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SCIENCE & ENGINEERING INDICATORS 2024

Labor Force

The STEM Labor Force: Scientists, Engineers, and Skilled Technical Workers

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This publication is part of the 2024 edition of the *Science and Engineering Indicators* (*Indicators*) suite of reports. *Indicators* is prepared under the guidance of the National Science Board by the National Science Foundation's National Center for Science and Engineering Statistics. The *Indicators* suite consists of a summary report called *The State of U.S. Science and Engineering*, more-detailed thematic reports with supporting data, and a data tool that provides state-level indicators.

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Executive Summary

Key takeaways:

- The science, technology, engineering, and mathematics (STEM) workforce (36.8 million workers) accounted for 24% of U.S. workers in 2021. Between 2011 and 2021, the percentage of workers in STEM occupations increased from 22% to 24%. STEM workers with a bachelor's degree or higher had greater growth than those without a bachelor's degree or higher, otherwise known as the skilled technical workforce (STW).
- Between 2019 and 2021, employment rates for people associated with STEM occupations decreased less (from 88% to 86%) than for people associated with non-STEM occupations (from 83% to 79%).
- In 2021, 18% of women worked in STEM occupations, which was about three-fifths the rate of men (30%).
- Men outnumbered women 2.75 to 1.00 in science and engineering (S&E) occupations and 8.50 to 1.00 in middle-skill occupations in 2021. The only STEM occupation group in which women outnumbered men was S&E-related occupations, with about twice as many women as men.
- In 2021, the percentage of Black or African American workers in STEM occupations (8%) was lower than their percentage of the total workforce (11%). The percentage of STEM workers that were Hispanic workers was 15%, compared with 18% of all workers.
- Among workers with a bachelor's degree or higher whose highest degree was in an S&E field, 60% of female workers and 58% of Black or African American workers held jobs outside of S&E or S&E-related areas.
- Full-time, year-round workers in STEM occupations in 2021 had median earnings about $19,100 per year more than those in non-STEM occupations. STEM middle-skill workers in the skilled technical workforce (STW) had median earnings about $10,000 more than non-STEM workers without a bachelor's degree or higher.
- About 46% of all STEM workers had a professional certification, license, or educational certificate in 2020. Work credentials were most common among S&E-related workers (67%) and least common among S&E workers (28%).
- In 2021, a larger portion of foreign-born workers held STEM occupations (26%) than U.S.-born workers (24%). Proportionally, more naturalized citizens worked in S&E-related occupations (11%) than noncitizens (5%) or U.S.-born citizens (9%). Additionally, larger proportions of noncitizens worked in STEM middle-skill occupations (12%) than naturalized citizens (8%) or U.S.-born workers (9%).

Introduction

To remain competitive in today's global economy, businesses and societies rely on contributions from the science, technology, engineering, and mathematics (STEM) workforce. This report provides an overview of the STEM labor force and details its size, growth, educational pathways, salary, and diversity. As in the previous *Science and Engineering Indicators* report "**The STEM Labor Force of Today: Scientists, Engineers, and Skilled Technical Workers**," this thematic report uses an expanded definition of STEM, which includes science and engineering (S&E) occupations, S&E-related occupations, and *STEM middle-skill* occupations, with the latter defined as occupations that require a high level of knowledge in a technical domain and do not require a bachelor's degree for entry.[1] There is not a standardized way to define the STEM workforce, and other agencies may identify different occupations for their products on the STEM workforce depending on their analytical goals. Readers should use caution when comparing STEM estimates from this thematic report with those from other sources. This thematic report frequently separates people associated with STEM occupations into those with a bachelor's degree or higher and those without one of those degrees. As with previous labor reports, this thematic report focuses on the non-institutionalized population ages 16–75 years but limits analysis to the civilian population due to limited data on the occupations of active-duty military personnel in some of the data sets used.[2] Those enrolled in primary or secondary school are not included. This thematic report's focus is on occupations that people hold or have held. The majority of this report is about the employed population. In the few sections that discuss those who are not employed, only those records with an associated occupation are included.[3] The data used for this thematic report were primarily from the American Community Survey (ACS),[4] the National Survey of College Graduates (NSCG),[5] and the Survey of Doctorate Recipients (SDR).[6]

In the 2021 ACS, among the civilian non-institutionalized population ages 16–75 years, 77.1% of the population were retained for analysis in the employment rates section of the report. About 10,778,018 people were currently enrolled in primary or secondary school (4.4%), and another 42,853,443 were missing occupation data (18.3% of total), had no work experience or had not worked in the last 5 years (0.4%), or previously held military occupations (0.3%).

Terminology

To establish a common understanding of terms used to describe the STEM labor force in this report, the following definitions will be adopted throughout the report.

Occupations

STEM occupations are a subset of all U.S. occupations that utilize science, engineering, mathematics and/or technology in the primary functions of their job. Workers in STEM occupations can have any educational background. For example, while the majority of STEM middle-skill occupations were comprised of those without a bachelor's degree in 2021, about 12.7% (1.8 million) had a bachelor's degree or higher (Table SLBR-1). Similarly, 22.3% of S&E workers (2.1 million) and 37.5% of S&E-related workers (5.1 million) did not have a bachelor's degree.

For the purposes of this report, STEM occupations can be broken into three distinct groups:

1. Science and engineering occupations (i.e., S&E occupations)
2. Science and engineering–related occupations (i.e., S&E-related occupations)
3. STEM middle-skill occupations

STEM middle-skill occupations were first identified in the previous *Indicators 2022* labor report to more fully describe the modern-day STEM economy. They represent occupations not previously identified as S&E or S&E-related that have incorporated technical knowledge into core work. STEM middle-skill occupations are performed by individuals with more diverse educational backgrounds than described by the traditional definition of S&E occupations (NSB 2021).

STEM occupations or *STEM groups* will be used to collectively refer to the three groups of occupations listed above (i.e., S&E, S&E-related, and STEM middle-skill occupation groups). A description of S&E occupations, S&E-related occupations, and STEM middle-skill occupations can be found in the ***Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023*** sidebar **The STEM Workforce of the United States**. See Table SLBR-1 for a list of occupations found in the 2021 ACS 1-year Public Use Microdata Sample (PUMS) and their classification into these STEM groups.

Workforce

The *STEM workforce* is comprised of workers in S&E, S&E-related, or STEM middle-skill occupations, regardless of their educational attainment or field of degree. The *skilled technical workforce* (*STW* or *STW workers*) is a subset of the STEM workforce and represents workers without a bachelor's degree who are employed in any of the identified STEM occupations (i.e., S&E, S&E-related, or STEM middle-skill occupations).

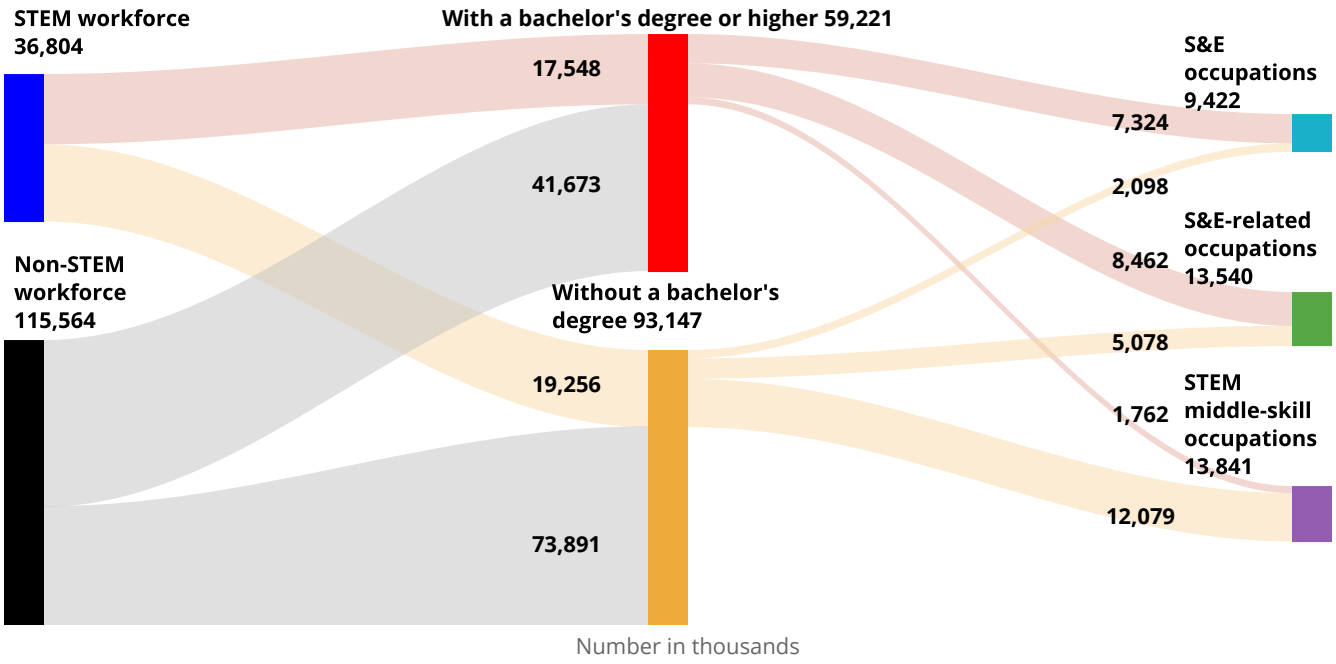
U.S. STEM Workforce: Size, Growth, and Employment

Size, Growth, and Employment

Individuals in the STEM workforce fuel the nation's innovative capacity through their work in technologically advanced activities and make important contributions to improving the nation's living standards, economic growth, and global competitiveness. In 2021, 24% of the U.S. workforce worked in STEM occupations (36.8 million workers), of which more than half (52%) did not have a bachelor's degree and therefore were classified as the STW. About 63% of the STW worked in STEM middle-skill occupations, and 26% worked in S&E-related occupations. Most of the workers with a bachelor's degree or higher (90%) worked in S&E or S&E-related occupations (**Figure LBR-1**).

Figure LBR-1

U.S. workforce, by STEM occupation group and education level: 2021



S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75 and exclude those currently enrolled in primary or secondary school. Numbers are rounded to the nearest 1,000.

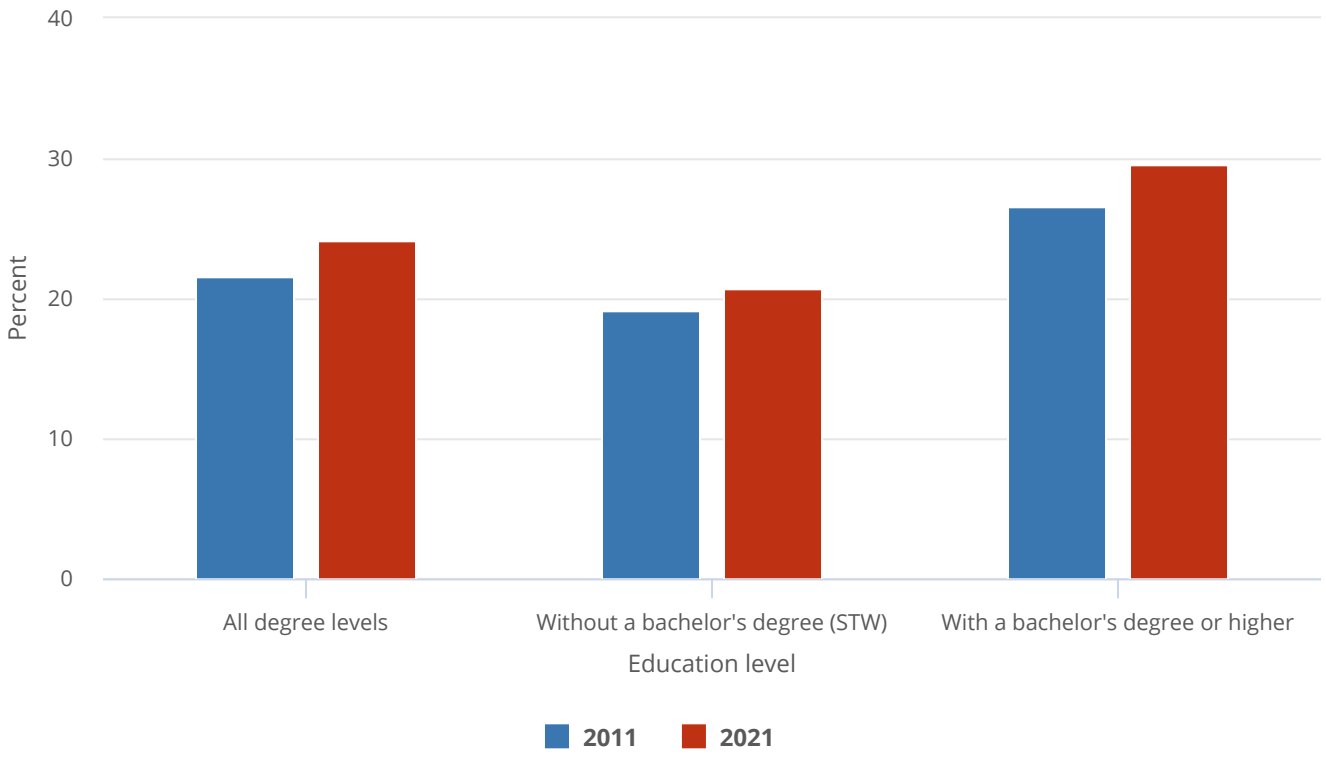
Source(s):
Census Bureau, American Community Survey (ACS), 2021, 1-Year Public-Use File, data as of 25 October 2022.

