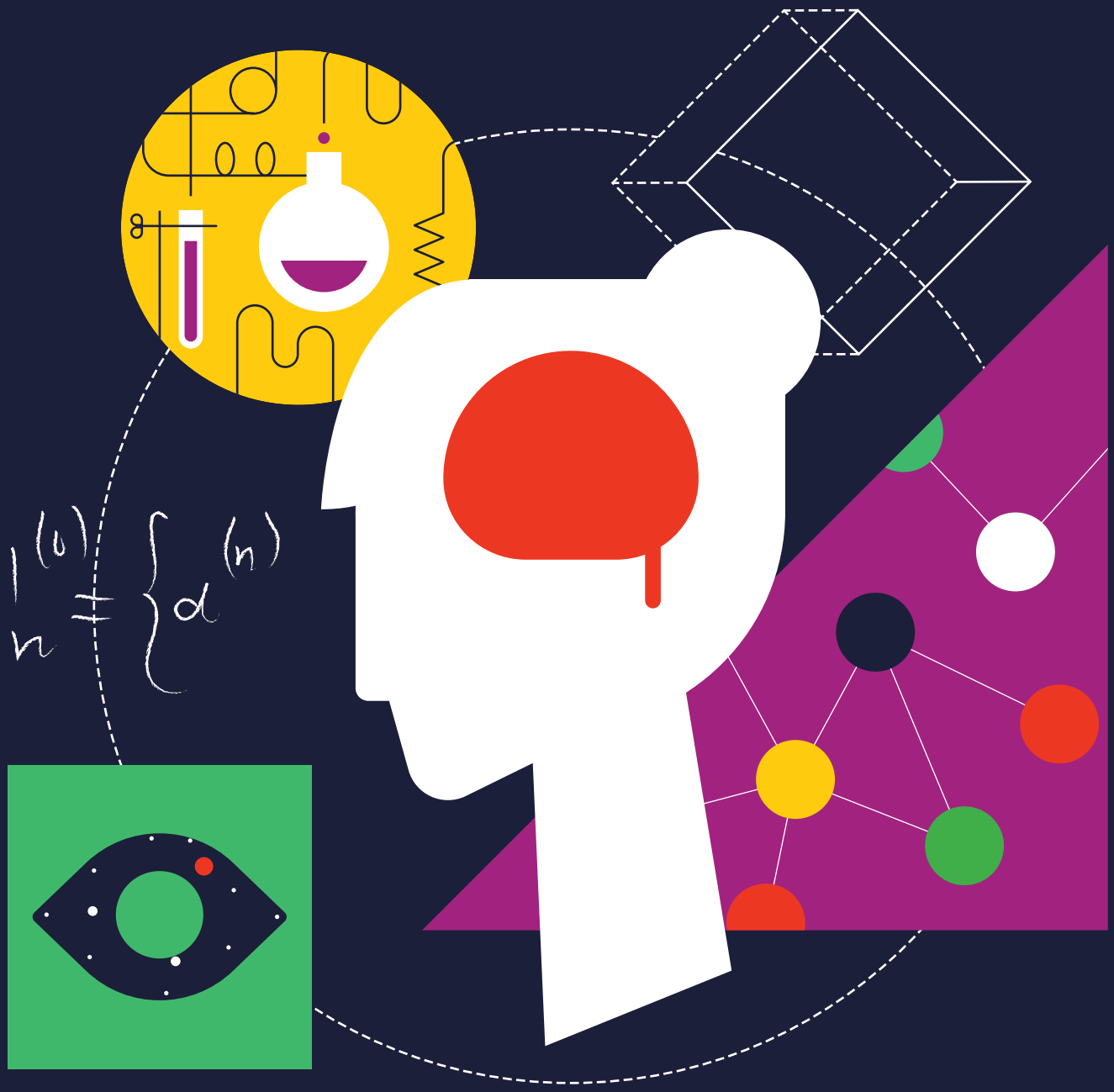
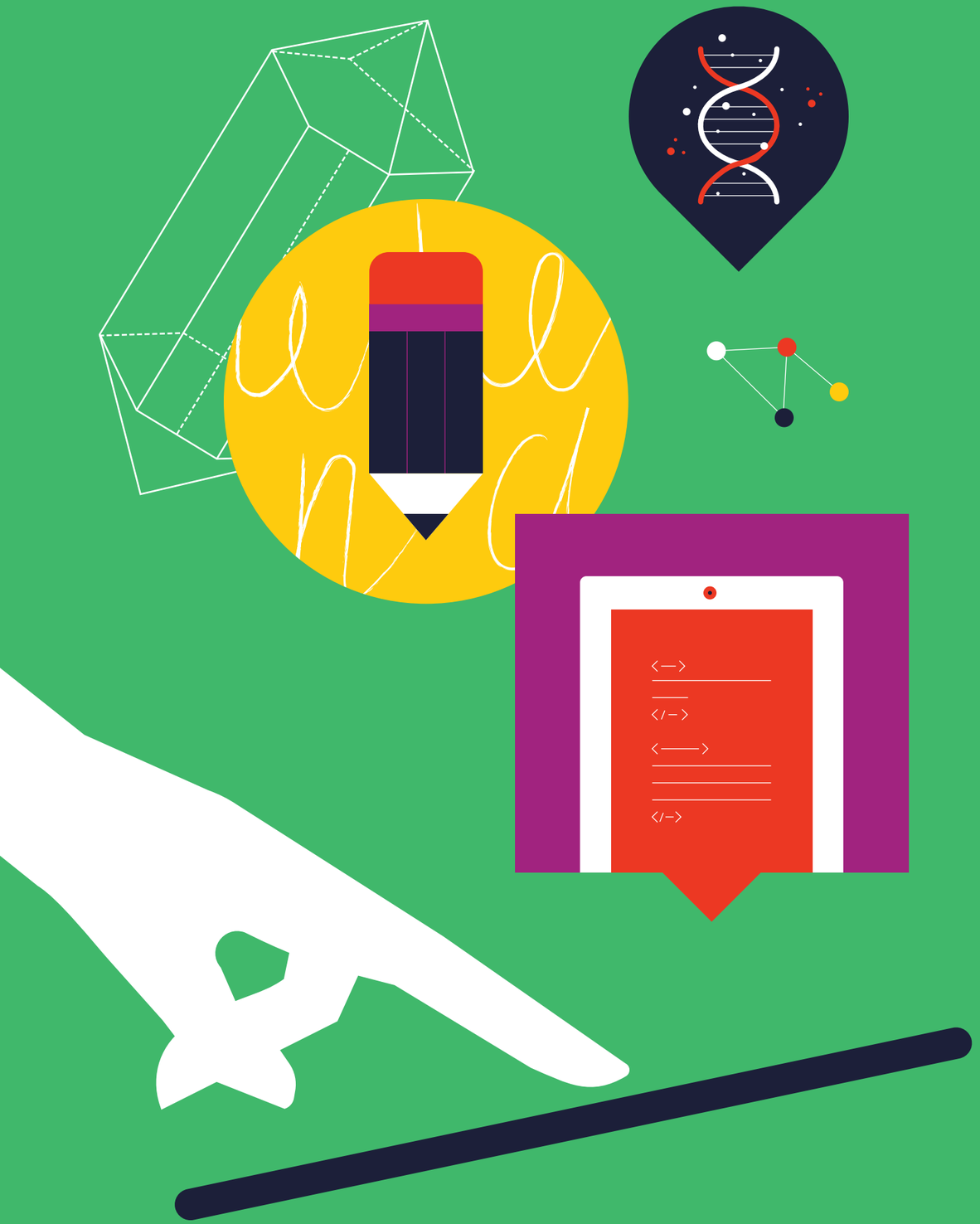
Reaching the Full Potential of STEM for Women and the U.S. Economy



Reaching the Full Potential of STEM for Women and the U.S. Economy

U.S. CHAMBER OF COMMERCE FOUNDATION
Center for Women in Business



Somewhere in America there is a tech executive looking for a skilled programmer. Somewhere else there is a young girl on a computer tablet learning to code.

It's about time these two got acquainted.

Across the country, companies are looking to hire people with skills in science, technology, engineering, and mathematics. But there remains a shortage of talented women in these fields, and this poses a threat to our competitiveness as a nation. That's why I am pleased to present the Center for Women in Business' new report *Reaching the Full Potential of STEM for Women and the U.S. Economy,*

The argument for more women in STEM careers is simple. Projections show that America will need to fill 6.6 million STEM jobs over the next 10 years. Although women are becoming more educated than ever before—making up half of all workers with postsecondary degrees—they compose just 25% of workers in STEM fields. How can companies find enough STEM workers if half our population is directed toward other professions? How can our nation compete if we are not luring the brightest minds into STEM fields?

