Wilson Consulting Services, LLC

STEM Workers: Shortage or Skill Set Mismatch?

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By

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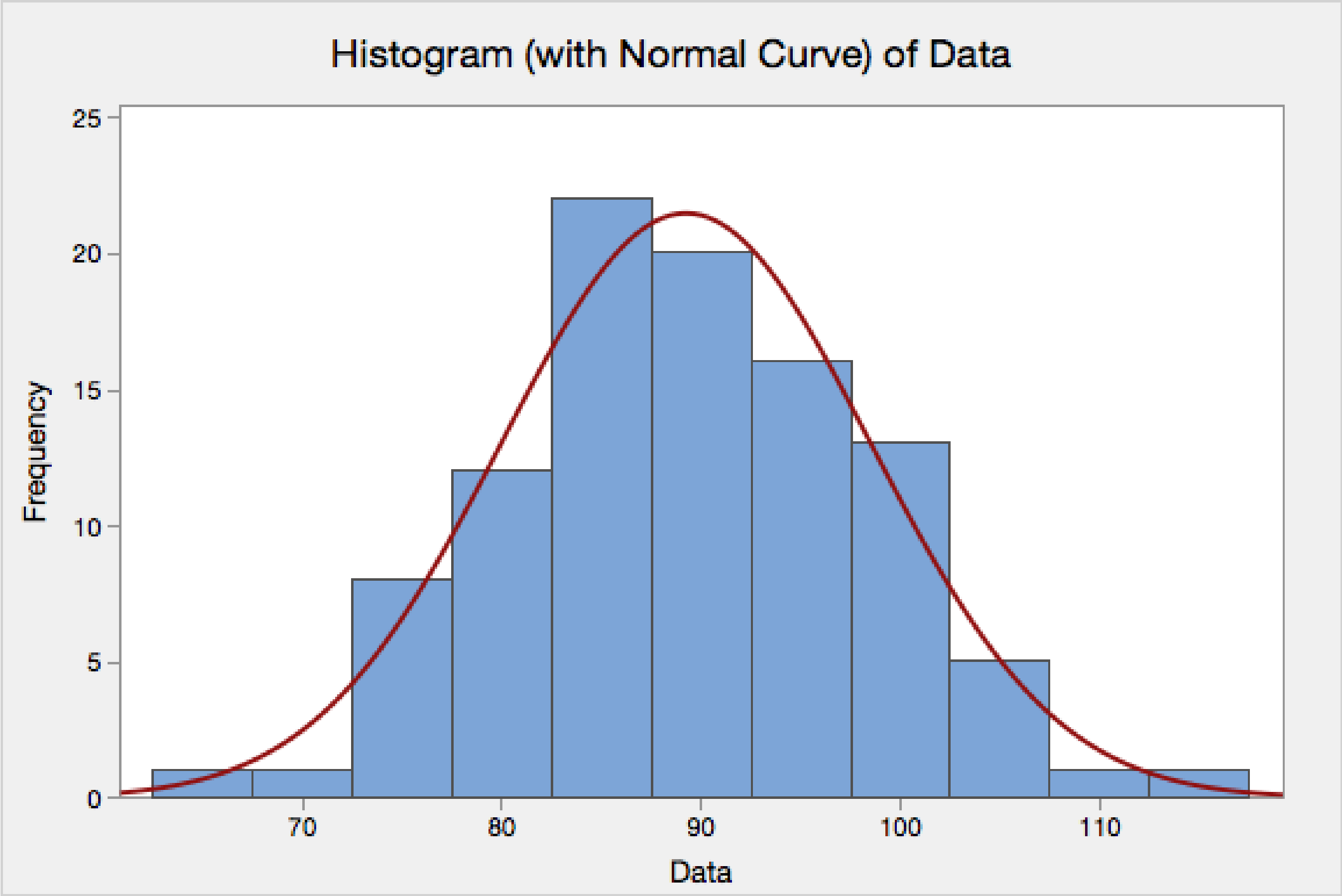
It must be demonstrated...

We are a proponent and advocate of literacy in STEM and statistics in a technological and data-driven world.



STEM = ∑(Science, Technology, Engineering, Mathematics)

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Author's Comments

As we listen to parents, teachers, administrators, analysts, businesses, politicians, and so on discuss the need for more students to consider a career in science, technology, engineering, and mathematics (STEM), one may wonder: Is there truly a shortage of STEM workers? What will happen to the high wages promised to the STEM workers when supply exceeds demand? Are there shortages in all areas of STEM, or is there a shortage in some sectors and a surplus in others?

When the former Soviet Union launched a satellite known as Sputnik in 1957, the United States felt it had lost its technological advantage; therefore, there was a massive galvanization to enact reforms in science and engineering education so that the nation could regain the technological ground it appeared to have lost to its Soviet rival. Perhaps not connected to Sputnik, a so-called new math was introduced, ushering in a dramatic change to the way mathematics was taught in American grade schools in the early 1960s, which failed miserably. In 2001, the No Child Left Behind Act (NCLB), which was passed by Congress, required states to develop assessments in basic skills. In 2009, Common Core State Standards were launched by state leaders, including governors and state commissioners, setting a high-quality mandate of academic standards in mathematics and English language arts/literacy.

Considering the controversies surrounding the NCLB and Common Core, the push behind STEM might be the perfect galvanization to boost overall education quality in grades K–12 because it is not a government mandate. Local school districts are setting the pace and agenda. STEM is different from previous initiatives because of its strong application component. Whether or not a STEM job shortage exists should be inconsequential to students; rather we should help students understand that STEM literacy and statistical literacy coupled with their hands-on application can and will be a huge asset to their careers, no matter what field they pursue, not to mention helpful in their everyday lives.

In the final analysis, students should never be pushed or coerced into a STEM career simply because they are good in math and science; rather they should be encouraged to select a career that they are interested in and use the STEM skills gained to help them be successful in that career and their everyday lives.

Respectfully,

David C. Wilson

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CEO/Author

David C. Wilson, MSEE

David C. Wilson—an electrical engineer and adjunct professor—retired. He is a consultant, statistical practitioner, family history researcher, author, and self-publisher.

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Wilson has worked in the engineering areas of product development, quality, and reliability for more than 35 years with multinationals such as IBM, General Electric, and Honeywell.

During his 25+ years as an adjunct professor, he taught engineering, mathematics, and statistics at Dutchess Community College (NY), Quinnipiac University (CT), and Horry Georgetown Technical College (SC). Additionally, he served one year on the prestigious IBM Faculty Loan Program.

He and his wife, Beverly, have two adult sons and six grandchildren. They reside in Conway, South Carolina.

Executive Summary

Science, technology, engineering, and mathematics (STEM) occupations have been propelled to the forefront of K–12 and postsecondary education. STEM occupations are the pillars that enable the United States to maintain its technological and economic advantage in an increasingly global economy.

There has been much discussion about the shortage or surplus of STEM workers; some experts say that there is a shortage of STEM workers, while others suggest a surplus exists. Circumstantial evidence suggests that the STEM shortage proponents are basing their opinion on anecdotal data, trade associations, lobbyists, and, among other factors, incorrect assumptions about STEM occupations and employers expressing concerns over the supply and availability of STEM workers. Nevertheless, many who argue about either the shortage or surplus have access to the same data, meaning perhaps their differing opinions could be a matter of their interpretation of the data.

This paper examines the STEM workforce in an effort to ascertain whether the notion of a STEM shortage is more of a mismatch in STEM skill set versus the skill set being sought to fill available openings.

The push by high-tech companies for more H1-B visas is also an indication that they are not finding the needed skills within the United States; therefore, companies looking to foreign countries for STEM workers with matching skills is an indication of a skills mismatch.

Key findings include:

- In 2016, there were 8.8 million STEM workers in the United States, representing 6.3% of the workforce. This means that 1 out of 18 workers was a STEM worker.
- The STEM workforce grew 18.7% from 2006–2016, representing 1.3 million new STEM jobs.
- The STEM workforce projection for the next 10 years is down (12.6%) from 2006–2016 (18.7%), resulting in 1.1 million new jobs, which means 195,000 fewer STEM jobs from the previous 10 years.
- More than half (60%) of projected growth of STEM jobs from 2016–2026 is expected to be in computer occupations and engineering.
- Of STEM workers, 73% have a bachelor's degree or higher compared to 36% for all other occupations with the same education attainment.
- Fewer than 50% of those with a bachelor's STEM degree are employed in a STEM job.
- About one-third (33%) of STEM workers have a non-STEM degree.
- STEM workers' average increase in wages was 0.4% from 2015 to 2016.
- STEM workers' average increase in employment was 1.2% from 2015 to 2016.
- The skill set mismatch might give the appearance of a STEM worker shortage.

§1. Introduction

Everyone from parents who have a child in a K–12 grade to the president of the United States has recently talked about STEM. STEM workers are a subset of the total United States workforce, making up only 6.3% of the total workforce. Nevertheless, they are a highly educated and talented group of workers. In recent years, the popularity of pursuing a career in STEM has skyrocketed, to the extent that many people and organizations report that a shortage of STEM workers is occurring or will occur in the future unless massive change is invested in STEM education now. Along with the popularity, some high schools are calling themselves a STEM school. Some reports are painting a near panic situation about a STEM worker shortage in the Untied States.

"What is a STEM or non-STEM worker, and can this definition to some extent be subjective?" This paper follows the Bureau of Labor Statistics guidelines to identify STEM occupations. Generally, a STEM worker is a person with an educational background in science (life and physical), technology, engineering, or mathematics who uses this knowledge and experience to understand how things work. They use the problem-solving, critical thinking, reasoning, creativity, and innovative skills they develop through learning and applying these disciplines. Any credible STEM degree must be mathematics-centered, which is fundamental to developing the kinds of analytical skills and logic needed to be successful as a STEM worker. It is important to mention that STEM graduates with a degree in any of the disciplines mentioned above also do well in non-STEM careers because of the analytical thinking, logic, creativity, and so on that they bring to their non-STEM job.

Numerous comments and reports indicate there exists a shortage of STEM workers in the United States. However, other reports such as the U.S. Census Bureau, Economic Policy Institute, the Rand Corporation, etc., including this paper have found no evidence of a systemic shortage of STEM workers. Matter of fact, this paper shows evidence that fewer than 50% of those with a bachelor's STEM degree are employed in a STEM job. In addition, other reports have stated that there is a shortage in specific sectors. For example, it has been reported by the Bureau of Labor Statistics/Monthly Labor Review that the academic sector is generally oversupplied, whereas the government sector and private industry have shortages in specific areas.

The Webster definition of mismatch is this: "To put (people or things that are not suited to each other) together: to match (people or things) badly." It seems that reports of shortages have more to do with mismatches of specific STEM degrees and/or skills sets being sought for specific positions. What is a mismatch relative to a STEM worker? A simplified definition of a mismatch is that the skills that a worker possesses versus the skills needed for a specific job do not match. Therefore, the position or positions cannot be filled because of a mismatch of skill set rather than a shortage of people with a STEM degree. The mismatch scenario creates a sense of a shortage because employers cannot find enough workers with the requisite skill set to fill open positions. (Section 9.3, mismatch theory).

As a follow-up to the STEM workers shortage or surplus phenomena, this paper examines volumes of quantitative data about many different distributions and backgrounds of STEM workers to better understand the discussion and share information with the general public. To that end, this paper catalogued and presents graphical data summaries of past, present, and future STEM occupations relative to workers. These summaries include an analysis of STEM degree holders, the percentage of STEM degrees conferred, the STEM labor force from 2006–2016, and the projected labor force in 2016–2026. It also includes a detailed analysis

§1. Introduction, cont'd

and distribution of 41.5 million workers, both STEM and non-STEM, in the United States. All of the 41.5 million workers possess a bachelor's degree or higher in STEM and non-STEM disciplines. The data used was analyzed and summarized using charts, graphs, tables, and so on. The bulk of the data used in the analyses came primarily from the US Department of Labor (Bureau of Labor Statistics), US Census Bureau, and US Department of Education (National Educational Center for Education Statistics).

Various studies include or exclude some occupations as STEM workers. For example, this paper excludes social science, psychology, multidisciplinary, and STEM-related jobs as STEM workers, as outlined in section 2. Therefore, to some extent, the conclusions might vary significantly among reports on whether there is a shortage, surplus, or equal number of STEM workers for STEM occupations.

The inclusion of social scientists as STEM workers could be problematic because the basic research, although it uses some statistics in publishing findings, is qualitative in nature, not quantitative as with science (life and physical science), technology, engineering, and mathematics.

This paper endeavored mightily to examine the available data as closely as possible to ascertain whether the notion of a STEM worker shortage or surplus is real. To that end, this paper is replete with graphical analysis. This was done to help the reader see the evidence from a practical view, such as growth, distribution of workers and wages, people with STEM degrees and non-STEM degrees working in STEM jobs, and so on. In addition, the preponderance of the graphical analysis allows the reader to easily browse the paper and interpret the outcomes of each topic without having to read every word, albeit reading everything will add clarity to the individual graphs.

§2. STEM Occupations and Domains

2.1 STEM Occupations, Domains, and Sub-domains

This paper used the Occupational Employment Statistics (OES) Standard Operational Code (SOC) of the US Department of Labor, Bureau of Labor Statistics to determine STEM occupations. This paper followed the guidelines for STEM workers in Domain 1 in defining a STEM worker by the occupation guidelines. It followed the format of the two domains as given by SOC.

Table 2.1. Hierarchy of STEM Occupational Domains and Sub-domains

Domain 1: Science, Engineering, Mathematics, Information Technology

- Sub-domain
  1. Life and Physical Science, Engineering, Mathematics, and Information Technology
  2. Social Science Occupations*

Domain 2: Science- and Engineering-Related

- Sub-domain
  3. Architecture Occupations
  4. Health Occupations

The STEM occupations were mapped using the five types of occupations listed below. An explanation of the grid is beyond the scope of this paper. The list of the types of STEM occupations were used in conjunction with the grid using OES STEM definition codes, which are limited to sub-domain number 1 as shown above.

Occupation Types:

A. Research, Development, Design, or Practitioners; B. Technological and Technician Occupations; C. Postsecondary Teaching Occupations; D. Managerial Occupations; and E. Sales Occupations

The occupations below were defined as science, technology, engineering, mathematics (STEM) occupations by OES/SOC definition of STEM occupations. This paper applied the SOC to OES's STEM definition from the list with the 99 OCC-Codes/Titles (Appendix A), which identifies all jobs in Sub-domain 1, and from architecture occupations from Sub-domain 3. The codes below are SOC summary and the matching codes in Appendix A. For example SOC 15-1100 consist of SOC 15-1111, 15-1121, 15-1122, etc. A list of the Standard Occupational Classification Policy Committee can be found at the link here. https://www.bls.gov/soc/Attachment_B_STEM.pdf.

OES/SOC Occupations list (sub-domain 1)

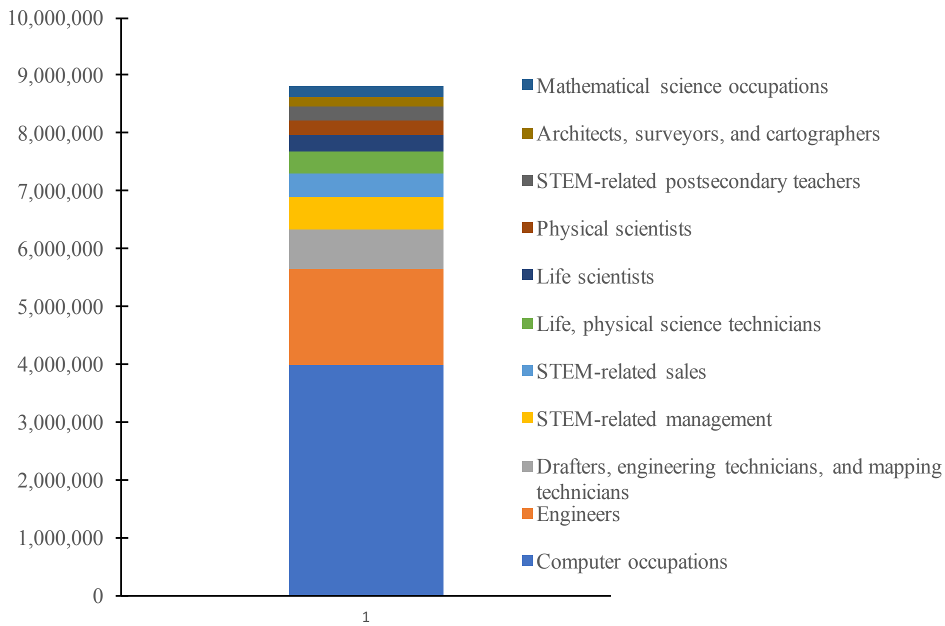
- Computer occupations (SOC summary 15-1100: 15-1111–15-199)
- Engineers (SOC summary: 17-2000: 17-2011–17-2199)
- STEM-related management (SOC 11-3020, 11-9040; 11-9120)
- Mathematical science occupations (SOC summary 15-2000: 15-2011–15-2099)
- STEM-related postsecondary teachers (SOC 25-1020; 25-1032; 25-1040; 25-1050)
- STEM-related sales (SOC 41-4011; 41-9030)
- Physical scientists (SOC summary 19-2000: 19-2011–19-2099)
- Life and physical science technicians (SOC summary 19-4000: 19-4011–19-4099**)
- Life scientist (SOC summary 19-1000: SOC 19-1011–SOC 19-1099)
- Architects, surveyors, and cartographers (SOC summaries 17-1010; 17-1020: 17-1011–17-1022
- Drafters, engineering technicians, and mapping technicians (SOC summery 17-3000: 17-3011–15-3033)

*The inclusion of social scientist in the first domain is problematic because their field's formal training and research are qualitative in nature, not quantitative. It is not clear why it was included as a mathematics-centered occupation.

§2. STEM Occupations and Domains

2.2 STEM Occupations Distribution

Figure 2.1: STEM Occupations as defined in Table 2.1 and in relative size to one another

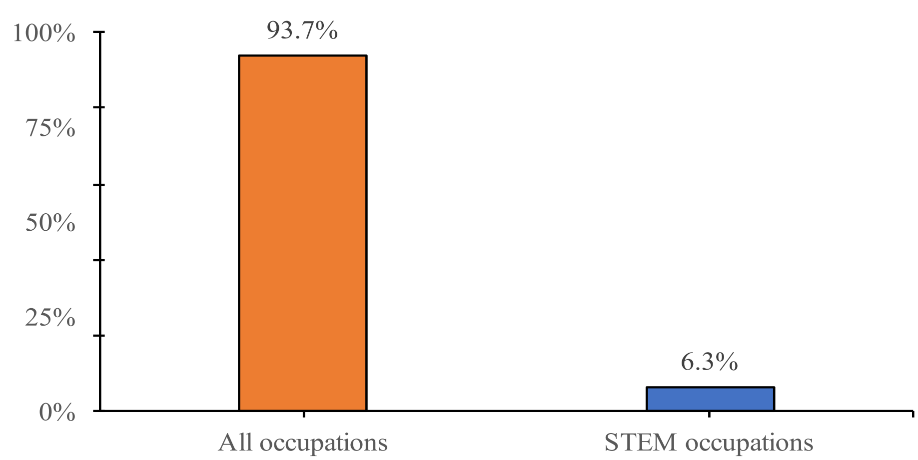


Source: U.S. Bureau of Labor Statistics

This section covers non-STEM occupations versus STEM occupations. It cover a summary of past and present STEM and non-STEM occupations. It also provides salary information on the many STEM occupations.

The graph (Figure 2.2) shows the share of STEM jobs relative to all jobs. STEM jobs make up only 6.3% of all occupations in the United States. However, this small share consists of a highly educated workforce (Figure 2.3).

Figure 2.2: Percentage share of all occupations versus STEM occupations



Source: U.S. Bureau of Labor Statistics

§2. STEM Occupations and Domains

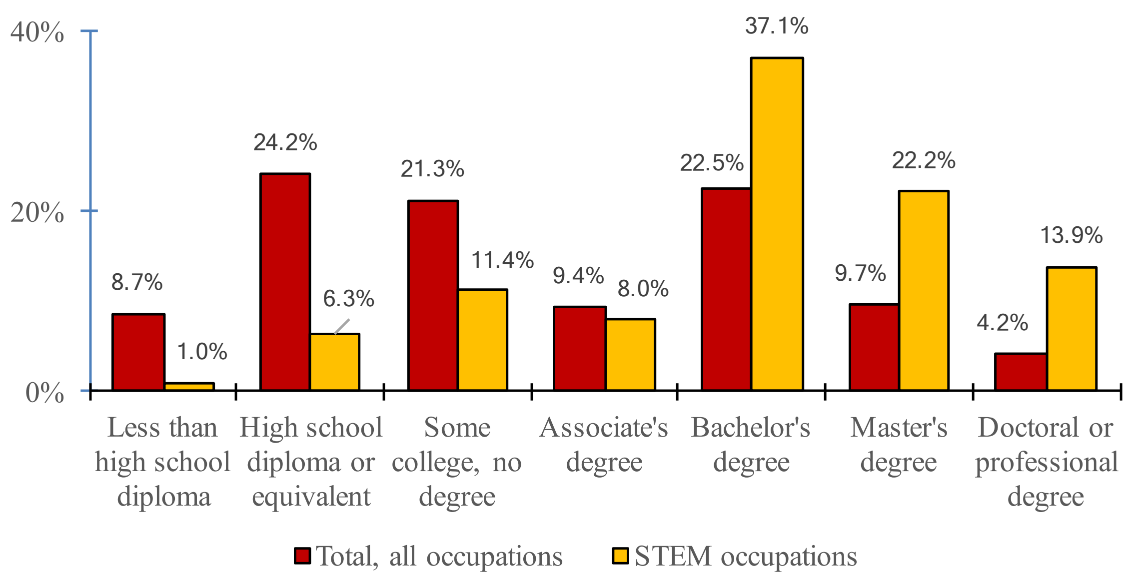
2.3 Occupation and Worker

The US Department of Labor's Bureau of Labor Statistics does not project employment shortages, surpluses, or equilibrium, rather it projects employment growth in occupations. It is the responsibility of the employers to decide how to manage their workforce. The projections are based on one person per projected opening. For example, the Bureau of Labor Statistic (BLS) may project three openings in a STEM occupation but an employer might decide to combine the three jobs into two, thus reducing the number of STEM workers. This illustrates that projected occupational openings do not guarantee the same number of workers being employed as the projected openings.

2.4 Education Attainment of STEM Workers

Figure 2.3 depicts a stark contrast that exists between the higher education credentials needed by STEM workers compared to all other occupations. It is factual evidence that STEM occupations require a high level of skills, critical-thinking skills, and so on. For example, 73.2% of workers have attained a bachelor's degree or higher, whereas only 36.4% of all other occupations have attained a bachelor's degree or higher. This means that for every non-STEM worker with a bachelor's degree, there are two STEM workers with a bachelor's degree or higher. The averages were not weighted; therefore, STEM workers holding associate's degrees may have been overshadowed by the overwhelming percentage of people with STEM bachelor's degrees or higher.

Figure 2.3: Comparison of education attainment of STEM workers to all other workers in the United States



Source: Employment Projections program, U.S. Bureau of Labor Statistics

§3. STEM Occupations: Actual Growth and Job Share, 2006–16

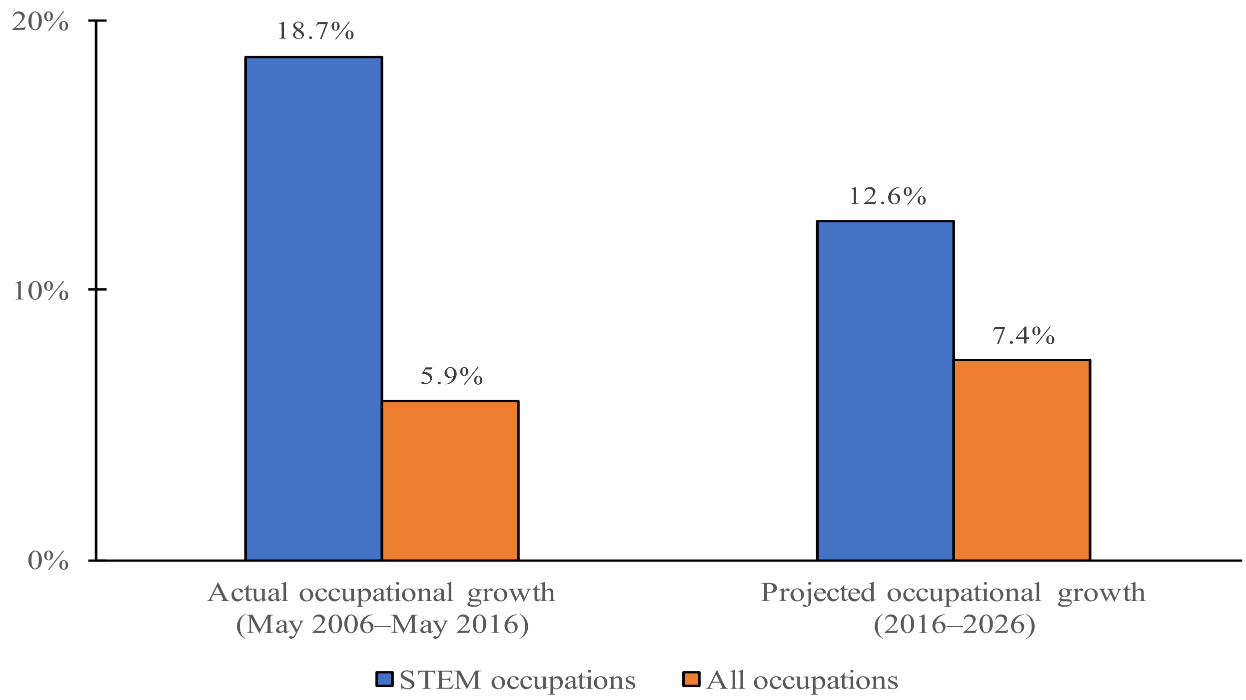
3.1 Comparison of Growth

Figure 3.1 depicts the percentages of actual growth of STEM jobs from 2006–2016. The graph also shows the projected percentage growth of all occupations and STEM jobs from 2016–2026. The occupational projected section of this report (Section 4), not only includes projected growth in new openings, but also openings due to separation from STEM occupations. The total openings are the combined growth in the number of jobs and openings due to separation.

The actual STEM job growth from 2006–2016 was 18.7%, whereas all occupational growth was 5.9%. Therefore, for every job growth in all occupations, three STEM jobs were created, creating a 3:1ratio in job growth.