Science and Engineering Indicators

Over the last decade, workers in STEM occupations increased in both number and percentage of the total civilian workforce (**Figure LBR-2**; Table SLBR-2). Between 2011 and 2021, STEM workers increased from 22% to 24% (corresponding to 7.1 million workers) of the U.S. civilian workforce. By educational attainment, the STEM workforce with a bachelor's degree or higher increased more than the STW. Among workers with a bachelor's degree or higher, the percentage of STEM workers increased from 27% to 30%, corresponding to 5.7 million workers. The percentage of the STW (again, defined as those in STEM occupations without a bachelor's degree) increased from 19% to 21% (corresponding to 1.4 million workers).

Figure LBR-2

Change in the percentage of STEM workers, by educational attainment: 2011 and 2021



STEM = science, technology, engineering, and mathematics; STW = skilled technical workforce.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75 and exclude those currently enrolled in primary or secondary school. Coding of occupations into STEM categories reflects changes to American Community Survey (ACS) occupation codes following the 2018 update to the Standard Occupational Classification (SOC) implemented by the Bureau of Labor Statistics. Data from 2011 use occupations from the 2010 occupation list, while data from 2021 use occupations from the 2018 occupation list.

Source(s):
Census Bureau, American Community Survey (ACS), 1-Year Public-Use File, 2021, data as of 25 October 2022.

Science and Engineering Indicators

Increased employment in the STEM workforce was not equally distributed among the different categories of STEM occupations. The percentage of all workers in S&E occupations grew in the last decade from 4% to 6%. Among workers without a bachelor's degree or higher, the percentage in S&E occupations increased by 44% from 1.6% in 2011 to 2.3% in 2021. The percentage of workers with a bachelor's degree or higher in S&E occupations increased from 10% to 12%. The percentage of all workers in S&E-related occupations also increased over the last 10 years (an increase of 13% from 7.8% to 8.9%), though less than the percent increase among S&E occupations, while the percentage of all workers in STEM middle-skill decreased slightly between 2011 and 2021.

While this report presents data on the STEM workforce from previous years, the sidebar **Projected Growth of Employment in STEM Occupations** provides an overview of forecasted growth in STEM occupations over the next 10 years using data released by the Bureau of Labor Statistics (BLS).

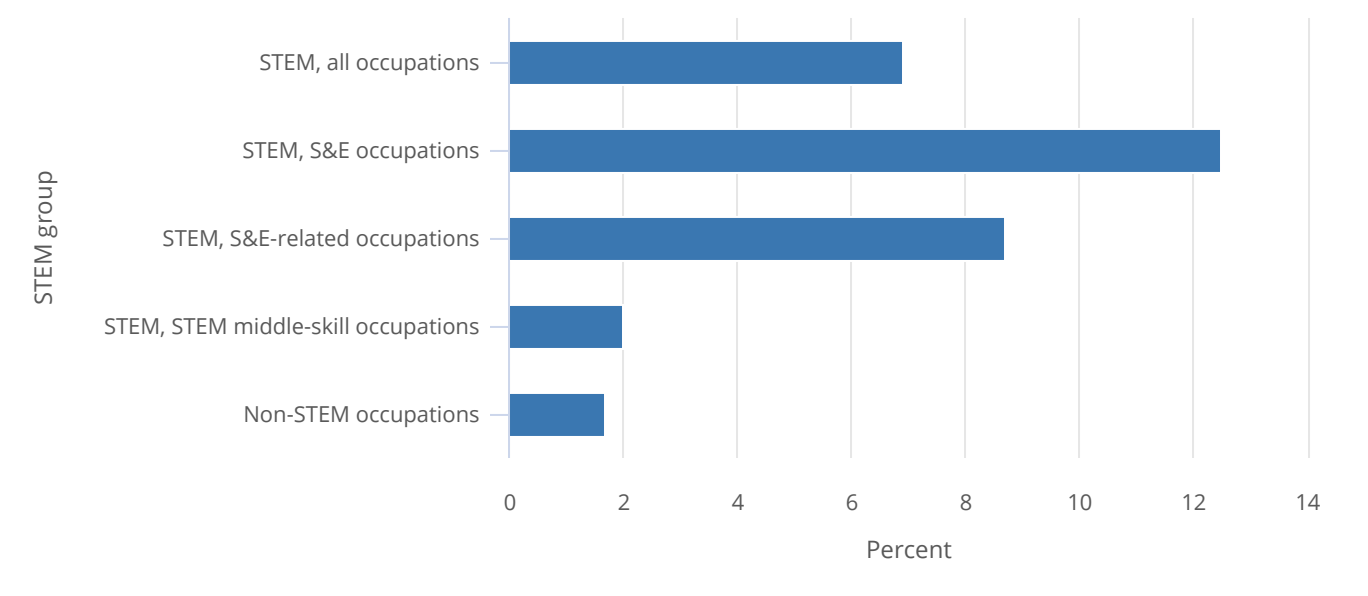
SIDEBAR

Projected Growth of Employment in STEM Occupations

According to Bureau of Labor Statistics (BLS) projections for 2022–32 (BLS 2022 Employment Projections), employment in science, technology, engineering, and mathematics (STEM) occupations* is expected to grow faster than in non-STEM occupations (7% vs. 2%) (**Figure LBR-A**).† While STEM middle-skill occupations are projected to have the largest number of STEM workers (Table SLBR-A), the fastest growth is expected among S&E occupations (12%), followed by S&E-related occupations (9%).

Figure LBR-A

Expected growth among STEM occupations: 2022–32



S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Estimates of current and projected employment for 2022–32 are from the Bureau of Labor Statistics (BLS) National Employment Matrix; estimates in the matrix are developed using data from the Occupational Employment and Wage Statistics (OEWS) program and the Current Population Survey (CPS). Together, these sources cover paid workers and self-employed workers in all industries, agriculture, and private households. Because data are derived from multiple sources, they can often differ from employment data provided by OEWS, CPS, or other employment surveys alone. BLS does not make projections for S&E occupations as a group, nor does it do so for some of the S&E and S&E-related occupational categories as defined by the National Center for Science and Engineering Statistics (NCSES); numbers in the figure are based on the sum of BLS projections for occupations that NCSES includes in the respective categories. The STEM classifications used here differ slightly from those used in the ACS due to additional occupation detail in the projections tabulations. A crosswalk will be provided upon request.

Source(s):
Bureau of Labor Statistics, special tabulations (2022) of the 2022–32 Employment Projections.

Science and Engineering Indicators

There are several ways to identify occupations with the greatest opportunity for employment in the next decade, such as by examining those with the fastest employment growth or those with the greatest expected job openings. The STEM occupations with the fastest expected growth were wind turbine service technicians (expected to grow 45% to 16,000 workers), nurse practitioners (expected to grow 45% to 385,000 workers), and data scientists (expected to grow 35% to 228,000 workers) (BLS 2022a, **Table 1.3**). In comparison, those occupations with the highest average job openings per year were registered nurses (193,000 openings), general maintenance and repair workers (152,000 openings), and software developers (136,000 openings) (BLS 2022a, **Table 1.10**).

The BLS projections also provide typical education requirements for these expected growth areas as well as related work experience or on-the-job training. While the majority of occupations with the greatest growth require at least a bachelor's degree, there are several that typically require less than a bachelor's degree, including wind turbine service technicians, solar photovoltaic installers, and computer numerically controlled tool programmers (BLS 2022a, **Table 1.7**, **Table 5.4**). All of these occupations are considered STEM middle-skill occupations. In contrast to projected growth, the STEM occupations with the fastest projected employment declines over the next decade were watch and clock repairers (30% decline to 1,000 workers) and refractory materials repairers, except brickmasons (21% decline to about 500 workers) (BLS 2022a, **Table 1.5**).

Job openings often result from a combination of factors, such as occupational growth (or increased demand for a particular job) and the replacement of workers leaving an occupation, either for retirement or a different job. About 62% of the registered nurses who leave their jobs, for example, are expected to also leave the labor force, while 32% of software developers who leave their jobs are expected to leave the labor force (BLS 2022a, **Table 1.10**). BLS publishes projected job openings by expected reason for job separation. The STEM occupations with the greatest percentage of workers leaving the labor force include acupuncturists, radiologists, and optometrists, while the STEM occupations with the greatest percentage of workers leaving for other occupations include atmospheric and space scientists, food scientists and technologists, and nuclear technicians (BLS 2022a, **Table 1.10**).

The BLS employment projections are developed using historical data and cover the 2022–32 period. The projections are long-term and intended to capture structural change in the economy, not cyclical fluctuations such as the impact of the recession that began in February 2020. Besides the immediate recessionary impact, the pandemic may have caused structural changes to the economy that would not be captured here. For more information on the BLS labor projections, see **https://www.bls.gov/emp/data/occupational-data.htm**.

* The STEM coding used for the Occupational Employment and Wage Statistics projections differs slightly from the occupations listed in Table SLBR-1 due to additional granularity of occupations available in the projections. Details will be provided upon request.

† BLS does not produce standard errors for projections, so statistical significance testing cannot be done for the numbers in this sidebar. All numbers in this sidebar are rounded to the nearest thousand.

Employment Rate and Labor Force Participation of STEM versus Non-STEM

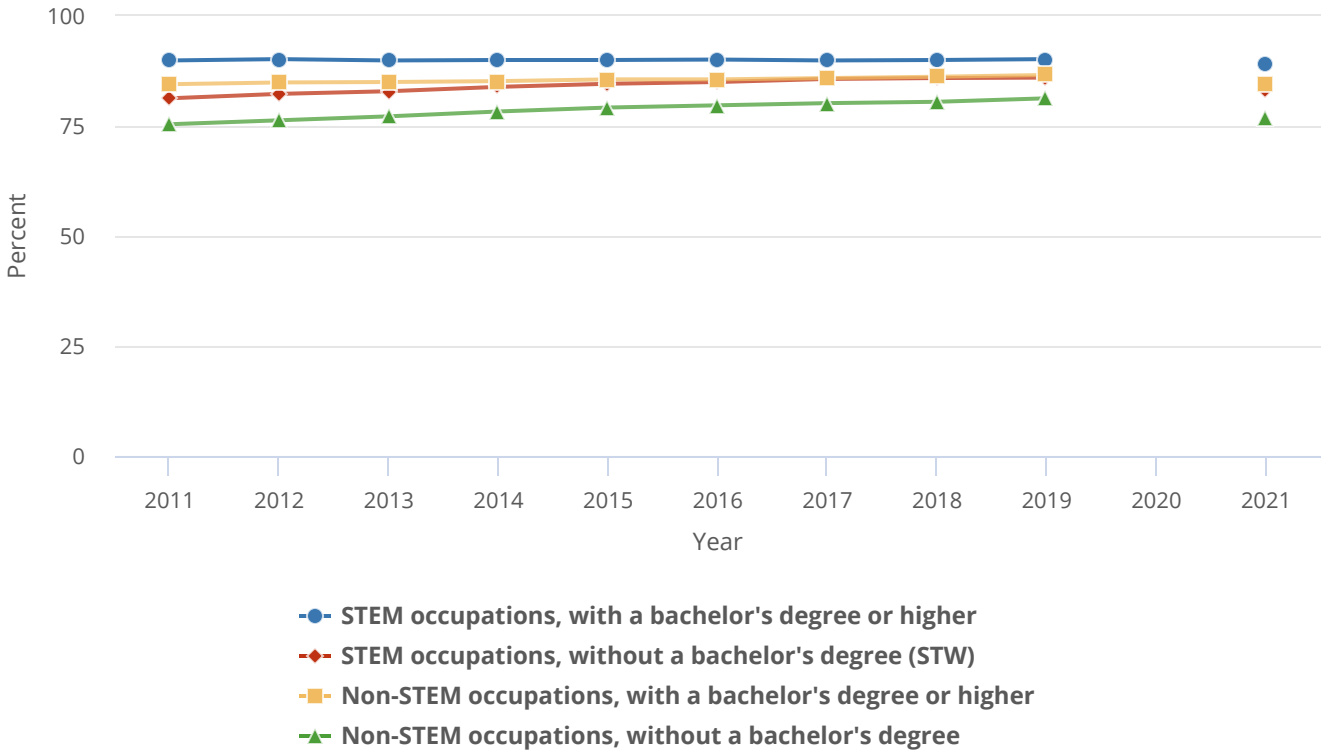
Labor force statistics for people associated with occupations can provide insights into a group's compared experiences with the labor market.[7] The employment rate of an occupation or a group of occupations is the measure of employed adults among all adults associated with an occupation—including both those who are not currently working (but have occupation information for their last held job) and those who have a job.[8] The category of "those not currently working" is comprised of two groups: individuals who do not have a job and are looking for work (*the unemployed*), as well as those who are not looking for work (*those not in the labor force*). The unemployment rate is the percentage of people who are unemployed among only those who are in the labor force (the employed and unemployed). Unemployment rate tables can be found in Table SLBR-3 and Table SLBR-4.

In 2021, people associated with a STEM occupation had a higher employment rate (86%) than those associated with non-STEM occupations (79%) (Table SLBR-5). These rates have been relatively stable over the last 5 years, despite overall employment declines during the 2020 recession. Between 2019 and 2021, people associated with non-STEM occupations experienced a larger decrease in their employment rates (from 83% to 79%) than those associated with STEM occupations (from 88% to 86%). This was primarily due to larger proportions of people associated with non-STEM occupations either leaving the labor force or being unable to find work in 2021. Among the types of STEM occupations, people associated with S&E occupations had the highest employment rate (89%) in 2021, followed by people associated with S&E-related occupations (87%).