Bringing more women into the STEM workforce is not just about gender equity. Women in STEM are essential for building a strong economy and a bright future for American enterprise. In a competitive global economy, we need STEM workers to solve our companies' toughest problems in new, creative ways. A diverse workforce keeps our perspectives fresh and our ideas innovative. That's why we need more female voices in all STEM positions, from entry-level app designers to technology executives.

We must motivate young girls to pursue an interest in science and mathematics and teach these subjects in ways that are compelling. We need mentoring programs that support women and girls in STEM fields. We must change work cultures to inspire more women to lead.

I encourage you to read this report and consider the ways we can bring more women into the STEM economy. Advancing women in STEM fields is not just about women. It's about creating the best workforce possible and boosting our nation's competitiveness along the way.

Roberta Phillips, Executive Director
Center for Women in Business
U.S. Chamber of Commerce Foundation

Abstract

Science, Technology, Engineering, and Mathematics (STEM) are essential to the U.S. economy and to sustainable long-term economic growth. STEM education and STEM employment are both crucial. The demand for STEM workers in the United States across industries is expected to grow faster than other occupations in the next decade.

Women account for half of the labor force, yet they account for only one-quarter of core STEM jobs. Although the participation rates of women in STEM education and occupations have been rising over the past decades, women are still underrepresented in the core STEM fields.

Additional public and private initiatives and programs are necessary to encourage women to enter and stay in STEM fields in order to fulfill the demand for STEM workers.

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Executive Summary

Skill sets in science, technology, engineering, and mathematics (STEM) are essential for ensuring long-term sustainable economic growth. The United States continues to lead in science and technology, accounting for 40% of global research and development (R&D) investment and employing a third of the world's scientists and engineers. STEM graduates work in a wide range of jobs. They contribute to manufacturing and the services industry. They are scientists in laboratories, engineers in manufacturing firms, nurses in hospitals, and teachers in schools, to name a few.

STEM education is critical to ensure a highly effective and competitive workforce. Formal training provides the advanced skills and knowledge necessary for scientists, technologists, engineers, and mathematicians to excel in their jobs. It is also effective training for those who choose non-STEM occupations in the fields of business, law, accounting, and teaching. The United States must continue to invest in human capital and STEM education in order to stay globally competitive, infusing this training in K-12 programs and continuing through postsecondary studies.

Women continue to be underrepresented in STEM careers, even as they account for half of the college-educated employees in the workforce. Although the educational attainment of women and their prominence in the workforce have grown steadily over the past decades, women are still lagging behind in STEM education and occupations compared with men. This leaves an unfortunate gap in the STEM workforce that prevents the American economy from reaching its full potential, and our nation's long-term competitiveness may suffer as a result. It also leads to a lack of diversity in organizations. Diverse organizations can be more successful and profitable. In addition, women are missing out monetarily since wages of STEM jobs are higher than those of non-STEM occupations. For these reasons, the U.S. Chamber of Commerce Foundation Center for Women in Business has embarked upon this research project to investigate the state of women in STEM education and occupations and how to increase these numbers.

More than 6.6 million STEM jobs need to be filled by 2022, which outpaces the growth rate of non-STEM jobs by about 6%. Public policy initiatives and private programs are necessary to encourage young girls and women to pursue these opportunities.

This report examines the participation of women in STEM education and occupations over the past decades in the United States. It also provides insights from a survey of leading experts in academia, government agencies, private companies, and nonprofit organizations to identify ways to attract women to STEM fields.

Here are some key statistics and findings of the report:

Since 1980, women have surpassed men in postsecondary education. In particular, the number of women graduating with science and engineering degrees has been increasing at a faster rate than their male counterparts over the past decades. Despite this trend, the number of women students and graduates in science and engineering fields still represents a very small share of the female student body.

> **Female enrollment has increased by 239% since 1970** to account for nearly 57% of total enrollment in postsecondary educational institutions in 2013.

> **During the period from 1990 to 2013, female graduates in physical sciences, technology, engineering, mathematics, statistics, and computer science, referred to in this report as core STEM fields, increased by 130%** compared with only a 76% increase of male graduates in these same fields.

The growth rates for women in broader STEM fields, including social sciences and health care, were even higher.

The number of female graduates in core STEM fields accounted for only 6% of total female graduates in 2013 (165,442 out of 2.65 million total graduates). That same year, 20% of male students graduated in these fields (369,792 out of 1.88 million total graduates).

With more women graduating each year, women now represent about half the total workforce with post-secondary education. Given the growing demand for STEM jobs—and the increasing number of women with STEM degrees—more women have gravitated toward STEM occupations over the past 20 years, especially in the health care industry.

However, women are still significantly underrepresented in core STEM occupations, such as physical scientists, technologists, engineers, programmers, and mathematicians. Women are also underrepresented in executive and high-level management positions held by STEM-educated individuals.

The number of STEM jobs increased by 21% more than non-STEM jobs, from 6.1 million in 1993 to 11.2 million in 2010. About 57% of those STEM jobs were core STEM and 43% were STEM-related jobs, including architecture and health care jobs where women are highly represented.

The participation of women in STEM jobs more than doubled over the past 20 years, largely in the health care industry. Indeed, the number of women working in core STEM jobs increased by 89% and in STEM-related jobs by 139%, both higher rates than for men.

While accounting for 43% of total STEM jobs, women accounted for only one-quarter of core STEM jobs. In fact, only one-third of women in STEM occupations are in core STEM jobs, while three-quarters of men in STEM are in core STEM occupations.

Our survey of leading STEM experts found that encouraging women to gain an interest in STEM starts at an early age and continues throughout their careers. For instance, mentoring girls and women in STEM fields can have a sizeable impact. In addition, fostering an inclusive culture in academia and the workplace, as well as developing programs that support women as they work to achieve their professional goals, can help retain and advance women in STEM careers. Both public and private programs are well placed to implement these initiatives.

In sum, more women are needed in STEM fields, particularly because of the field's significance to the advancement of women and the competitiveness of the American economy. More programs and initiatives are needed to encourage girls to study science and engineering and to promote women to enter and remain in STEM fields in which they are still underrepresented.

“Women want STEM jobs where they MATTER to people, communities, business and government.”

— Dr. Kathryn Sullivan, Administrator and Under Secretary of Commerce for Oceans and Atmosphere, National Oceanic and Atmospheric Administration (and a former NASA Astronaut)

Reaching the Full Potential of STEM for Women and the U.S. Economy

STEM, Innovation, and Economic Growth

The United States has been a leader in science and technology over the past 50 years. The United States accounts for 40% of worldwide research and development investment and employs nearly one-third of the world’s scientists and engineers. Furthermore, American universities and colleges attract the most accomplished and promising young students across the globe. Innovation and economic growth are inextricably linked to one another. Innovation has drastically transformed the American economy since the Industrial Revolution by increasing productivity, connecting companies to a wider range of customers, and raising the standard of living. A strong innovation pipeline is essential to continue introducing technologically new and creative products and services into the market.[2]

“There are women in key leadership positions, but we are missing women in important middle management roles. That is the test bed; that is where you create new leaders. To populate that, you need to have more women as new employees. There is no question that women are starting to enter engineering programs at a much higher rate. If you are increasing the pool of new graduates who are women, that will filter up. I think it is important to speed up the process a little bit.”[3]

— Gwynne Shotwell, President and Chief Operating Officer, SpaceX

The impact of innovation and related skill sets on economic growth has been a key focus of public policy initiatives in recent years. Studies have found strong evidence to support the linkages of higher levels of education, training, skills, and innovation to the economic performance of companies, industries, and countries. A primary focus of these studies is the relationship between R&D and innovation, documenting the extent to which scientific research has been the dominant driver of innovation.[4] While innovation is still heavily reliant on basic scientific research, it is more broadly influenced by disciplines such as social science, health care, and sales.[5]

STEM workers are crucial drivers of long-term sustainable economic growth, and their expertise is needed beyond technology companies and research firms. In fact, STEM employees are found across all industries including agriculture, mining, utilities, manufacturing, wholesalers, and services. Moreover, employees with STEM backgrounds are working across different occupational functions, for example, R&D personnel, managers, educators, and technical salespeople. STEM employees create innovative ideas and commercialize new products and services. Introducing these new products into the market, in turn, creates more jobs and boosts the overall workforce and economy.

“STEM is important for two reasons. First, the solutions to many of the important challenges facing the world rely on knowledge, skills, and advancements in STEM fields. Second, the economic future of the U.S. and the world increasingly depends on producing enough graduates in some STEM areas, particularly in fields related to information technology and computer science.”