The projected growth in STEM occupations from 2016–2026 is 12.6% and for all other occupations it is 7.4%. On the basis of the projections, all occupational growth will increase by 22.6% and STEM growth will decrease by 40% (Down from 18.7% to 12.6%) from the previous 10 years.

Figure 3.1: Percentage of actual occupational growth and projected growth from 2006–2016 and 2016–2026



Source: Employment Projections program, U.S. Bureau of Labor Statistics

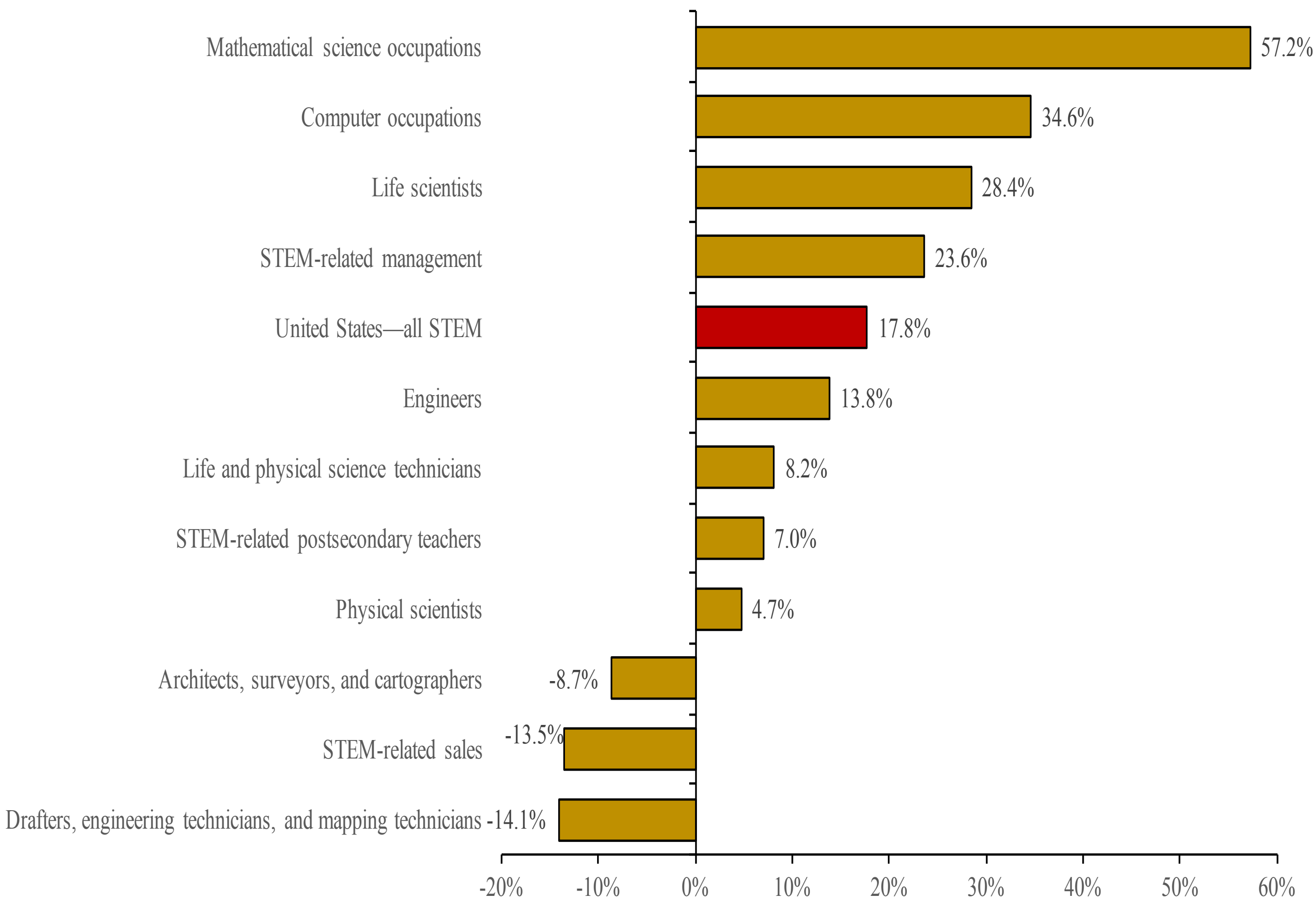
§3. STEM Occupations: Actual Growth and Job Share, 2006–16

3.2 Actual Percentage Growth by Occupation

Figure 3.2 shows the percentage increase in STEM jobs from May 2006 to May 2016. The largest percentage increase was in mathematical science occupations (57.2%). STEM-related sales jobs had the smallest increase with negative growth (-14.1%).

The kind of uneven distribution shown in Figure 3.3 can easily skew the STEM job market, resulting in a surplus in some occupations and a shortage in others. In addition, these kinds of situations can and will cause a dilemma in determining whether there is a shortage or surplus or even in assessing the STEM jobs' demand and supply. Conceptually, there could be a shortage in mathematical science occupations and a surplus in the engineering sector because engineering jobs grew only 13.8% and mathematical science jobs grew 57.2% in 10 years. However, the difference between mathematical science and engineering job growth could be misleading. For example, absolute growth in jobs for engineers was 198,610 and only 61,080 for mathematical science (Figure 3.3). Therefore, in absolute numbers, this scenario illustrates the reason percentages alone are not always the best measure and can be misleading. Consequently, determining whether there is a blanket shortage of STEM workers is far more complex than determining the number of people exiting college with a STEM degree.

Figure 3.2: Actual percentage of STEM job growth, May 2006–May 2016



Source: Current Population Survey, U.S. Bureau of Labor Statistics

§3. STEM Occupations: Actual Growth and Job Share, 2006–2016

3.3 Percentage and Number of STEM Workers' Share by Occupation

Computer occupations by far experienced the largest growth of STEM workers by more than one million from 2006–2016 (Figure 3.3). The overall STEM growth was more than 1.3 million jobs from 2006–2016.

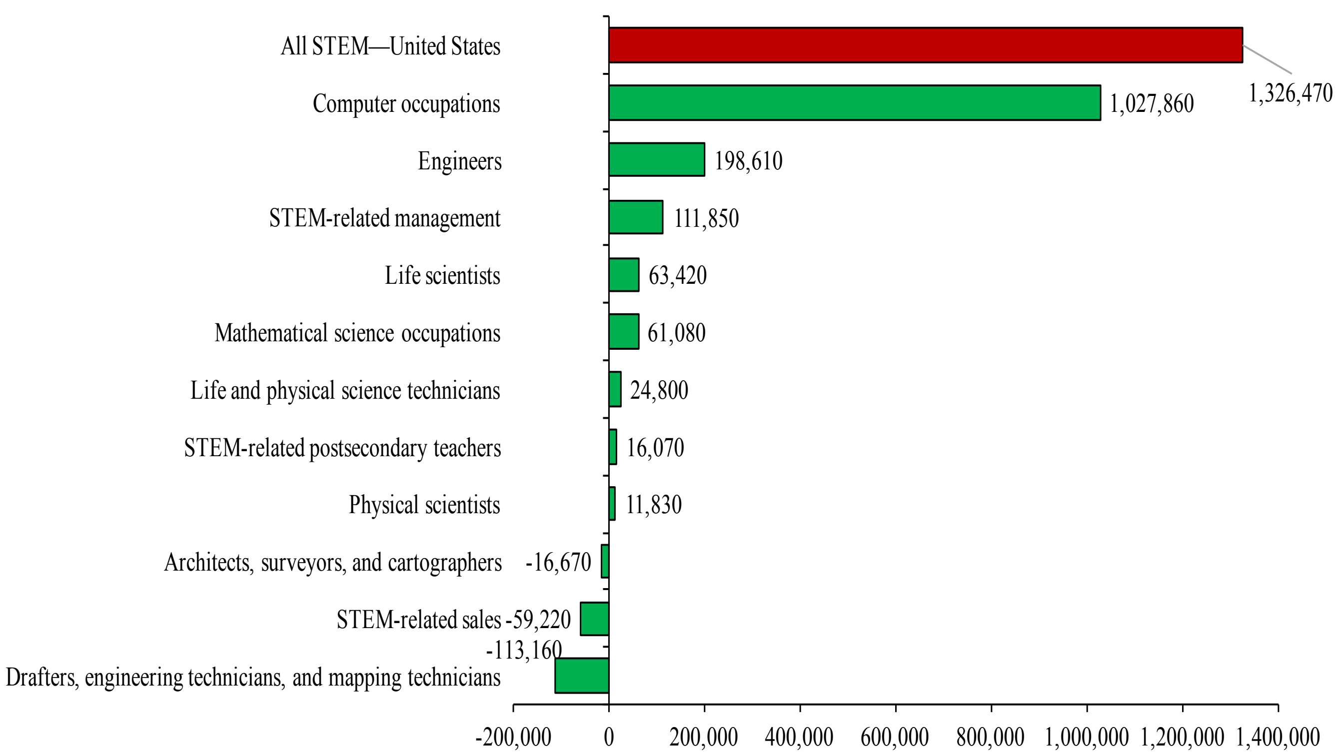
Engineers experienced the second-highest growth in the number of jobs during the same time period. Drafters, engineering technicians, and mapping technicians experienced the highest negative growth: more than 100,000 jobs.

Another interesting observation is that STEM-related postsecondary teachers grew by 16,070 jobs. This correlates nicely to the fact that more students are electing to take on a STEM major for their first degree. Once again, these uneven growth patterns adds more complexity to the debate of shortage, surplus, or even relative to STEM workers. This most likely contributes to the fact that about 33% of STEM workers do not have a STEM degree. Possessing a desirable skill set in addition to a bachelor's degree weighs heavily in a job search than simply possessing a STEM degree.

Although there might be an adequate supply of workers with a STEM degree applying for a job, organizations that cannot find suitable skill set fits for their positions may become frustrated and report being unable to find STEM workers to fill vacant positions. Therefore, they will seek out H-1B workers.

STEM work can be more demanding than many jobs in the sense that bluffing is not an option when an employee is confused; therefore, one's mismatch of skills for the job will be exposed rather quickly.

Figure 3.3: STEM actual jobs growth numbers, May 2006–May 2016



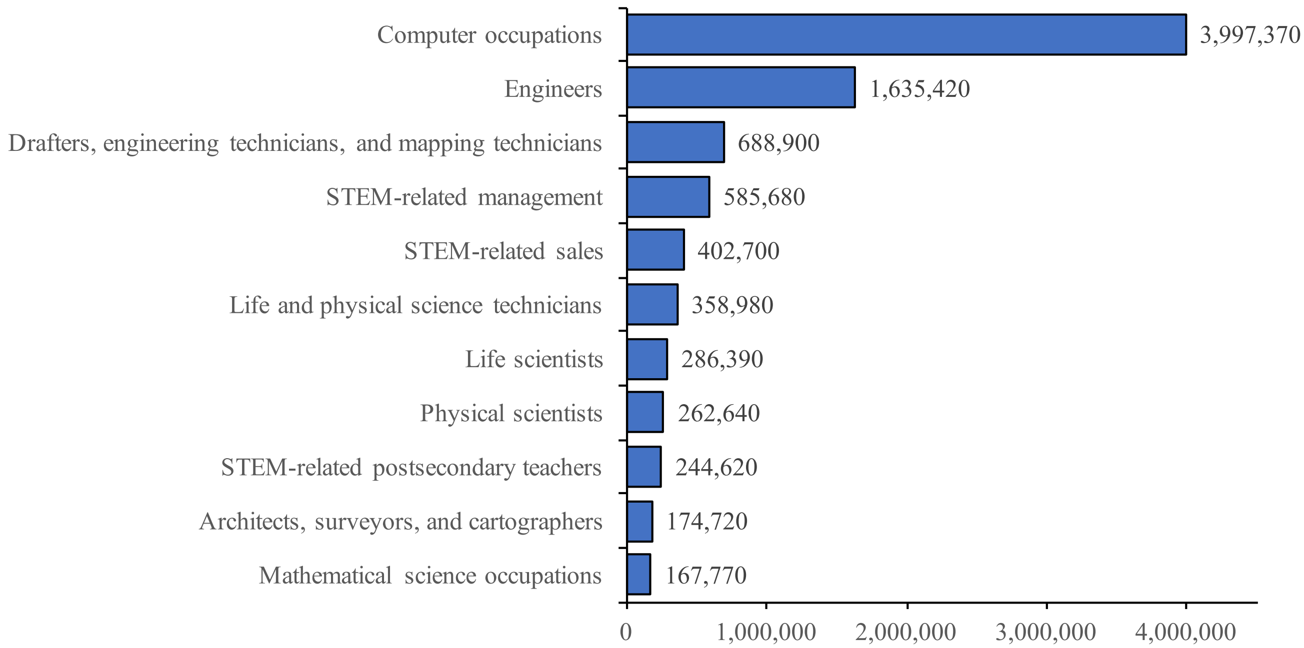
Source: Current Population Survey, U.S. Bureau of Labor Statistics

§3. STEM Occupations: Actual Growth and Job Share, 2006–2016

3.4 Number and Percentage of STEM Workers' Share

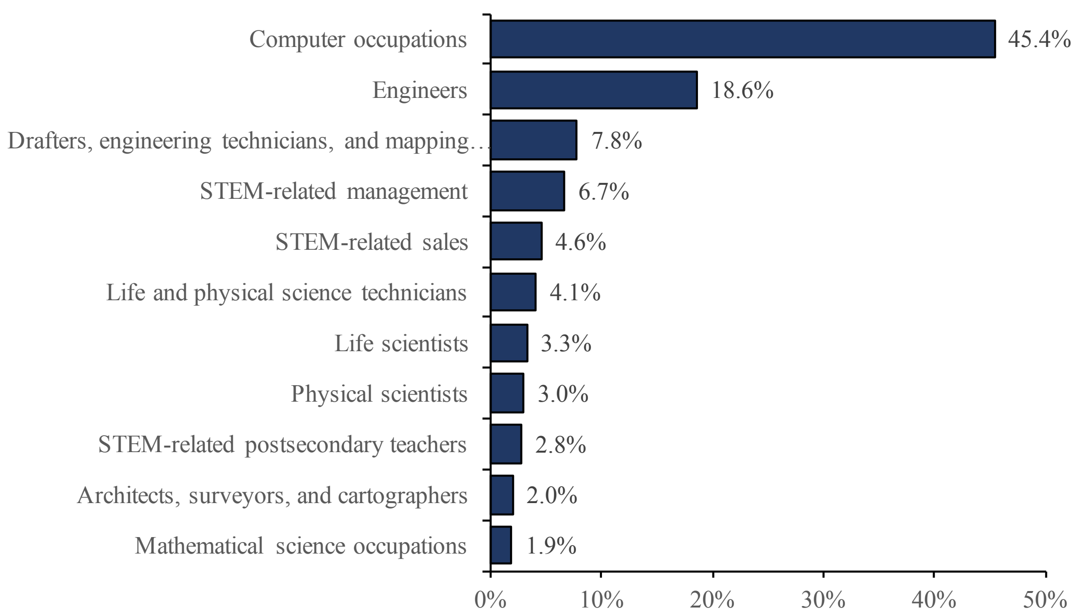
Figures 3.4 and 3.5 respectively depict the total distribution share and percentage distribution share by occupations of all 8.8 million STEM workers as of May 2016. Computer occupations has the largest share of STEM workers: close to 4 million (45.4%). Engineers were next with a total share of 1.6 million (18.6%). Also, computer occupations and engineering comprise of more than half of STEM jobs (62%). See Figure 3.5.

Figure 3.4: STEM distribution share of workers by occupations, May 2016



Source: Current population Survey, U.S. Bureau of Labor Statistics

Figure 3.5: STEM percentage distribution share of workers by occupation, May 2016



Source: Current Population Survey, U.S. Bureau of Labor Statistics

§4. STEM Occupational Projected Growth, Separations, and Openings

4.1 Comparison of Actual and Projected Occupational Growth

Figure 4.1 below provides actual and projected growth of STEM jobs and separations. The final projected count is a combination of separation and projected growth. These two numbers form the annual projected openings in STEM occupations. The Bureau of Labor Statistics does not estimate jobs, but rather projects openings in occupations. The employer determines whether an opening will be filled due to separation. The number of openings per year is calculated by dividing 10 by the growth and adding it to the separation per year number.

Figure 4.1: Actual and projected STEM occupational growth, separations, and openings, 2016–2026*

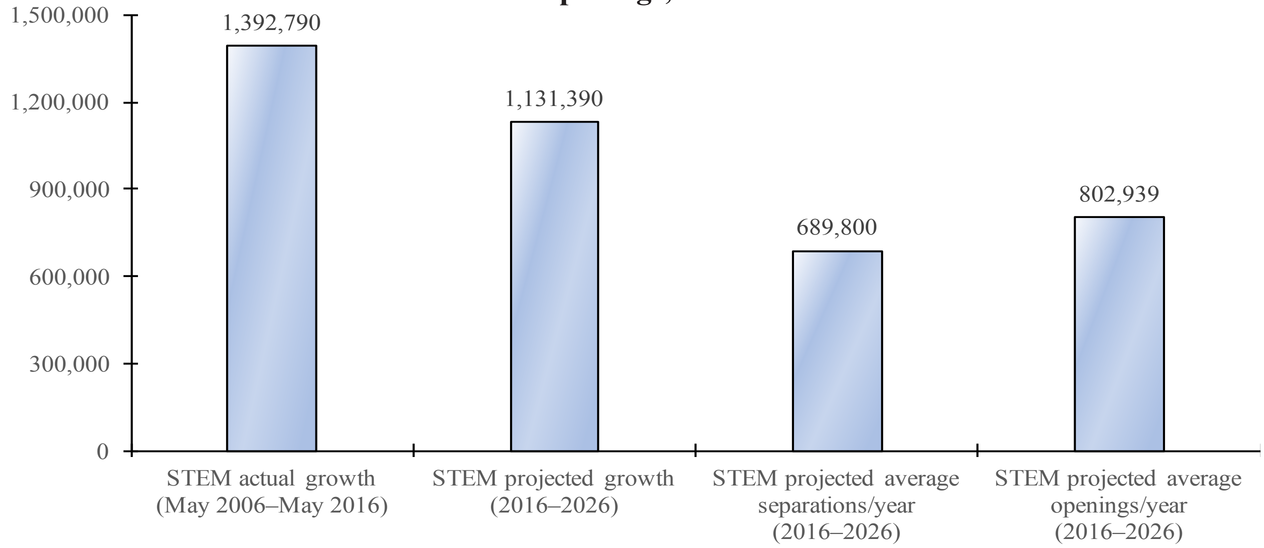
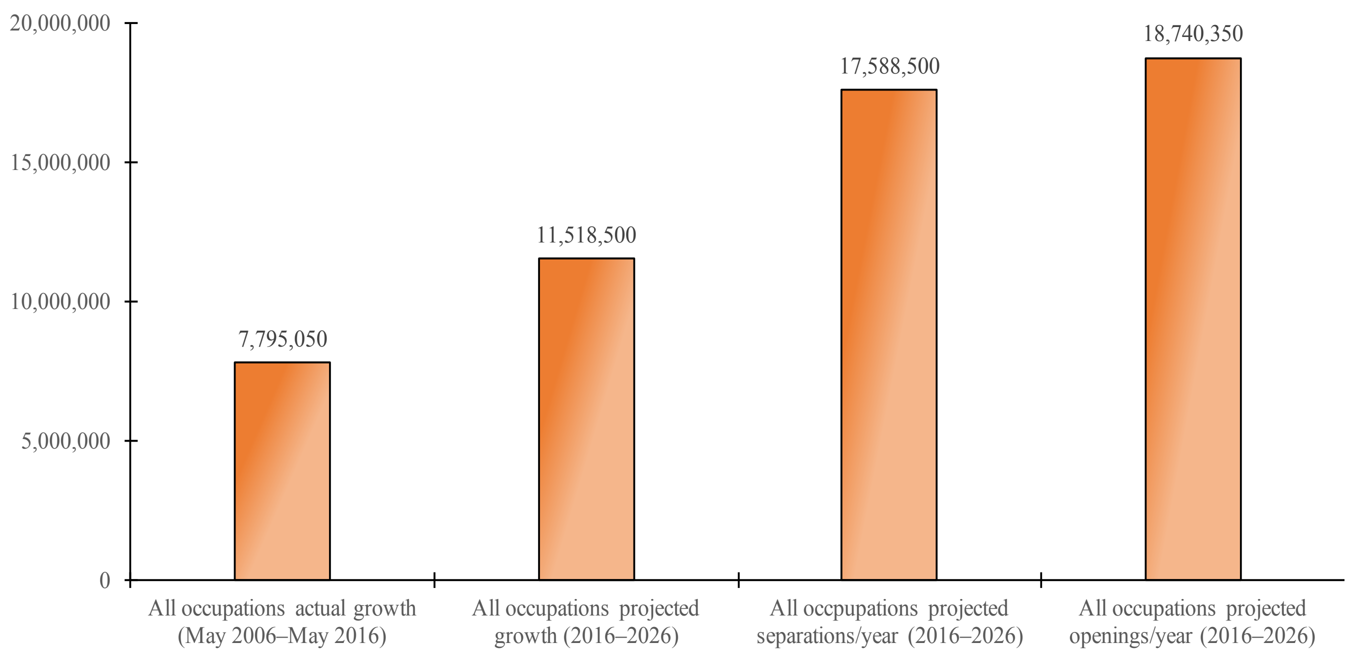


Figure 4.2 examines all occupations in the manner of the previous graph. STEM occupations are a subset of all occupations. To provide the reader perspective, it is important that this comparison be shown whenever possible.

Figure 4.2: Projected all occupational growth, separations, and openings, 2016–2026



Source: Employment Projections program, U.S. Bureau of Labor Statistics (Both figures this page)

*Month was used in actual growth because the Bureau of Labor Statistics had actual data from May-to-May of the given year.

§4. STEM Occupational Projected Growth, Separations, and Openings

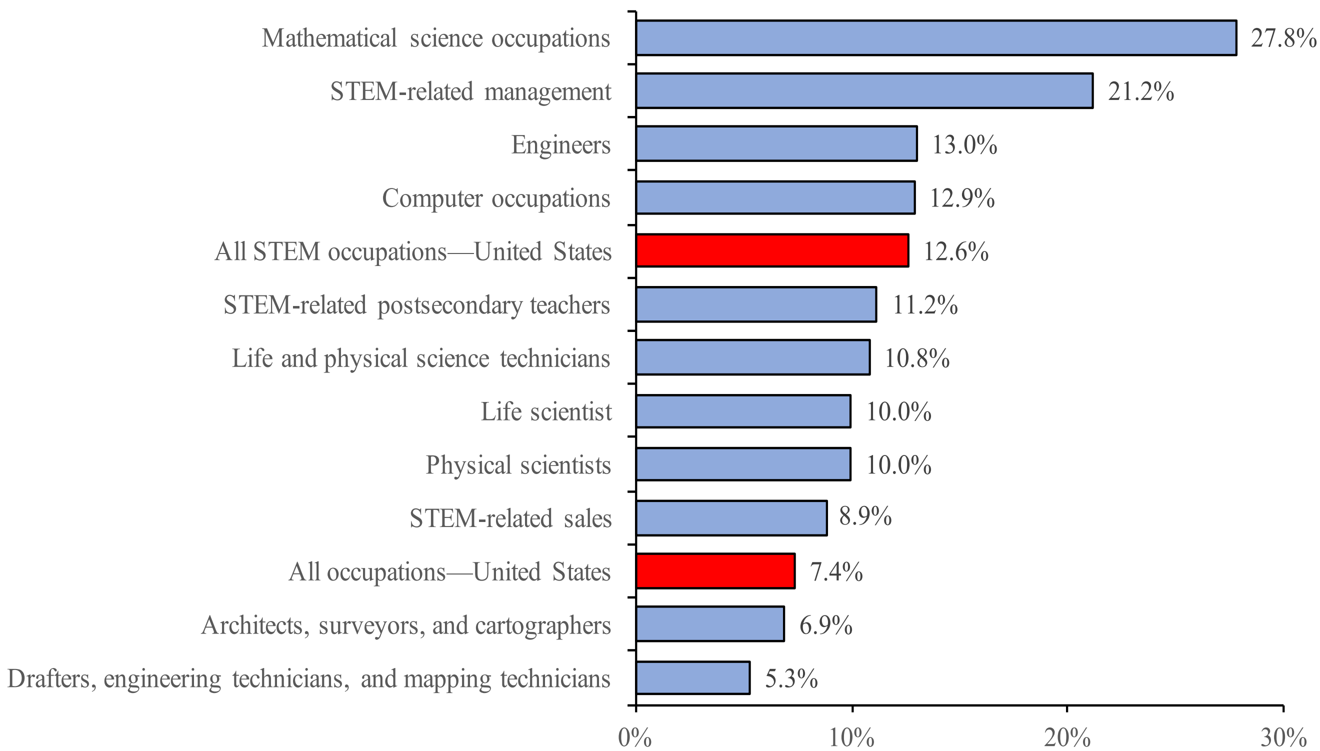
4.2 Projected Percentage Occupational Growth of New Jobs

Figure 4.3 illustrates the projected growth of STEM jobs relative to all US jobs. The projected highest growth is in mathematical science occupations at 27.8%, whereas engineers have a much lower growth rate at 13%. This is another case where percentage growth can be misleading. For example, in absolute numbers, engineers have a projected growth of 209,300 new jobs and mathematical science occupations have an absolute number of new jobs of about 50,200 (Figure 4.4).

This means that in absolute numbers, new jobs grow for engineers will be about four times greater than those for mathematical science.

The projected growth rate for all occupations is 7.4 percentage points versus 12.6 percentage points for STEM occupations. Although STEM employment is a small portion of the US workforce, its average growth will rise over the next 10 years faster by 52 percentage points compared to all occupations.