While overall employment rates for people associated with STEM occupations had relatively low changes between 2016 and 2021, there was variation by different types of STEM occupations (Table SLBR-6). People associated with all three STEM groups had consistently higher employment rates than those associated with non-STEM occupations during this period. People associated with S&E occupations had the highest employment rates, followed by those associated with S&E-related occupations. By educational attainment, people associated with S&E and S&E-related occupations with a bachelor's degree or higher had the highest employment rates over the period (**Figure LBR-3**; Table SLBR-6). In addition, people associated with S&E and S&E-related occupations in the STW, as well as all people associated with STEM middle-skill occupations, had about the same employment rates as people associated with non-STEM occupations with a bachelor's degree or higher. This suggests that STW occupations provide greater employment opportunities for people without a bachelor's degree than non-STEM occupations.

Figure LBR-3

Employment rate in each workforce, by educational attainment: 2011–19, 2021



STEM = science, technology, engineering, and mathematics; STW = skilled technical workforce.

Note(s):
Data include the civilian, non-institutionalized population ages 16–75 and exclude those with military occupations, those missing occupation data or who have not worked in the last 5 years, and those currently enrolled in primary or secondary school. Coding of occupations into STEM categories reflects changes to American Community Survey (ACS) occupation codes following the 2018 update to the Standard Occupational Classification (SOC) implemented by the Bureau of Labor Statistics. Data from 2011 through 2017 use occupations from the 2010 occupation list, while data from 2018 through 2021 use occupations from the 2018 occupation list. Data for 2020 are not available due to the impact of the COVID-19 pandemic on ACS data collection for the survey year. Additional information is available at https://www.census.gov/programs-surveys/acs/data/experimental-data/2020-1-year-pums.html.

Source(s):
Census Bureau, American Community Survey (ACS), 1-Year Public-Use File, 2011–19, 2021, data as of 25 October 2022.

Science and Engineering Indicators

Analyzing data between 2019 and 2021 (the most recent year available) can suggest how people associated with STEM occupations were affected by the COVID-19 pandemic. During this period, people associated with S&E occupations experienced the smallest decline in employment rate (0.4 percentage points, from 90% to 89%), primarily due to increases in the percentage unemployed over the same period. People associated with S&E-related occupations had a moderate drop in employment rates (1.4 percentage points), decreasing to 87%. Among people associated with S&E-related occupations, those in the STW had the largest drop in employment (2.0 percentage points, from 86% to 84%), which declined about as much as people associated with non-STEM occupations with a bachelor's degree or higher (2.2 percentage points, from 87% to 84%). People associated with STEM middle-skill occupations had the greatest employment decrease among the STEM occupation groups (3.5 percentage points, from 86% to 83%) due to relatively equal portions of people leaving the labor force and being unable to find work. There was no significant difference between the employment declines of having a bachelor's degree or higher or not (Table SLBR-6).

Representation of Demographic Groups in STEM

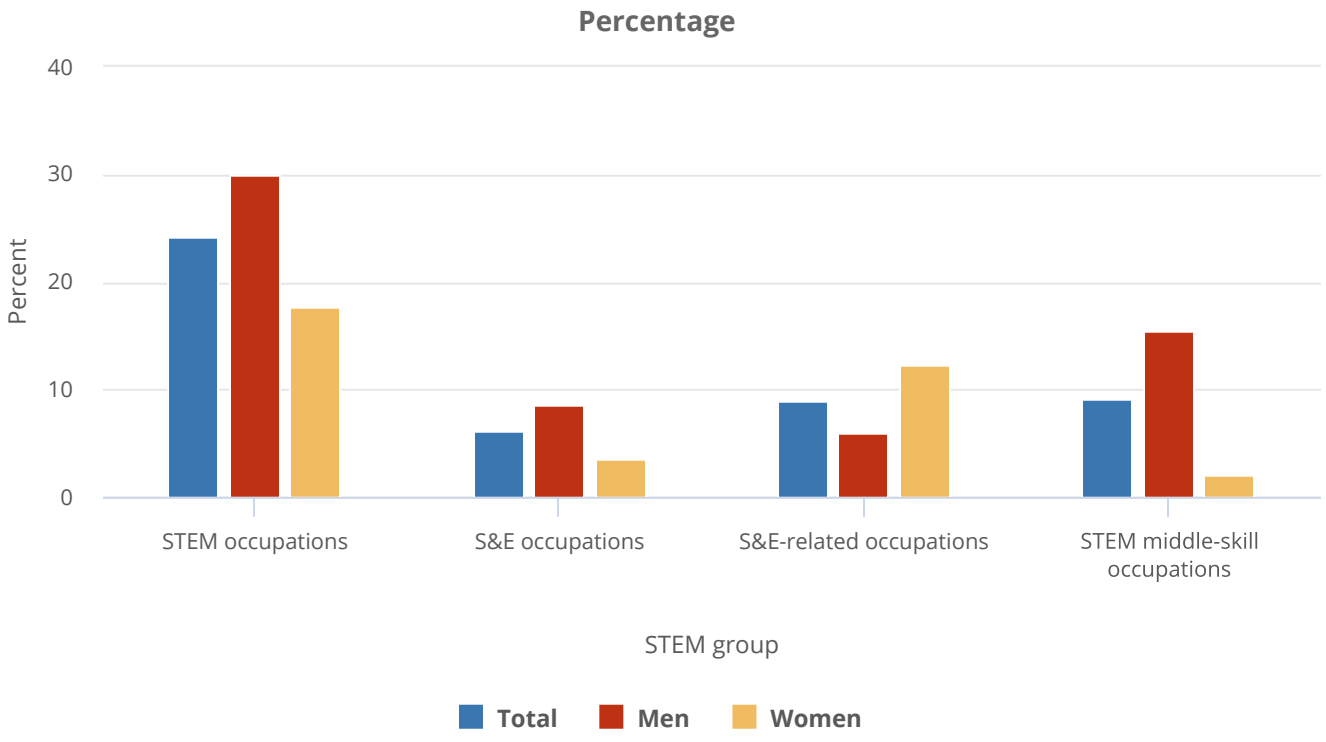
A diverse STEM workforce is vital to the country's innovative capacity (Bell et al. 2019; Hsieh et al. 2019). Broadening the representation of different social and demographic groups in STEM occupations contributes to diversity and helps create a robust workforce that will be able to meet the demands of the future (NSB 2020). To this end, the National Science Board's (NSB's) *Vision 2030* emphasized the future need for STEM talent as well as the need to improve diversity among the STEM workforce (NSB 2020). Many factors influence entry and persistence in the STEM workforce, such as educational history (NSF 2020; NSTC 2021), demographic representation among educators (NSF 2020; Miriti 2020), and educational and employment environments or atmospheres (Keyes 2019; NSTC 2021; Malcom 2022). This section provides analyses of the STEM workforce demographics and the demographics of workers with their highest degree in an S&E or S&E-related field who were working in non-S&E or S&E-related occupations in 2021 to provide a benchmark in measuring STEM retention among underrepresented demographic groups.

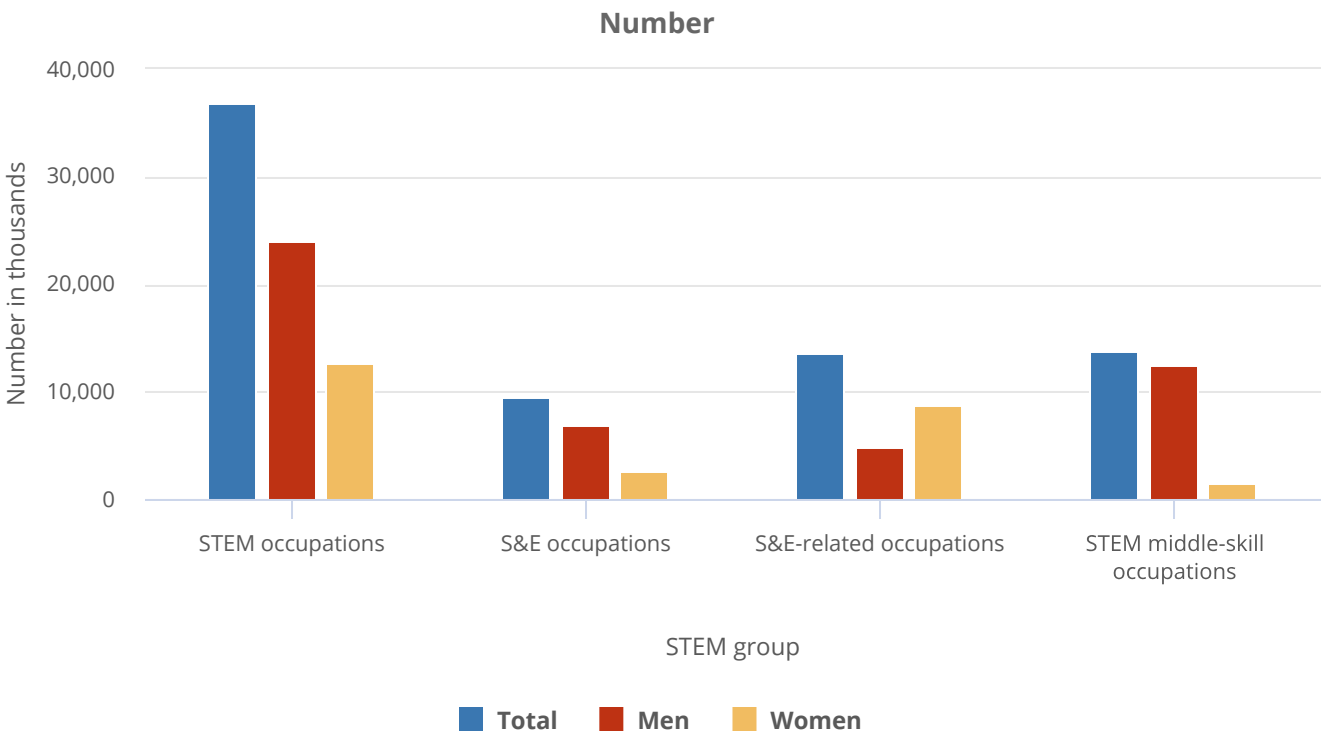
Women in STEM

Women have long been underrepresented in STEM occupations, which is one of the driving factors for the emphasis by policy advocates and others on engaging more women in STEM occupations (NSB 2014, 2020; Joseph 2016; Achieving the Promise of a Diverse STEM Workforce 2019; Malcom 2022). In 2021, while 24% of U.S. workers held a STEM occupation, 18% of female workers held a STEM occupation—three-fifths the rate of male workers (30%) (**Figure LBR-4**).

Figure LBR-4

Employed STEM workers, by sex and occupation group: 2021





S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75 and exclude those currently enrolled in primary or secondary school. Non-STEM occupations are not shown.

Source(s):
Census Bureau, American Community Survey (ACS), 1-Year Public-Use File, 2021, data as of 25 October 2022.

Science and Engineering Indicators

The difference in the participation of men and women in STEM occupations varies by the type of STEM occupation. In 2021, men outnumbered women approximately 2.75 to 1.00 in S&E occupations and 8.5 to 1.0 in STEM middle-skill occupations (**Figure LBR-4**). S&E-related occupations were the only STEM occupation group in which women outnumbered men, with about twice as many women working in S&E-related occupations than men. Among STEM workers, more men belonged to the STW than women in 2021 (59% compared with 39%). In addition, within S&E and STEM middle-skill workers, a higher percentage of men were part of the STW (23% and 89%, respectively) than their female counterparts (19% and 75%, respectively) (Table SLBR-7).

In about the last 5 years (2016 to 2021), the percentage of women working in STEM occupations increased about as much as the percentage of men working in STEM (2 percentage points) (Table SLBR-8). This equates to an additional 1,613,800 women and 2,182,100 men in STEM occupations in 2021 compared with 2016. Between 2011 and 2021, the percentage of women working in STEM increased more than men—from 15% to 18% (an increase of 3,060,200 women), compared with the increase in the percentage of men working in STEM from 28% to 30% (an increase of 4,005,200 men). Despite this gain, the proportion of men in STEM occupations remained higher than that of women in 2011, 2016, and 2021 (Table SLBR-8). Historic trends of women in S&E or S&E-related occupations with a bachelor's degree or higher can be found in Table SLBR-9.

Race or Ethnicity in STEM

One way to analyze the racial and ethnic representation in the STEM workforce is by comparing the distributions to those in the total U.S. workforce.[9] Using this comparison, in 2021, STEM workers were disproportionately Asian and White according to the ACS (**Table LBR-1**). In 2021, Black or African American workers comprised 8% of workers in STEM occupations, which was lower than their percentage of the total workforce (11%). The percentage of STEM workers that were Hispanic was 15%, compared with 18% of all workers. In contrast, Asian workers were present in STEM occupations (10%) more than they were present among all occupations (6%).