— Maria Klawe, President, Harvey Mudd College

While occupations are inherently dynamic and job responsibilities change over time, a major focus is placed on STEM education as a means to increase innovation. Colleges and other post graduate institutions are essential producers of skilled workers. Students from around the world travel to the United States to attain a world-class education and training in STEM fields. An Organisation for Economic Co-operation and Development (OECD) study shows that a strong relationship exists between human capital development and higher education institutions, and that innovation clusters in regions highly concentrated with skilled and creative workers.[6] A formal STEM education leads to a higher degree of critical thinking and an improvement in problem-solving skills.[7] STEM education helps instill an innovative mind-set that leads to creative new ventures and increased economic growth.

While women represent more than half of postsecondary enrollment and graduates, they continue to be underrepresented in STEM education and STEM occupations. This leaves an unfortunate gap that prevents the U.S. economy from reaching its full potential. Public policies as well as private initiatives are needed more than ever to encourage women to enroll in STEM education fields, and to ensure that they have the appropriate opportunities to pursue, and remain in, STEM occupations. STEM occupations are projected to grow at a faster rate than non-STEM jobs over the next decade and will contribute directly to our economic growth through greater innovation and increased competitiveness.

"STEM is important because it is the basis of many technologies that are advancing rapidly and making it easier to solve humanity's problems. It provides a foundation for learning about computers, science, engineering, and so on."

— Vivek Wadhwa, Fellow, Stanford University

Analytical Approach of the Report

This report examines the participation of women in postsecondary STEM education and STEM occupations. Since STEM fields have evolved over the years, the definition of STEM has also expanded beyond traditional categories of science, technology, engineering, and mathematics. Our analyses therefore include both core STEM and broader STEM-related fields to provide a more complete landscape. Our quantitative analyses are based on official data published by U.S. government agencies. Our qualitative analysis is based on an interview-style survey of executives and subject-matter experts.

The first part of the report analyzes the participation of women in education. We used enrollment and graduation data from the U.S. Department of Education and the National Science Foundation. The analysis identifies the number of women enrolled in postsecondary education, as well as those majoring and graduating specifically in STEM fields of study. We follow three main classifications of STEM fields of study defined by the U.S. Department of Education's National Center for Education Statistics (NCES), the U.S. Department of Homeland Security (DHS), and the National Science Foundation (NSF). We apply the NCES classification to discuss core STEM education while relying on the NSF classification to analyze STEM-related education that goes beyond science, technology, engineering, and mathematics. See the Appendix for further discussion on our classification of STEM fields.

The second part of the study analyzes the participation of women in STEM occupations. We used employment data published by the NSF. The dataset is based on the NSF survey that links occupations of postsecondary graduates to their field of study. We adopt the classification of STEM occupations defined by the STEM working group that includes representatives of federal agencies and approved by the Office of Management and Budget. We used employment data and projections by industries from the U.S. Bureau of Labor Statistics of the Department of Labor. While health care jobs are considered STEM occupations by the working group, health education is generally not considered as a STEM field of study.

The report includes direct quotes from senior executives and noted subject-matter experts in academia, government agencies, and private corporations. We conducted these interview surveys in November and December 2014 to obtain these experts' views on the development of women in STEM fields of study and STEM occupations. Their quotes amplify our finding that much more needs to be done to attract women into STEM education and occupations. We also summarize various public and private initiatives to promote women in STEM fields that surfaced from our survey.

Women in STEM Fields Of Study

"Tech companies are about building nonhuman solutions to life's problems, but we rely on people to build those solutions. We desperately need to make sure we doing everything we can to attract and retain the best people on the planet to fill those roles."

— Marco Zappacosta, CEO and Co-Founder, Thumbtack, Inc.

Female postsecondary enrollment across all fields of study has outpaced male enrollment since 1980, registering 57% of the 21.1 million postsecondary students in 2013.
The American labor force has become more educated over the past 40 years, with nearly 28% of the labor force having obtained at least a bachelor's degree. In 2013, more than 21.1 million people were enrolled in postsecondary educational institutions in full- and part-time programs. Increased opportunities for both women and part-time students to attain postsecondary education contribute significantly to the rising educated labor force. Indeed, female enrollment increased 239% between 1970 and 2013 compared with a 146% increase in total enrollment during the same period. Furthermore, female enrollment in part-time programs increased 282% compared with 186% for both genders during this period (Table 1).

In the last four decades, female enrollment in postsecondary educational institutions has surpassed that of their male counterparts. In 2013, women accounted for nearly 57% of the enrollment in postsecondary educational institutions, 12 million female students of the total 21.1 million enrolled students. In 1970, 4.9% of the female civilian population, defined as women older than 16, were enrolled in postsecondary education. That number increased to 9.4% in 2013. Meanwhile, male civilian postsecondary enrollment has dropped slightly from 7.8% in 1970 to 7.7% in 2013

Despite a higher share of postsecondary enrollment, women lag behind men in science and engineering education.
"There is nothing more important for girls and women than seeing academics brought to life in real world settings. The more we can draw them into the workplace to experience STEM in action, the more that lights a fire to study and learn and then apply."

— Sarah Friar, Chief Financial Officer and Operations Lead, Square

Table 1.

Postsecondary Enrollment, 1970-2013 (in millions)[8]

Year	1970	1980	1990	2000	2013	Growth
Total enrollment	**8.6**	**12.1**	**13.8**	**15.3**	**21.1**	**+146%**
● Full-time	5.8	7.1	7.8	9.0	13.2	+127%
◐ Part-time	2.8	5.0	6.0	6.3	7.9	+186%
Female enrollment	**3.5**	**6.2**	**7.5**	**8.6**	**12.0**	**+239%**
● Full-time	2.3	3.4	4.0	4.9	7.3	+216%
◐ Part-time	1.2	2.8	3.5	3.7	4.7	+282%

Despite a higher overall share of postsecondary enrollment, female enrollment in science and engineering (S&E) fields still remains considerably lower than for their male counterparts. For example, based on NSF's broader STEM definition that also includes social, behavioral, and agriculture sciences, the percentage of freshman female students who intended to major in S&E increased from 26.4% in 1998 to 33.5% in 2012. During the same period, freshman male students who intended to major in S&E increased from 39.1% to 45.8%. Although the gap between female and male freshman students intending on majoring in S&E has slightly narrowed in the last 15 years, female students are still underrepresented in S&E by more than 10 percentage points (Figure 1).

While 33.5% of female freshmen intend to major in NSF's broad definition of STEM fields, the percentage of female students is significantly smaller in core STEM fields. Indeed, only 7.2% of female freshman students in 2012 intended to major in mathematics, statistics, computer sciences, physical sciences, and engineering, which remained relatively unchanged from 6.7% in 1998 (Figure 1).[9] Furthermore, female students intending to major in mathematics, statistics, and computer science as a percentage of total female freshman students declined from 2.5% in 1998 to only 1.4% in 2012. In contrast, about 26.6% of male students in 2012 intended to major in mathematics, statistics, computer sciences, physical sciences, and engineering (Figure 1).

Although still lagging behind men, female graduates with core STEM degrees are increasing faster than male graduates.
Female graduates with STEM degrees have more than doubled since 1990. Approximately 4.5 million students graduated with degrees and certificates across all STEM and non-STEM fields in 2013. Female graduates increased nearly 130%, from 1.15 million in 1990 to 2.65 million in 2013, while male graduates increased by only 88% from about 1 million in 1990 to 1.88 million in 2013. Women accounted for more than 58% of total graduates in 2013 across all fields of study (Table 2).

In 2013, among 4.5 million graduates, 535,000 of graduates (12%) had degrees in core STEM fields of study.[11] Of these graduates, about 165,000 of the graduates (31%) were women. This is higher than the 25.5% of female STEM graduates in 1990, since the growth rate of women in core STEM fields between 1990 and 2013 was much higher for female students (130%) than for male students (76%) (Table 2). The growth rates of women studying STEM are even higher when other fields such as social sciences and psychology are considered.[12]

"For our country and our companies to advance, we need talented young people to be involved. If we inspire them in science and engineering today, we secure our ability to innovate tomorrow."
— Patricia Elizondo, Senior Vice President, Xerox Corporation

Figure 1.

