitary engineers are women;  
○ 17.1% of industrial engineers are women;  
○ 10.7% of electrical or computer hardware engineers are women; and  
○ 7.9% of mechanical engineers are women.

**Race and ethnicity are salient factors in rates of participation in the science and engineering workforce.**\textsuperscript{14}  

● The U.S. science and engineering workforce has become more diverse, but several racial and ethnic minority groups continue to be significantly underrepresented.  
● In 2013, 70% of workers in science and engineering occupations were white, which is close to the proportion in the U.S. working age population.  
● Hispanics, blacks, and American Indians/Alaska Natives make up a smaller share of the science and engineering workforce (11%) than their proportion in the general population (27% of U.S. working age population).  
● Asians work in science and engineering occupations at higher rates (17%) than their representation in the U.S. working-age population (5%). Asians are particularly highly concentrated in computer and information science occupations.  
● The increase in female participation in science and engineering over the past two decades includes increasing participation by members of all racial and ethnic groups, especially Hispanic and Asian women.  
● Minority women comprise fewer than 1 in 10 employed scientists and engineers \textsuperscript{15}
Organizations Supporting Women in STEM:

World Wide Learn list the 15 organizations working to improve women’s and girls interest and success in STEM fields.

National Girls Collaborative Project (NGCP):
The goals of NGCP are to:
1. Maximize access to shared resources within projects, with public and private sector organizations and institutions interested in expanding girls’ participation in STEM.
2. Strengthen capacity of existing and evolving projects by sharing exemplary practice research and program models, outcomes, and products.
3. Use the leverage of a network and the collaboration of individual girl-serving STEM programs to create the tipping point for gender equity in STEM.

Million Women Mentors (MWM):
Million Women Mentors supports the engagement of one million Science, Technology, Engineering and Math (STEM) mentors (male and female) to increase the interest and confidence of girls and women to persist and succeed in STEM programs and careers. MWM is an initiative of STEMconnector in collaboration with over 60+ partners reaching over 30 million girls and women, 45+ corporate sponsors, and 35+ state leadership teams.

Women in Engineering Proactive Network (WEPAN):
According to collegeprator.com, “WEPAN “works to transform culture in engineering education to attract, retain, and graduate women.” To this end, WEPAN supports a network of female engineering students at over 150 campuses across the country, reaching 60 percent of the female engineering student population. The main mission of the network is to make the atmosphere of engineering—in college and beyond—more amenable to women.”

What is the Opportunity Moving Forward?

The opportunity moving forward is for companies to collaborate with higher education to work towards closing the gender and pay equity gap and to strengthen programs for underrepresented ethnic populations. Even at Ivy League schools the earnings gap by gender continues to significant.
The Gender Earnings Gap at Elite Colleges

Women who enrolled at elite colleges are making less than their male counterparts. The gap is largest at M.I.T.: $58,100. Women who enrolled at Harvard are making as much as men who enrolled at Tufts.

Average earnings 10 years after enrollment

Graphic by the New York Times, used with permission.


7 National Science Board, 2008


13 NSF, Science & Engineering Indicators, 2016

14 NSF, Science & Engineering Indicators, 2016