Table LBR-1

Distribution of select racial and ethnic groups in the workforce, by occupation group: 2021

(Percent)

Occupation group	White	Hispanic	Black or African American	Asian	American Indian or Alaska Native	Other race alone or in combination
All workers	59.8	18.2	11.0	6.3	0.4	4.3
STEM workers	62.9	14.8	8.2	9.5	0.3	4.3
S&E workers	60.9	9.5	6.8	18.0	0.2	4.6
S&E-related workers	65.3	10.6	9.6	9.9	0.3	4.3
STEM middle-skill workers	62.0	22.5	7.7	3.4	0.5	4.0
Non-STEM workers	58.8	19.3	11.9	5.2	0.4	4.4

S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75 and excludes those currently enrolled in primary or secondary school. Percentages may not add to 100% because of rounding. Hispanic may be any race. Race categories represent race alone and exclude Hispanic origin.

Source(s):
Census Bureau, American Community Survey (ACS), 1-Year Public-Use File, 2021, data as of October 2022.

Science and Engineering Indicators

Racial and ethnic representation also varied by the type of STEM occupation (**Table LBR-1**). Asian workers were employed in S&E occupations (18%) at almost three times their employment in the U.S. workforce (6%), while S&E-related occupations employed them slightly more than 1.5 times the rate that they were employed in the total workforce. In contrast, Hispanic workers were employed in both S&E occupations (9%) and S&E-related occupations (11%) at about half (52% and 58%, respectively) the rate of their employment in the total workforce (18%). In STEM middle-skill occupations, however, several of these comparisons were inverted. For example, Hispanics were employed in STEM middle-skill occupations (22%) at 1.2 times their employment in the total workforce.

The STW had higher concentrations of Hispanic workers (20%) and Black or African American workers (9%) than STEM workers with a bachelor's degree or higher (9% and 7%, respectively) (Table SLBR-10). This trend was consistent across S&E and S&E-related occupations. In both occupation groups, the STW had higher percentages of Black or African American workers and Hispanic workers than the corresponding workforce with a bachelor's degree or higher. Among STEM middle-skill occupations, the STW had a higher concentration of Hispanic workers (24%) than the corresponding workers with a bachelor's degree or higher (13%), but there was no significant difference in the percentage of Black or African American workers between the two workforces (both at 8%). A more detailed discussion of racial and ethnic groups in STEM can be found in the ***Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023*** report.

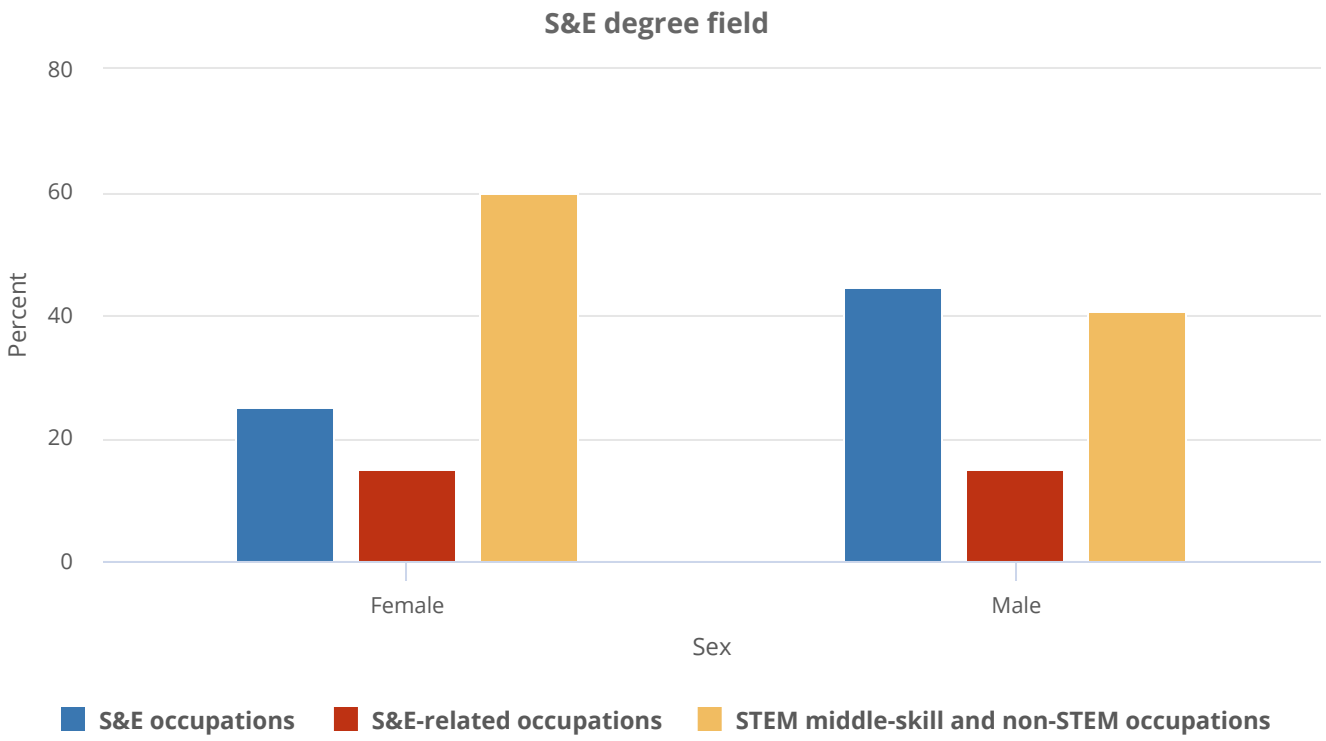
Who Is Working Outside of Their Highest Degree Field

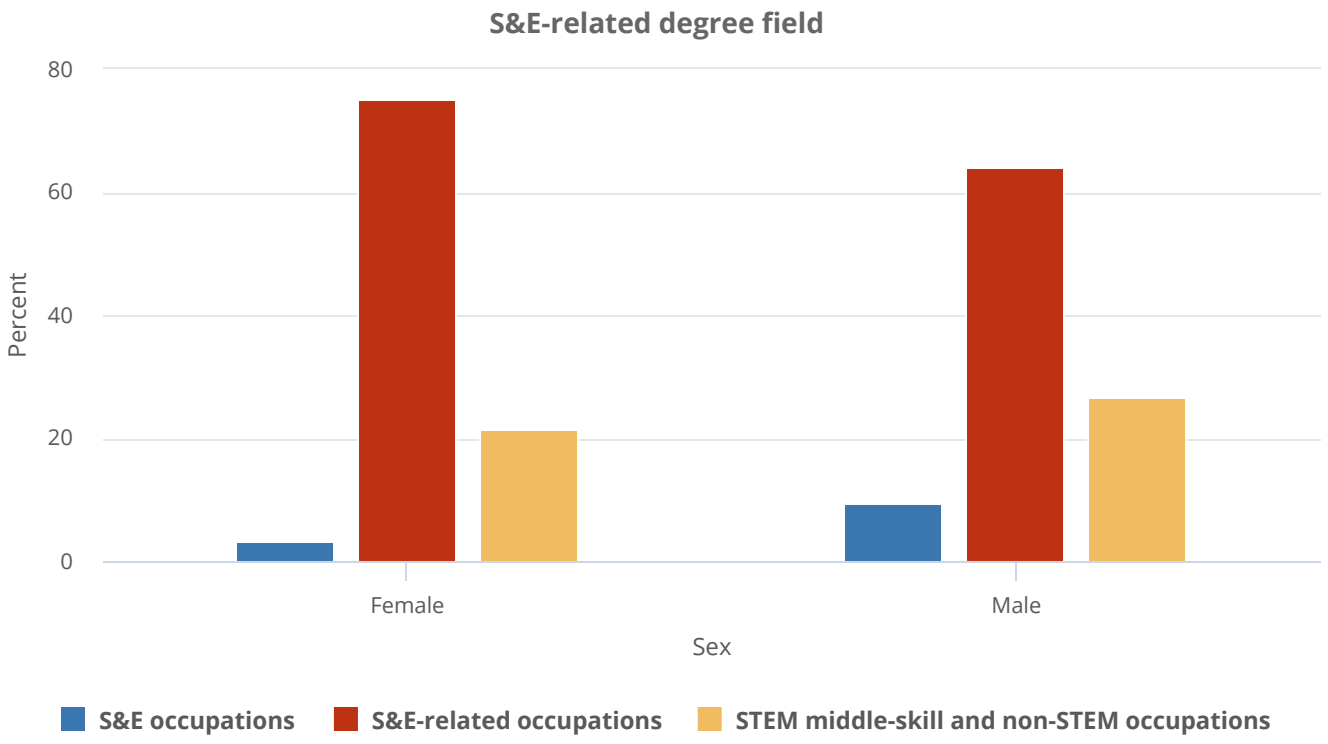
Researchers have been exploring if environmental or social factors potentially inhibit persons from historically underrepresented demographic groups in the STEM workforce from persisting in STEM career paths (Fry, Kennedy, and Funk 2021; NCSES 2023; Ngo 2016; Kahn and Ginther 2017; Funk and Parker 2018a, 2018b; Achieving the Promise of a Diverse STEM Workforce 2019; Keyes 2019; Agarwal 2020; Jelks and Crain 2020). This section analyzes the alignment between the field of highest degree and occupation among workers with a bachelor's degree or higher. Employment in a non-S&E occupation among workers with an S&E or S&E-related degree measures a loss of trained workers in S&E or S&E-related occupations. Data in this section are from the National Survey of College Graduates (NSCG), which only includes respondents with at least a bachelor's degree.[10]

The percentage of workers in S&E and S&E-related occupations varied between sexes. In 2021, a larger share of women with their highest degree in an S&E field worked in non-S&E occupations than men (**Figure LBR-5**). Although about the same percentage of men and women with their highest degree in an S&E field worked in S&E-related occupations, a higher percentage of female S&E degree holders (60%) worked outside of both S&E and S&E-related occupations, indicating a lower rate of working in S&E and S&E-related occupations than male S&E degree holders (41%). Among S&E-related highest degree holders, a higher percentage of women stayed in S&E-related fields for work (75%), while a higher percentage of men went into S&E occupations (9%).

Figure LBR-5

Workers with highest degree in S&E or S&E-related fields, by sex and occupation: 2021





S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75. Workers in non-S&E occupations are those with a bachelor's degree or higher in non-STEM and middle-skill occupations. Percentages may not add to 100% because of rounding.

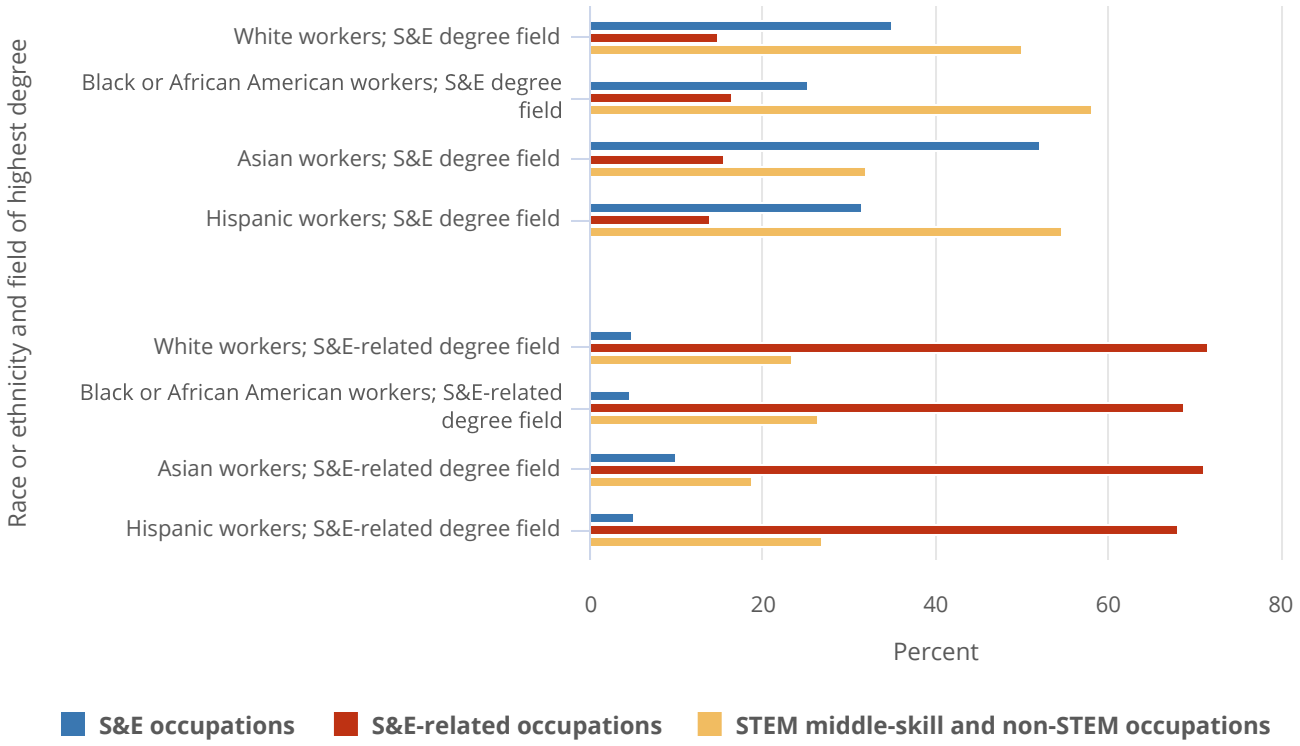
Source(s):
National Center for Science and Engineering Statistics, National Survey of College Graduates (NSCG), 2021.