Figure 4.3: Projected percentage growth in new jobs in STEM occupations, 2016–2026 (n = 1.1 million)



Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

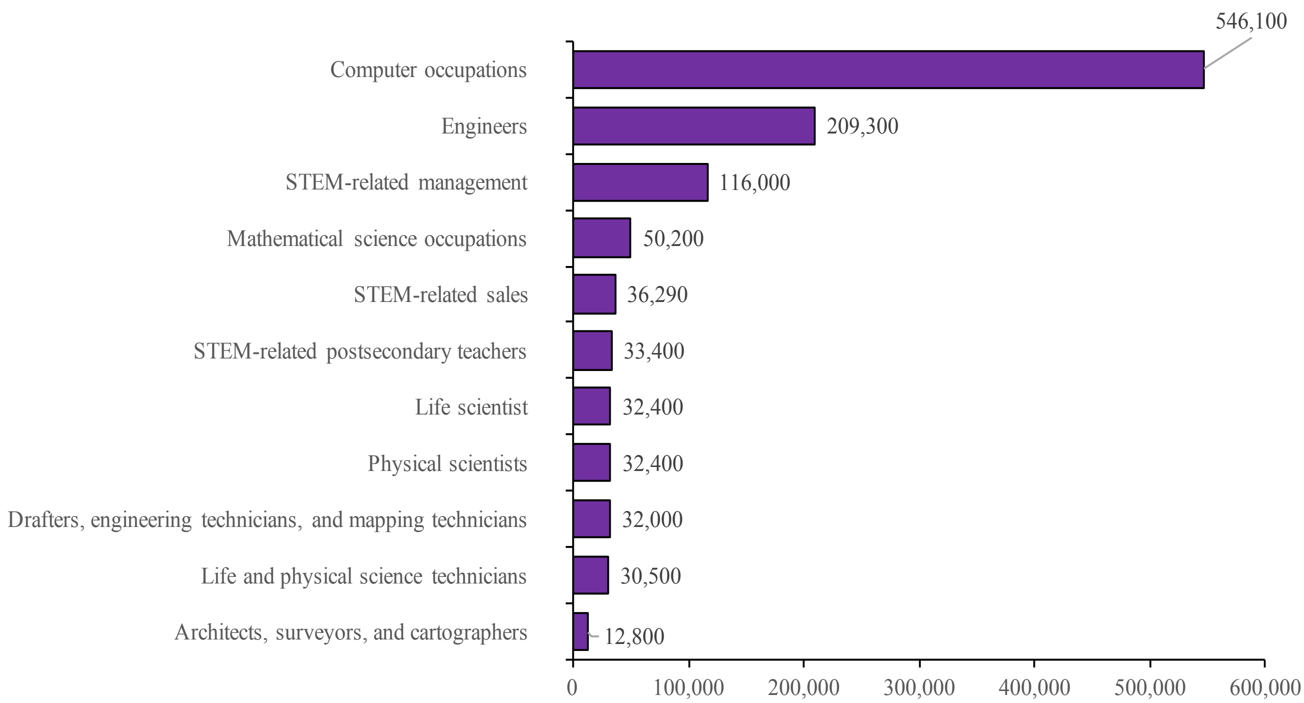
§4. STEM Occupational Projected Growth, Separations, and Openings

4.3 Projected Number in Growth of New Jobs

Figure 4.4 depicts the projected growth of STEM occupations in absolute numbers, which is useful in comparison to percentage growth. It highlights the difference between the percentages shown in Figure 4.3 by using absolute numbers. The projected highest growth in new jobs is computer occupations (546,100). Although significant, engineers followed with a credible number, albeit a distant second (209,300). Architects, surveyors, and cartographers smallest projected new jobs in absolute numbers (12,800).

These new job growth numbers are coupled with openings due to annual separations as shown in Figure 4.5, to determine annual job openings (Figure 4.6).

Figure 4.4: Projected growth of new jobs in absolute numbers for STEM occupations, 2016–2026 (n = 1.1 million)



Source: Employment Projections program, U.S. Bureau of Labor Statistics

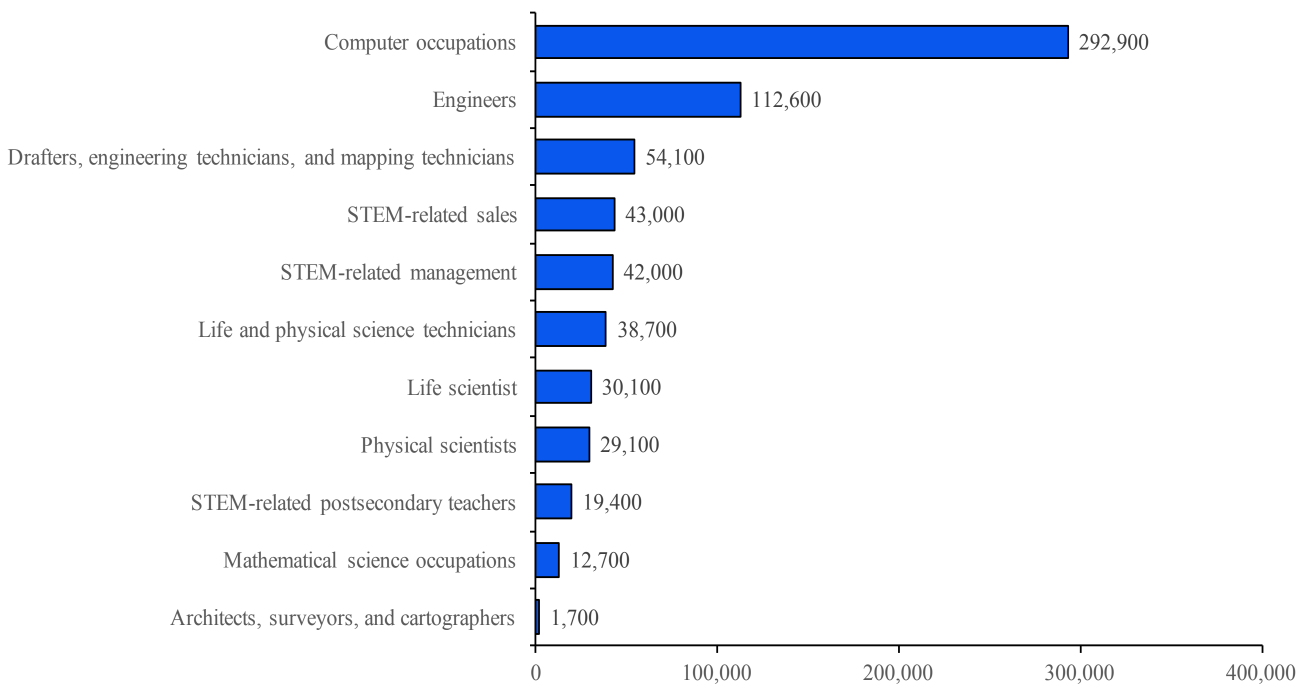
§4. STEM Occupational Projected Growth, Separations, and Openings

4.4 Projected Annual Occupational Openings Due to Separation

Figure 4.5 depicts the absolute annual numbers of employees separating from the workforce. How is separation determined? The Bureau of Labor Statistics uses two different models to project occupational separations, one for labor force exits and the other for occupational transfers. Occupational transfer means the worker leaves the occupation. Exits refers to when a person retires. Both models use a regression analysis of historical data to identify the characteristics of a worker, such as age and educational attainment, that make them likely to separate from their occupation. These patterns from historical data are then applied to the current distribution of employment for each occupation to project future separations.

The data in the graph below are interim numbers that will be coupled with new jobs openings to arrive at final projected job openings in the various STEM occupations. The final openings for STEM jobs are shown in (Section 4.5) highlights the most important numbers to determine STEM jobs' growth because it sums the possible total available jobs openings, including openings and vacancies due to growth and separation.

Figure 4.5: Projected annual average STEM labor force due to separations 2016–2026



Source: Employment Projections program, U.S. Bureau of Labor Statistics

§4. STEM Occupational Projected Growth, Separations, and Openings

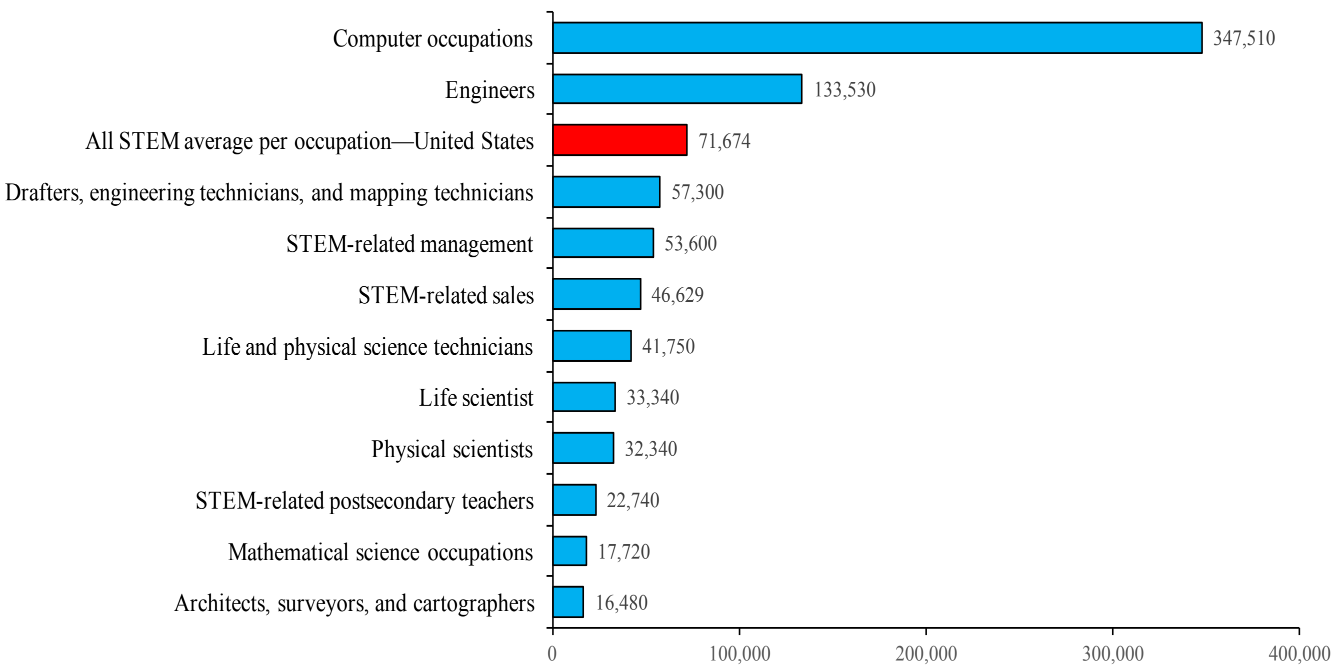
4.5 Projected Annual Number of Occupational Openings Due to Growth and Separation

All STEM occupations shown in Figure 4.6 are a combination of occupational growth and openings due to separation. These openings are considered projected annual openings in STEM occupations from 2016–2026. Computer occupations continue to lead all other STEM jobs in openings into the future. All STEM occupations are projected to provide average openings of 71,674 jobs annually through 2026. However, the median number of openings is 41,750 jobs, which is much less than the average for all STEM jobs. This demonstrates that the non-normal distribution of job openings is right-skewed, which tends to pull the average to the right of the median. However, in this situation, the median is perhaps a better measure of STEM annual openings for the lower end of job openings because it is not affected by higher-end openings such as computer operations and engineers.

The final projection for each occupation is calculated by dividing the job growth by 10 and adding it to the number of openings due to separation: [(New growth ÷ 10) + Separation].

Computational example: See Figures 4.4, 4.5, and 4.6, respectively: 546,100 ÷ 10 + 292,900 = 54,610 + 292,900 = 347,510. QED

Figure 4.6: Projected annual average STEM labor force openings due to growth and separations, 2016–2026



Source: Employment Projections program, U.S. Bureau of Labor Statistics

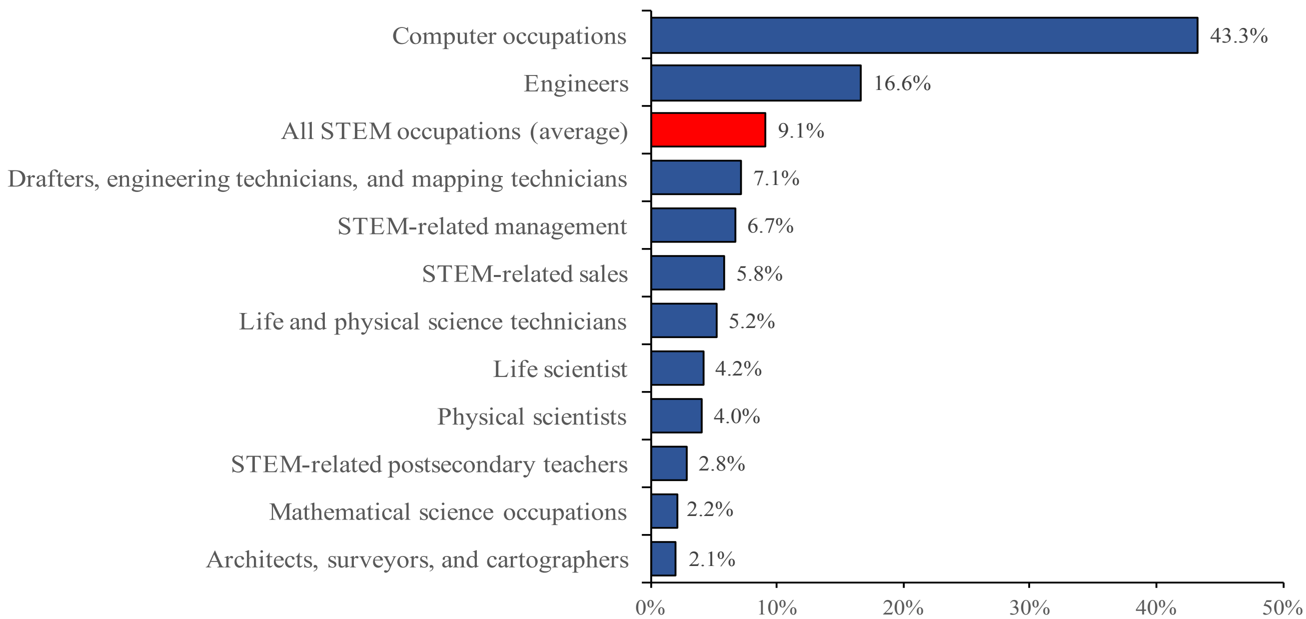
§4. STEM Occupational Projected Growth, Separations, and Openings

4.6 Projected Annual Percentage of Occupational Openings Due to Growth and Separations

Figure 4.7 is similar to Figure 4.6 except in that it depicts percentages instead of absolute number metrics. The average percentage implies that the average STEM occupation opening will be 9.1%. This poses the same scenario as Figure 4.6 with the normal distribution of openings skewed right. Therefore, the median percentage openings of 5.2% (Figure 4.7-Life and physical science technicians) share of occupations openings is a better measure of the true distribution because it will not be affected by the large percentages such as computer occupations and engineers. Hence, the 9.1% average is significantly affected by the large number of openings, which can be misleading to interpreting the job openings of lower-end number of occupations.

The graph below demonstrates that almost 60% of STEM openings every year from 2016–2026 will be for computer occupations and engineering. This far exceeds all other STEM jobs combined. This concentration of occupations continues to beg the question of whether there is a STEM shortage or a mismatch of skill sets for specific positions.

Figure 4.7: Percentage projected annual average of STEM labor force openings due to growth and separations, 2016–2026



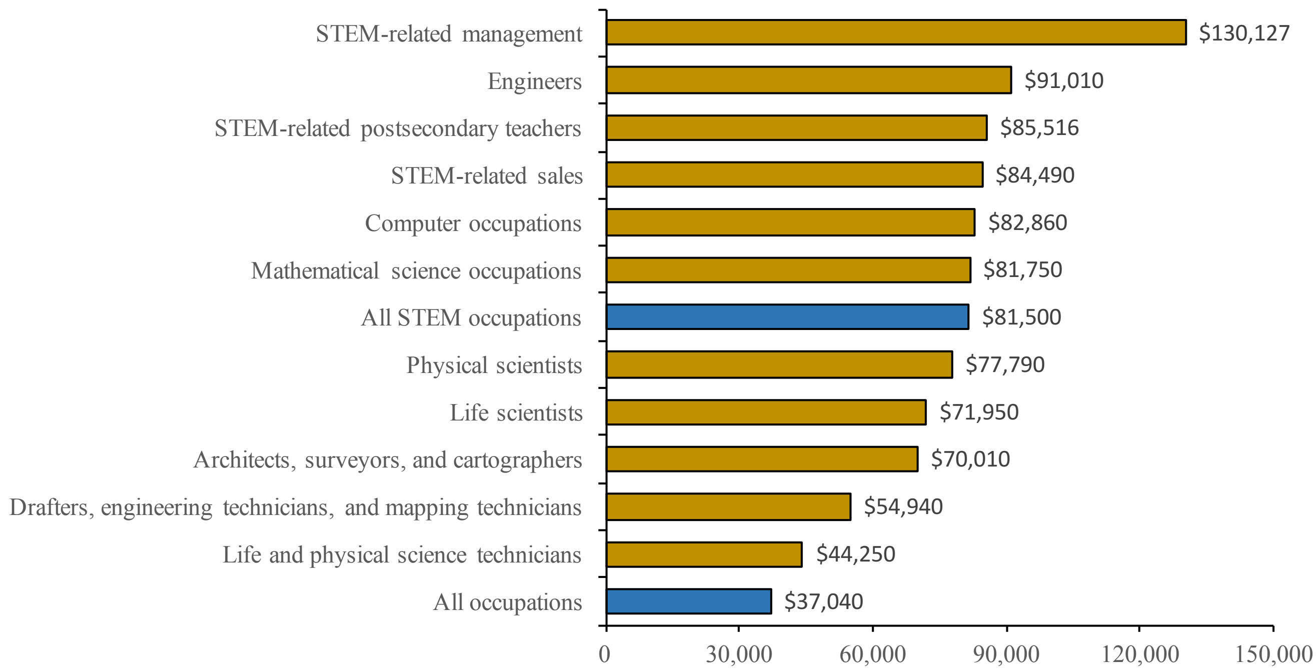
Source: Employment Projections program, U.S. Bureau of Labor Statistics

§5. STEM Workers: Wages, Rise in Wages and Employment

5.1 STEM Median Annual Wages as of May 2016

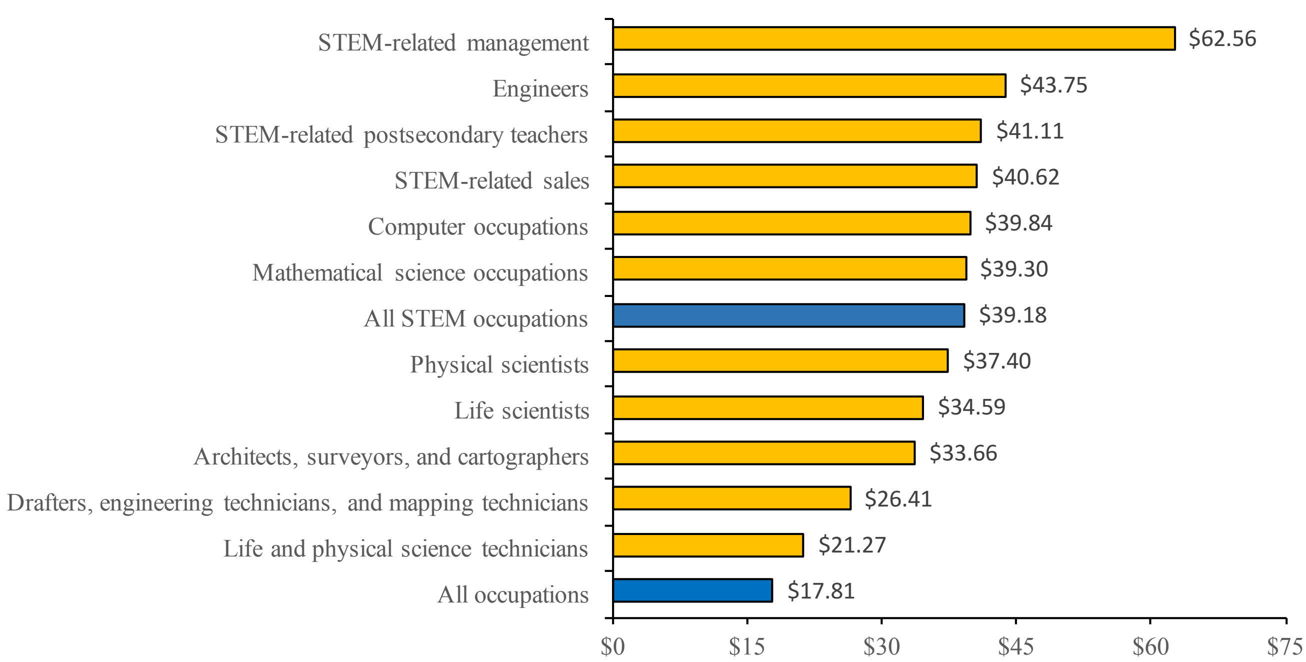
Figures 5.1 and 5.2 depict the median incomes for STEM occupations. STEM-related management and engineering are the highest-paid occupations, and life and physical science technicians are the lowest-paid occupations. Figure 5.2 shows the distribution of the hourly wages as of May 2016.

Figure 5.1: Median annual wages for all STEM workers discretely and collectively, and all occupations collectively, May 2016



Source: Occupational Employment Statistics, U.S. Bureau of Labor Statistics

Figure 5.2: STEM workers hourly wages, May 2016



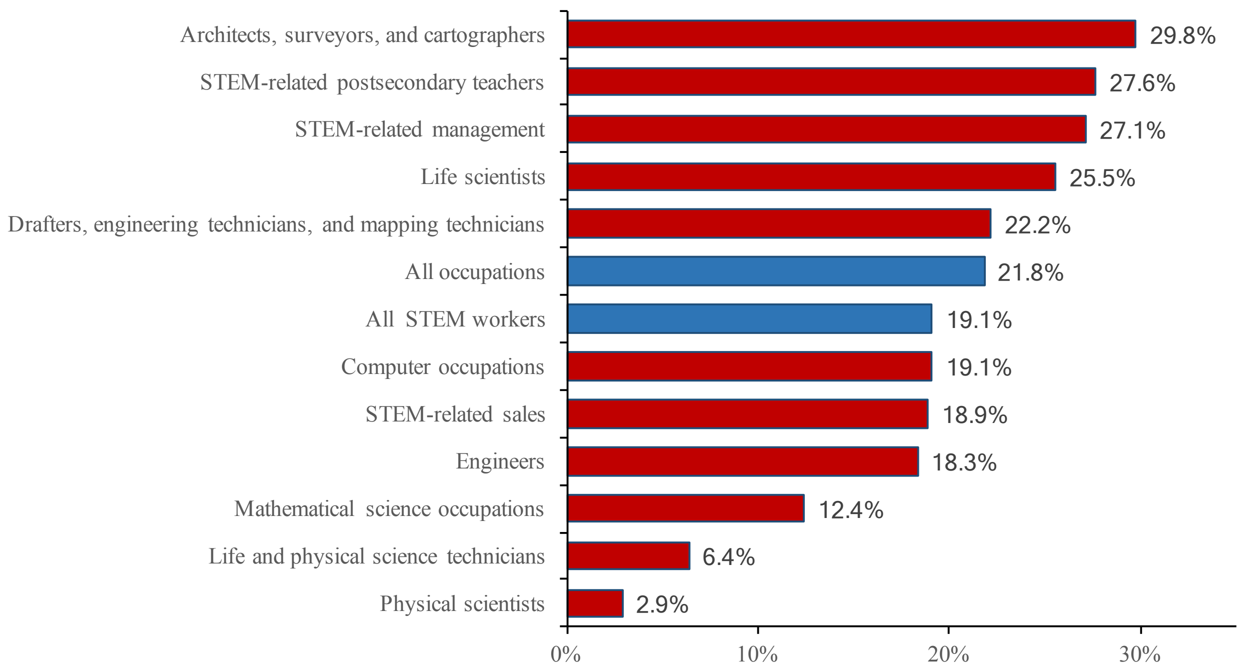
Source: Occupational Employment Statistics, U.S. Bureau of Labor Statistics

§5. STEM Workers: Wages, Rise in Wages, and Employment

5.2 Actual Percentage Rise in Wages, 2006–2016

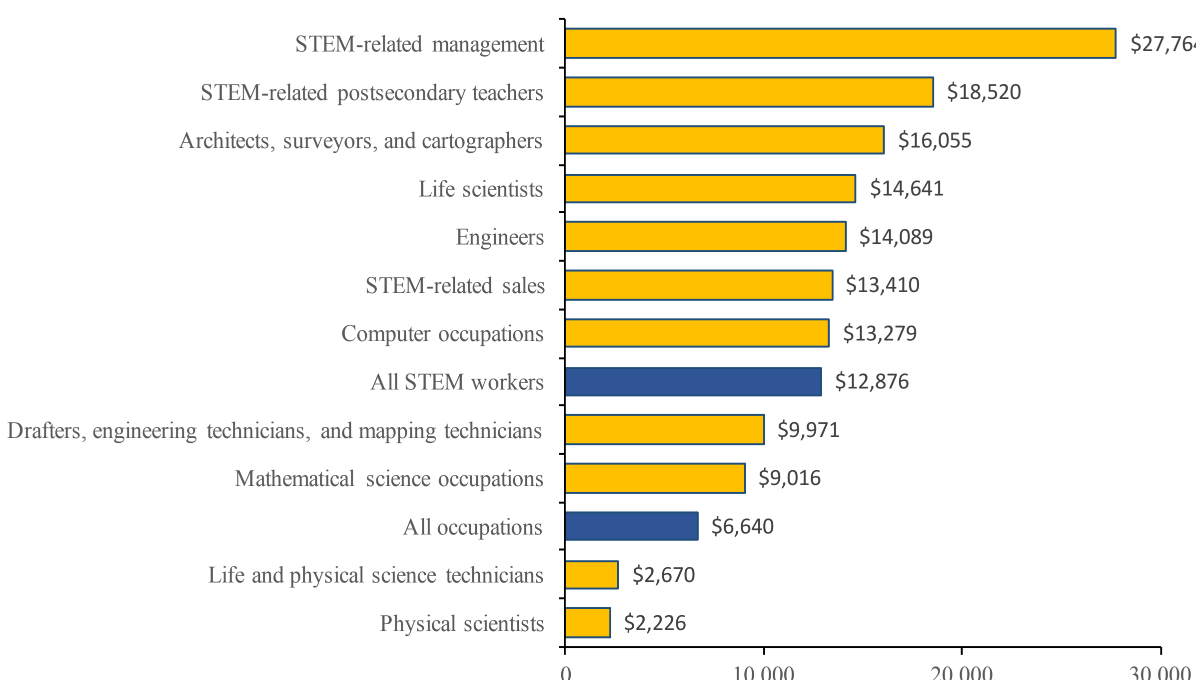
Figure 5.3: Although the wage increase for all occupations was 13.1% greater than for STEM occupations, in absolute dollars, STEM workers' increase was about $6,236 higher than that of all other occupations due to the high salaries STEM workers enjoy. See Figures 5.1 and 5.4 respectively.