The Percentage of Total Female Students in Science and Engineering Fields, 1998-2012[10]

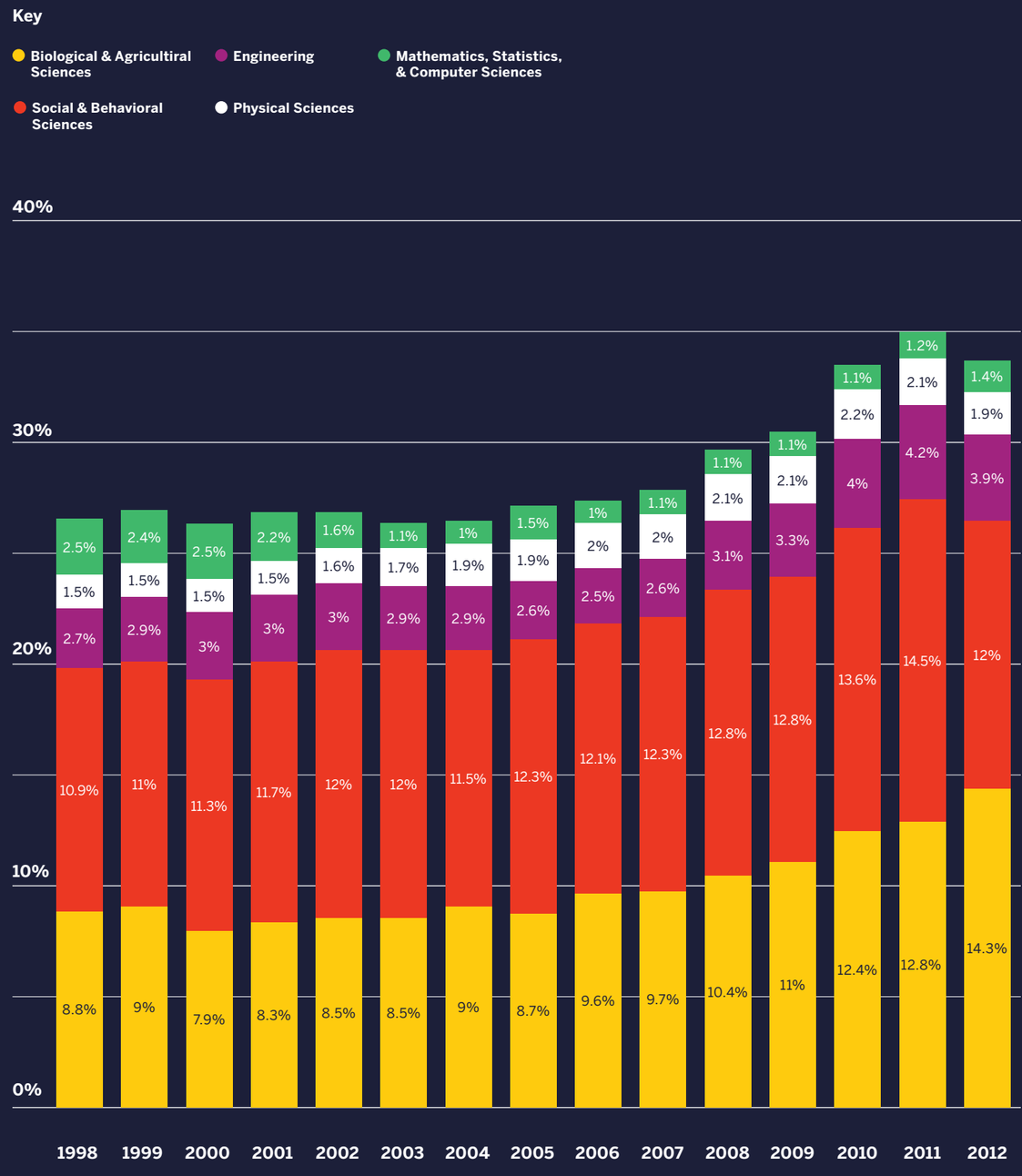


Table 2.

Graduates by Gender, 1990 and 2013 (in millions)[14]

	1990			2013		
	All	Female	Male	All	Female	Male
All Fields	2.152	1.153	0.999	4.527	2.650	1.877
Core STEM	0.282	0.072	0.21	0.535	0.165	0.37

Table 3.

Employment Status of Postsecondary Education Degree Holders, 2010 (in millions)[15]

	All	Female	Male
Total Postsecondary Degrees	**51.6**	**26.8**	**24.7**
Labor Force	**42.8**	**21.2**	**21.6**
Employed	40.6	20	20.6
Unemployed	2.2	1.2	1
Out of Labor Force	**8.8**	**5.6**	**3.1**

Despite the fact that the number of female STEM graduates has increased considerably over the past 25 years, and that the share of total STEM graduates who are women has also increased, the popularity of STEM studies for women is still substantially lower than for men. Female core STEM graduates accounted for only 165,000 (6.2%) of the 2.6 million total female graduates in 2013, while male core STEM graduates accounted for 370,000 (19.7%) of the nearly 1.9 million total male graduates (Table 2).[13]

Clearly there is still a gender gap in STEM education, and there is great opportunity to increase STEM graduates overall by focusing on drawing more women into postsecondary STEM education.

Women in STEM Occupations

Women and men with postsecondary education are equally represented in the overall labor force.

The number of people who have postsecondary education degrees has increased by 78% in the past 20 years to 51.6 million in 2010. Among those, 40.6 million were employed, 2.2 million were unemployed, and 8.8 million were out of the labor force. Among the 51.6 million postsecondary education degree holders, 26.8 million were women, though 5.6 million of them were out of the labor force. Interestingly, although there are at least two million more women than men with postsecondary degrees, enough of these women are outside of the labor force that the remaining labor force participants with postsecondary degrees are roughly equal in terms of gender—21.2 million women and 21.6 million men (Table 3).

STEM workers are across all industries.

The distinction between core and related STEM job domains is important as our analysis shows that the representation of women in these two domains differs considerably. The STEM working group of federal agencies, under the auspices of the Office of Management and Budget (OMB), finalized guidelines for the classification of STEM workers in 2012. The STEM classification matrix has two "domains" of occupations: the core STEM and STEM-related domains.

The core STEM domain includes occupations in life and physical sciences, technology, engineering, mathematics, and social sciences; the STEM-related domain includes architecture and health care. Each STEM domain has five major occupational types: (1) research, development, design, and practitioner occupations; (2) technologist and technician occupations; (3) postsecondary teaching occupations; (4) managerial occupations; and (5) sales occupations.[16]

The health care industry accounts for 38.3% of all STEM workers, and most of these are in STEM-related occupations compared with core STEM jobs. Professional services industries and government are the second- and third-largest industries employing STEM workers. Figure 2 provides a snapshot of STEM workers across industries in the United States based on the OMB Working Group definitions.

"Sparking a girl's interest in STEM at an early age significantly increases the odds that she will pursue a STEM career."

— Marillyn Hewson, Chairman, President, and Chief Executive Officer, Lockheed Martin

More women have gravitated to STEM occupations, but they are still underrepresented.

"We cannot achieve the high bar of developing breakthrough medicines without a top-notch and sustainable STEM-focused workforce. Encouraging young women to explore and commit to scientific disciplines will lead to better and more productive innovation over the course of their careers."

— Dr. Leonard Bell, Chairman and Chief Executive Officer, Alexion Pharmaceuticals

There were 11.2 million STEM jobs in 2010, of which 6.4 million jobs were core STEM jobs and 4.8 million were STEM-related jobs. Between 1993 and 2010, the number of STEM jobs increased by 86%, compared with a 65% increase in non-STEM jobs. The number of STEM-related jobs increased at a higher rate than for core STEM jobs.

The participation of women in the STEM workforce has increased noticeably over the past 20 years. Approximately 4.8 million women with postsecondary education degrees were working in STEM fields in 2010, more than doubling the number of women in STEM occupations in 1993. Of the 6 million STEM occupations available in 1993, 2.2 million (36%) were held by women. By 2010, these numbers had significantly increased and of the 11.2 million STEM jobs available, 4.8 (43%) were held by women. This marked increase of women in STEM fields is due in large part to the growth of employment in the health care industry, where women are highly represented. In fact, the number of women employed in STEM-related occupations, which includes health care jobs, increased from 1.3 million to 3.1 million (139%) between 1993 and

Figure 2.

A Snapshot of STEM Occupations Across Industries, 2013[17]