Science and Engineering Indicators

Comparisons across race reveal that 25% of Black or African American workers and 31% of Hispanic workers with their highest degree in S&E worked in S&E occupations, compared with 35% of White and 52% of Asian workers with S&E highest degrees (**Figure LBR-6**).[11] About the same proportion of White, Black or African American, Hispanic, and Asian workers with an S&E degree as their highest degree went into S&E-related occupations.[12] This indicates that Black or African American workers and Hispanic workers with an S&E highest degree work more frequently in non-S&E or S&E-related occupations.

Figure LBR-6

Prevalence of STEM occupations among workers, by select race or ethnicity and field of highest degree: 2021



S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75. Workers in non-S&E occupations are those with a bachelor's degree or higher in non-STEM and STEM middle-skill occupations. Percentages may not add to 100% because of rounding. Hispanic may be any race. Race categories represent race alone and exclude Hispanic origin.

Source(s):
National Center for Science and Engineering Statistics, National Survey of College Graduates (NSCG), 2021.

Science and Engineering Indicators

Among workers with their highest degree in an S&E-related field, about the same proportion of White, Black or African American, Hispanic, and Asian workers held S&E-related occupations. However, the percentage of Black or African American workers and Hispanic workers in S&E occupations was lower than that of Asian workers, and the percentage of Black or African American workers and Hispanic workers in non-S&E or S&E-related occupations was higher than Asian workers.

These patterns suggest that, in addition to lower degree attainment in certain S&E and S&E-related fields (Fry, Kennedy, and Funk 2021; NCSES 2023), the lower presence of female, Black or African American, and Hispanic workers in S&E occupations may be related to fewer trained workers from these demographics working in their degree fields. Research into potential causes suggests that a variety of factors in work environments may contribute to members of minority groups leaving STEM occupations (Ngo 2016; Kahn and Ginther 2017; Funk and Parker 2018a, 2018b; Achieving the Promise of a Diverse STEM Workforce 2019; Keyes 2019; Agarwal 2020).

STEM Labor Market Characteristics: Earnings, Occupations, and Industries

Indicators of labor market conditions, such as salaries, provide information on economic rewards and the overall attractiveness of STEM careers. In addition, details on where STEM jobs are located and what jobs are identified as STEM provide information on the breadth of STEM skills across the economy and what areas utilize STEM talent the most. The sidebar **Veterans in STEM** highlights the presence of veterans in STEM occupations.

SIDEBAR

Veterans in STEM

In 2021, military veterans had a lower employment rate (77%) than nonveterans (81%). For those that were employed, a higher proportion of military veterans were employed in science, technology, engineering, and mathematics (STEM) occupations (32%) than nonveterans (24%) (**Table LBR-A**). This higher percentage of veterans in STEM occupations was related to a higher percentage of them in STEM middle-skill occupations (15%) and S&E occupations (9%) when compared to nonveterans (9% and 6%, respectively) (**Figure LBR-B**). The majority of veterans (65%) did not have a bachelor's degree or higher. Still, a higher percentage of veterans without a bachelor's degree or higher held STEM middle-skill occupations (20%) than nonveterans (13%) (**Table LBR-A**).

Table LBR-A

Select characteristics of veterans and nonveterans: 2021

(Number, percent, and years)

Select characteristics	Nonveteran	Veteran
Employment		
Number	179,242,246	9,170,862
Employment rate (%)	81.1	76.5
Number of employed	145,350,651	7,016,924
Percent working in STEM occupations	23.8	32.2
Educational attainment among the employed (%)		
With a bachelor's degree or higher	39.0	35.4
STEM occupations	29.5	33.1
S&E occupations	12.2	15.5
S&E-related occupations	14.4	12.6
STEM middle-skill occupations	2.9	5.0
Without a bachelor's degree	61.0	64.6
STEM occupations	20.1	31.7
S&E occupations	2.1	5.3
S&E-related occupations	5.4	5.9
STEM middle-skill occupations	12.6	20.5
Median age of the employed (years)		
All occupations	41	51
STEM occupations	40	50
S&E occupations	39	49
S&E-related occupations	41	50
STEM middle-skill occupations	41	50

S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

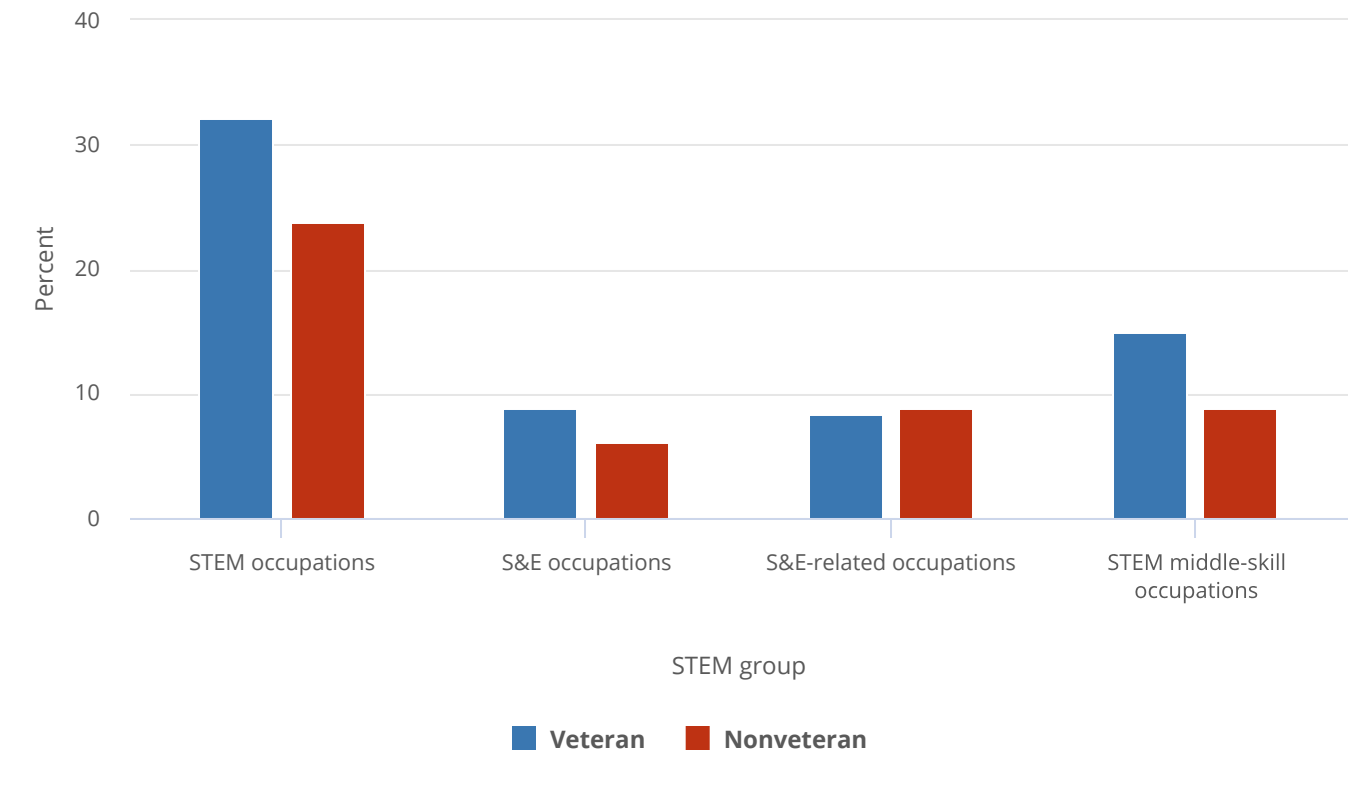
Note(s):
Data include the civilian, non-institutionalized population ages 16–75 and exclude those with military occupations, those missing occupation data, and those currently enrolled in primary or secondary school. Employment rate is calculated among all eligible persons. Other estimates are calculated only among eligible persons who are currently employed.

Source(s):
Census Bureau, American Community Survey (ACS), 2021, 1-Year Public-Use File.

Science and Engineering Indicators

Figure LBR-B

Workers employed in STEM, by veteran status: 2021



S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75 and exclude currently enrolled in primary or secondary school. Non-STEM occupations are not shown. Percentages are taken among 145,350,651 nonveterans and 7,016,924 veterans.

Source(s):
Census Bureau, American Community Survey (ACS), 1-Year Public-Use File, 2021, data as of October 2022.

Science and Engineering Indicators

The federal government employed a large percentage of veterans across all three STEM groups. For example, 21% of all veterans in S&E occupations worked for the federal government, compared with 6% of nonveterans. Among veterans in STEM middle-skill occupations, 8% were employed by the federal government, compared with 2% of comparable nonveterans. Among veterans employed in S&E-related occupations, 15% worked in the federal government, compared with only 3% of nonveterans employed in S&E-related occupations (Table SLBR-B).

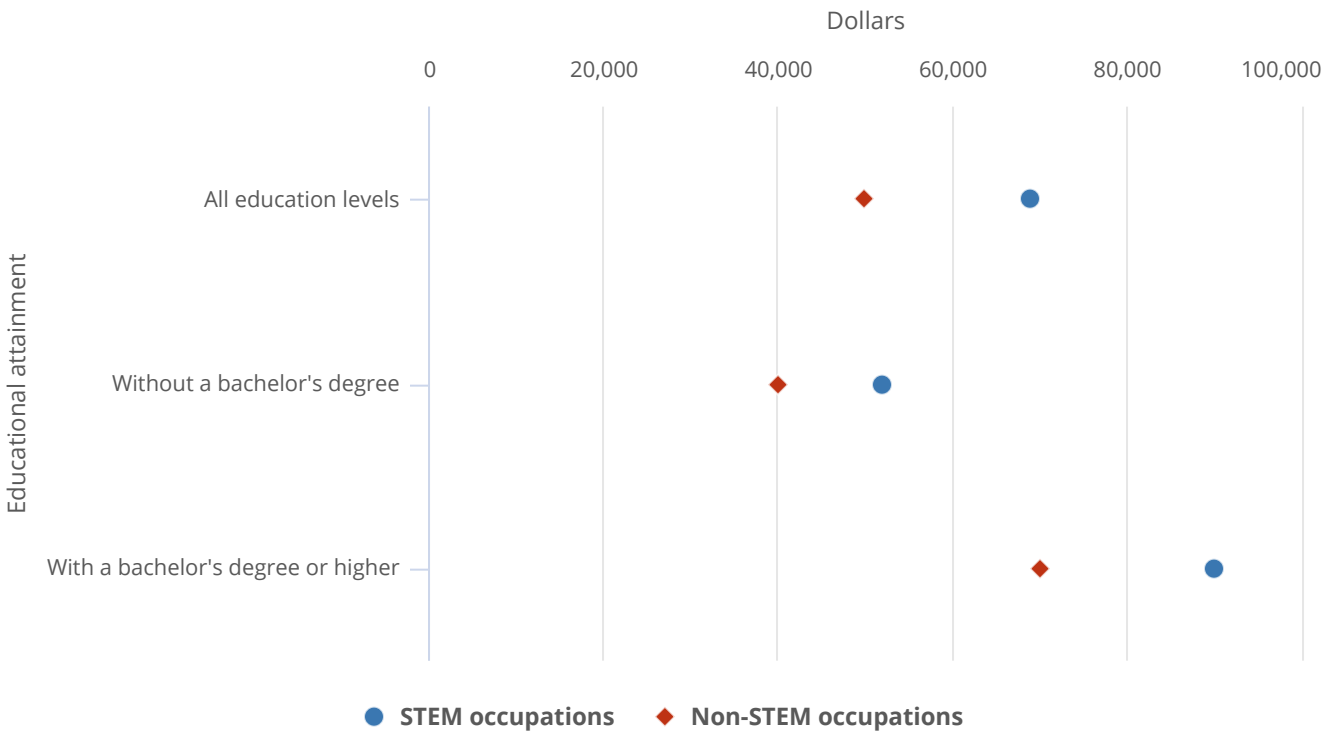
Among federal STEM workers, both veterans and nonveterans were about equally represented in S&E and S&E-related occupations, while veterans worked in STEM middle-skill occupations at a ratio of about five veterans for every three nonveterans (Table SLBR-C). Among workers in for-profit companies, veterans were employed at higher rates in both S&E (9%) and STEM middle-skill (17%) occupations than nonveterans. The same is true among workers in nonprofit establishments, where veterans were employed more frequently in S&E (7%) and STEM middle-skill (7%) occupations than nonveterans.

Earnings of STEM Workers

Employment in a STEM occupation provides workers, on average, a wage premium. In 2021, median earnings for full-time, year-round STEM workers ($69,000) were $19,100 more than for non-STEM workers ($49,900) (**Figure LBR-7**). Full-time, year-round workers in both S&E and S&E-related occupations also earned significantly more than workers in non-STEM occupations. The greatest difference in median earnings ($40,700) was between S&E workers and non-STEM workers; median earnings among S&E-related workers was $23,000 more than non-STEM workers (Table SLBR-11).

Figure LBR-7

Median personal earnings for full-time, year-round workers in STEM and non-STEM occupations, by educational attainment: 2021



STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the full-time, year-round, employed, civilian, non-institutionalized population ages 16–75 and exclude those currently enrolled in primary or secondary school.

Source(s):
Census Bureau, American Community Survey (ACS), 1-Year Public-Use File, 2021, data as of 25 October 2022.

Science and Engineering Indicators

A similar median wage premium holds true for comparisons of full-time, year-round workers within each component of the STEM workforce. S&E and S&E-related workers in the STW ($71,800 and $54,500, respectively) had higher median earnings than non-STEM workers without a bachelor's degree ($40,000). The median earnings among STEM middle-skill workers in the STW ($50,000) were about $10,000 more than non-STEM workers without a bachelor's degree. However, STEM middle-skill workers with a bachelor's degree or higher ($64,900) had lower median earnings than non-STEM workers with a bachelor's degree or higher ($70,000).