Figure 5.3: Percentage of median salary increase of STEM workers, 2006–2016



Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

Figure 5.4: Average increase in STEM workers' annual median wages, 2006–2016



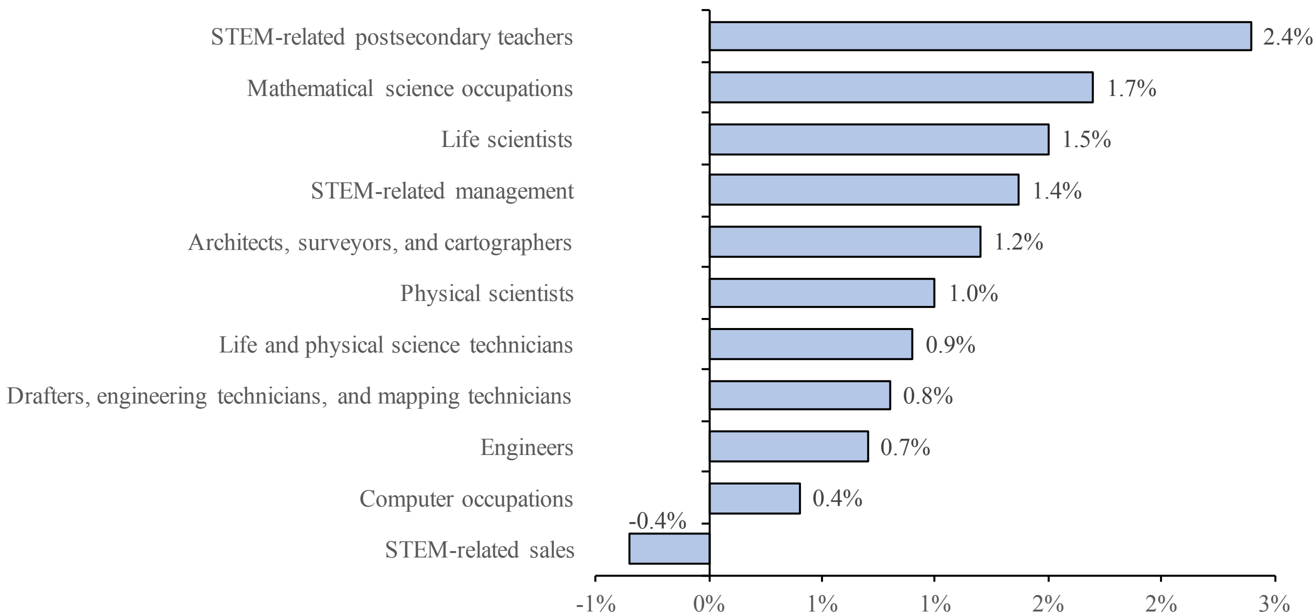
Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

§5. STEM Workers: Wages, Rise in Wages, and Employment

5.3 Percentage Rise in Employment and Wages, 2015–2016

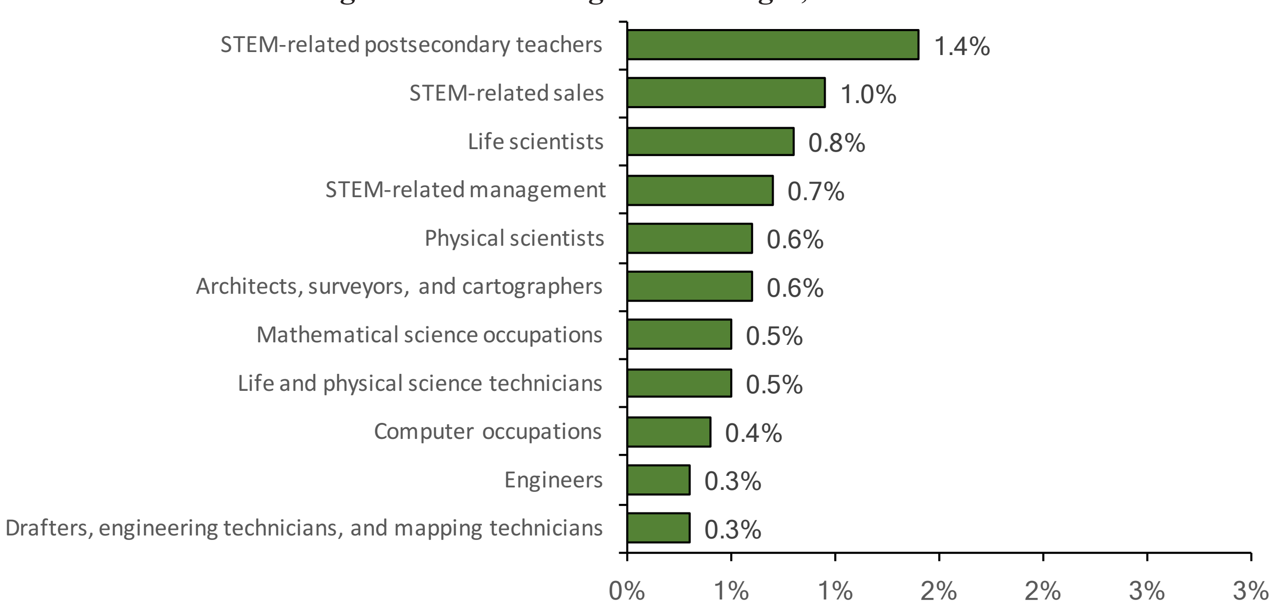
Figures 5.5 and 5.6 show a rise in employment and wages, respectively, from 2015 to 2016. In this one year, STEM-related postsecondary teachers showed the highest percentages increase in both employment and wages. These are modest increases. Although, the computer occupation field demand for workers in absolute quantities is higher than any other STEM occupation, nevertheless, the rise in wages from 2015 to 2016 was only 0.4%. This kind of modest increase in wages does not show evidence of a shortest of STEM workers. STEM employment overall rose only by an average of 1.2% during the same time frame.

Figure 5.5: Percentage rise in employment, 2016 over 2015



Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

Figure 5.6: Percentage rise in wages, 2016 over 2015

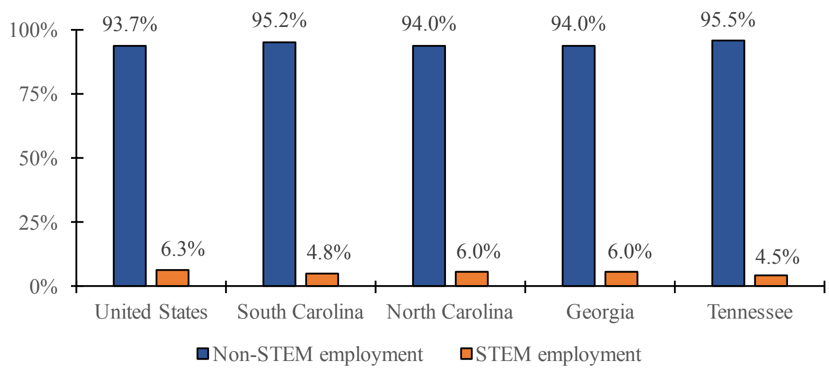


Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

§5. STEM Workers: Wages, Rise in Wages, and Employment

5.4 Comparison of Four States' STEM Workers and Non-STEM Workers

Figure 5.7: Percentage comparison of STEM and non-STEM workers in four states, May 2016

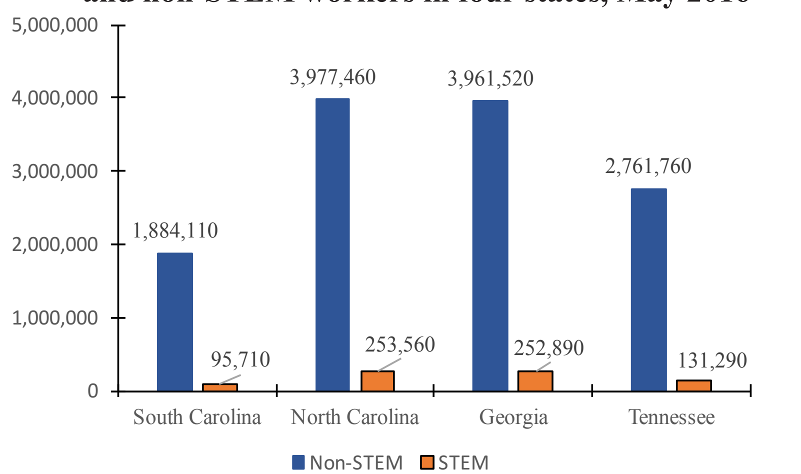


Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

Figure 5.7 depicts the percentage comparison of STEM workers and non-STEM workers in Georgia, South Carolina, North Carolina, and Tennessee. All four states' percentages of STEM workers were below the national share of 6.3%. Despite all the hype about STEM careers, it is still a very small percentage of total employment in the United States.

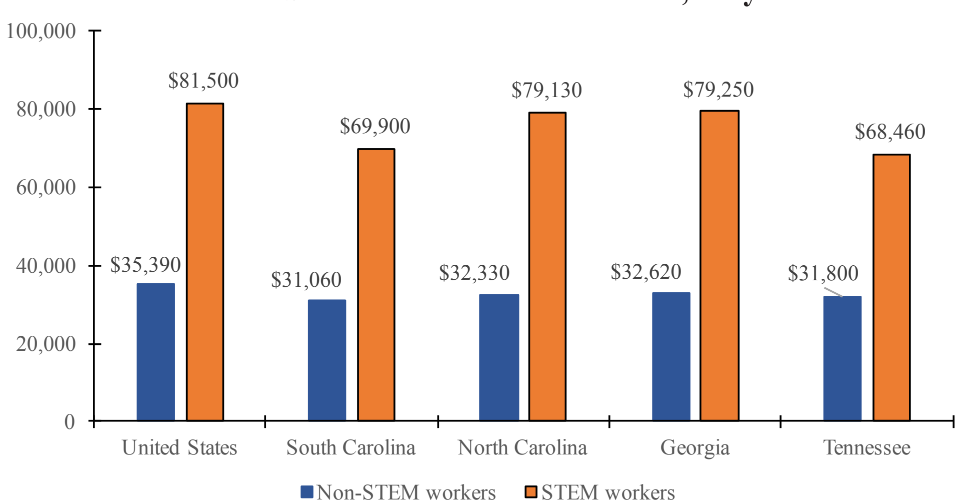
Figure 5.8 shows the numerical comparison of STEM and non-STEM workers in Georgia, South Carolina, North Carolina, and Tennessee. As shown in Figure 5.7, STEM workers constitute a small portion of the total workforce in each state. However, North Carolina and Georgia have a significantly higher number of STEM workers compared to South Carolina and Tennessee. Both states have a large number of high-tech companies.

Figure 5.8: Comparison of absolute number of STEM and non-STEM workers in four states, May 2016



Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

Figure 5.9: Annual median income comparison of STEM and non-STEM workers in four states, May 2016



Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

Figure 5.9 depicts the comparative analysis of the median salary for STEM and non-STEM workers in the four states cited in this section. Nationally, a STEM workers makes over 100% more than all other workers. These are median salaries; statistically, the salary for all other workers might be misleading because one group is highly educated with more than half of the cohorts with a bachelor's degree or higher.

§6. Distribution of 41.5 Million Workers with a Bachelor's Degree or Higher

6.1 Percentage Distribution of STEM and Non-STEM Degree Workers

This section is based on data from 41.5 million workers conducted in 2012 by the U.S. Census Bureau's American Community Survey. This section examines these 41.5 million workers with bachelor's degrees or higher between the ages of 25–64. Although 9.4 million of the workers in this survey had a STEM degree, only 3.4 million (36.2%) were STEM workers. STEM workers made up 5.1 million of the 41.5 million workers in this survey. This examination considered disciplines that are mathematical centered and follow the U.S. Bureau of Labor Statistics' OES/SOC STEM occupations. Consequently, social science and STEM-related occupations were excluded from this analysis. There are other reports that do not follow the definition of mathematical-centered degrees (Table 2.1); therefore, many of these reports include social science, psychology, multidisciplinary studies, STEM-related occupations, and so on. Consequently, they will most likely have differences in percentages, proportions, quantities, and conclusions.

The analysis graphically depicts the distributions and proportions of STEM and non-STEM employed workers with STEM degrees employed and not employed in STEM occupations, including non-STEM-degreed workers in STEM occupations. Much of the analysis is based on the various subpopulations within the 41.5 million workers. Frequently, workers, jobs, and occupations are used interchangeably. Therefore, the distributions are relative to these subpopulations. Figure 6.1 provides the proportion of STEM degree holders who are employed as STEM workers and non-STEM workers. The STEM degree fields and non-STEM degree fields are shown in Table 6.1 and Table 6.2, respectively.

STEM workers in this survey comprise 12.3% of the 41.5 million workers. In Figure 6.1, only 36.2% of workers with STEM degrees were employed in STEM jobs and 63.8% of STEM degree holders were employed in non-STEM jobs. As mentioned earlier, associated with these percentages were 9.4 million STEM degree holders, but only 3.6 million of these STEM degree holders were identified as STEM workers out of the 5.1 million STEM workers. Figure 6.2 shows the distribution of the 5.1 million STEM workers. Hence, 33.8% of the STEM workers did not have a STEM degree and the remaining 66.2% were staffed by workers with a STEM degree. This shows that matching of a prospective employee's fit relative to the skill set required, regardless of degree type, is paramount. See page 30 (Section 6.5) for additional discussions on the distributions shown in Figures 6.1 and 6.2.

Figure 6.1: Percentage distribution of of workers with a STEM degrees (n = 9.4 million)

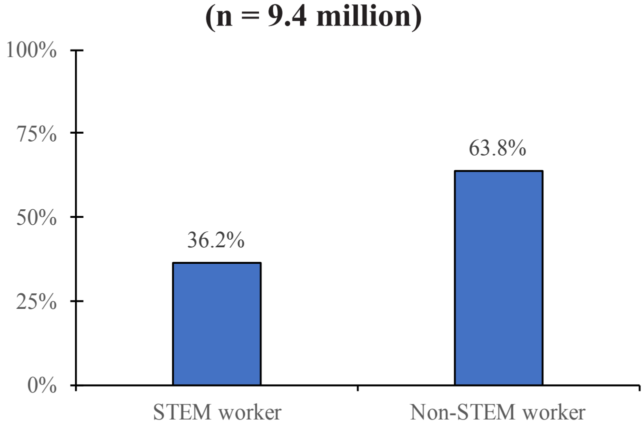
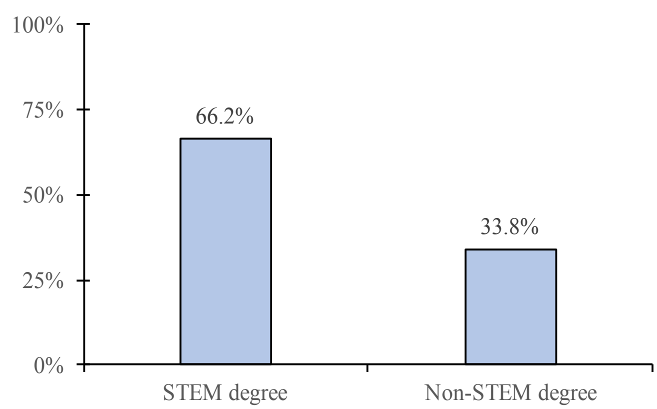


Figure 6.2: Percentage of STEM workers with STEM and non-STEM degrees (n = 5.1 million)



Source: U.S. Census Bureau, 2012 American Community Survey.

§6. Distribution of 41.5 Million Workers with a Bachelor's Degree or Higher

6.2 Degrees and Occupations of 41.5 Million Workers

The degrees denoted as STEM degrees listed in Table 3 encompass the occupations provided in the guidelines by the Bureau of Labor Statistics' SOC (Appendix A). The non-STEM degrees are also listed below in Table 3. The 41.5 million workers consist of employees with STEM and non-STEM degrees. Related STEM degrees are not included as STEM workers and this paper does not address STEM-related occupations. Therefore, the analysis takes a binary approach: STEM worker or non-STEM worker.

Figures 6.3 through 6.7 provide a quick Pareto summary of workers (STEM and non-STEM), relative to percentage associated with each of the STEM degrees and collective percentages for the non-STEM degrees (Tables 6.1 and 6.2).

In this survey, the U.S. Census Bureau did not include Native American/Alaska Native, those of two or more races or non-resident aliens. No reason was given for the omission of these groups.

The information in the columns in the tables below is spelled same as they appeared in the survey.

Table 6.1: Fields of Study

Bachelor's degree or higher	
STEM degrees	Non-STEM degrees
• Computers, mathematics, and statistics	• Psychology
	• Social sciences
• Engineering	• Multidisciplinary studies
• Physical sciences	• Health care
• Biological, environmental, and agricultural sciences	• Engineering-related
	• Business education
	• Literature and languages
	• Liberal arts and history
	• Visual and performing arts
	• Communications
	• Other (e.g. criminal justice, social work)

Table 6.2: Occupation of Workers

Occupations	**Workers**
• Computer workers	STEM
• Engineers	↓
• Mathematicians and statisticians	
• Life scientists	
• Physical scientists	
• Architects	
• Agriculture	
• Social scientists	Non-STEM
• Health care	↓
• Managers (non-STEM)	
• Business and financial	
• Social services	
• Legal	
• Education	
• Arts and entertainment	
• Service	
• Sales	
• Office support	
• Construction	
• Production	

Source: U.S. Census Bureau, 2012 American Community Survey.

§6. Distribution of 41.5 Million Workers with a Bachelor's Degree or Higher

6.3 Percentage Distribution of Workers with a STEM Degree

Figure 6.3: Percentage distribution of workers by occupation with a degree in computers, mathematics, and statistics (n = 2 million)*

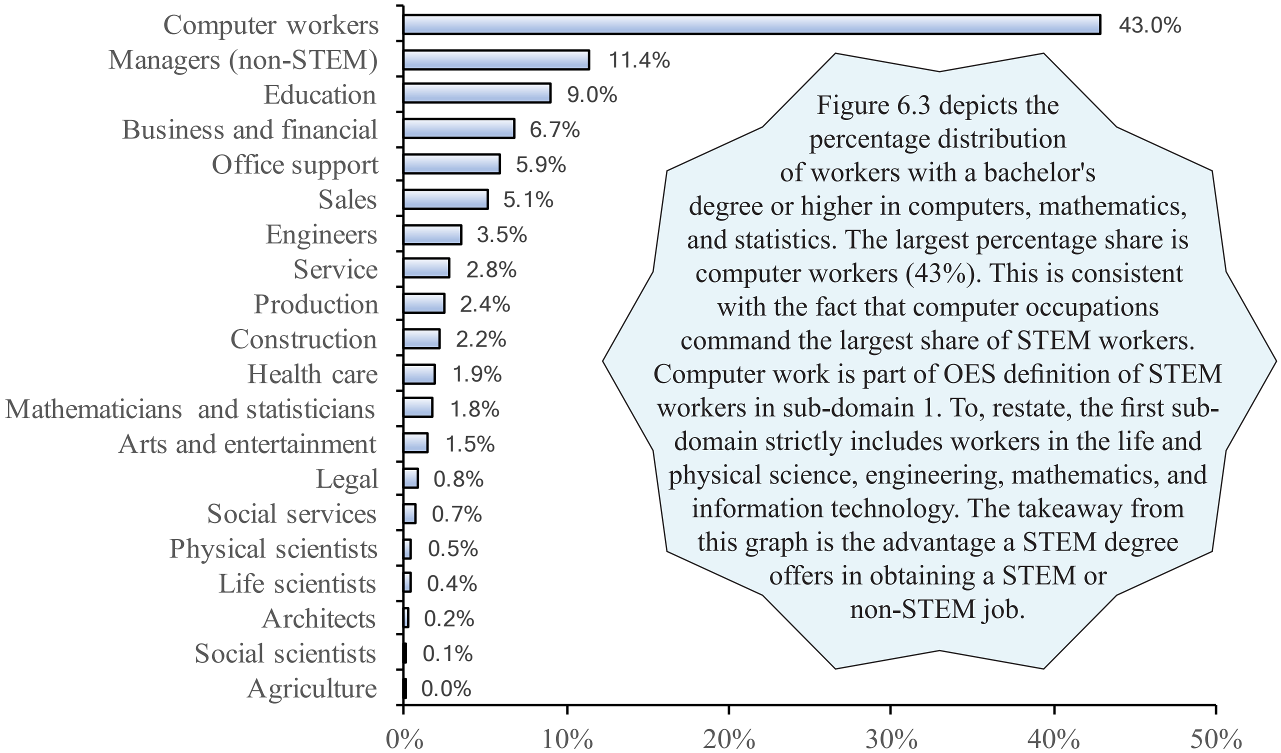
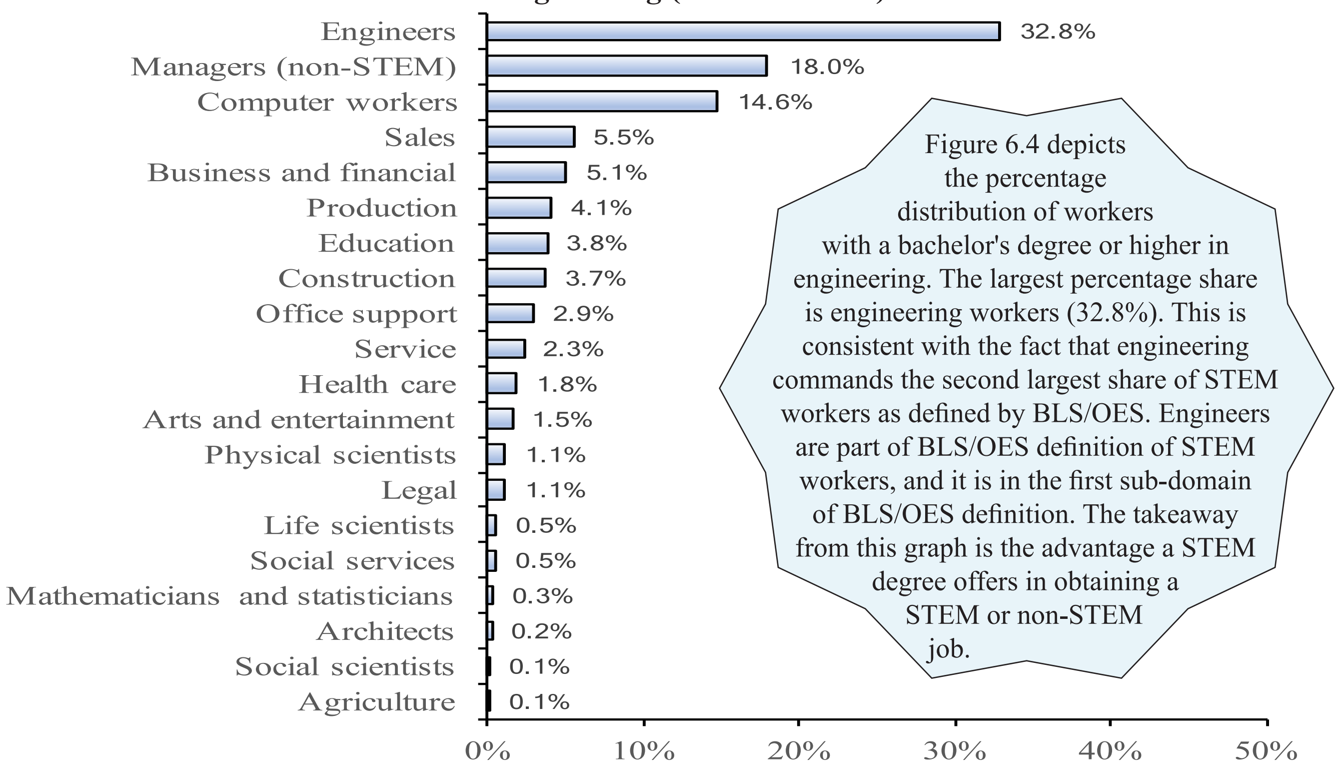


Figure 6.4: Percentage distribution of workers with a degree in engineering (n = 3.3 million)



*Source: U.S. Census Bureau, 2012 American Community Survey

§6. Distribution of 41.5 Million Workers with a Bachelor's Degree or Higher

6.3 Percent Distribution of Workers with a STEM Degree, cont'd

Figure 6.5: Percentage distribution of workers with a degree in the physical sciences (n = 1.3 million)*