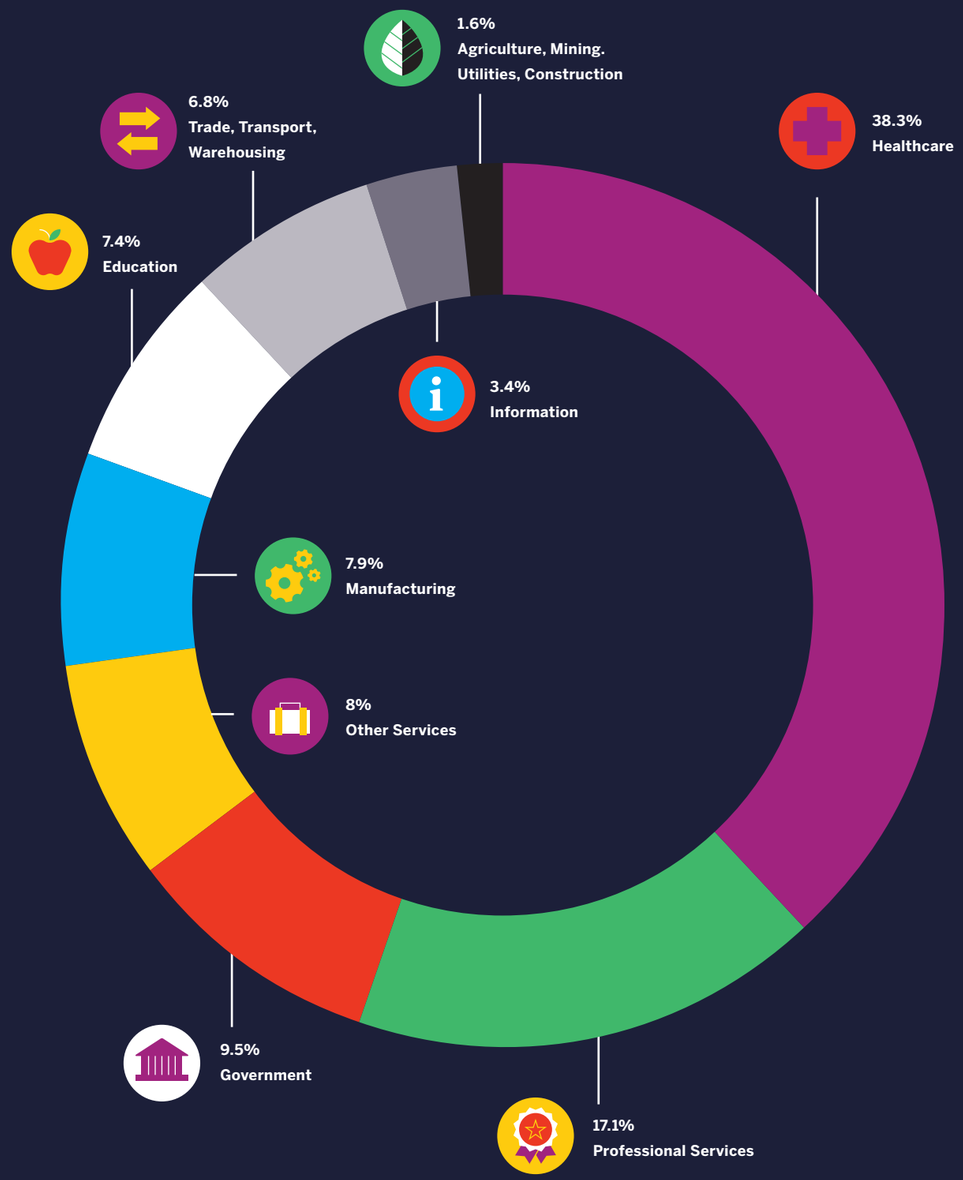


Table 4.

STEM Occupations with Postsecondary Education in 1993 and 2010 (in millions)[18]

	1993			2010		
	All	Female	Male	All	Female	Male
All Occupations	**23.8**	**10.2**	**13.7**	**40.6**	**20**	**20.6**
STEM Occupations	6	2.2	3.9	11.2	4.8	6.4
Core STEM	3.6	0.9	2.7	6.4	1.7	4.7
Related STEM	2.4	1.3	1.1	4.8	3.1	1.7
Non-STEM Occupations	17.8	8	9.8	29.4	15.1	14.2
Total Labor Force	129.2	58.8	70.4	153.9	71.9	82

2010, compared with an increase from 1.1 million to 1.7 million (55%) for men. When jobs in STEM related occupations are not included, only 35% of women in 2010 had occupations in core STEM fields. To compare, 73% of men held core STEM jobs in that same year (Table 4).

Despite STEM employment gains over the past 20 years, women are still underrepresented in STEM occupations compared with men, overall and particularly in core STEM fields. While accounting for 20 million of the 40.6 million jobs in 2010—nearly 50%—the numbers dip when we look at STEM occupations. In that same year, women held only 4.8 million of the 11.2 million STEM jobs available, less than 43%, and only 1.7 million of the 6.4 core STEM jobs available, less than 27%. In 2010, women working in core STEM jobs accounted for only 1.7 million (8.5%) of the 20 million jobs held by the total female workforce with postsecondary education. In comparison, 23% of their postsecondary educated male counterparts are employed in core STEM jobs (Table 4).

Lower STEM education rates for women contribute to the underrepresentation of women in core STEM occupations.
STEM jobs require greater knowledge and formal training given the reliance on advanced technology and specialized skills. About three-quarters of core STEM jobs (4.8 million jobs) are held by those who have formal education in STEM fields. While the number of STEM jobs has increased by 78% from 3.6 million in 1993 to 6.4 million in 2010, the percentage of core STEM employees with STEM education has not changed during this period (Table 5).

The participation of women working in core STEM fields increased by 89% from 900,000 jobs in 1993 to 1.7 million jobs in 2010. Among these women, 600,000 had formal education in STEM fields in 1993 compared with 1.2 million in 2010. In terms of STEM educated individuals who work in core STEM jobs, women made up only 1.2 million of the 4.8 million total (25%) of this group in 2010, only a slight increase from 22% in 1993. (Table 5).

The progress of women in STEM fields is better when considering STEM-related occupations, which include jobs in the health care and architectural design industries. In 2010, women held nearly 69% of the 3.2 million STEM-related jobs that required formal education in STEM fields, increasing from 60% in 1993. Overall, the number of STEM-related jobs doubled from 2.4 million jobs in 1993 to 4.8 million jobs in 2010. Like core STEM occupations, many jobs in STEM-related fields also require formal training in the related fields of study (Table 6).[20]

“STEM careers should be framed in a way that is appealing to girls and women, makes math and science interesting and compelling, and stresses the criticality of solving important issues in the world—like improved water quality and access to health care—through collaboration and innovation.”

— Susan Puglia, Vice President, Technical Development Programs, IBM

STEM graduates found jobs across occupations.
While many core STEM and STEM-related jobs require STEM education, STEM graduates also frequently apply their skillsets to a broader range of non-STEM jobs in different industries. In 2010, 16.9 million American workers had postsecondary STEM degrees, but only 8 million of them (47%) worked in STEM jobs while the other half worked in non-STEM jobs. When broken down by gender, we see that 49% of men with STEM education worked in STEM occupations, a higher ratio than for women at 45% (Table 7).

In 2010, 8.9 million STEM postsecondary degree holders worked in non-STEM jobs. They were executives and high-level managers (24.7%), specialists such as lawyers and accountants (18%), teachers (14.6%), sales and marketing personnel (13.5%), social workers (6.7%), administrators (5.6%), and employed in other non-STEM work (16.9%).

Among these non-STEM positions occupied by STEM-educated individuals, women were substantially underrepresented in the executive and high-level management positions (28.9%) and sales and marketing positions (37.2%). In contrast, more women held positions in administrative work (74.1%), social work (71.1%), and teaching (63.5%) (Table 8).

Addressing the Role of Women in the Future STEM Workforce

STEM fields are powering the innovation that is creating new business, products, and services in the United States. As a result, the strength of the U.S. economy rests heavily on the ability to educate future generations in STEM fields and to place them in STEM occupations distributed across a wide range of industries. Health care and professional services industries will continue to attract a large number of STEM professionals, and they are currently employing two-thirds of STEM research, development, design, practitioner, technologist, and technology employees and half of the STEM managers in the United States.

The increased demand for STEM-educated employees is driven by the fact that STEM jobs are growing at a faster rate and have lower levels of unemployment than other occupations in the workforce. Moreover, wages in STEM jobs are higher than those in non-STEM jobs. In 2012, the median annual wage of all occupations in the United States was $34,750 per employee. Meanwhile, the median annual wage of computer and mathematical occupations, one of the core STEM occupations, was $76,270 per employee and was $102,190 for computer and information research scientists. Health care practitioners and technical occupations, one of the STEM occupations dominated by women, reported a median annual wage of $60,200 per employee.[24]

Table 5.

Core STEM Occupations in 1993 and 2010 (in millions)[19]

	1993			2010		
	All	Female	Male	All	Female	Male
Core STEM Occupations	**3.6**	**0.9**	**2.7**	**6.4**	**1.7**	**4.7**
STEM Education	2.7	0.6	2.1	4.8	1.2	3.6
Non-STEM Education	0.9	0.3	0.6	1.6	0.5	1.1

Table 6.

STEM-Related Occupations in 1993 and 2010 (in millions)[21]

	1993			2010		
	All	Female	Male	All	Female	Male
STEM-Related Occupations	**2.4**	**1.3**	**1.1**	**4.8**	**3.1**	**1.7**
STEM-Related Education	1.5	0.9	0.6	3.2	2.2	1
Non-STEM Education	0.9	0.4	0.5	1.6	0.9	0.7

Table 7.

Jobs of STEM Graduates in 1993 and 2010 (in millions)[22]

	1993			2010		
	All	Female	Male	All	Female	Male
STEM Education	9.1	3.2	5.9	16.9	7.3	9.6
STEM Occupations	4.2	1.5	2.7	8	3.3	4.7
Non-STEM Occupations	4.9	1.7	3.2	8.9	4	4.9

Table 8.