While full-time, year-round workers in STEM occupations had higher median earnings than those in non-STEM occupations, certain STEM occupations provided higher median earnings than others. Occupations that rank among the top 10 and bottom 10 in median earnings for full-time, year-round workers highlight the most and least financially beneficial occupations within each occupation group (Table SLBR-12, Table SLBR-13). The range of median earnings for full-time, year-round workers varied greatly, with S&E-related occupations having the greatest span in median earnings, ranging from $452,300 (surgeons) to $30,000 (dietetic technicians and ophthalmic medical technicians). Although many S&E-related occupations belong to the health care fields, 3 of the top 10 paid occupations were outside of health care: architectural and engineering managers ($147,400), actuaries ($126,300), and computer and information systems managers ($119,600). Notably, 5 of the highest paid S&E-related occupations had higher median earnings than all of the highest paying S&E occupations.

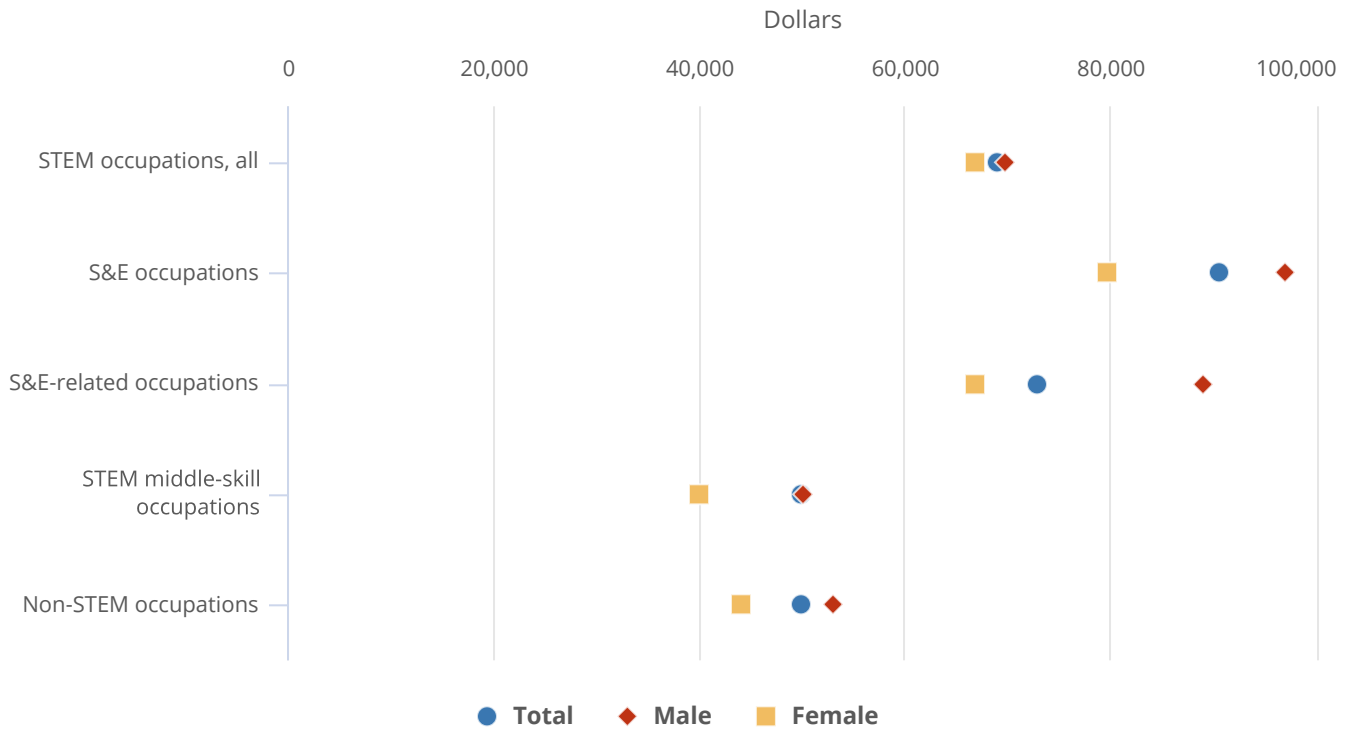
STEM middle-skill occupations had the narrowest range in median earnings for full-time, year-round workers, from $84,400 (industrial production managers) to $35,800 (butchers and other meat, poultry, and fish processing workers). Two of the lowest paid S&E-related occupations (veterinary technologists and technicians and dietetic technicians and ophthalmic medical technicians) made less than the lowest paid STEM middle-skill occupations. Overall, the lowest paying S&E occupations had higher median earnings than the lowest paying S&E-related and STEM middle-skill occupations.

Earnings Differences, by Select Demographics

In 2021, men's median earnings ($69,800) were more than women's ($66,800) among full-time year-round workers in STEM occupations. The disparity was lower in STEM occupations than it was in non-STEM occupations, where men's median earnings were about $9,000 more than women's annually among full-time, year-round workers (**Figure LBR-8**).

Figure LBR-8

Median personal earnings for full-time, year-round workers, by sex and STEM occupation group: 2021



S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include full-time, year-round, civilian, non-institutionalized workers ages 16–75 and exclude those currently enrolled in primary or secondary school.

Source(s):
Census Bureau, American Community Survey (ACS), 1-Year Public-Use File, 2021, data as of 25 October 2022.

Science and Engineering Indicators

Earnings differences of full-time, year-round workers between men and women occurred within occupations as well. The largest percentage of STEM workers (9%) were registered nurses, in which men's median earnings were $7,100 higher than women's (Table SLBR-1, Table SLBR-14). Other STEM occupations with large pay disparities between the median earnings of men and women included computer and information systems managers ($17,200 higher among men), medical and health services managers ($15,400 higher among men), general maintenance and repair workers ($14,100 higher among men), and software developers ($13,800 higher among men).

Men earned more than women in four of the top-paying S&E occupations. Economists were among the S&E occupations with the highest median earnings for full-time, year-round workers ($131,800), with median earnings of male economists about $38,300 more per year (about 35% more) than female economists (Table SLBR-12). About six of the selected S&E-related and five of the selected STEM middle-skill occupations also had earnings disparities by sex among the top-paying occupations, though not among those with the highest median earnings in each group.

Regardless of race or ethnicity, full-time, year-round workers in STEM occupations had higher median earnings than those in non-STEM occupations.[13] However, earnings disparities existed among full-time, year-round STEM workers between the race and ethnicity groups. Asian STEM workers had the highest median earnings ($98,600) of all the racial and ethnic groups (Table SLBR-15). Hispanic and American Indian or Alaska Native STEM workers had the lowest median earnings among the racial and ethnic groups ($50,000 and $51,600, respectively). Full-time, year-round workers in S&E and S&E-related occupations had higher median earnings than those in non-STEM occupations across race and ethnicity groups. Asian workers had the highest median earnings in both S&E ($107,900) and S&E-related ($95,700) occupations. American Indian or Alaska Native workers had the lowest median earnings in S&E occupations ($67,500), and American Indian or Alaska Native ($58,800), Black or African American ($59,800), and Hispanic workers ($62,500) had the lowest median earnings in S&E-related occupations.

Among the five occupations that employ the most STEM workers (Table SLBR-1, Table SLBR-16), Black and Hispanic registered nurses ($69,400 and $69,500, respectively) had comparable median earnings to their White counterparts ($69,900) among full-time, year-round workers, while Asian registered nurses had the highest median earnings ($85,900) among the race groups, and American Indian or Alaska Native registered nurses had the lowest median earnings ($59,200). In contrast, among software developers, Black and Hispanic full-time, year-round workers ($99,100 and $99,600, respectively) had lower median earnings than their White and Asian counterparts ($114,900 and $125,000, respectively).

While comparisons of median earnings did not take into account all the factors that could impact earnings differences in the above analyses, the data can inform additional research. Additional analyses of earnings by sex, race, or ethnicity can be found in the ***Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023*** report, which utilized the Current Population Survey for its analyses.

STEM Occupations

In 2021, the most common STEM occupation by employees was registered nurses, representing 9% of the total STEM workforce, followed by software developers (5%) and miscellaneous production workers (4%) (Table SLBR-1). Each of these occupations was also the most common among their respective STEM occupation group. Registered nurses were 25% of all S&E-related occupations, software developers were 20% of all S&E occupations, and miscellaneous production workers were 9% of all STEM middle-skill occupations.

S&E and S&E-Related Occupations of the Skilled Technical Workforce

Just over a third (37%) of skilled technical workers held S&E and S&E-related occupations (Table SLBR-17). The most common S&E occupations for skilled technical workers were computer support specialists, all other computer occupations, and software developers. Together, these accounted for about 47% of skilled technical workers in S&E occupations (Table SLBR-18). The most common educational attainment among STW workers in these occupations was “some college” (Table SLBR-19). The percentage of workers in these occupations that belonged to the STW ranged from 14% of software developers to 52% of computer support specialists.

Among S&E-related occupations, the greatest proportion of the STW worked as registered nurses and licensed practical and vocational nurses. These two occupations accounted for 33% of STW workers in S&E-related occupations (Table SLBR-18). Of these two occupations, licensed practical and vocational nurses had a higher concentration of workers in the STW (Table SLBR-19).

Industries That Utilize STEM Workers

While STEM workers were distributed across multiple industries in the United States, some industries had higher concentrations of STEM workers than others. STEM industries can be loosely categorized as industries in which the proportion of STEM workers is at least 2.5 times the national rate.[14] Based on this definition and on categorizing STEM occupations individually, 75 industries were identified as a STEM industry; together, they accounted for 68% of all STEM workers in the United States in 2021. Across STEM occupation groups, 21 industries had a high concentration of S&E workers, 11 had a high concentration of S&E-related workers, and 43 had a high concentration of STEM middle-skill workers (Table SLBR-20).

In 2021, the industries with the highest concentration of STEM workers were electronic and precision equipment repair and maintenance, with 75% of its workforce in STEM occupations, and offices of other health practitioners, with 72% of its workforce classified as STEM (Table SLBR-20). Computer systems design and related services had the highest percentage of workers in S&E occupations (51%), general medical and surgical hospitals had 61% of workers in S&E-related occupations, and electronic and precision equipment repair and maintenance had 61% of workers in STEM middle-skill occupations.

Geographic Distribution of the STEM Workforce

Geography plays an important role not only in the capacity of a U.S. state or area to support innovative activity but also in a worker's ability to access jobs that utilize their skills (Moretti 2013; Wright, Ellis, and Townley 2016; Chow 2022). Research also suggests that areas with denser STEM labor markets have a higher likelihood of people working in the same field as their degree (Wright, Ellis, and Townley 2016).

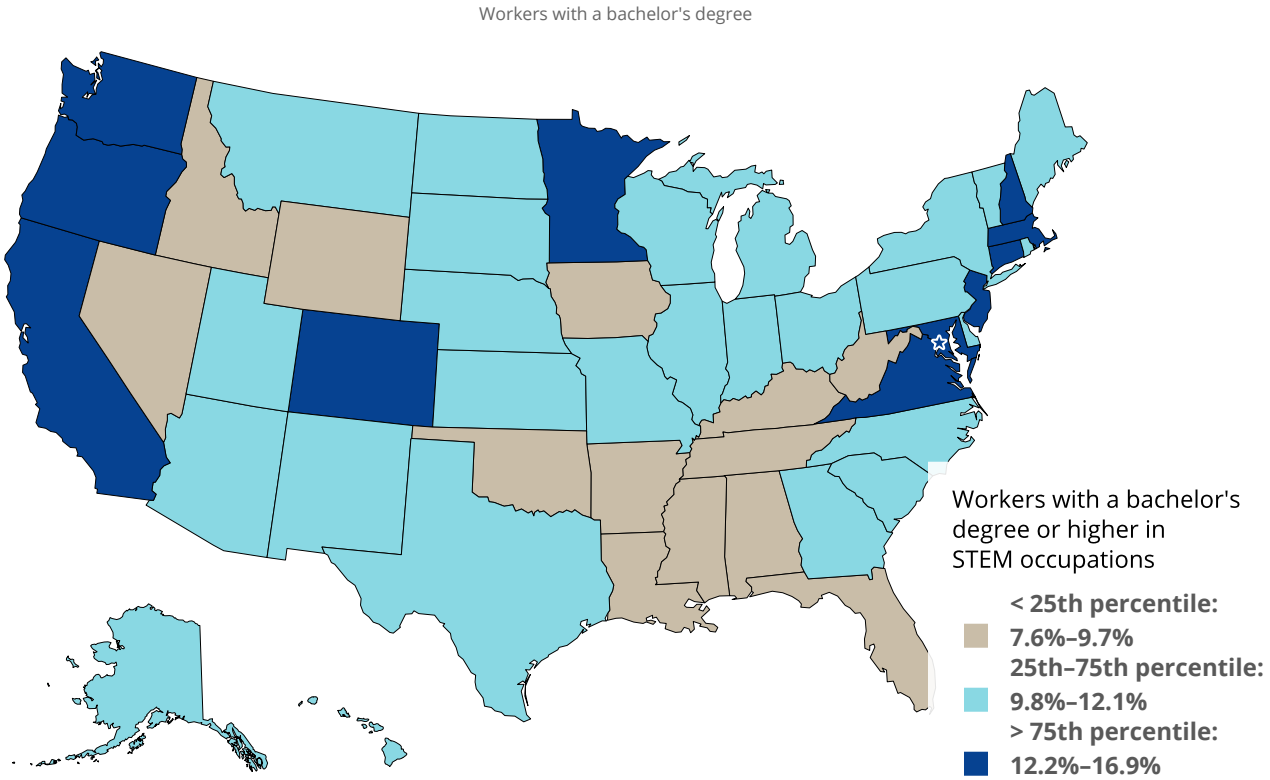
States Where the U.S. STEM Workers Are: 2021