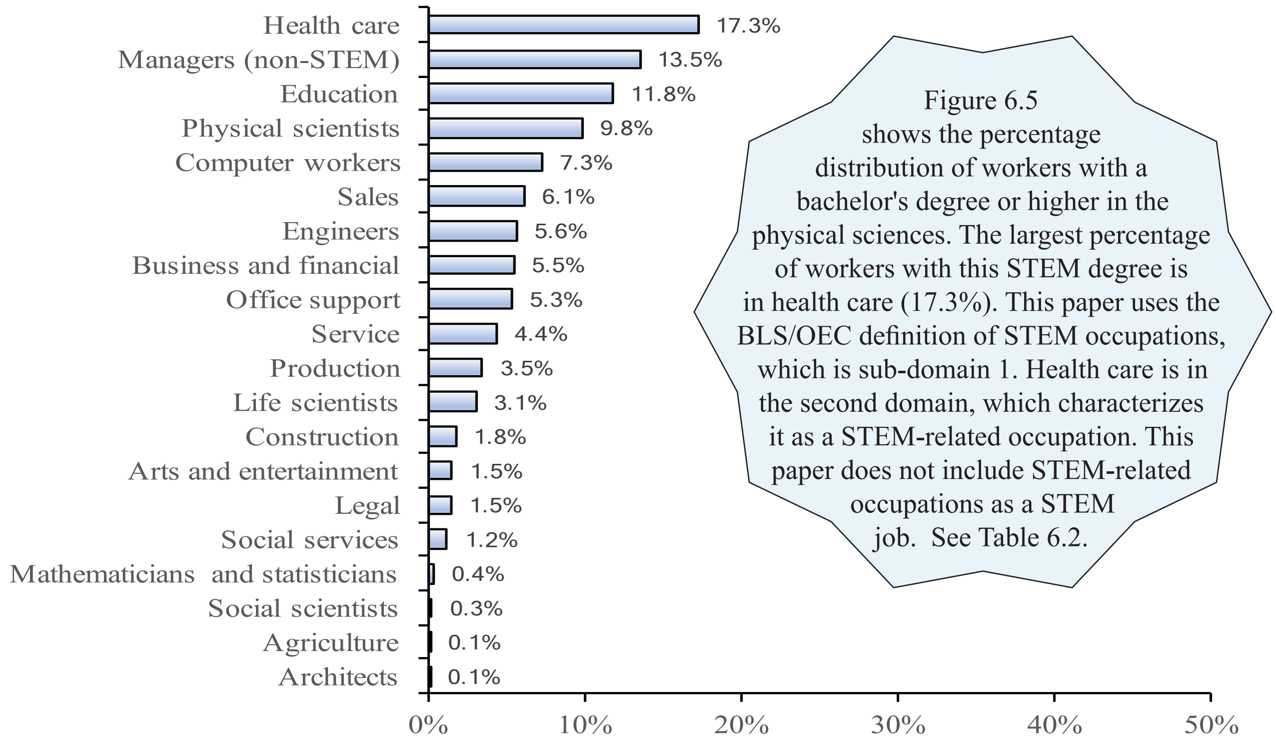
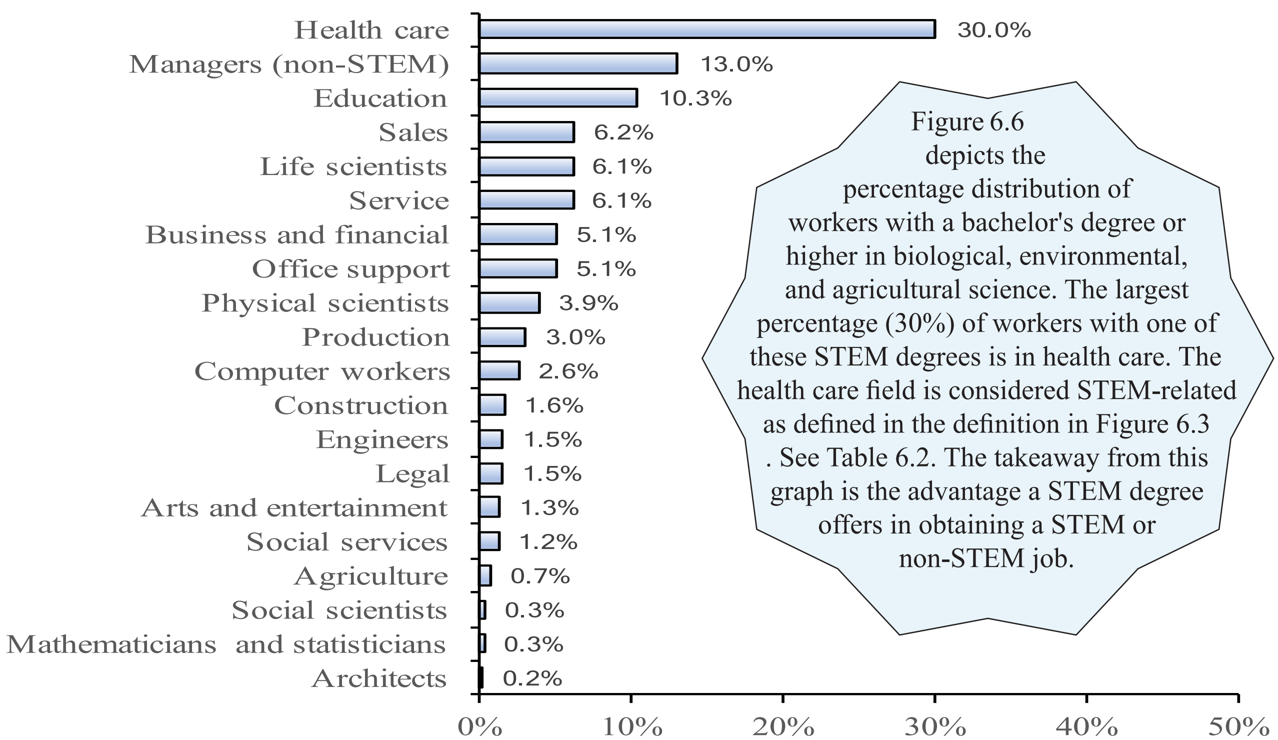


Figure 6.6: Percentage distribution of workers with a degree in biological, environmental, and agricultural science (n = 2.8 million)*

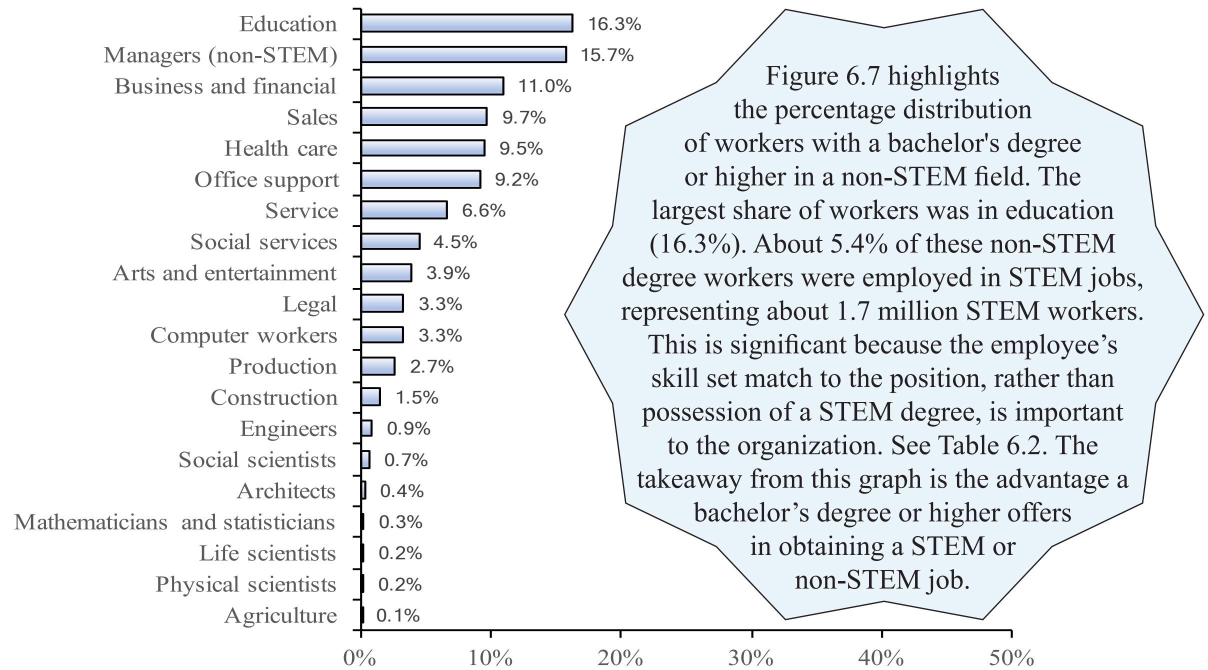


*Source: U.S. Census Bureau, 2012 American Community Survey

§6. Distribution of 41.5 Million Workers with a Bachelor's Degree or Higher

6.4 Percentage Distribution of Workers with a Non-STEM Degree

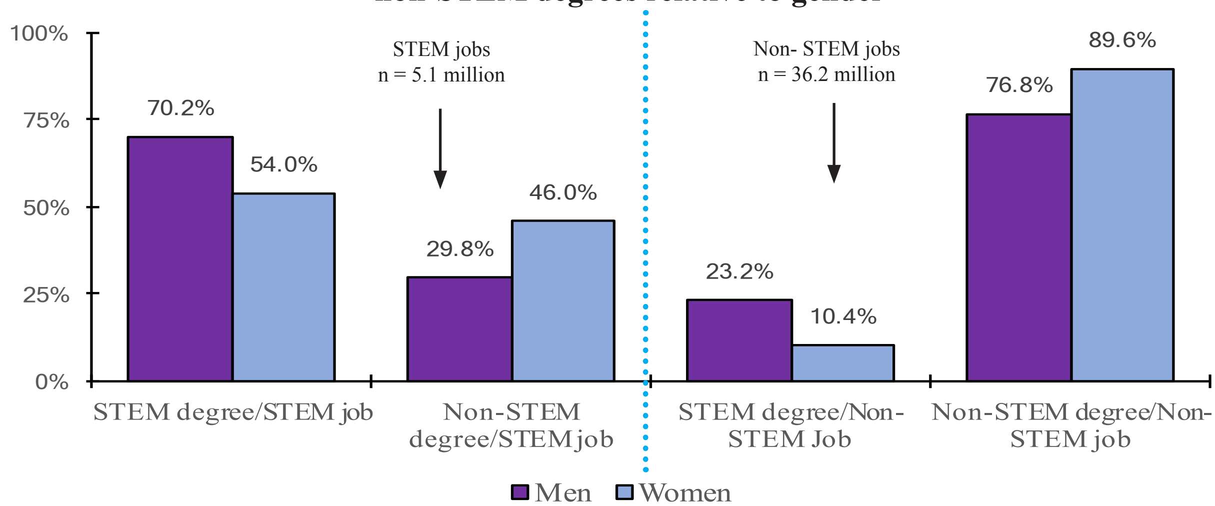
Figure 6.7: Percentage distribution of workers with a degree in a non-STEM field (n = 32.3 million)*



6.5 Percentage of STEM Workers with a STEM and Non-STEM Degree by Gender

Figure 6.8 illustrates a distribution of STEM and non-STEM workers who are STEM degree and non-STEM degree holders relative to being employed as a STEM worker or non-STEM worker, including gender. "Worker" and "job" are used interchangeably here. The percentages were derived from subpopulations of STEM workers and non-STEM workers and other subpopulations. For example, women with a STEM degree who worked in a STEM job were included in the subpopulation of women STEM workers. Therefore, the percentage of STEM jobs for women sums to 100% (Left section of the graph).

Figure 6.8: Percentage split of workers with STEM and non-STEM degrees relative to gender

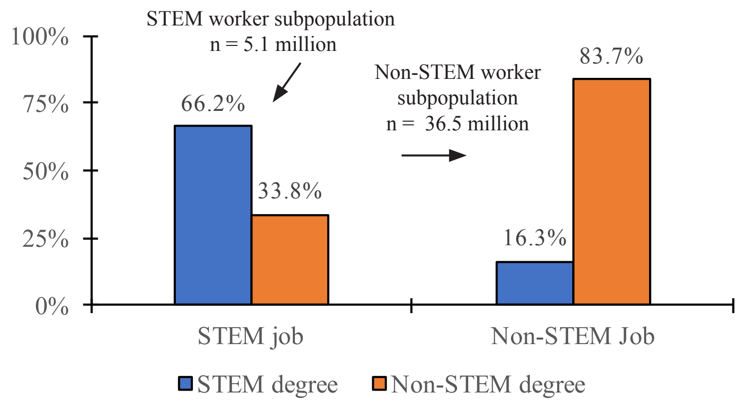


*Source: U.S. Census Bureau, 2012 American Community Survey

§6. Distribution of 41.5 Million Workers with a Bachelor's Degree or Higher

6.5 Percentage of STEM Workers with a STEM and Non-STEM Degree by Gender, cont'd

Figure 6.9: Percentage of STEM and non-STEM workers by STEM and non-STEM degree

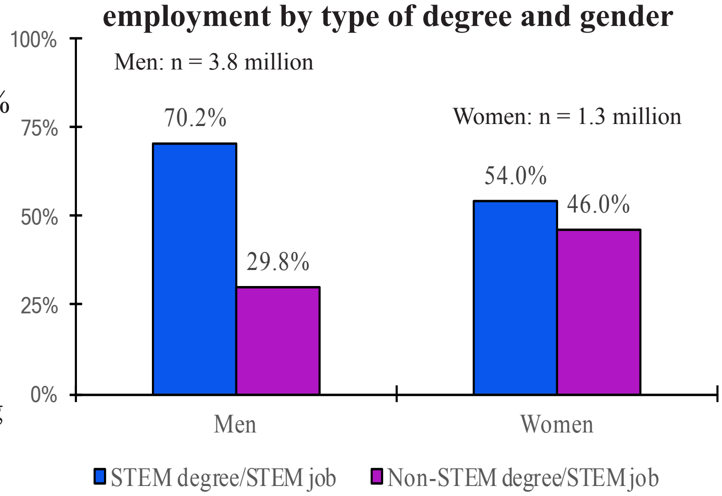


Source: U.S. Census Bureau, 2012 American Community Survey

Figure 6.9 expands on Figure 6.11 to include non-STEM workers with STEM degrees. This means that 16.3 % of non-STEM workers have STEM degrees. The 66.2% and 33.8% represent the distribution of the STEM worker sub-population, whereas the 16.3% and 83.7% show the breakdown by degree type for non-STEM workers. In absolute numbers, the 16.3% portion represents 6 million workers with a STEM degree working in non-STEM jobs of 36.6 million workers. The evidence tend to leans toward a skill set mismatch rather than a shortage of STEM degrees.

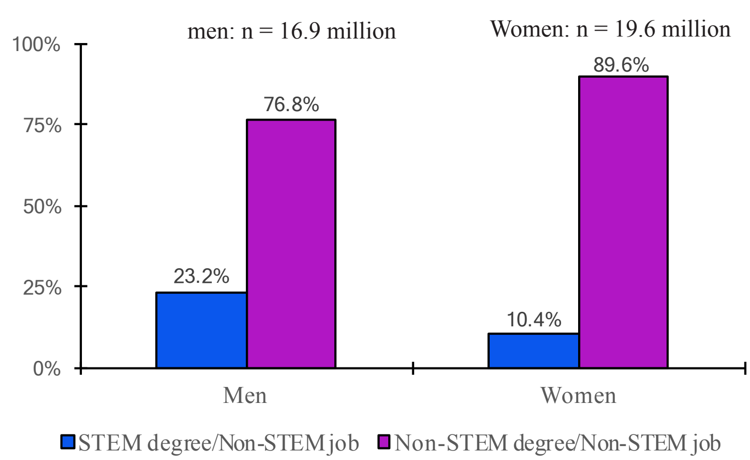
Figure 6.10 shows the percentage of STEM employment by type of degree and gender. About 70% of the STEM workers in the male subpopulation with a STEM degree were employed in a STEM job. Approximately 54% of women with a STEM degree in the female subpopulation were employed in a STEM job. However, about 46% of non-STEM degreed women had a STEM job in this sub-population, and 29.8% of non-STEM degreed men in this sub-population held a STEM job. This is significant because it highlights the fact that skill set is the overriding determining factor of being employed in a STEM job, not merely a STEM degree.

Figure 6.10: Percentage of STEM employment by type of degree and gender



Source: U.S. Census Bureau, 2012 American Community Survey

Figure 6.11: Percentage of non-STEM employment by type of degree and gender



Source: U.S. Census Bureau, 2012 American Community Survey

Figure 6.11 illustrates the percentage of non-STEM employment by type of degree and gender. The percentage share of men in the subpopulation of non-STEM workers who have a STEM degree is 23.2%. The female subpopulation of non-STEM workers who have a STEM degree is 10.4%. This means that for every two men with a STEM degree working in a non-STEM job, there is one woman with a STEM degree working in a non-STEM job. Women have a 50% greater chance of not working in a non-STEM job if they have a STEM degree.

§6. Distribution of 41.5 Million Workers with a Bachelor's Degree or Higher

6.6 Percentage Distribution of STEM and Non-STEM Workers by Race/Ethnicity

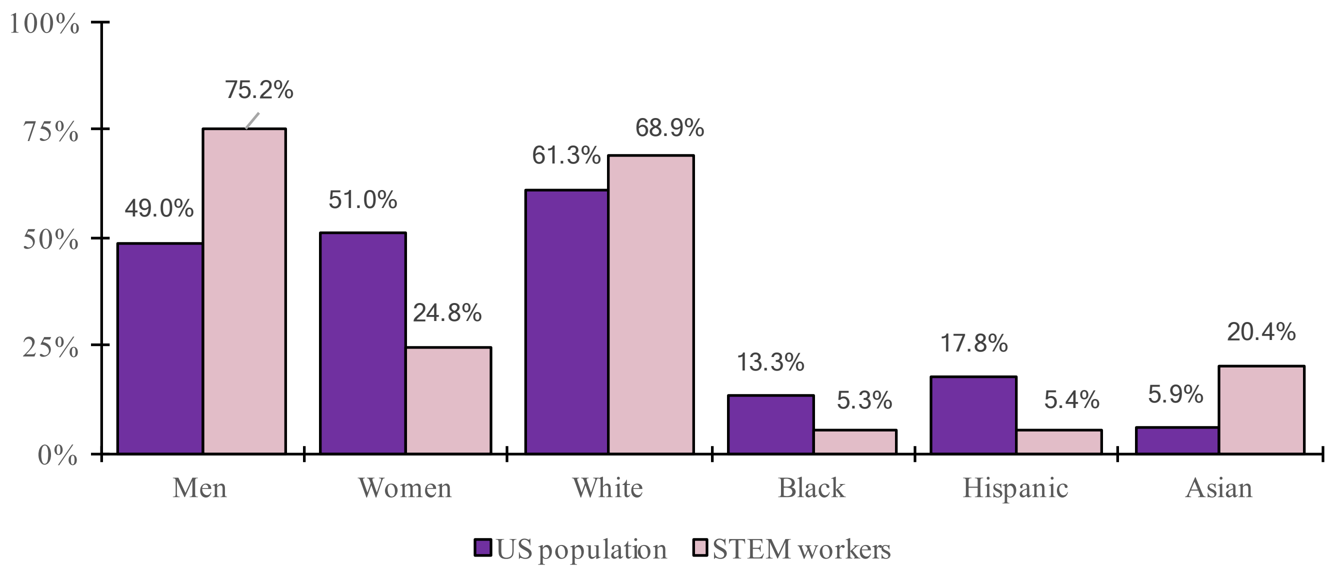
Figure 6.12 provides a percentage proportion of a partial list of demographics in the United States. We created this graph to compare the general population with the share of STEM workers relative to race/ethnicity.

This comparison provides the reader a better perspective when interpreting data from comparative analyses where proportionality is very important and fair. We calculated the percentages using the race/ethnicity subpopulations of STEM workers.

Men STEM workers exceeded their proportion representation in the US general population by 42%. Women STEM workers as a group underperformed their proportion of the US general population by 69%. White and Asian STEM workers exceeded their proportion relative to the US general population by 12% and 110%, respectively. Black and Hispanic STEM workers underperformed their representation in the US general population by 86% and 107%, respectively. To restate, the percentages in this section are based on each group's share of the 5.1 million STEM workers.

Despite these significant discrepancies, there is much effort being done to improve the participation of women and underprivileged groups. Hispanic STEM workers' share is steadily increasing whereas black STEM workers' share has remained statistically flat over the years.

Figure 6.12: Percentage share of STEM worker relative race/ethnicity and gender (US population 2010 census: n = 308.8 million and STEM subpopulation: n = 5.1 million)



Source: U.S. Census Bureau, 2012 American Community Survey

§6. Distribution of 41.5 Million Workers with a Bachelor's Degree or Higher

6.7 Percentage Share Distribution of STEM and non-STEM Workers by Race/Ethnicity

Figure 6.13 depicts the percentage distribution of 5.1 million STEM jobs out 41.5 million workers. Each race/ethnicity subpopulation represents the distribution of their share of the 5.1 million STEM jobs. For example, the two bars in the graph for black STEM workers show the percentage split between that group's workers in a STEM job with or without a STEM degree. The percentages for each group should sum to 100%. In Figure 6.14, the graph represents non-STEM workers, including those with a STEM degree. The 16.3% of all workers with a STEM degree who are working in a non-STEM job consist of 6 million workers with a STEM degree, but are working in a non-STEM occupation.

This is another example that employers are filling jobs on the basis of skill set fit regardless of degree type.

Figure 6.13: Percentage distribution of STEM workers with a STEM or Non-Stem degree relative to race/ethnicity*

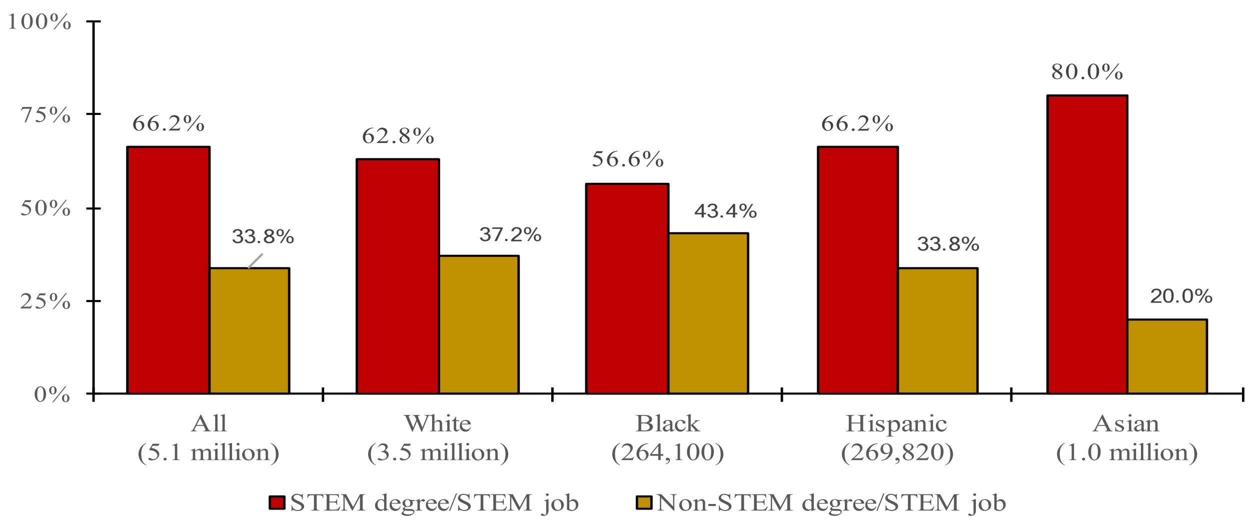
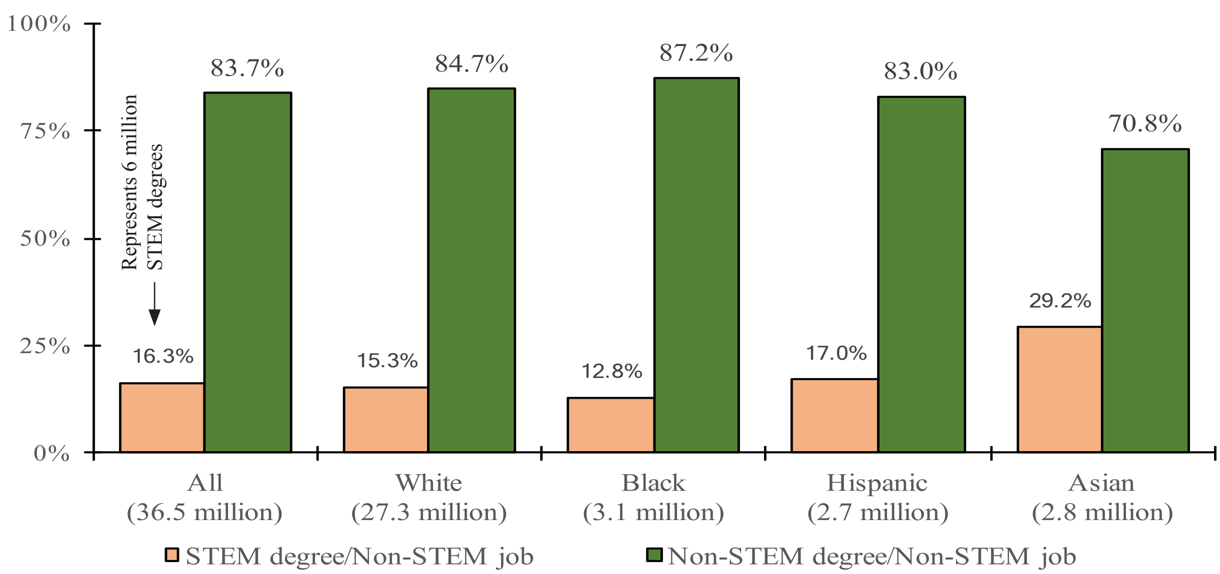


Figure 6.14: Percentage distribution of non-STEM workers in non-STEM jobs with a STEM or non-STEM degree by race/ethnicity*



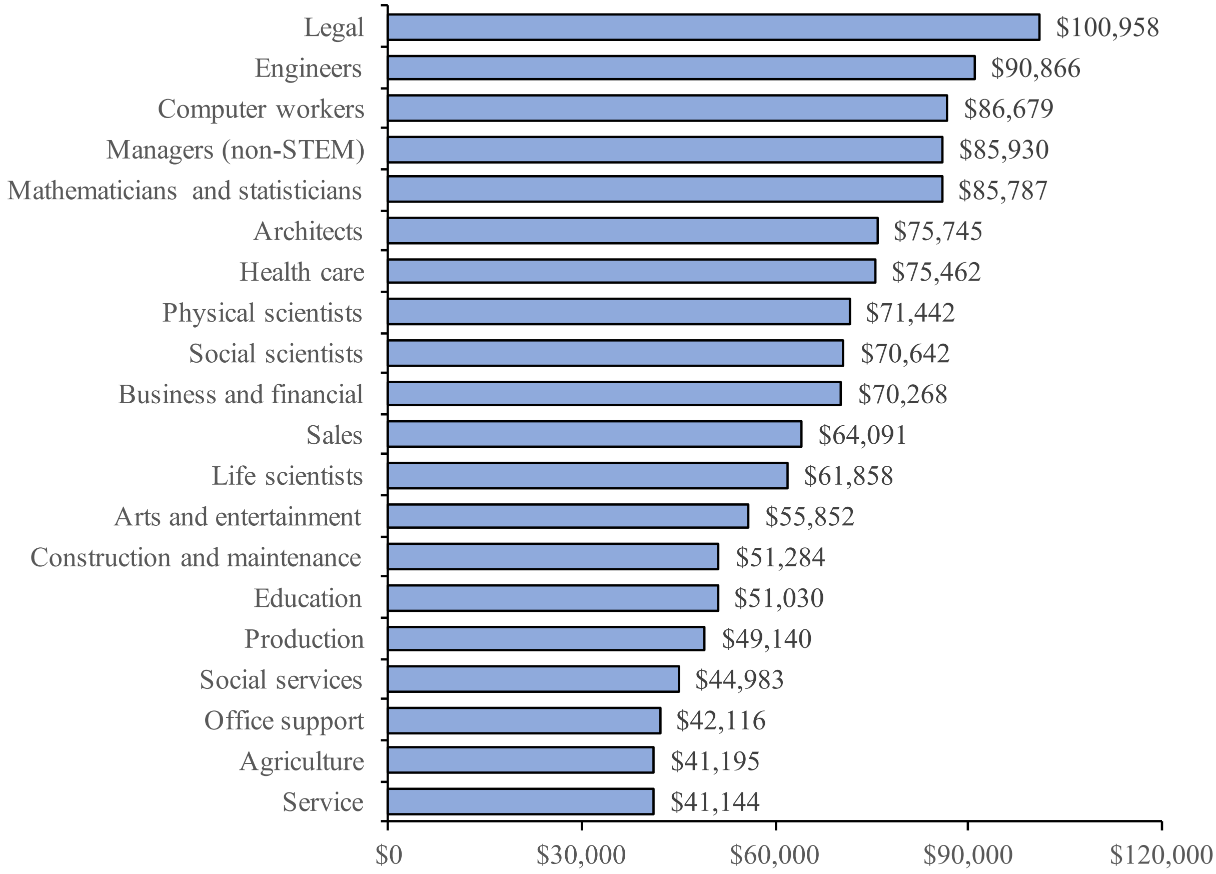
*Source: U.S. Census Bureau, 2012 American Community Survey, 2012

§6. Distribution of 41.5 Million Workers with a Bachelor's Degree or Higher

6.8 Median Annual Income of 41.5 Million Workers: STEM and Non-STEM Workers

Figure 6.15 depicts the median incomes for all workers with a bachelor's degree in one of the fields listed in Table 6.1 and is working in one of the jobs listed in Table 6.2. The worker might have an advanced degree; however, the emphasis is on median income of the bachelor's degree being in at least one of the fields listed in Table 6.1. Of the STEM workers in this survey, computer workers and engineers enjoyed the highest annual median income. Although the survey was done in 2012, there has not been any significant change since 2012 in the median income for STEM workers (Figures 5.1 and 5.2). These two groups are still the largest and highest paid of STEM workers. Agriculture wages are the lowest paid STEM job among the STEM jobs listed in Figure 6.2 with a bachelor's degree.