Non-STEM Occupations with STEM Education, 2010 (in millions)[23]

Occupations	All	Female	Male	% Female
Number of People	**8.9**	**4**	**4.9**	**44.6%**
Executives, High-level Managers	2.2	0.6	1.5	28.9%
Specialists (i.e., accountants, lawyers)	1.6	0.7	0.9	44.4%
Teachers	1.3	0.8	0.5	63.5%
Sales & Marketing	1.2	0.5	0.8	37.2%
Social Workers	0.6	0.4	0.2	71.1%
Administrators	0.5	0.4	0.1	74.1%
Others	1.5	0.6	0.9	36.7%

Table 9.

Projected Job Growth Rates, 2012-2022[25]

Field	Number of New Jobs (in 1,000)	Growth Rate
All Occupations	**15,628**	**10.8%**
STEM Occupations	**3,060**	**17.4%**
Practitioner, Research, Development, Design	1,798	17.4%
Technologist, Technician	931	17.8%
Teaching	153	22%
Managerial, Sales	183	13.7%

The U.S. Bureau of Labor Statistics (BLS) projects that the growth in new STEM jobs will significantly outpace that for other new jobs in the United States over the next ten years: 17.4% growth for STEM jobs compared with 10.8% for all occupations. More than 3 million new jobs in the fields of computer sciences, mathematics, health care, life and social sciences, and engineering will have to be filled by 2022, across all levels from practitioner, research, design, technologist, teaching, to management functions (Table 9).

In addition to these new jobs, the BLS projects that at least 3 million STEM employees will be needed by 2022 simply to replace current workers in these fields. To fulfill the need for a combined more than 6.6 million new and replacement STEM employees, a comprehensive commitment from both the public and private sectors will be needed to train the workforce in STEM fields. Furthermore, eliminating the disparities in the educational attainment and career success between women and men in STEM fields is crucial to meet the STEM workforce demand. In this aspect, it is important for companies, small businesses, nonprofit organizations, governments, and educational institutions to recognize the need for inclusion, actively change cultural stereotypes, and enhance workplace benefits to narrow the gap between women and men in STEM occupations.

Leaders and subject-matter experts were surveyed from academia, business, nonprofit organizations, and the public sector to obtain perspectives on how to narrow the gap between women and men in STEM fields. The insights of these leaders and experts are synthesized in four categories: (1) encouraging interest in STEM education and careers at an early age; (2) mentoring girls and women in STEM fields; (3) changing the culture in academia and the workplace to be more inclusive for women; and (4) providing workplace benefits and programs to retain and advance women in STEM careers. Insights for each of these categories, along with key quotes from the survey participants, are summarized here.

Encouraging early interest in STEM education and careers is imperative.
Introducing young girls to science, technology, engineering, and mathematics at an early age is essential. Teachers should present math and science in ways that are interesting and relatable to young girls. STEM curricula should emphasize that STEM knowledge and its application through STEM careers are critical for solving the world's most pressing problems. Companies play an important role through their investments in early STEM education and in closing the gender gap through engagements and programs with women as they study STEM fields. With these programs' support, these women eventually gain experience and are attracted into STEM careers and leadership roles.

"Many of the jobs of the future are dependent on people with a higher degree of skill in STEM disciplines including aerospace, energy, manufacturing, and technology."

— Margaret Spellings, President of the George W. Bush Presidential Center and 8th United States Secretary of Education

"I believe an undergraduate education in engineering is extremely helpful, even for someone who wants to be a doctor or lawyer. It gives you a logical toolbox and teaches you how the world works. That's why I am trying to get more people into it, especially women."

— Gwynne Shotwell, President and Chief Operating Officer, SpaceX[26]

"It starts with childhood. Girls have to be encouraged by their parents to take an interest in STEM fields. Then we need to deal with the discrimination and discouragement they face through the education system to the corporate world. The future belongs to women – despite all the obstacles that have been historically placed in their way."

— Vivek Wadhwa, Fellow, Stanford University

"Make technology cool for girls."

— Reshma Saujani, Founder, Girls Who Code

"Introduce girls to STEM at an early age through toys and media that make it fun and accessible."

— Debbie Sterling, Founder and CEO, GoldieBlox

Girls and women in STEM fields need mentors.
The key to recruiting, retaining, and advancing more women in STEM careers is to provide them with mentors and role models. Companies and professional organizations are increasingly proactive in engaging successful women in STEM fields to speak to groups of women early in their education and careers to inspire them to follow STEM careers. Active mentoring and career networking programs at STEM-based companies help women avoid feeling isolated or uncertain about their future career path by providing role models who can help them navigate their organizations and highlight opportunities for growth.

"Mentorship can come from both men and women. If we limit to just role models that 'look like you,' the smaller the potential pool is. Instead let's make it broad, understanding that men are just as capable of inspiring the next generation of women in the field."

— Sarah Friar, Chief Financial Officer and Operations Lead, Square

“We must share how rewarding it is to be an engineer. Engineers and scientists are making the planet a better place by addressing important issues such as climate change, health care, hunger, urban congestion and more.”

— Patricia Elizondo, Senior Vice President, Xerox Corporation

“First and foremost, girls and women need encouragement to show up, going all-in on worthwhile things. They need support to try and persist—to get up one more time than they fall down. They need opportunities to explore and try new things. They need to be fortified to take the hard jobs with big challenges.”

— Dr. Kathryn Sullivan, Administrator and Under Secretary of Commerce for Oceans and Atmosphere, National Oceanic and Atmospheric Administration (and a former NASA Astronaut)

“This effort must start in middle school and high school. It is important to emphasize these careers and to have role models available to discuss career paths.”

— Maggie Wilderotter, Chairman and Chief Executive Officer, Frontier Communications

Creating an inclusive culture will help women advance.
In order to close the STEM gender gap, organizations of all types should focus on creating a diverse and inclusive culture. This change begins during childhood, where parents can encourage their girls to take an interest in science, technology, engineering, and mathematics. Schools and colleges should also address any lingering discrimination, discouragement, or stigmas involved in girls and women studying STEM topics. Curricular changes must ensure that teachers can inspire female students by engaging them in experiential projects, showing them the powerful impact of STEM on society, and empowering girls to pursue careers in STEM fields. Finally, companies must ensure greater representation of women not only in entry-level positions but also in leadership positions. The proper representation of women in senior management and boardroom ranks will help create a culture that is more inclusive to women.

“It takes a long-term commitment to increase the number of women students in STEM disciplines. The problem can only be addressed if the entire STEM community commits to making changes so that the culture becomes one in which everyone is supported and encouraged independent of gender, race, or other unimportant attributes.”

— Maria Klawe, President, Harvey Mudd College

“Build a collaborative culture, encouraging diverse ideas and perspectives to retain women in STEM careers. Companies should provide unconscious bias training and offer development and visibility opportunities to all employees, including the women.”

— Telle Whitney, President and Chief Executive Officer, Anita Borg Institute

“The way that technology companies can support women is to ensure that their cultures are inclusive and that they become places where women want to work and grow their careers. That involves being mindful of the culture of the company when small and supporting all your employees as you grow.”

— Marco Zappacosta, CEO and Co-Founder, Thumbtack, Inc.

Workplace programs can help to retain and advance women.
To retain women and advance them in their careers, companies should consider implementing professional development programs, flexible work options, leadership conferences, and mentoring programs to hone their managerial skills, and ensure access to resources that encourage their professional success.

“It is critical for companies in the pharmaceutical and biotechnology industries to provide resources and infrastructure to attract and retain talented women in STEM roles.”

— Dr. Leonard Bell, Chairman and Chief Executive Officer, Alexion Pharmaceuticals, Inc.

Closing the gender gap in STEM fields requires focused efforts and investments throughout the various stages of education and career progression. Girls must be encouraged to study STEM subjects in middle and high school as well as in college. Women leaders in STEM fields need to serve as role models and mentor younger women to pursue and succeed in STEM occupations. An inclusive workplace environment should provide opportunities and encouragement for women to advance into managerial and executive positions. These initiatives will help address the growing demand for a well-educated STEM workforce over the next decade.

Programs and Initiatives To Support Women in STEM

Over recent decades, women have become more visible in STEM fields, in part due to public- and private-sector initiatives targeted at advancing women in STEM education and careers. Thousands of programs and initiatives across the country have been created to promote and attract young people into STEM fields. These programs were created with different focus areas to target different demographic, income, and age groups. The STEM Connector database identifies more than 3,000 STEM organizations working with the federal government, private corporations, colleges, universities, foundations, and other types of associations. These STEM programs have more than 4,700 focused missions for different demographic, economic, gender, and racial backgrounds. Also, the STEM Connector database lists more than 7,000 resources to promote STEM education and careers (Table 10).