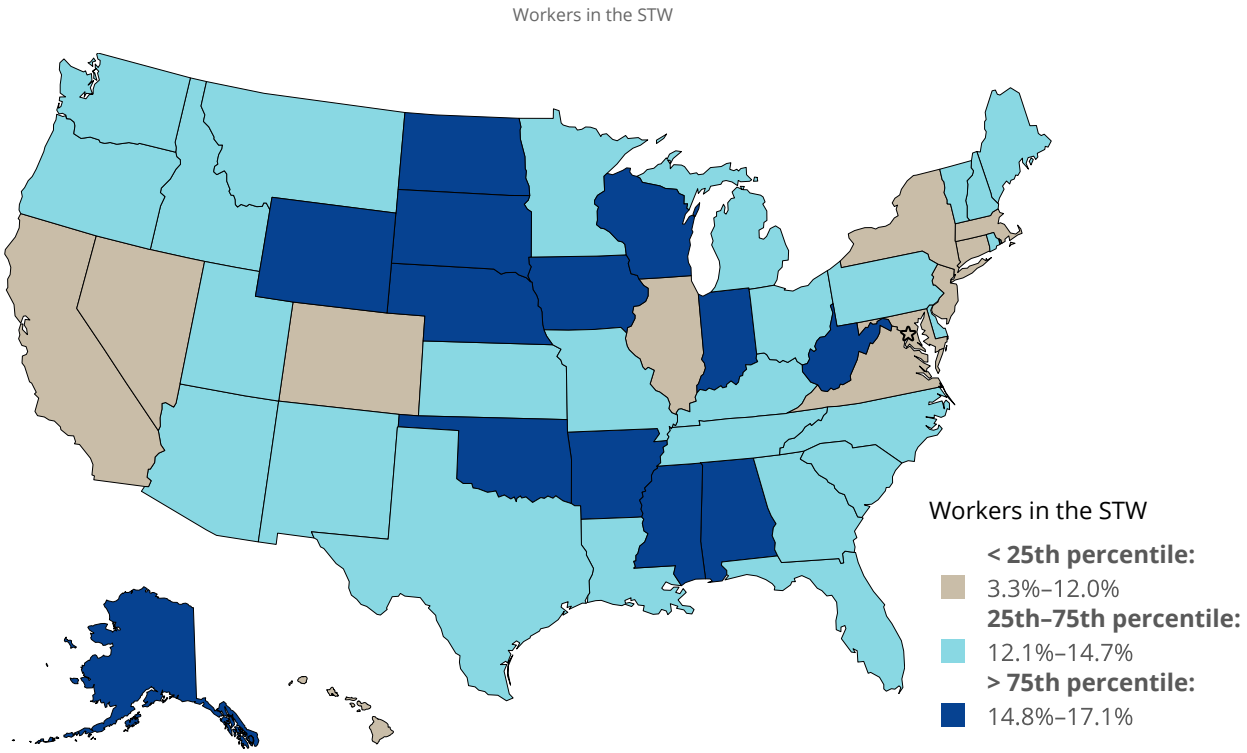
In 2021, about half of U.S. states had a workforce in which at least a quarter was employed in STEM occupations. Many of these states were in the Midwest; however, several states outside the Midwest also had at least a quarter of their workforce in STEM occupations (Table SLBR-21). Notably, New Hampshire (28%), Washington (27%), Maryland (27%), South Dakota (27%), and Nebraska (27%) were among the states with the highest percentage of workers in STEM occupations.

Examining the STW as a percentage of a state's total workforce indicates that the District of Columbia had the lowest concentration of workers in a STEM occupation with less than a bachelor's degree (STW) (3%); however, the rest of the states had between 10% and 17% of their workers in the STW (**Figure LBR-9**). Wyoming was among the states with the highest percentage of its workers in the STW (17%), followed closely by several states in the Midwest and South—South Dakota (16%), Iowa (16%), Indiana (16%), and Alabama (15%), to name a few.[15]

Figure LBR-9

Prevalence of STEM workers among all workers in the state, by educational attainment: 2021





STEM = science, technology, engineering, and mathematics; STW = skilled technical workforce.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75 and exclude those currently enrolled in primary or secondary school. Data are limited to those in STEM occupations.

Source(s):
Census Bureau, American Community Survey (ACS), 1-Year Public-Use File, 2021, data as of 25 October 2022.

Science and Engineering Indicators

The STEM Workforce within States

While state-level data provide important information about state-level economies, local economies may be different than the state-level numbers (Table SLBR-22). This is to be expected for states large in both population and land area—such as Texas, Florida, New York, and California—given that they have multiple cities and large rural regions. However, variations exist across states of all sizes. The estimates referenced in this section were rendered at the smallest level of geography available in the ACS—the Public Use Microdata Area (PUMA).[16] PUMAs indicate where individuals live rather than work (Census Bureau 2021). PUMAs are geographic areas that contain at least 100,000 people, and while some PUMAs are geographically large, such as Northern Arizona, others cover smaller, more densely populated areas, such as in and around Phoenix, Arizona. PUMAs do not cross state lines but do allow for analysis of areas that cross state lines, such as the cluster of PUMAs in northern Virginia, the District of Columbia, and Southern Maryland that represent the larger economy of the District of Columbia region. For ease of discussion, Table SLBR-22 contains both the PUMA label and the Metropolitan Statistical Area (MSA) where all or most of the PUMA falls when a PUMA is in an MSA (IPUMS 2020). Comparisons to national proportions of workers come from Table SLBR-2.

The percentage of PUMA residents working in STEM occupations varies widely. Nationally, 21.6% of workers worked in a STEM occupation, while about 45% of resident workers were employed in STEM occupations in three PUMAs in the San Jose–Sunnyvale–Santa Clara, CA, MSA (i.e., Silicon Valley). In contrast, three PUMAs in the Bronx borough of New York City and two in Laredo, Texas, had 12% or fewer resident workers employed in STEM occupations. Overall, there were 20 MSAs in 13 states with at least 1 PUMA that had 35% or more of the residents employed in STEM occupations.

Types of occupations tended to cluster. Nationally, about 4.2% of workers were in S&E occupations, with some areas having higher and lower densities of S&E workers. For example, the 10 PUMAs with 25% or more of workers in S&E occupations were in 4 MSAs: San Jose–Sunnyvale–Santa Clara, CA; San Francisco–Oakland-Hayward, CA; Seattle-Tacoma-Bellevue, WA; and Boston-Cambridge-Newton, MA-NH. Conversely, 55 PUMAs in 22 states had about 1% or less of workers employed in an S&E occupation, including 1 PUMA in the Merced, CA, MSA, which is less than 100 miles southeast of the high S&E occupation PUMAs in San Jose–Sunnyvale–Santa Clara, CA, MSA.

S&E-related occupation data highlight different PUMAs. Specifically, 22% of workers in the PUMA that covers Rochester, Minnesota (where the Mayo Clinic is located), worked in S&E-related occupations, which include many health care occupations, compared to 8% of the national workforce. Other PUMAs with around 17% or more of their workers in S&E-related occupations were in the Albuquerque, NM; New York–Newark–Jersey City, NY-NJ-PA; Philadelphia-Camden-Wilmington, PA-NJ-DE-MD; Lafayette, LA; Durham–Chapel Hill, NC; and Houston–The Woodlands–Sugar Land, TX, MSAs. The PUMAs with about 3% or fewer workers in S&E-related occupations overall tended to also have low percentages of workers in S&E occupations. Specifically, of PUMAs with 3% or fewer residents working in S&E-related occupations, only 1 (Atlanta, DeKalb County South) had about 4% of workers in S&E occupations. Of the 9 PUMAs with 20% or more of residents working in STEM middle-skill occupations, 5 were in Texas, with 3 of those 5 in the Houston–The Woodlands–Sugar Land, TX, MSA.

STEM Pathways: Degree Attainment and Training of Workers in STEM

For over a decade, there has been an effort to expand both the size and diversity of the STEM workforce (NASEM 2017; NSTC 2018, 2021; NSB 2019). Given that many STEM occupations require specialized training and or education, one aspect of this effort to grow the STEM workforce has been a focus on the education of future STEM workers (NSB 2020; NSF 2020; NSTC 2021). Although educational interests and graduation rates among S&E and S&E-related degree fields are important discussions, this thematic report focuses on the educational attainment of workers in STEM occupations. For a detailed discussion of educational pathways, see the *Indicators 2024* report "**Higher Education in Science and Engineering**" and the *Indicators 2024* report "**Elementary and Secondary STEM Education**."

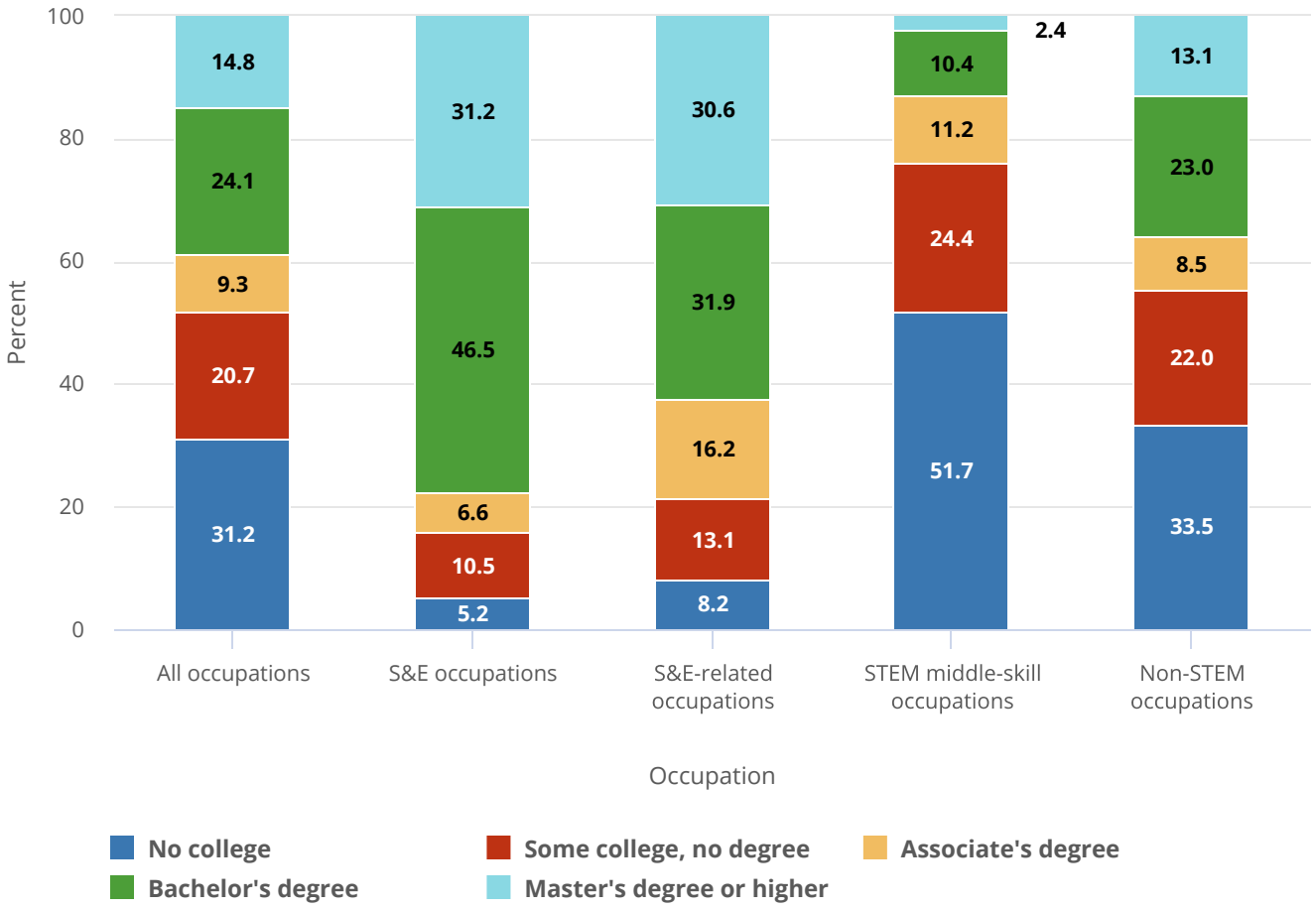
Educational Attainment of STEM Workers

Workers in STEM occupations have diverse educational backgrounds. In 2021, the largest proportion of STEM workers had not earned a bachelor's degree. Specifically, 24% of STEM workers had not attended any college, 17% had attended some college but not earned a degree, 12% held an associate's degree, 28% a bachelor's degree, and 20% an advanced degree (master's or higher degree) (Table SLBR-23).