Figure 6.15: Median income of STEM and non-STEM degree workers out of the 41.5 million workers



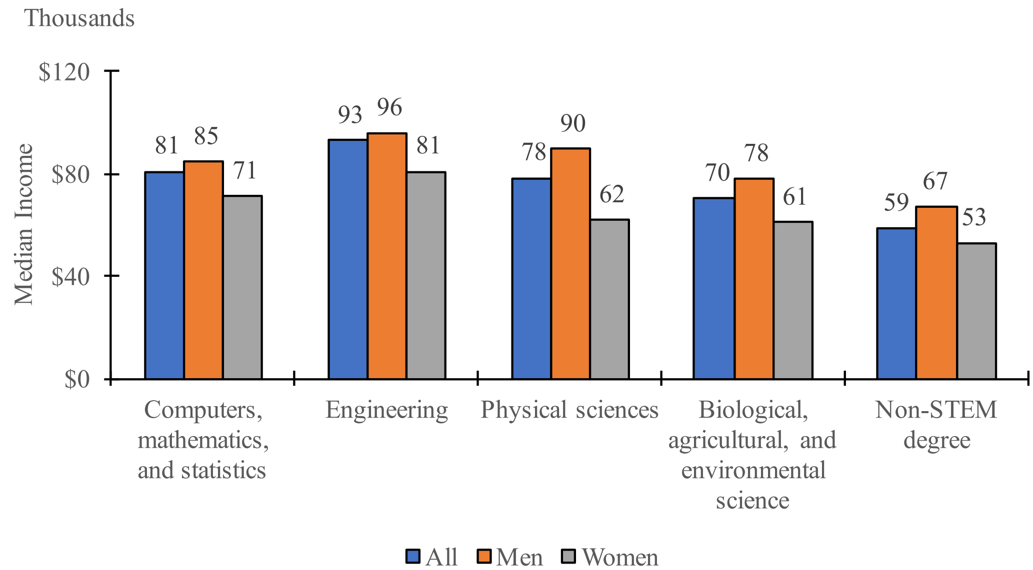
Source: U.S. Census Bureau, 2012 American Community Survey.

§6. Distribution of 41.5 Million Workers with a Bachelor's Degree or Higher

6.9 Median Income of Workers by Degree Field, Gender, and Race/Ethnicity

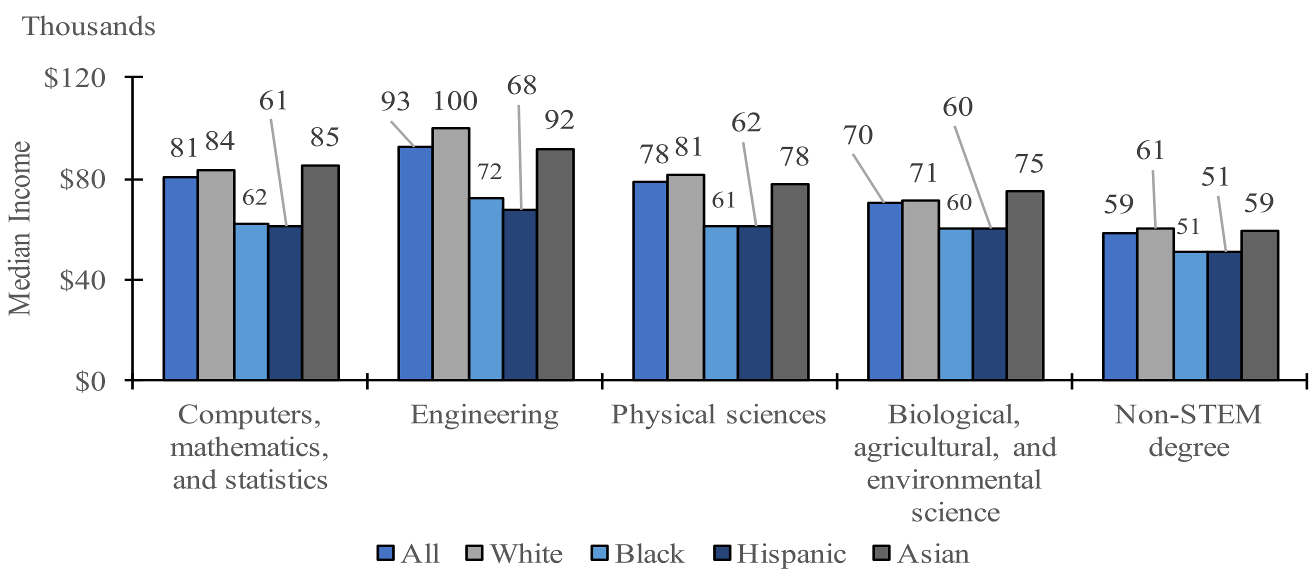
Figure 6.16 illustrates the difference in median annual income by STEM and non-STEM by degree type, and gender. In the graph in Figure 6.16, men with a STEM degree median's income is 24% greater that of women who are holders of a STEM degree. In Figure 6.17, STEM degree holders who are white have a median income that is 27% greater than that of black a worker with a STEM degree.

Figure 6.16: Median annual income of STEM and non-STEM degree workers by gender



Source: U.S. Census Bureau, 2012 American Community Survey.

Figure 6.17: Median annual income of STEM and non-STEM degree workers by race/ethnicity



Source: U.S. Census Bureau, 2012 American Community Survey.

§7. STEM Degrees/Certificates Conferred, 2009–2015

7.1 Percentage of STEM Degrees/Certificates Conferred

This section examines the number and percentage distribution of STEM degrees/certificates conferred to US citizens and nonresident aliens by postsecondary institutions. The analysis includes distributions by race/ethnicity, gender, and level of degree/certificate. These data are from postsecondary institutions participating in Title IV federal financial aid programs.

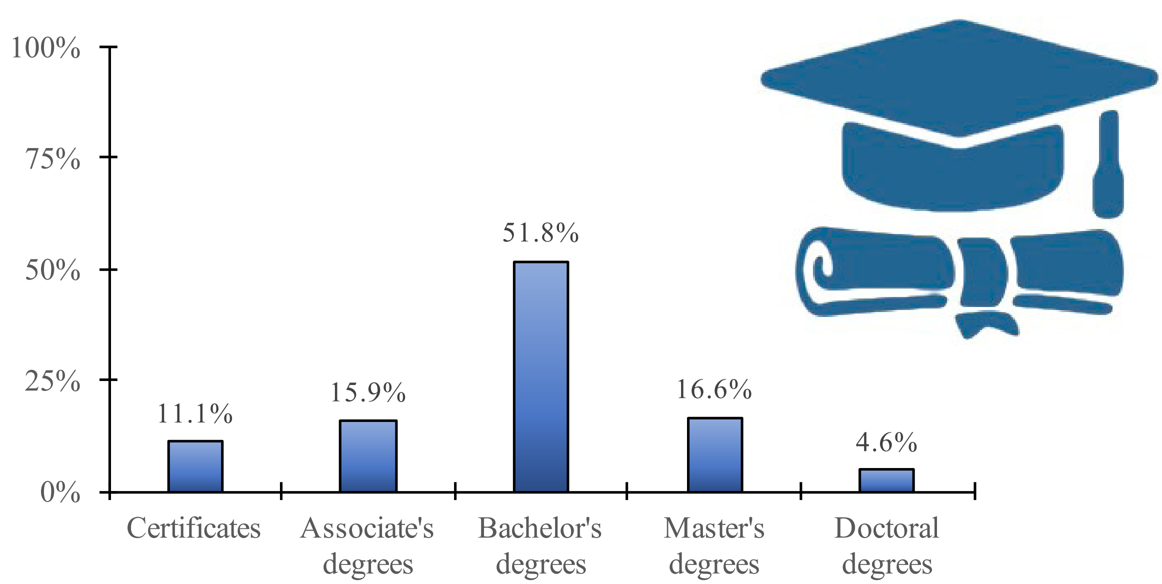
This section also shows the number and percentage of STEM degrees/certificates from colleges and universities. These degrees are associate’s degree, bachelor's degree, master's degree, and doctoral degree. The degrees/certificates comprise the types of degrees that satisfied (BLS/OES) definition of the first sub-domain of STEM fields (Table 6.2) The degrees/certificates in these analyses include biological and biomedical sciences, computer and information sciences, engineering and engineering technologies, mathematics and statistics, and physical sciences and science technologies. The medical doctor degree is included in the doctoral degree distribution.

The STEM degrees/certificates presented in this paper are based on academic years 2008–2009 through 2014–2015.

Figure 7.1 depicts the percentage of STEM degrees/certificates conferred by postsecondary institutions. The STEM educational levels in the graph combined certificates, associate’s, bachelor’s, master’s, and doctoral degrees.

The bachelor’s degree level has the largest percentage (51.8%) out of the total degrees / certificates conferred during this seven academic-year period. This large percentage is expected because it is the most popular entry-level degree to a STEM job. The doctoral degree has the smallest percentage (4.6%). Generally, graduate degrees build on top of the bachelor’s degrees.

Figure 7.1: STEM degrees/certificates conferred academic year 2008–2009 through 2014–2015 (n = 3.9 million)



Source: U.S. Department of Education, National Center for Education Statistics, November 2015

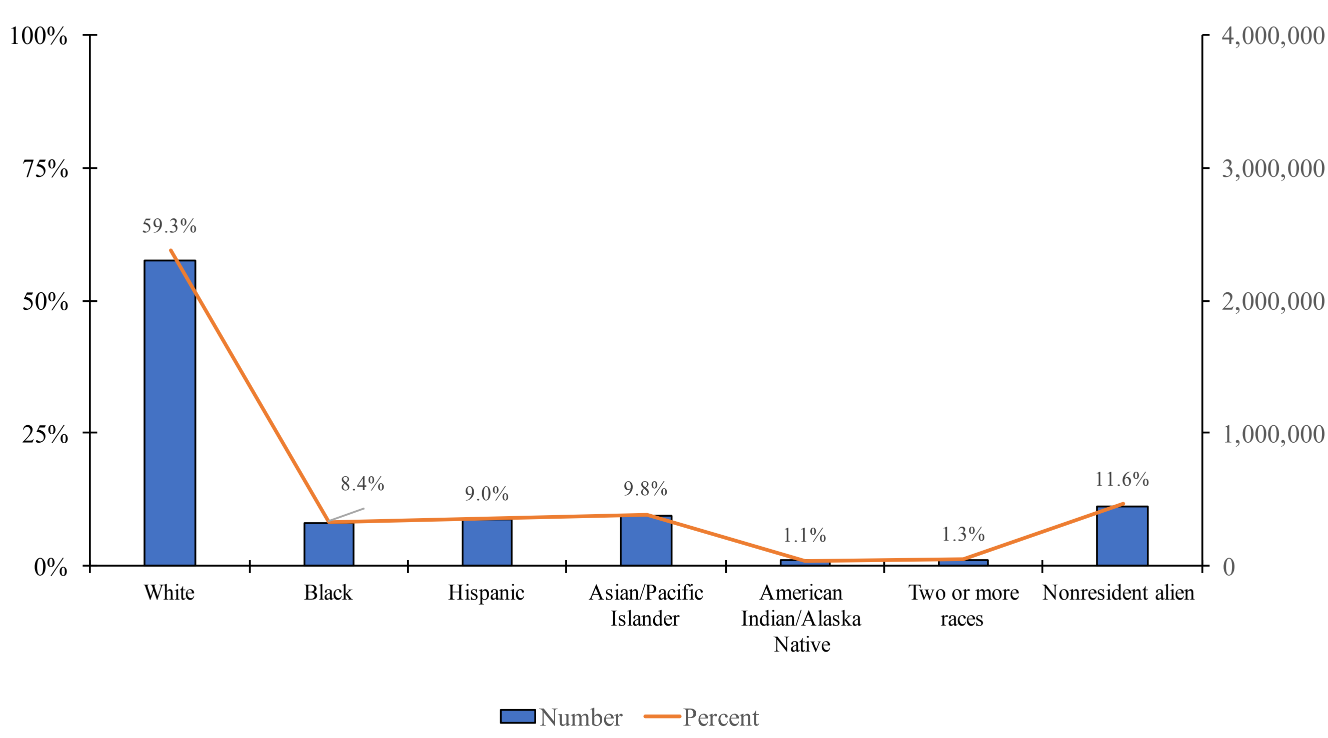
§7. STEM Degrees/Certificates Conferred, 2009–2015

7.2 Percentage of STEM Degrees/Certificates Conferred by Race/Ethnicity

Figure 7.2 shows the number and percentage of STEM degrees/certificates conferred by postsecondary academic institutions for the academic years 2008–2009 through 2014–2015. These distributions are also relative to race/ethnicity. To add perspective to each group's percentage, Figure 7.3 compares the STEM credentials earned from 2008–2009 through 2014–2015 to each group's proportion in the US population. The group classified as nonresident aliens is not included in the general population comparison. Generally, they are international students; therefore, not considered part of the permanent US population. Nonresident aliens are included in all other analysis of degrees conferred from 2009–2015.

The former students in this analysis are about 3.9 million holders of STEM degrees/certificates. As is noted throughout the analysis, the bachelor's degrees command the largest share of degrees/certificates with about two million conferred in the seven-year time frame.

Figure 7.2: Number and percentage distribution of STEM degrees/certificates conferred by postsecondary institutions, academic years 2008–2009 through 2014–2015



Source: U.S. Department of Education, National Center for Education Statistics, November 2015

§7. STEM Degrees/Certificates Conferred, 2009–2015

7.3 Percentage of Degrees/Certificates Conferred Relative to the General Population

In Figure 7.3, blacks and Hispanics make up about 13% and 18% of the US population, respectively. However, their proportionality in earning STEM credentials is about 45% and 66% below their proportion in the general population, respectively. Asian/Pacific Islanders' share is 50% higher than their proportion in the US population. Whites' participation is the closest with only 3% below their percentage share in the US population.

The good news is that from 2009–2015, blacks' share of conferred STEM degrees/certificates has increased by 28%, and Hispanics' share has increased by 81%. Whites' share in earning of STEM degrees/certificates has increased by about 19% since the academic year 2008–2009.

Figure 7.3: Percentage of STEM degrees/certificates conferred proportionally to US population by race/ethnicity 2008–2009 through 2014–2015 (n = 3.9 million)

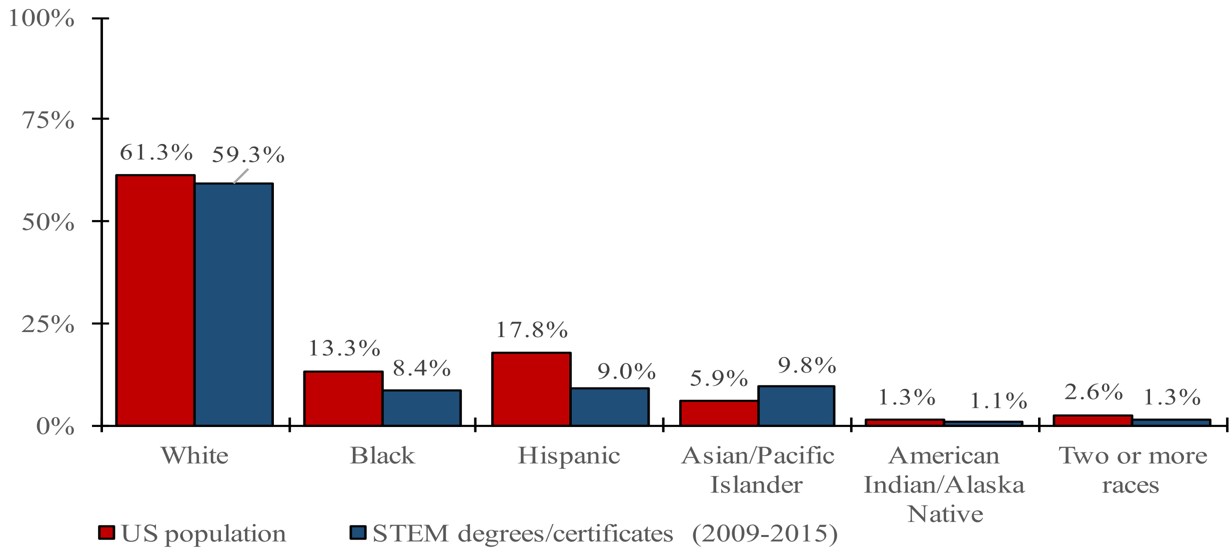
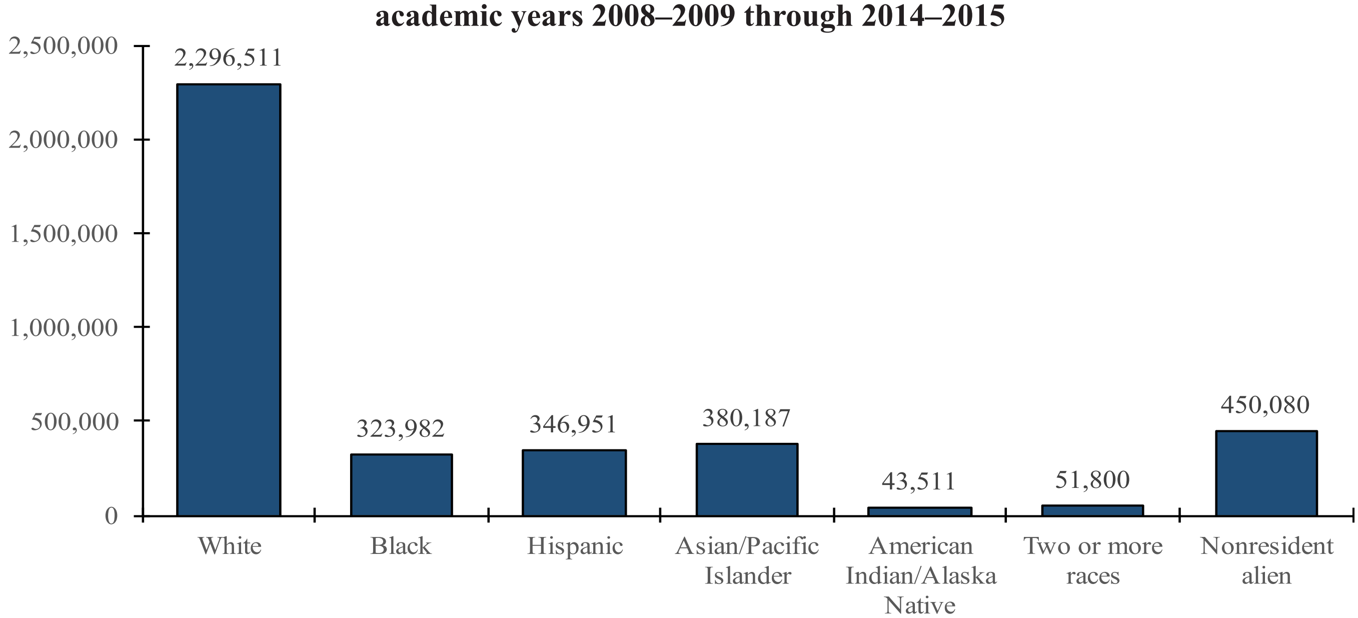


Figure 7.4: Number of STEM degrees/certificates conferred in academic years 2008–2009 through 2014–2015



Source: U.S. Department of Education, National Center for Education Statistics, November 2015

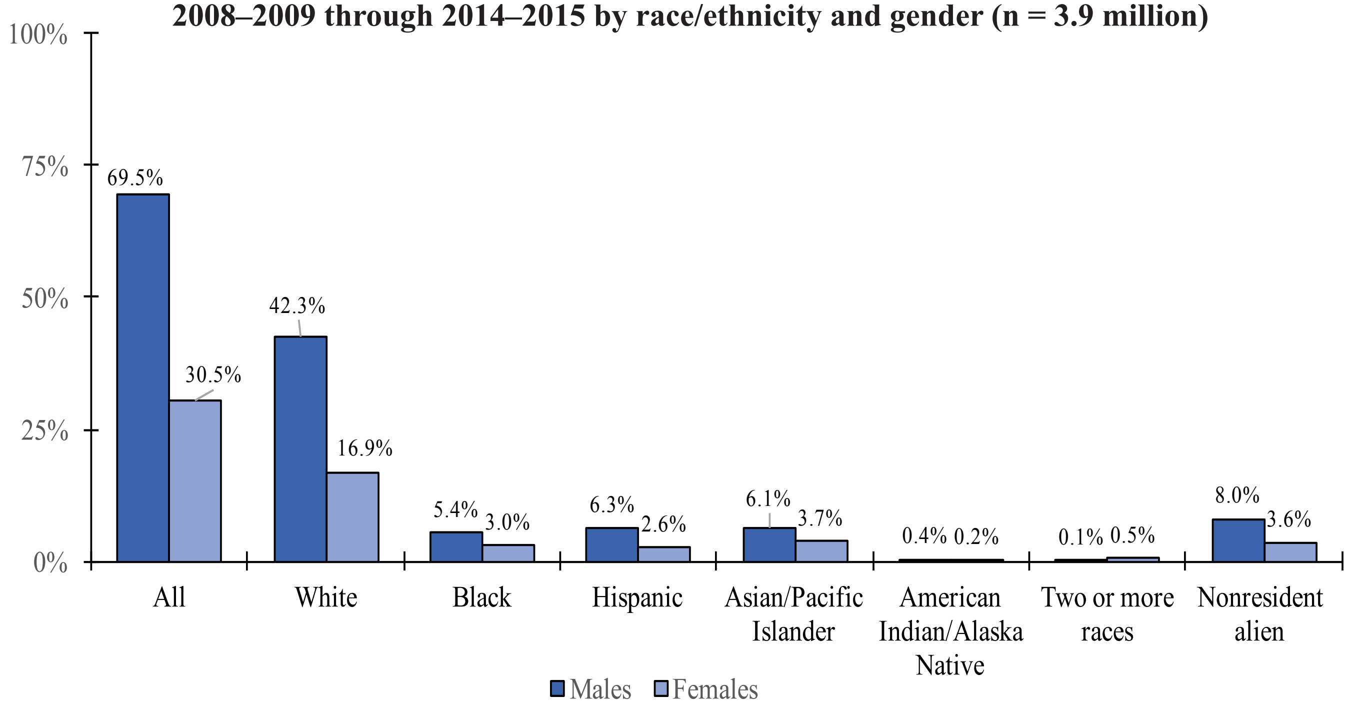
§7. STEM Degrees/Certificates Conferred, 2009–2015

7.4 Growth and Share of STEM Degrees/Certificates Conferred by Race/Ethnicity, and Gender

Women comprise of about 51% of the US population, but their share of STEM degrees during the academic years shown in Figure 7.5 is only 30.5% (Difference in share of men and women is 78%). Black and Hispanic women's share of STEM degrees is even more anemic relative to their percentage in the general population. As previously mentioned in this paper, a group's proportionality in the general population is the best comparative measure of any group's participation in various aspects of society, especially underrepresented groups.

Note: Figure 7.5 is the same as Figure 7.3, but broken down by gender.