Public Programs

All levels of government (federal, state, and local) have played a role in the development of STEM education and careers. Federal government agencies, including the Department of Defense, the Department of Energy, the National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautics and Space Administration (NASA) have created STEM mentoring programs and public initiatives to increase opportunities for women, girls, and minorities in STEM fields. For example, NOAA invests in the future STEM workforce through scholarships, fellowships, and internships, and through formal and informal education opportunities for girls to get involved in rigorous STEM experiences related to NOAA’s mission. State and local governments work with K - 12 schools, community colleges, and local universities to promote events and educational programs that provide mentoring, foster inclusion, and deliver experiential learning opportunities targeted toward STEM careers.

The most successful programs in STEM education and careers are a result of public-private partnerships. On the federal level, the Obama administration has made STEM education and careers a top priority of the White House’s *Educate to Innovate* program, with the goal of increasing math and science achievement for American students. The *Educate to Innovate* program is a public-private partnership involving the federal government together with leading companies, foundations, nonprofits, and professional organizations to bolster the pipeline of STEM-educated students into professional occupations. This program has raised more than

Table 10.

STEM Organization Profiles

There are many different organizations encouraging STEM education and careers. Due to the sheer volume of work to be done in the space, groups often focus their efforts on specific sectors, demographics, age groups, STEM subjects, or resources.

Sector

3,015 Programs

Education
Colleges and Universities
Elementary, Middle, Junior, and High Schools
Educational Companies
Educational Management Organizations

Public Sector
Federal Government
State-Focused Organizations

Corporations

Others
Competitions and Contests
Foundations
Media
Museums
National Non-Profits
Professional Societies
Trade Associations

Demographic

4,719 Programs

Underserved Groups
Low-Income
Youth
Community Development

Gender
Women and / or Girls

Race/Ethnicity
African-American
Hispanic
Asian
American Indian
Alaska Native
Native Hawaiian

Age Group

3,983 Programs

Age
K-12
2-Year-College
Higher Education
Adult Education
Teachers

Subject

7,763 Programs

Science
Technology
Engineering
Mathematics

Resource

7,085 Programs

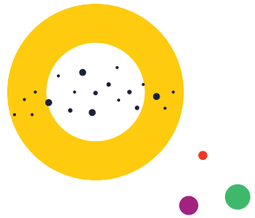
Tutoring
After-School
In-School
Out-of-School Programs
Mentoring
Digital Training

Awards
Fellowships
Internships
Scholarships

Networking Opportunities
Career Planning Tools
Conferences
Competitions and Contests
Publications
Research Proposals

“We are focusing on programs that increase access and exposure to computer science and are working to change the perception of computer science and computer scientists.”

— Susan Molinari, Vice President of Public Policy and Government Relations, Google



$700 million in contributions and in-kind donations to bolster the success of STEM students, including encouraging girls to pursue and succeed in STEM education and careers.[28]

“We believe it will take a village to grow the pipeline of STEM workers. Collaborative ventures and partnerships among diverse groups with shared interests will be key to filling the gap.”

— P. Gopalakrishnan, PhD, Vice President, Technology Leadership & Community, IBM

The campaign includes a number of mentoring programs at government agencies for women to gain professional support to pursue STEM careers. The White House Office of Science and Technology Policy works with the private sector, state and local governments, academic communities, and other nations to develop and implement sound science and technology policies and budgets, including making it easier for people with STEM backgrounds who have left the workforce for a number of years to return.

State governments have used a similar approach of public and private partnerships involving governments, the private sector, universities, community colleges, and professional organizations to empower women to pursue STEM education and careers. These statewide learning networks and public-private partnerships advance STEM education to prepare all students for academic and career success.

Private Sector Programs

The private sector is investing significant resources, designing training programs, and reforming workplace policies to encourage women to pursue STEM education and ensure that they stay in the workforce and advance in their careers. In addition to working with the public sector, companies are investing resources and energy into creating leadership programs and community initiatives that increase participation in STEM activities. Companies and nonprofits are developing creative ideas, such as producing toys designed for aspiring female engineers and delivering computer science programs to teach young girls how to write software programs. Successful companies are recognizing the need to bring in young, talented women for leadership programs to give them the confidence, inspiration, and skills for STEM careers. Businesses are changing workplace policies to retain women in the workforce, accelerate their development into leadership positions, and change cultural stereotypes to be more inclusive.

“Advancing STEM education requires collaboration among industry, educators, policy makers and families. That’s why Lockheed Martin and our peers in the aerospace and defense industry have a comprehensive education outreach strategy in place to help fill the STEM pipeline. We believe that advancing STEM education requires collaboration among industry, educators, policy makers and families.”

— Marillyn A. Hewson, Chairman, President, and Chief Executive Officer, Lockheed Martin

Through our survey of executives at leading nonprofit organizations and STEM-based companies in aerospace, biotechnology, IT, and technology we compiled the following information on some of the programs and initiatives that these organizations have developed. These programs seek to encourage more participation from women to participate and help reduce the gender gap in STEM fields[29]:

Alexion Pharmaceuticals recognizes that it is critical for companies in the pharmaceutical and biotechnology industry to provide the resources and infrastructure to attract and retain talented women in leadership in STEM roles. The STEM disciplines are fundamental to driving medical innovation in the biotechnology industry. Alexion Pharmaceuticals has made STEM education an important commitment and criteria in its community outreach efforts. The company has been a leader in STEM-focused programs on the state and local level, including community outreach programs, events, and science fairs.

The Anita Borg Institute's (ABI) programs lead women in computing and organizations. The Institute works with Fortune 500 companies and academic institutions to promote technology innovation—an imperative for economic competitiveness. ABI believes that technology innovation powers the global economy and that women are crucial to building technology the world needs. ABI's best-known program is the Grace Hopper Celebration of Women in Computing, which is now the world's largest annual gathering of women technologists.

Girls Who Code, launched in spring 2012, is a national nonprofit organization working to close the gender gap in the technology and engineering sectors. Girls Who Code, with support from public institutions and private companies, works to educate and motivate high school girls with the skills and resources to pursue opportunities in technology fields. The organization has tripled its reach to offer 60 summer programs in 2015, which will empower 1,200 girls with intensive computer science education, training, and mentorship with its dozens of partner companies.

GoldieBlox aims to interest girls in engineering at an early age. GoldieBlox has developed construction toys, fun engineering tools, and games to promote an early interest in STEM subjects. Its goal is to "disrupt the pink aisle" and inspire the next generation of female engineers. The company creates role models for young girls through characters that are fun, smart, and relatable in their experiences of growing up with an interest in solving hard problems.

Google aspires to be an organization that reflects the globally diverse audience that its search engine and tools serve. Through Google's education and scholarship programs, the company hopes to inspire students to become future leaders in computing and technology and to break down the barriers that have historically kept students from entering these fields. Google's focus on computer science education includes research, funding and support of innovative nonprofits, and the development of educational materials and programs for teachers and students.

Harvey Mudd College is a leading institution for women and girls in STEM education and careers. Under the leadership of President Maria Klawe, Harvey Mudd provides women in STEM fields with experiences that build confidence and activities that promote an inclusive learning community. The college has focused on developing curriculum that encourages majoring in computer science or double majoring in computer science and other STEM disciplines. Under Klawe's leadership, the college has increased the percentage of women majoring in computer science from 10% to 40% over a four-year period and tripled the total number of majors over a six-year period.

Lockheed Martin supports programs that generate an interest in STEM careers in girls at an early age to encourage the pursuit of education and careers in STEM fields. Lockheed Martin has committed millions of dollars in funding and scholarships to organizations such as Girls, Inc., Project Lead the Way, Engineers in the Classroom, FIRST Robotics, and the 4-H Robotics Club. For example, the company's program with Girls, Inc. pairs Lockheed Martin mentors with girls age 9 – 12 to show that STEM is a great career choice. The company's efforts will continue to focus on programs that enhance student achievement, teacher development, and gender and ethnic diversity.

IBM is among leading corporations in promoting women and girls to STEM careers. The company has internal initiatives to bring back professional women who left the technical career path, create programming for women to help accelerate their development, and ensure women progress to positions of importance. IBM has created programs such as P-TECH, which works with schools that blend high school and college students with curriculum, mentoring, and internships on the pathway to technology careers. IBM also works with students of all ages in local communities at its corporate locations to expand community and educational outreach through provision of resources and turnkey programs for employees and volunteers to promote positive visibility within engineering and technology communities.

SpaceX, one of the largest private space companies, supports programs and organizations geared toward the advancement of women in engineering and other STEM disciplines. Through participation in these groups, such as the Society of Women Engineers, SpaceX seeks to attract female candidates for full-time positions and for the company's robust internship program. SpaceX's corporate initiatives encourage excitement about science from a young age through supporting K – 12 STEM programs locally as well as national engineering programs and competitions.

Square, a leading mobile payments company, has put significant effort in Code Camp for Women. Code Camp is a program built by Square to inspire, educate, and empower the next generation of women in technology through leadership sessions, coding workshops, mentorship, and team-building activities. The goal of Code Camp is to help close the gender gap through mentorship, technical and leadership learning, and community to continue with careers in technology. There are three key aspects of Code Camp: community, leadership, and technical skills. To date, 70 young women have participated in Code Camp, spanning more than 30 universities in the United States and Canada, and six San Francisco high schools.

Xerox is a founding member of For Inspiration and Recognition of Science and Technology (FIRST) and continues to support the organization today. The Xerox Science Consultant Program is one of the longest running industry-education partnerships in the country. For the past 40 years, Xerox scientists and engineers have worked in the class room to make science fun for hundreds of thousands of elementary students. Xerox has also invested several hundred million dollars in educational grants to fund programs and scholarships at universities and science centers throughout North America. Thousands of students have received educational assistance through Xerox's Technical Minority Scholarship Program and more than half of the nearly $15 million granted by the Xerox Foundation support STEM initiatives.

The initiatives launched by these companies and organizations reflect a strong commitment to encourage women to pursue STEM education and careers and develop corporate policies that support the retention of women in STEM careers and their ascension to leadership positions. Many of these programs involve the public sector, universities, or nonprofit organizations in order to build an inclusive community of STEM professionals.

Conclusion

The participation of women in STEM fields is critical to the long-term sustainable growth and competitiveness of the American economy. Indeed, the comparative advantages of U.S. industries in global markets have shifted to innovation and the skilled workforce. More than 6.6 million jobs in the fields of computer sciences, mathematics, engineering, health care, life sciences, and social sciences will need to be filled by 2022, and the demand for highly trained STEM workers will undoubtedly continue to grow beyond then.

Women currently account for more than half of the labor force with postsecondary education but for only 25% of core STEM jobs. This underrepresentation of women in STEM occupations is largely because of their lower education rates in STEM fields of study. Only 6% of female graduates in 2013 (compared with 20% of their male counterparts) were in core STEM majors. Since STEM education also provides a useful background for non-STEM professions, and more than half of STEM graduates are in such positions, encouraging women to study STEM fields has widespread benefits across all industries.

Additional efforts and investments made by government agencies, private corporations, and educational institutions are needed to narrow the gender gap in STEM fields. Schools must increase the exposure of girls to STEM topics at an early age, and more programs should be developed to engage girls in experiential projects that illustrate the power and impact of STEM ideas. Corporations should expand their efforts to recruit, retain, and advance women in STEM occupations, including increased mentoring programs, a more inclusive corporate culture, and providing improved benefits and work-life balance programs. To ensure a much higher representation of women in STEM fields and to more fully leverage the competitive advantages of the U.S. economy, more persistent and innovative efforts are required to inspire and encourage women to pursue a STEM education and STEM careers.

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Appendix

There is a lack of consensus regarding the definitions of STEM fields of study and STEM occupations, reflecting that STEM has expanded beyond narrowly defined science and engineering fields. There are at least three widely accepted STEM field of study classifications defined by: (1) the National Science Foundation (NSF); (2) the U.S. Department of Homeland Security (DHS); and (3) the U.S. Department of Education's National Center for Education Statistics (NCES). Each organization's definition includes additional fields of study to the 17 core fields of sciences, engineering, and mathematics (in the first row of Table A.1). While both the NSF and DHS include agriculture science, architecture, environmental design, and psychology, the NSF also includes social sciences in its STEM education definition. In addition to the core fields, the NCES and the DHS include medical sciences, and engineering and science technologies. DHS includes all health, science, and engineering technologies in its STEM fields of study (Table A.1).

Upon the approval of the Office of Management and Budget (OMB), the STEM working group that consisted of representatives of federal agencies in 2012 finalized general guidelines for the classification of STEM workers.[30] The STEM classification matrix has two domains of occupations, core STEM and STEM-related, and five major occupational types. Core STEM occupations consists of life and physical sciences, technology, engineering, mathematics, and social sciences. STEM-related occupations include architecture and health care. Occupational functions are broadly grouped into five types: (1) research, development, design, and practitioner occupations; (2) technologist and technician occupations; (3) postsecondary teaching occupations; (4) managerial occupations; and (5) sales occupations (Table A.2).

Table A.1.

Three Major Classifications of STEM Fields of Study[31]

Field of Study	NCES	DHS	NSF
Sciences Atmospheric, Astronomy, Biological, Chemistry, Earth, Oceanography, and Physics	●	●	●
Engineering Aerospace, Chemical, Civil, Electrical, Industrial, Materials, and Mechanical	●	●	●
Mathematics Statistics and Computer Science	●	●	●
Agriculture Science, Architecture, Environmental Design, Interdisciplinary, Other Engineering, Other Physical Sciences, Other Life Sciences, and Psychology		●	●
Medical Sciences, Engineering Technologies, and Science Technologies	●	●	●
Anthropology, Economics, Ethnic Studies, History Of Science, Linguistics, Other Social Sciences, Public Administration, Political Science, and Sociology			●
Health Technologies, Other Science Technologies, and Other Engineering Technologies		●	

Table A.2.

STEM Workers by Occupation Type and by Domain[32]

	Science, Technology, Engineering, Mathematics Domain		Science and Engineering-Related Domain	
	Life and Physical Science, Technology, Engineering, Mathematics Occupations	**Social Science Occupations**	**Architecture Occupations**	**Health Occupations**
Research, Development, Design, and Practitioner Occupations	**Computer** Ex-Programmers and Support Specialists **Scientists** Engineering, Math, Life, and Physical Sciences	Scientists and Researchers	Architects (Ex-Naval)	Health Diagnosing and Treating Practitioners
Technologist and Technician Occupations	**Computer** Programmers and Support Specialists **Technicians** Engineering, Math, Life, Physical, and Social Sciences **Drafters, Surveyors** **Cartographers** **Photogrammetrists**	Research Assistants	Civil Drafters	Health Technologists and Technicians, Other Health Care Practitioners and Technical Occupations
Postsecondary Teaching Occupations	**Postsecondary Teachers** Computer, Math, Engineering, Life, and Physical Sciences	Postsecondary Teachers (Social Sciences)	Postsecondary Teachers (Architecture)	Postsecondary Teachers (Health)
Managerial Occupations	**Managers** Computer, IT, Engineering, Natural Sciences		Managers (Architecture)	Managers (Medical and Health Services)
Sales Occupations	**Sales Engineers and Representatives** Technical and Scientific Products			

Endnotes

1 Nam D. Pham is Managing Partner at ndp | analytics and Alex J. Triantis is Dean of the Robert H. Smith School of Business at the University of Maryland. Justin Badlam, Principal and Michael Hardesty, Associate at ndp | analytics, provided analytical assistance. We want to thank the Center for Women in Business of the U.S. Chamber of Commerce Foundation for their financial support to conduct this study. The opinions and views expressed in this report are solely those of the authors.

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8 NCES Digest of Education Statistics, Web.

9 The U.S. Department of Education's National Center for Education Statistics does not include agriculture, social, and behavioral sciences in STEM fields of study. (See Table A.1 in the Appendix)

10 National Science Foundation. 2014. "S&E Indicators 2014 Report." Web.

11 Based on the definition of STEM fields of study defined by the Department of Education (NCES).

12 Using a broader National Science Foundation definition that includes agriculture, social, and behavioral sciences and other disciplines (see Table A.1 in the Appendix), STEM graduates were 48% of total graduates.

13 Similarly, based on the broader NSF definition, 17% of female graduates were in STEM fields, compared with 26% of male graduates in 2013.

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16 Table A.2 in the Appendix provides more details of the classifications.

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29 Companies, organizations, and individuals surveyed in the report were identified and selected due to their contributions to thought leadership on the topic of women in STEM and represent a broad range of perspectives on the topic.

30 The Standard Occupational Classification Policy Committee (SOCPC) includes Bureau of Labor Statistics and Employment Training Administration, Department of Labor; the Census Bureau, Department of Commerce; Defense Manpower Data Center, the Department of Defense; the Equal Employment Opportunity Commission; Health Resources and Services Administration, Department of Health and Human Services; National Center for Education Statistics, Department of Education; and the National Science Foundation.

31 U.S. Department of Education, "Postsecondary Awards in Science, Technology, Engineering, and Mathematics." Web; Department of Homeland Security, "STEM-Designated Degree Program List: 2012 Revised List." Web; National Science Foundation, "Classification of Fields of Study." Web.

32 U.S. Department of Labor. 2012. "Options for Defining STEM Occupations under the 2010 Standard Occupational Classification System." Bureau of Labor Statistics.

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Center for Women in Business

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