Figure 7.5: Percentage share of STEM degrees conferred in academic years 2008–2009 through 2014–2015 by race/ethnicity and gender (n = 3.9 million)



Source: U.S. Department of Education, National Center for Education Statistics, November 2015

Table 7.1. Total number of STEM degrees conferred in academic years 2008–2009 through 20014–2015 by race/ethnicity and gender

Description	Total	White	Black	Hispanic	Asian/ Pacific Islander	American/ Indian/ Alaska Native	Two or more races	Non-resident alien
Certificates	429,661	249,146	69,493	73,984	21,561	5,226	5,563	4,688
Associate degrees	614,440	399,395	79,502	78,039	33,516	25,417	7,285	9,884
Bachelor's degrees	2,007,793	1,309,055	140,265	162,196	250,959	10,782	31,774	102,762
Master's degrees	642,372	261,531	30,170	27,083	61,208	1,662	6,118	254,600
Doctoral degrees	180,158	77,384	4,552	5,649	12,943	424	1,060	78,146
Total	3,874,424	2,296,511	323,982	346,951	380,187	43,511	51,800	450,080

§7. STEM Degrees/Certificates Conferred, 2009–2015

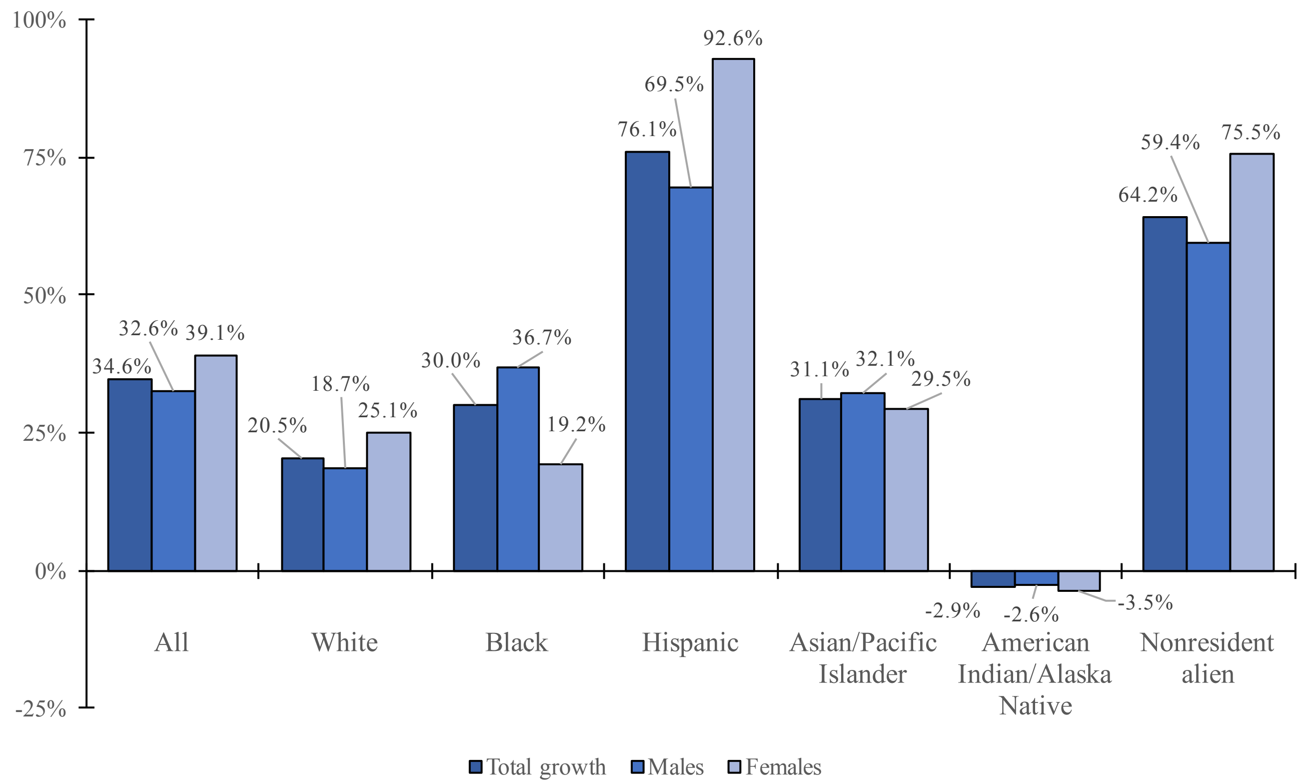
7.4 Growth and Share of STEM Degrees/Certificates Conferred by Race/Ethnicity, and Gender, cont'd

Figure 7.6 depicts the percentage increase of STEM degrees from academic years 2008–2009 to 2014–2015. Although blacks and Hispanics still lag far behind in parity with whites, the good news is that these two groups increased their share of STEM credentials per academic year from 39,041 to 50,741 for blacks and from 36,092 to 63,562 for Hispanics. This resulted in percentage increase of 30% for blacks and 76% for Hispanics.

Hispanic women had an astounding increase of STEM degrees conferred going from 10,279 in 2009 to 19,800 per academic year in 2015 (92.6%). There was not enough historical data to show practical growth on two or more races.

See Table 7.1 for cumulative total of STEM degrees/ certificates conferred in the seven academic years by race/ethnicity.

Figure 7.6: Percentage growth of STEM degrees conferred in academic years 2008–2009 through 20014–2015 by race/ethnicity and gender (n = 3.9 million)



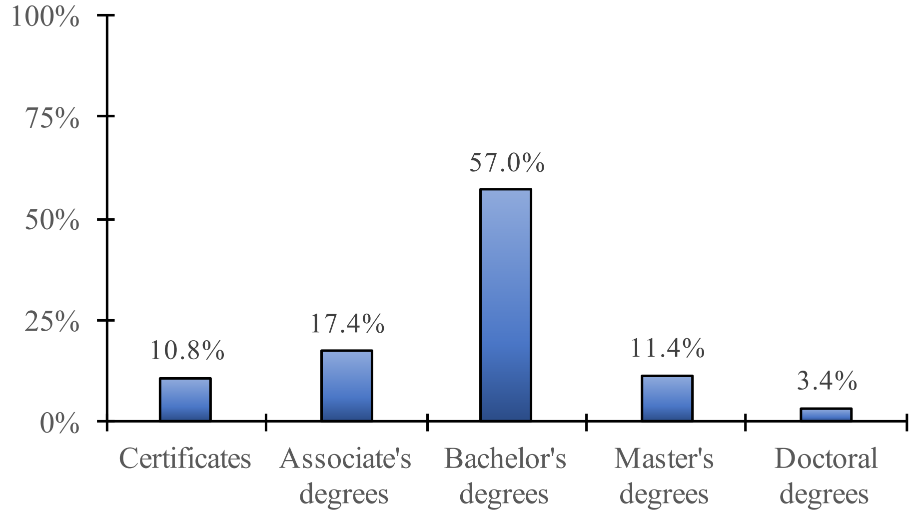
Source: U.S. Department of Education, National Center for Education Statistics, November 2015

§7. STEM Degrees/Certificates Conferred, 2009–2015

7.5 White Students: Percentage of STEM Degrees/Certificates Conferred

Figure 7.7: White percentage distribution of graduates with STEM degrees/certificates, 2009–2015 (n = 2,296,511)

Source: U.S. Department of Education, National Center for Education Statistics, November 2015



7.6 Black Students: Percentage of STEM Degrees/Certificates Conferred

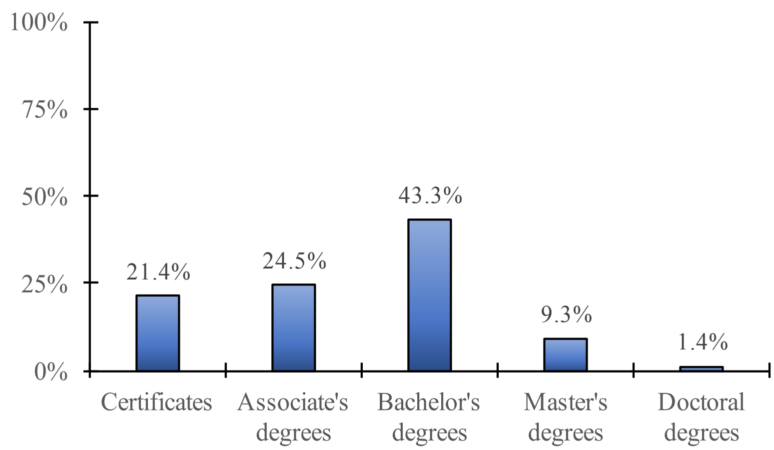


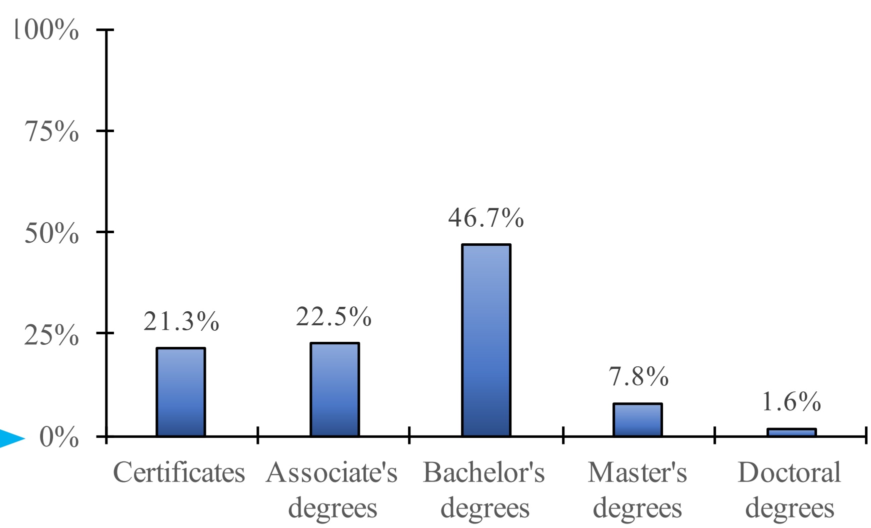
Figure 7.8: Black percentage distribution of graduates with STEM degrees/certificates 2009–2015 (n = 323,982)

Source: U.S. Department of Education, National Center for Education Statistics, November 2015

7.7 Hispanic Students: Percentage of STEM Degrees/Certificates Conferred

Figure 7.9: Hispanic percentage distribution of graduates with STEM degrees/certificates 2009–2015 (n = 346,951)

Source: U.S. Department of Education, National Center for Education Statistics, November 2015



§7. STEM Degrees/Certificates Conferred, 2009–2015

7.8 Asian/Pacific Islander: Percentage of STEM Degrees/Certificates Conferred

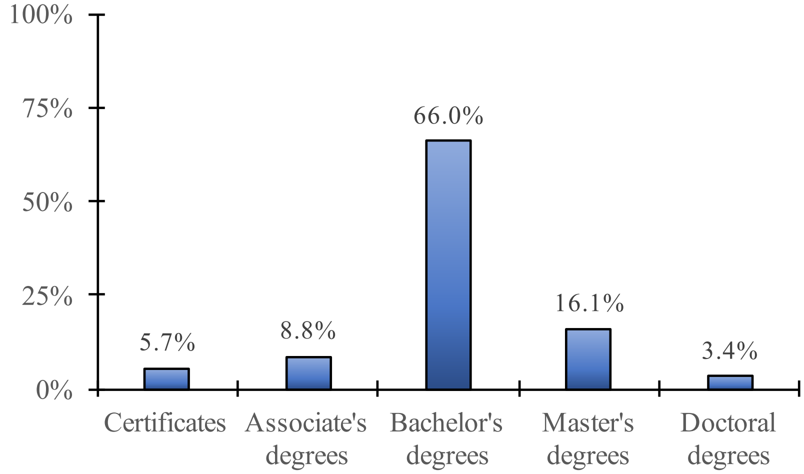


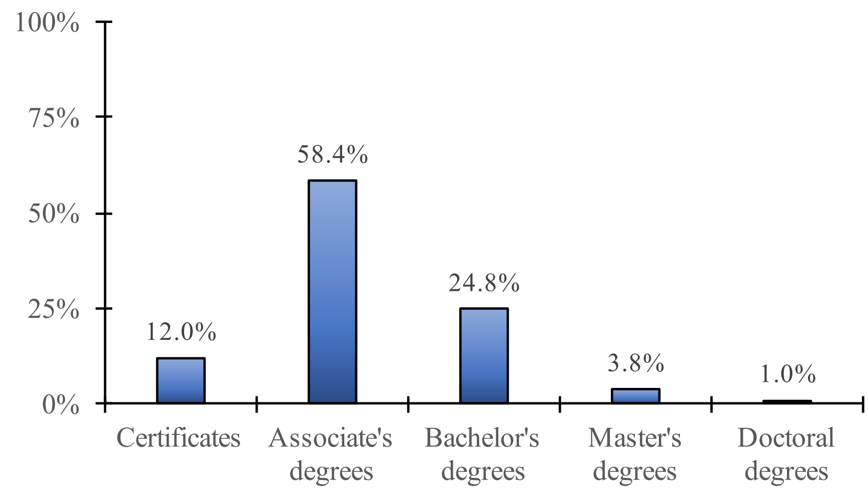
Figure 7.10: Asian/Pacific Islander percentage distribution of graduates with STEM degrees/certificates 2009–2015 (n = 380,187)

Source: U.S. Department of Education, National Center for Education Statistics, November 2015

7.9 American Indian/Alaska Native: Percentage of STEM Degrees/Certificates Conferred

Figure 7.11: American Indian/ Alaska Native percentage distribution of graduates with STEM degrees/certificates 2009–2014 (n = 43,511)

Source: U.S. Department of Education, National Center for Education Statistics, November 2015



7.10 Two or More Races: Percentage of STEM Degrees/Certificates Conferred

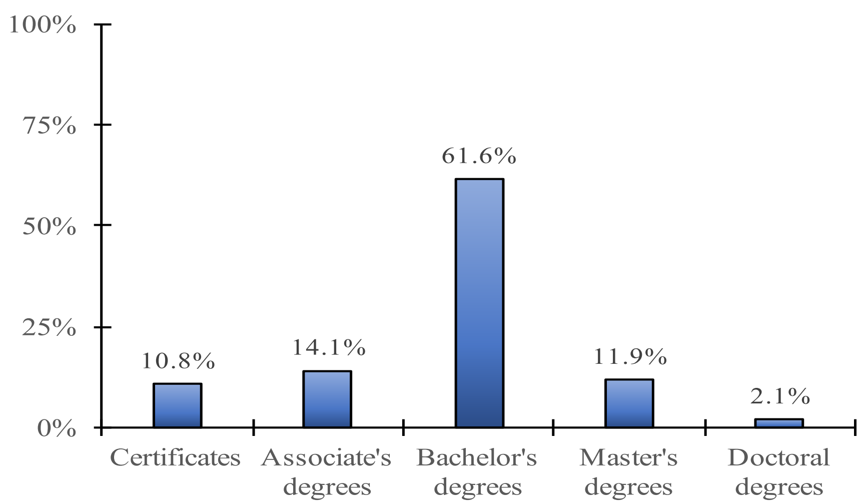


Figure 7.12: Two or more races percentage distribution of graduates with STEM degrees/certificates 2009–2015 (n = 51,800)

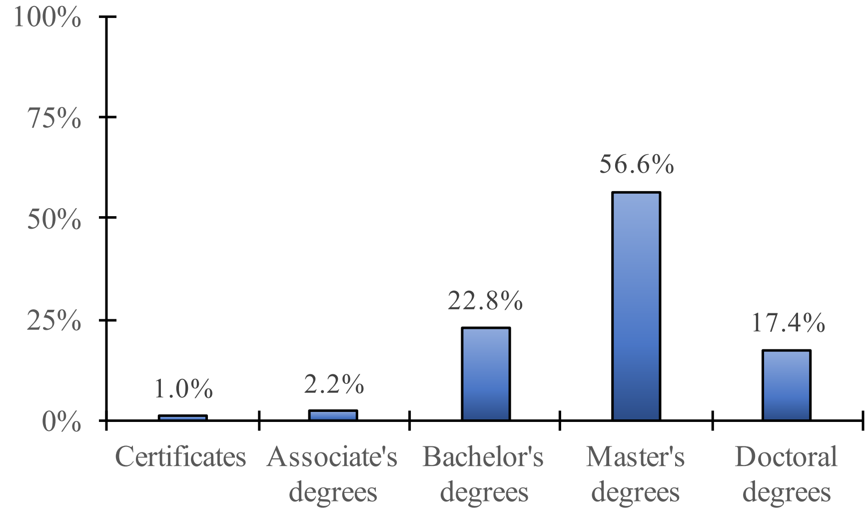
Source: U.S. Department of Education, National Center for Education Statistics, November 2015

§7. STEM Degrees/Certificates Conferred, 2009–2015

7.11 Nonresident Alien: Percentage of STEM Degrees/Certificates Conferred

Figure 7.13: Non-resident alien percentage distribution of graduates with STEM degrees/certificates 2009–2015 (n = 450,080)

Source: U.S. Department of Education, National Center for Education Statistics, November 2015

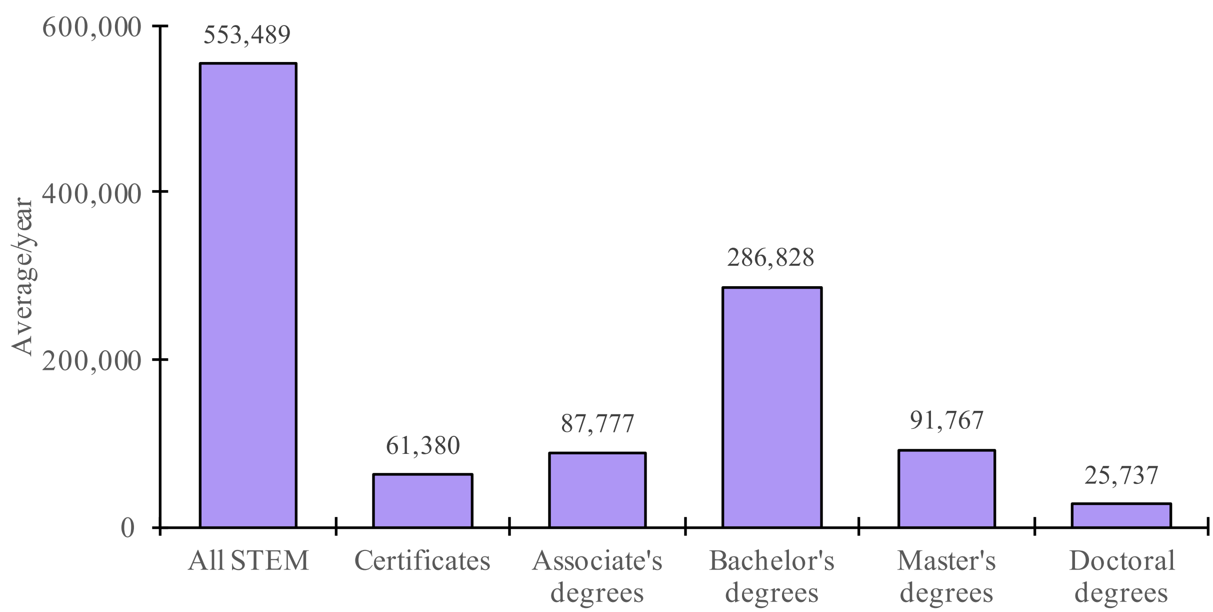


7.12 Average Percentage of STEM Degrees/Certificates Conferred per Academic Year

Figure 7.14 depicts the average number and type of STEM degrees/certificates conferred per year during the observed period of time (2009–2015). The average number of STEM credentials awarded per year was more than 500,000. Bachelor's degrees, as expected, had the largest average share and percentage of this degree, 286,828 and 51.8% (Figures 7.14 and 7.1), respectively. The bachelor's degree data once again suggest that it is the premier degree among STEM occupations.

The STEM certificate is not often discussed in academic circles; nevertheless, it bodes well when compared to the associate's STEM degree with 11% and 16% (Figure 7.1), respectively.

Figure 7.14: Average number of STEM degrees/certificates conferred per academic year, 2008–2009 through 2014–2015



Source: U.S. Department of Education, National Center for Education Statistics, November 2015

§7. STEM Degrees/Certificates Conferred, 2009–2015

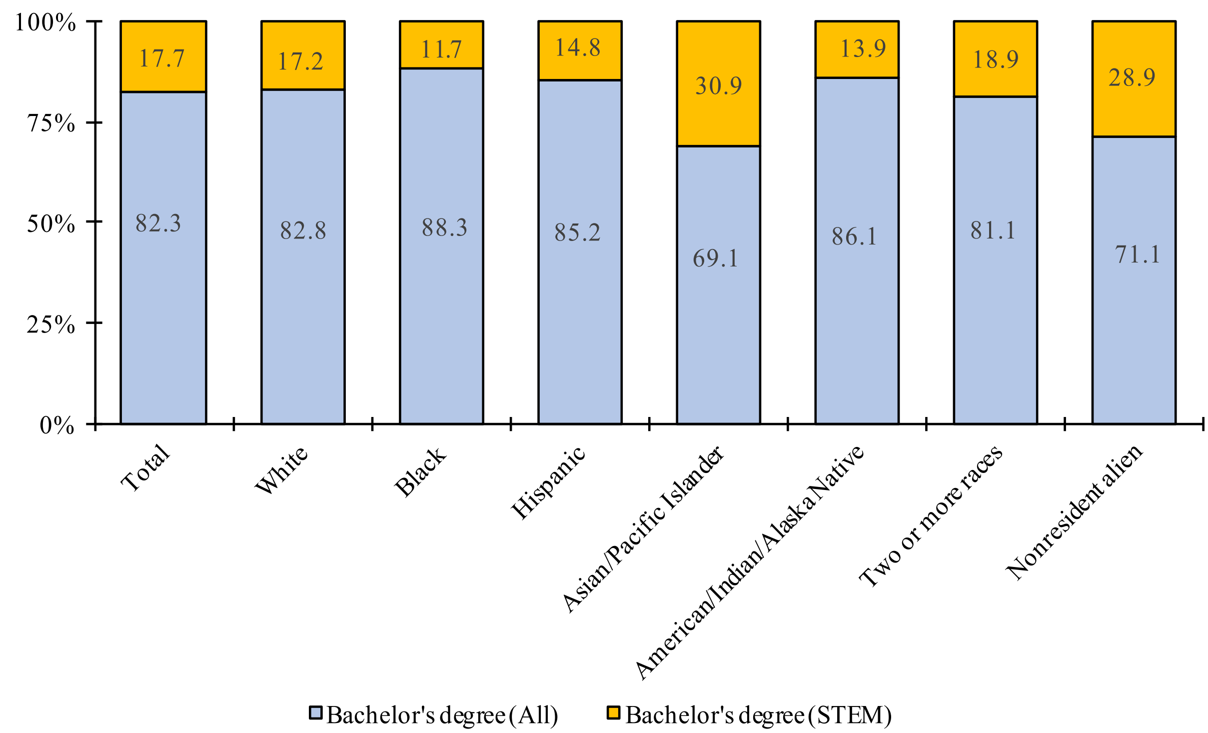
7.13 Percentage Between All Bachelor's and STEM Bachelor's Degrees Conferred

Figure 7.15 summarizes the comparative analysis between all STEM bachelor's degrees and all other degrees for the academic year 2014–2015 alone. This is significant because STEM bachelor's degrees made up almost 18% of the approximately 1.9 million bachelor's degrees conferred in this single academic year. If this number holds or increases, this means that an additional of about 3.4 million STEM bachelor's degrees will be conferred by 2025. Also, there was a credible showing in the share of STEM degrees for blacks (11.7%) and Hispanics (14.8%) compared to total bachelor's graduates in a single academic year. Asians/Pacific Islanders had the largest share of STEM degrees (30.9%), and non-resident aliens followed with (28.9%) STEM degrees conferred in the academic year 2014–2015 relative to total bachelor's degrees in each of these subpopulations.

Although STEM occupations make up only 6.3% of the total US workforce, its share of bachelor's degrees is almost three times that of its share in US total occupations.

For example (Figure 2.3, page 11), of all STEM workers, 37% have a bachelor's degree, and all other workers, 23% have a bachelor's degree. Also, more than 73.2% of STEM workers hold a bachelor's degree or higher. About 37% of STEM workers have advanced degrees compared to 14% for all workers.

Figure 7.15: Percentage comparison between total bachelor's degrees and STEM bachelor's degrees by race/ethnicity for the academic year 2014-2015 (All: n = 1,894,934 and STEM: n = 335,837)



Source: U.S. Department of Education, National Center for Education Statistics, November 2015

§8. Actual and Projected Growth/Share of All Degrees, 2004–2024

8.1 Percentage Distribution of Actual and Projected Growth of All Degrees by Gender

This section examines all degrees and share of degrees by type and gender, actual growth, and projected growth for academic years 2004–2014 and 2014–2024, respectively. Figure 8.1 depicts the percentage of actual growth and projected growth for all degrees. The degrees are associate's, bachelor's, master's, and doctoral conferred and projected from postsecondary institutions in the academic years listed in this section. These are postsecondary institutions that participate in Title IV federal financial aid programs. The doctoral degree includes PhD, EdD, and comparable degrees at the doctoral level. Also, it includes most degrees formerly classified as first-professional, such as MD, DDS, and law degrees.

Women growth in degrees conferred was 42.6% from 2004-14 and the growth is projected to decrease to 29.2% by 2024, resulting in a drop of about 31%. Men growth for the same time frame was 33.6%, but is expected to decrease to 26.4% by 2024, resulting in drop of 21.4% by 2024.

The projected growth in percentage is smaller (28.3%) than the actual growth (38.7%), which represents an actual compound annual growth rate of 3.3% over the previous 10 years and a projected annual growth rate of 2.5% to 2024. Although the projected growth in percentage is smaller than the actual growth of the previous 10 years, in absolute numbers, the projected growth is up by 9.5 million degrees from academic years 2004–14.

Figure 8.1: Percentage distribution of actual and projected growth of all college degrees for the academic years 2004-05 through 2023–24

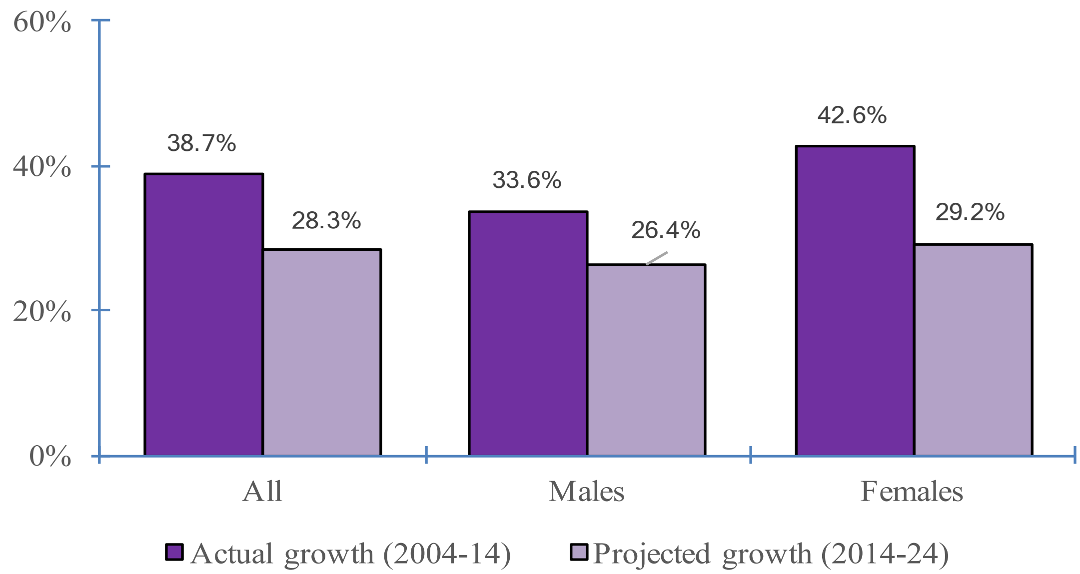


Table 8.1: All actual conferred and projected degrees

	Academic years	
Description	2004-14	2014-24
Associate's degree	8,557,646	12,203,000
Bachelor's degree	16,432,008	19,422,000
Master's degree	6,814,113	9,251,000
Doctoral degree	1,564,221	1,947,200

Source: U.S. Department of Education, National Center for Education Statistics, Higher Education General Information Survey

§8. Actual and Projected Growth/Share of All Degrees, 2004–2024

8.2 Percentage Distribution of Actual and Projected Growth of All Degrees by Type

Figure 8.2 shows percentage distribution of actual and projected degrees by degree type. The lower projected growth for each degree means that the number of new degrees will not grow at the same rate as the actual growth.

The actual growth in bachelor's degree was 32.4% and the projected growth is 18.2%, which is 59% lower than the actual; nevertheless, in absolute numbers, the number of bachelor's degrees is projected to add about 19.4 million degrees by 2024, thus maintaining its trajectory of absolute count of degrees conferred. Based on data from the previous five years, about 7.7 million of these degrees will be STEM degrees and about 3.5 million of the 7.7 million will be STEM bachelor's degrees.

The associate's degree has high percentages in both actual and projected growth, which is consistent with the robust return on investment for those earning this degree.

Figure 8.2: Percentage distribution of actual and projected growth of all college degrees by type for the academic years 2004-05 through 2023–24*

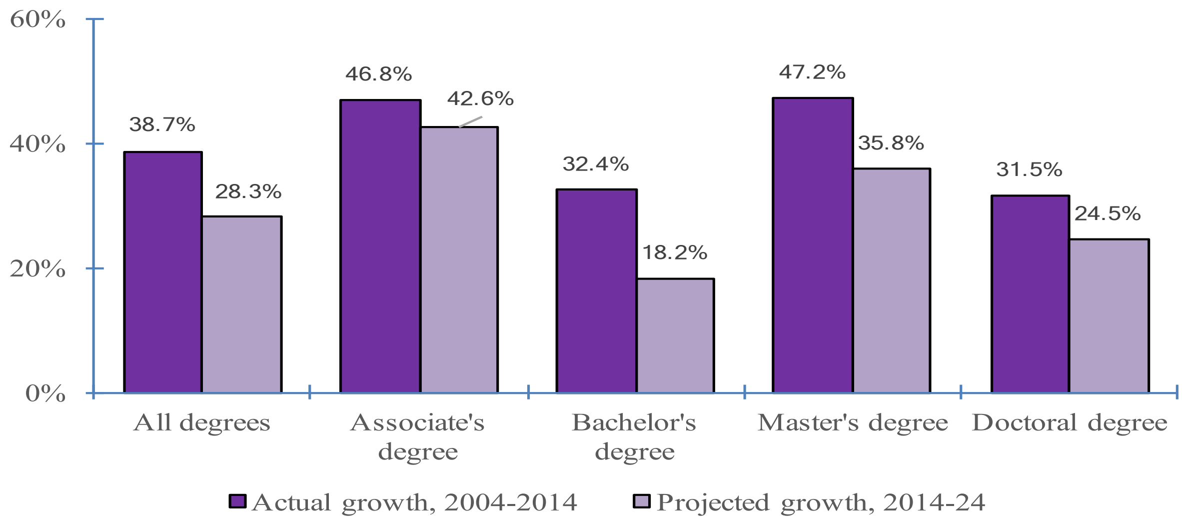
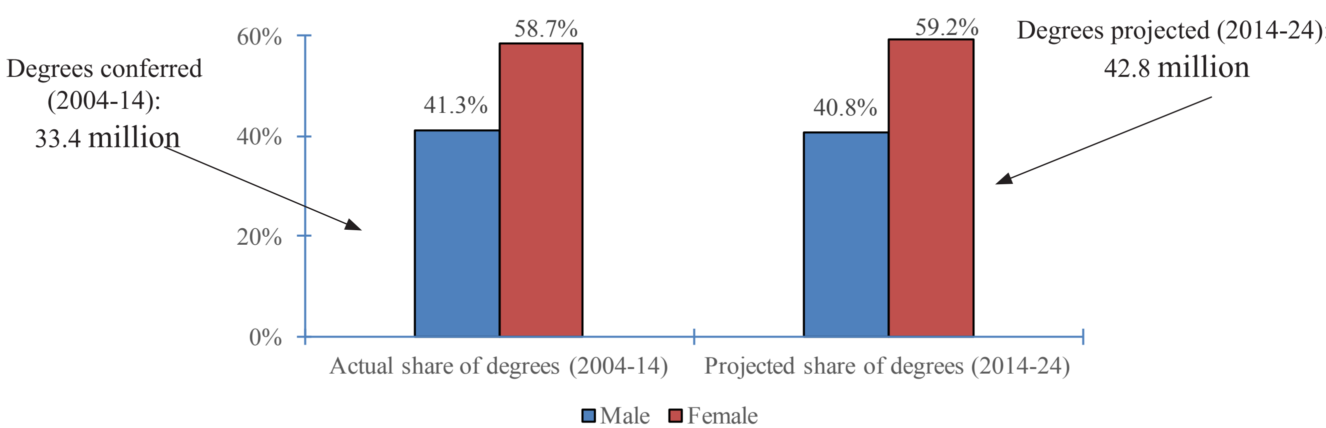


Figure 8.3: Percentage of actual and projected share of all college degrees for the academic years 2004-05 through 2023–24*



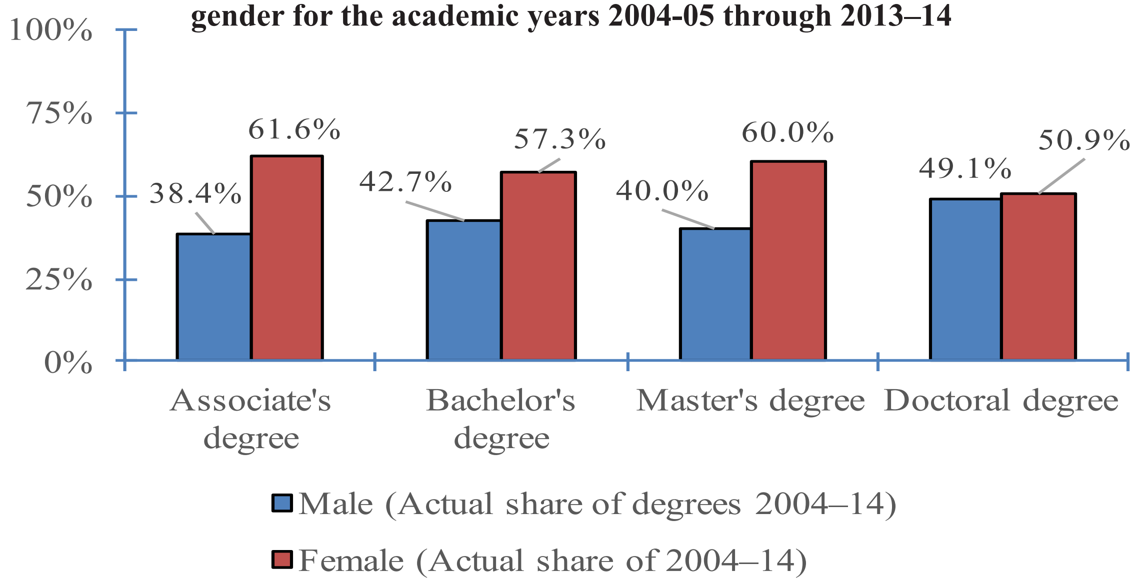
Source: U.S. Department of Education, National Center for Education Statistics, Higher Education General Information Survey

§8. Actual and Projected Growth and Share of All Degrees, 2004–2024

8.3 Actual and Projected Share of Degrees in Each Subpopulation by Type and Gender

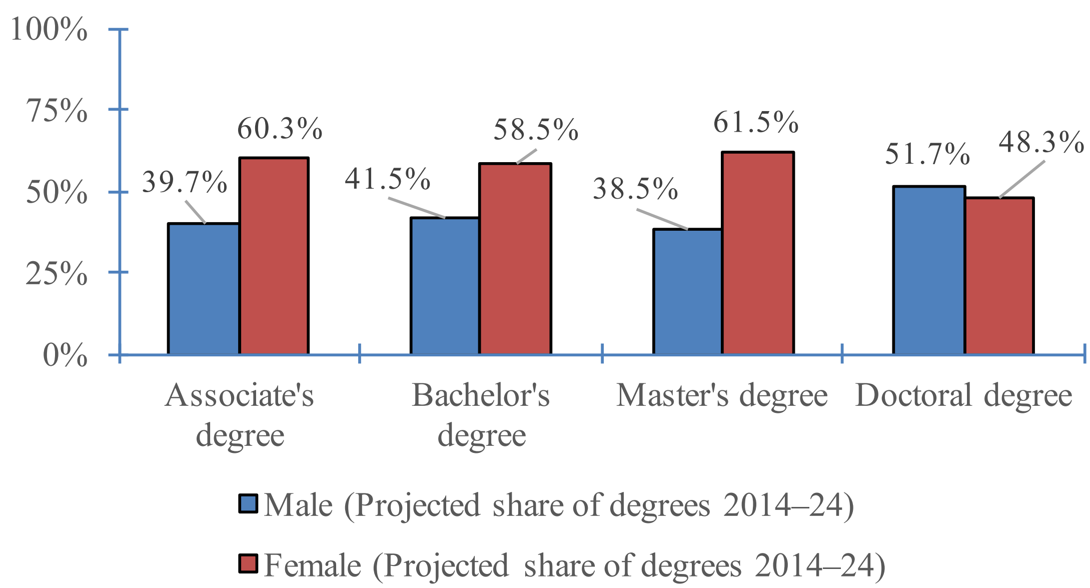
Figures 8.4 and 8.5 depict actual and projected share for all degrees for the years shown in the graphs. The projected shares do not show any significant changes in the ratio of degrees that were conferred in academic years 2004-14 and those projected in the academic years 2014–24. The sub-population of each degree was used in calculating the percentages.

Figure 8.4: Percentage share of actual college degrees conferred by type and gender for the academic years 2004-05 through 2013–14



Source: U.S. Department of Education, National Center for Education Statistics, Higher Education General Information Survey

Figure 8.5 Percentage share of projected college degrees by type and gender for the academic years 2014–15 through 2023–24



Source: U.S. Department of Education, National Center for Education Statistics, Higher Education General Information Survey

§9. Discussion

9.1 Advantages of a STEM Degree

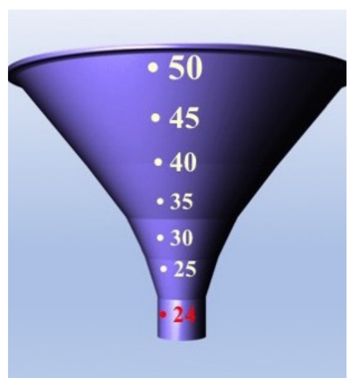
In today's marketplace, flavors of STEM are needed and used in almost every career. In a substantial percentage of non-STEM occupations, people might need to possess minimum depth and breadth in STEM skills to do their jobs effectively. Consequently, the difference in certain skills between the STEM worker and the non-STEM worker can be and is often blurred. For example, non-STEM workers such as supply chain technicians, truck drivers, or accountants all need some level of proficiency in mathematics and technological literacy to do their jobs productively.

If people are trained in a bachelor's level STEM discipline but do not secure or want a STEM position, they will most likely excel in a STEM-related or a non-STEM occupation because of the valuables skills learned from formal training in a STEM discipline; therefore, earning a degree in a STEM discipline can still be beneficial, even in a non-STEM job. Also, preparing for a STEM career in high school can be an advantage after graduation, no matter whether one later attends a college/technical school, joins the military, or simply enters the job market. In pursuing a quality education, participating in STEM activities for grades K–12 and postsecondary education can be a positive move, regardless of the type of work one might ultimately do. Developing critical thinking, reasoning, and problem-solving skills can be invaluable in one's professional and personal everyday life.

9.2 STEM Skill SET Mismatch Theory

The mismatch theory hypothesis relating to STEM occupations is when the education discipline and skills set of a person are insufficient to be paired with a specific occupation requirement. Included in the mismatch theory are STEM degrees that do not match the job. For example, people with a bachelor's degree in physics might or might not be a right fit for writing software code. Of course, this would depend on the software skills they have acquired through formal courses work and/or from previous jobs. By the same token, people with a bachelor's degree in computer science might not make it through the funnel (Figure 9.1) for a computer job; therefore, they will not be one of the 24 people who will make it through to a STEM job. However, there are many reasons that fewer than half of STEM graduates are not employed in a STEM occupation. For instance, the funnel concept illustrates an example of 50 STEM degree holders, but through the application process, only 24 out of the 50 secured a STEM job. The funnel scenario might make an employer believe that there is a shortage because, for example, there may be a need for 35 STEM workers, but only 24 out of 50 will meet the requisite skill set that some employers are seeking in a candidate. This could easily be misconstrued as a shortage of STEM workers by the employer, when, in fact, only about one out of two STEM degree holders have the requisite skills that employers are seeking in a candidate. Employers are looking for STEM workers who can be productive almost immediately. In STEM jobs, the learning curve has become something of the past because there is no such thing as hanging around for six months to get a feel for the job. In addition, employees change jobs and occupations frequently. The notion of hanging around with the same employer for 30 years is a phenomenon of the past.

Figure 9.1: Mismatch concept



Most employers will not fill a position simply because they cannot find the right fit, rather they

§9. Discussion

9.2 STEM Skill Set Mismatch Theory, cont'd

will leave the position open until they are able to find a fit or merge the job duties and responsibilities under two existing employees. Employers might feel at times that there is a shortage because they are not able to find the skill set for positions available. Considering the massive push for students to major in STEM fields, there might already be an adequate supply of candidates with STEM degrees, but their degrees are not in the discipline and/or the skill set being sought by prospective employers. High technical jobs can be a bit tricky because job mismatches can and will rise to the surface rather quickly. Unlike in the past when employees spent their lives serving one employer, today they change jobs and occupations frequently; therefore, employers expect a steep learning curve. This was one reason the Bureau of Labor Statistics changed to a regression model in 2016 to project future employment and occupational changes.

The perception of a shortage of highly qualified STEM workers could have more to do with this noted mismatch. For example, a candidate with a non-STEM bachelor's degree who has STEM skills and the requisite experience might be a better fit for a particular STEM job than someone who has a STEM degree; therefore, they may be hired for the position instead of the candidate who has a STEM degree. This kind of scenario is played out thousands of times throughout the industry. Hence, about 33% of STEM workers do not have a STEM degree.

These two opposite analyses, especially by those people who review the data from the Bureau of Labor Statistics paint a paradoxical situation; that is, one group says there is a shortage and the other group says there is a surplus. The situation is much more complex than a headcount of the number of STEM degrees conferred annually. A simplified characterization of the STEM workforce is this: it is a diverse market, and it is seeking talented workers who will fit the employer requisite job skills set.

9.3 College Degrees

There was a total of 33.4 million degrees conferred at the associate's, bachelor's, master's, and doctoral level from 2004–2014. About 3.5 million were in STEM degrees conferred from 2009–2015. The projected number for all bachelor degrees from 2014–2024 is 19.4 million (Table 8.1, page 45). On the basis of past data, there should be about 4.5 million STEM degrees conferred in the mix (See Section 7). When counting STEM degrees, analysts often assume incorrectly that only STEM degree holders are placed in STEM jobs, when in fact about 33% of STEM workers do not have a STEM degree, especially computer workers.

9.4 STEM K-12 Education

As the accelerated STEM debate continues, it is most likely advantageous to those in grades K–12 to study harder in science and math and acquire literacy in STEM and statistics. This is important regardless of whether they pursue a postsecondary STEM or non-STEM degree. However, caution should be adhered to with children. Namely, (1) children should not be pushed in a STEM direction simply because they are good at math, rather we should let their interest be the prevailing factor for whatever excites them about a future career; and (2) parents should better understand the hype surrounding the STEM phenomena because STEM workers comprise only 6.3% of the total workforce. However, STEM literacy and statistical literacy will be an enormous benefit to students, professionally and personally, in this ever-expanding technological and informational revolution.

§10. Summary

Although STEM workers start at higher salaries than non-STEM workers, the annual wage increases were modest for STEM workers from 2015–2016. For example, employment for STEM workers increased by only 1.2% during the same year. The rise in STEM wages from 2015 to 2016 was only 0.6% (computer occupations increased by only 0.4%, and engineering rose by only 0.7% from 2015 to 2016).

STEM workforce occupational growth from May 2006 to May 2016 was 18.7%. This represented an actual growth of about 1.4 million new jobs. The projection for 2016 to 2026 is less (12.6%), which shows less job growth, totaling about 1.1 million workers. However, the projected openings due to separation coupled with new job growth will create significant openings for STEM workers every year. Subsequently, it is the employer who decides if a vacancy should be merged with another job rather than filled or eliminated. The idea is that openings in a STEM occupation do not always result in the hiring of a STEM worker.

After examining the data from the 2012 American Community Survey conducted by the US Census Bureau, a better perspective emerged on the notion of a mismatch rather than a simple supply shortage of people with STEM degrees. The survey included 41.5 million workers aged 25 to 64 with a bachelor's degree or higher. Of this population, 9.3 million of the workers had a STEM degree, and the remaining had a non-STEM degree. Of the 41.5 million workers, 5.1 million were STEM workers. Although there were 9.3 million workers with STEM degrees, only 36.1% were able to secure a STEM job. Of the 5.1 million STEM workers, only 66.2% had a STEM degree, and 33.8% of these STEM workers did not have a STEM degree. See Section 6 of this report, which clearly highlights the fact that merely having a STEM degree does not always translate to STEM employment.

In conclusion, although this paper encourages and supports a continuation of K–12 literacy in STEM education coupled with statistical literacy, it did not find any evidence to support the notion that there is a shortage of science (life and physical), technology, engineering, or mathematics (STEM) workers. However, it did find circumstantial evidence that points to significant skills mismatches in placing STEM degree holders in STEM occupations, such as having fewer than 50% of STEM degree holders working in a STEM job. In addition, there is evidence of small annual percentage wage rises, growth being down by 195,000 new jobs over the next 10 years, and often assuming incorrectly that all STEM jobs require a STEM degree. Non-STEM degree workers make up 33% of the available STEM jobs, which also indicates a skills mismatch problem associated with STEM degree holders.

In support of the conclusion reached in this paper, the Institute of Electrical and Electronics Engineers, the Economic Policy Institute, the Rand Corporation, the Urban Institute, and the National Research Council have all found no evidence that STEM workers are in short supply. Additionally, the US Census Bureau reported that 74% of those who have a bachelor's degree in a STEM field are not employed in STEM occupations. ■

Appendix A

Table 5. List of occupations used in OES STEM definition

OCC_CODE	OCC_TITLE
11-3021	Computer and Information Systems Managers
11-9041	Architectural and Engineering Managers
11-9121	Natural Sciences Managers
15-1111	Computer and Information Research Scientists
15-1121	Computer Systems Analysts
15-1122	Information Security Analysts
15-1131	Computer Programmers
15-1132	Software Developers, Applications
15-1133	Software Developers, Systems Software
15-1134	Web Developers
15-1141	Database Administrators
15-1142	Network and Computer Systems Administrators
15-1143	Computer Network Architects
15-1151	Computer User Support Specialists
15-1152	Computer Network Support Specialists
15-1199	Computer Occupations, All Other
15-2011	Actuaries
15-2021	Mathematicians
15-2031	Operations Research Analysts
15-2041	Statisticians
15-2091	Mathematical Technicians
15-2099	Mathematical Science Occupations, All Other
17-1011	Architects, Except Landscape and Naval
17-1012	Landscape Architects
17-1021	Cartographers and Photogrammetrists
17-1022	Surveyors
17-2011	Aerospace Engineers
17-2021	Agricultural Engineers
17-2031	Biomedical Engineers
17-2041	Chemical Engineers
17-2051	Civil Engineers
17-2061	Computer Hardware Engineers
17-2071	Electrical Engineers
17-2072	Electronics Engineers, Except Computer
17-2081	Environmental Engineers
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors
17-2112	Industrial Engineers
17-2121	Marine Engineers and Naval Architects
17-2131	Materials Engineers
17-2141	Mechanical Engineers
17-2151	Mining and Geological Engineers, Including Mining Safety Engineers
17-2161	Nuclear Engineers
17-2171	Petroleum Engineers
17-2199	Engineers, All Other
17-3011	Architectural and Civil Drafters
17-3012	Electrical and Electronics Drafters
17-3013	Mechanical Drafters
17-3022	Civil Engineering Technicians

U.S. Department of Labor, Bureau of Labor Statistics

Appendix A

Table 5. List of occupations used in OES STEM definition, cont'd

17-3023	Electrical and Electronics Engineering Technicians
17-3024	Electro-Mechanical Technicians
17-3025	Environmental Engineering Technicians
17-3026	Industrial Engineering Technicians
17-3027	Mechanical Engineering Technicians
17-3029	Engineering Technicians, Except Drafters, All Other
17-3031	Surveying and Mapping Technicians
19-1011	Animal Scientists
19-1012	Food Scientists and Technologists
19-1013	Soil and Plant Scientists
19-1021	Biochemists and Biophysicists
19-1022	Microbiologists
19-1023	Zoologists and Wildlife Biologists
19-1029	Biological Scientists, All Other
19-1031	Conservation Scientists
19-1032	Foresters
19-1041	Epidemiologists
19-1042	Medical Scientists, Except Epidemiologists
19-1099	Life Scientists, All Other
19-2011	Astronomers
19-2012	Physicists
19-2021	Atmospheric and Space Scientists
19-2031	Chemists
19-2032	Materials Scientists
19-2041	Environmental Scientists and Specialists, Including Health
19-2042	Geoscientists, Except Hydrologists and Geographers
19-2043	Hydrologists
19-2099	Physical Scientists, All Other
19-4011	Agricultural and Food Science Technicians
19-4021	Biological Technicians
19-4031	Chemical Technicians
19-4041	Geological and Petroleum Technicians
19-4051	Nuclear Technicians
19-4091	Environmental Science and Protection Technicians, Including Health
19-4092	Forensic Science Technicians
19-4093	Forest and Conservation Technicians
19-4099	Life, Physical, and Social Science Technicians, All Other
25-1021	Computer Science Teachers, Postsecondary
25-1022	Mathematical Science Teachers, Postsecondary
25-1031	Architecture Teachers, Postsecondary
25-1032	Engineering Teachers, Postsecondary
25-1041	Agricultural Sciences Teachers, Postsecondary
25-1042	Biological Science Teachers, Postsecondary
25-1043	Forestry and Conservation Science Teachers, Postsecondary
25-1051	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary
25-1052	Chemistry Teachers, Postsecondary
25-1053	Environmental Science Teachers, Postsecondary
25-1054	Physics Teachers, Postsecondary
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
41-9031	Sales Engineers

References

Center for Immigration Studies
https://cis.org/sites/cis.org/files/camarota-STEM.pdf

Economic Policy Institute
http://www.epi.org/?s=stem

Georgetown University Center on Education and the Workforce
https://www.nsf.gov/attachments/241885/public/Carnevale_Smith_Melton_STEM.pdf

National Review
http://www.nationalreview.com/article/378334/what-stem-shortage-steven-camarota

National Science Foundation
https://search.nsf.gov/search?query=stem&affiliate=nsf&search=

U.S. Census Bureau Reports Majority of STEM College Graduates Do Not Work in STEM Occupations https://www.census.gov/newsroom/press-releases/2014/cb14-130.html

U.S. Department of Labor, Bureau of Labor Statistics/Monthly Labor Review
https://www.bls.gov/opub/mlr/2015/article/stem-crisis-or-stem-surplus-yes-and-yes.htm

U.S. Department of Labor, Bureau of Labor Statistics, Employment Projections
https://www.bls.gov/spotlight/2017/science-technology-engineering-and-mathematics-stem-occupations-past-present-and-future/home.htm

U.S. Department of Labor, Bureau of Labor Statistics, Employment Projections
https://www.bls.gov/emp/
https://data.bls.gov/projections/occupationProj
https://www.bls.gov/emp/tables.htm

U.S. Department of Labor, Bureau of Labor Statistics, American Community Survey (ACS)
https://www.bls.gov/lau/acsqa.htm

U.S. Department of Labor, Bureau of Labor Statistics/Occupational Employment Statistic (OES)
https://www.bls.gov/oes/

U.S. Department of Education, National Center for Education Statistics
https://nces.ed.gov

U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Fall 2009 through Fall 2015
https://nces.ed.gov/ipeds/Home/UseTheData

U.S. Department of Labor, Bureau of Labor Statistics Standard Occupational Classification
https://www.bls.gov/soc/Attachment_B_STEM.pdf

U.S. Census Bureau/Census Bureau Reports Majority of STEM College Graduates Do Not Work in STEM Occupations - https://www.census.gov/newsroom/press-releases/2014/cb14-130.html

Employment Statistics of College Graduates
https://www.census.gov/data/tables/2012/demo/industry-occupation/college-graduates.html

U.S. Department of Commerce, Economics and Statistics
http://www.esa.doc.gov/sites/default/files/stem-jobs-2017-update.pdf

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https://www.wilsonconsultingservices.net/wcs_poplar_16.pdf

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Normalizing Throughput Yield
https://www.wilsonconsultingservices.net/Normalizing_data.pdf

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Science

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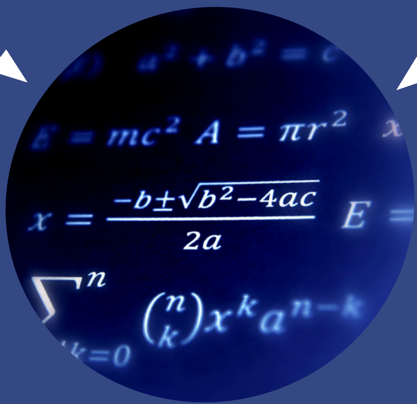
Engineering



Mathematics

STEM = ∑(Science, Technology, Engineering, Mathematics))

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