Across the different STEM occupation groups, the level of educational attainment varies greatly. Larger proportions of workers in S&E occupations had a bachelor's degree (47%) than in S&E-related occupations (32%) (**Figure LBR-10**). Among workers in STEM middle-skill occupations, the majority of workers had not attended college (52%). In addition, among STEM middle-skill workers, a larger proportion had some college and no degree (24%) than held an associate's degree (11%). This diversity in education within and across the STEM occupation categories highlights the multiple pathways for workers to find jobs that fit their skills and interests—many workers may not need a college degree or an advanced degree to work in STEM.

Figure LBR-10

Educational attainment of STEM workers, by occupation group: 2021



S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75 and exclude those currently enrolled in primary or secondary school.

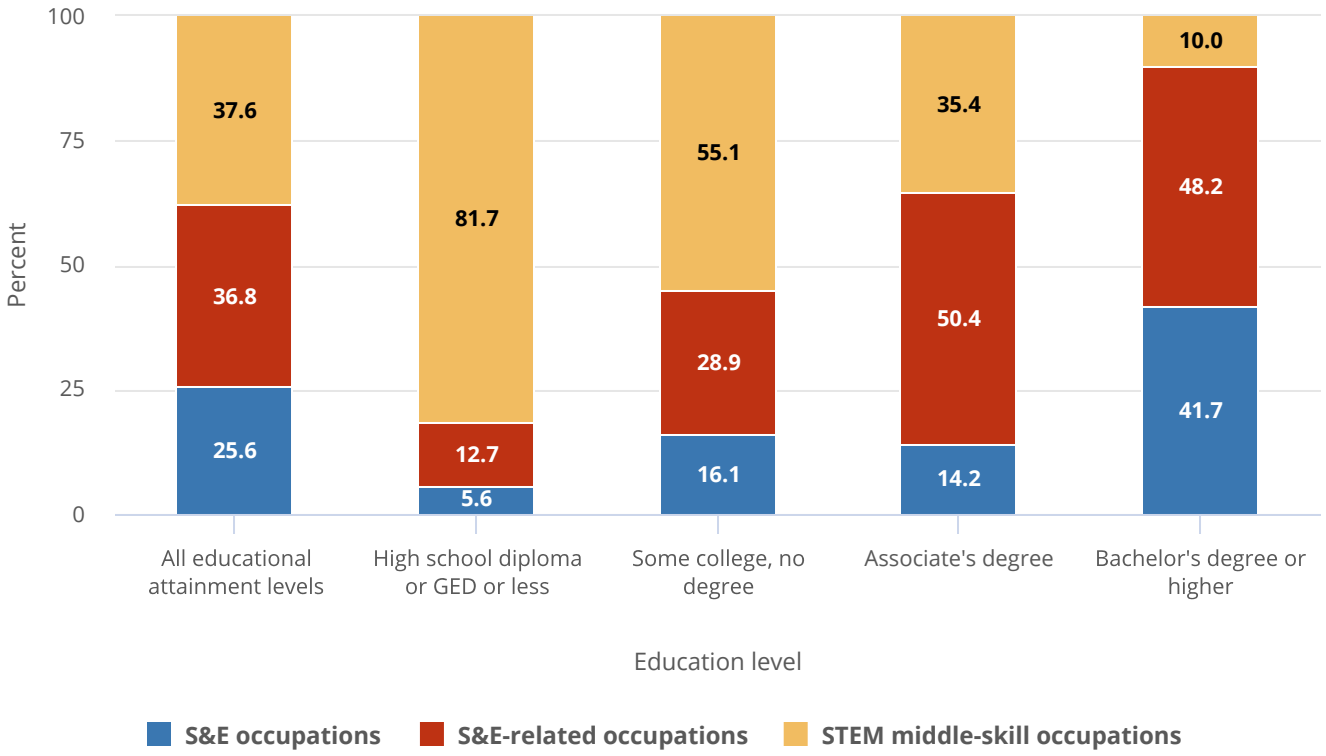
Source(s):
Ruggles S, Flood S, Goeken R, Schouweiler M, Sobek M, 2022, *IPUMS USA: Version 12.0, 2021 American Community Survey (ACS)*, https://doi.org/10.18128/D010.V12.0, accessed 23 December 2022.

Science and Engineering Indicators

The distribution of STEM workers across the types of STEM occupations varies by the level of educational attainment of the STEM workers. Overall, 26% of STEM workers were in S&E occupations, 37% were in S&E-related occupations, and 38% were in STEM middle-skill occupations (**Figure LBR-11**). Looking at this by educational attainment, among STEM workers with a high school diploma or less, 82% were employed in STEM middle-skill occupations, which was a larger proportion than those who attended college but did not earn a degree (55%) or who held an associate's degree (35%) (**Figure LBR-11**; Table SLBR-23). Half of associate's degree holders and 48% of those with a bachelor's degree or higher worked in S&E-related occupations. In contrast, 29% of those with some college and 13% of those with a high school diploma or less worked in S&E-related occupations.

Figure LBR-11

STEM workers, by educational attainment and STEM occupation group: 2021



S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75 and exclude those currently enrolled in primary or secondary school.

Source(s):
Ruggles S, Flood S, Goeken R, Schouweiler M, Sobek M, 2022, *IPUMS USA: Version 12.0, 2021 American Community Survey (ACS)*, https://doi.org/10.18128/D010.V12.0, accessed 23 December 2022.

Science and Engineering Indicators

Among those with a bachelor's degree or higher, a majority of workers in S&E occupations had their highest degree in an S&E field, while a majority of workers in S&E-related occupations had their highest degree in an S&E-related field, according to the NSCG (**Table LBR-2**). Over 75% of S&E workers with a bachelor's degree or higher earned their highest degree in an S&E field, and an additional 5% earned their highest degree in an S&E-related field. Of workers in S&E occupations, 5% held an S&E or S&E-related degree that was not their highest degree, with only 13% of workers in S&E occupations without any degree in an S&E or S&E-related field. Across S&E occupations, the percentage of workers with their highest degree in an S&E field varied from 92% of workers (physical science occupations) to about 70% (computer science and social science occupations). The sidebar **Science, Engineering, and Health Doctorate Holders in STEM Occupations** provides information specifically about doctorate holders in STEM. For more information on college graduates in the S&E or S&E-related labor force, see NCSES (2022a).

Table LBR-2

Educational background of employed adults with a bachelor's degree or higher, by major occupation: 2021

(Percent)

Occupation	Total (number)	Highest degree in S&E field	Highest degree in S&E-related field	A degree in S&E or S&E-related field but not highest	No degrees in S&E or S&E-related fields
All occupations	51,525,300	31.9	14.8	7.3	45.9
S&E occupations	7,878,300	77.0	5.3	4.7	12.9
Computer and mathematical scientists	4,026,800	70.9	4.5	4.8	19.8
Biological, agricultural, and environmental life scientists	793,500	82.5	12.0	2.6	2.9
Physical scientists	407,600	91.7	3.2	2.8	2.3
Social scientists	709,000	70.4	6.9	7.8	14.8
Engineers	1,941,400	86.8	4.2	4.8	4.2
S&E-related occupations	9,489,800	25.9	57.3	4.1	12.7
STEM middle-skill and non-STEM occupations	34,157,100	23.2	5.2	8.8	62.8

S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75. Workers in non-S&E occupations include those with a bachelor's degree or higher employed non-STEM and STEM middle-skill occupations. Numbers are rounded to the nearest 100. Numbers may not sum due to rounding. Percentages may not sum to 100% because of rounding.

Source(s):
National Center for Science and Engineering Statistics, National Survey of College Graduates (NSCG), Public-Use File, 2021.

Science and Engineering Indicators

SIDEBAR

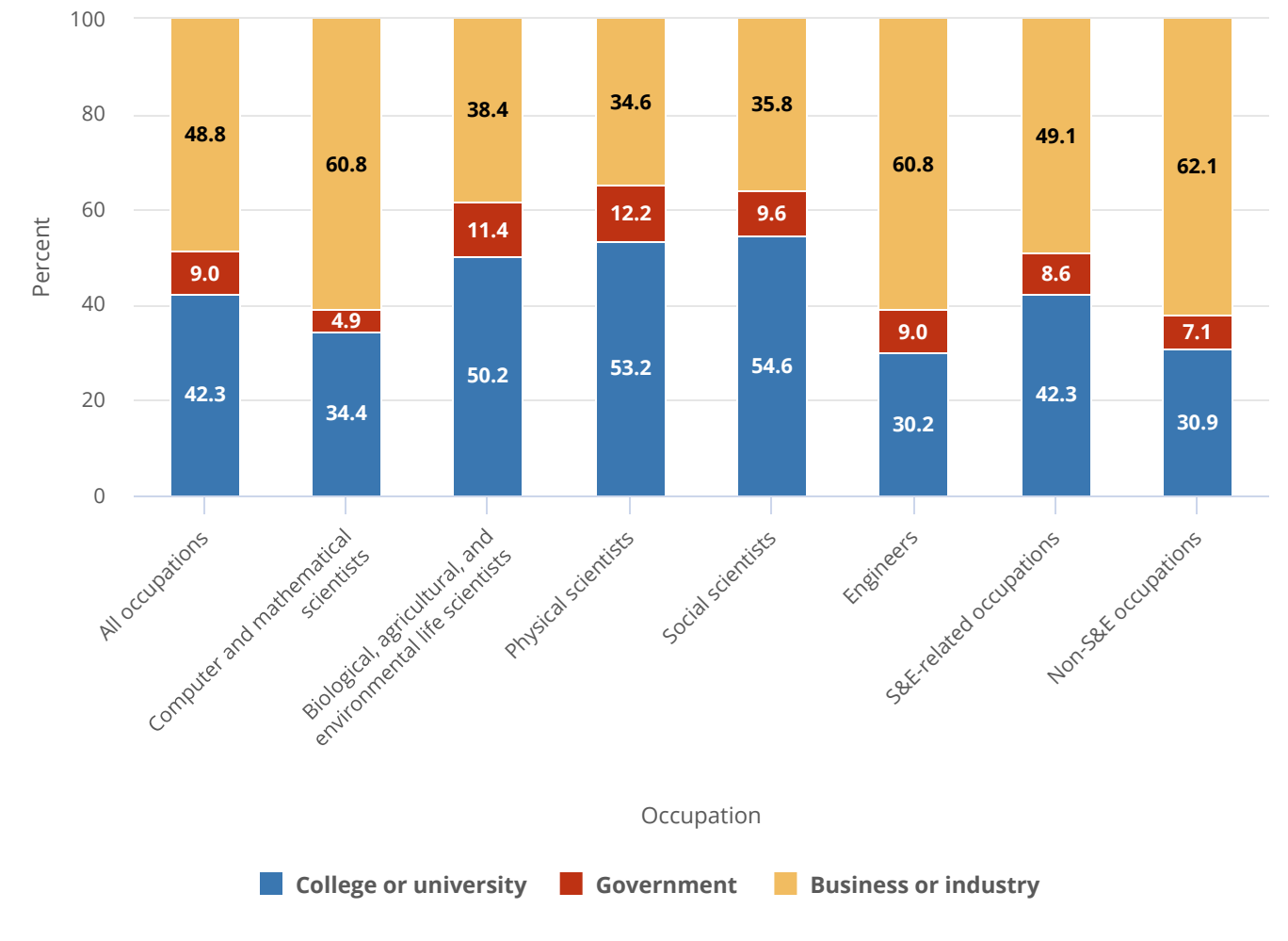
Science, Engineering, and Health Doctorate Holders in STEM Occupations

Doctorate holders in science, engineering, and health (SEH) fields represent the individuals in the labor market with the most training specific to their respective fields—particularly, research skills. The 2021 Survey of Doctorate Recipients estimated that there were 872,100 U.S.-trained SEH research doctorates living and working in the United States (NCSES ***SDR 2021***: **Table 42**), of which 725,000 were working in S&E or S&E-related occupations (Table SLBR-D).

The fields in which SEH doctorate recipients work vary by occupation type (**Figure LBR-C**; Table SLBR-D). Within this population, 17% (or 146,600) worked in non-S&E occupations. Overall, 42% of S&E doctorate recipients worked in educational institutions, and 49% worked in business or industry, with variations by occupation. Over half of SEH doctorate recipients with occupations in biological, agricultural, or environmental life sciences (50%), physical sciences (53%), and social sciences (55%) occupations worked in educational institutions. For SEH doctorate recipients with occupations in computer and mathematical sciences and engineering fields, over half worked in for-profit businesses (55% and 56%, respectively). Within this population, those in social science occupations had the highest proportion of self-employed workers (13%), whereas those in S&E-related occupations had the highest proportion (11%) of doctorate recipients working in nonprofit organizations. For more information on doctorate recipients working in higher education research and development, please see the *Indicators 2024* report "**Academic Research and Development**."

Figure LBR-C

Sector of employed science, engineering, and health research doctorate recipients living in the United States, by occupation: 2021



S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include employed doctorate holders ages 16–75 living in the United States in 2021. Non-S&E occupations includes doctorate holders working in both non-STEM and STEM middle-skill occupations. Percentages may not add to 100% due to rounding.

Source(s):
National Center for Science and Engineering Statistics, Survey of Doctorate Recipients (SDR), Public-Use File, 2021.

Science and Engineering Indicators

Certifications and Licenses

One pathway into STEM occupations is by obtaining educational or professional certificates or by obtaining certifications or licenses to perform certain occupations. These work credentials can signal proficiency in occupation fields and serve as a demonstration of the skills needed to perform a certain job (BLS 2019). Holding work credentials is also associated with higher earnings in the labor market, especially among workers without a bachelor's degree or higher (Kominski and Ewert 2014).

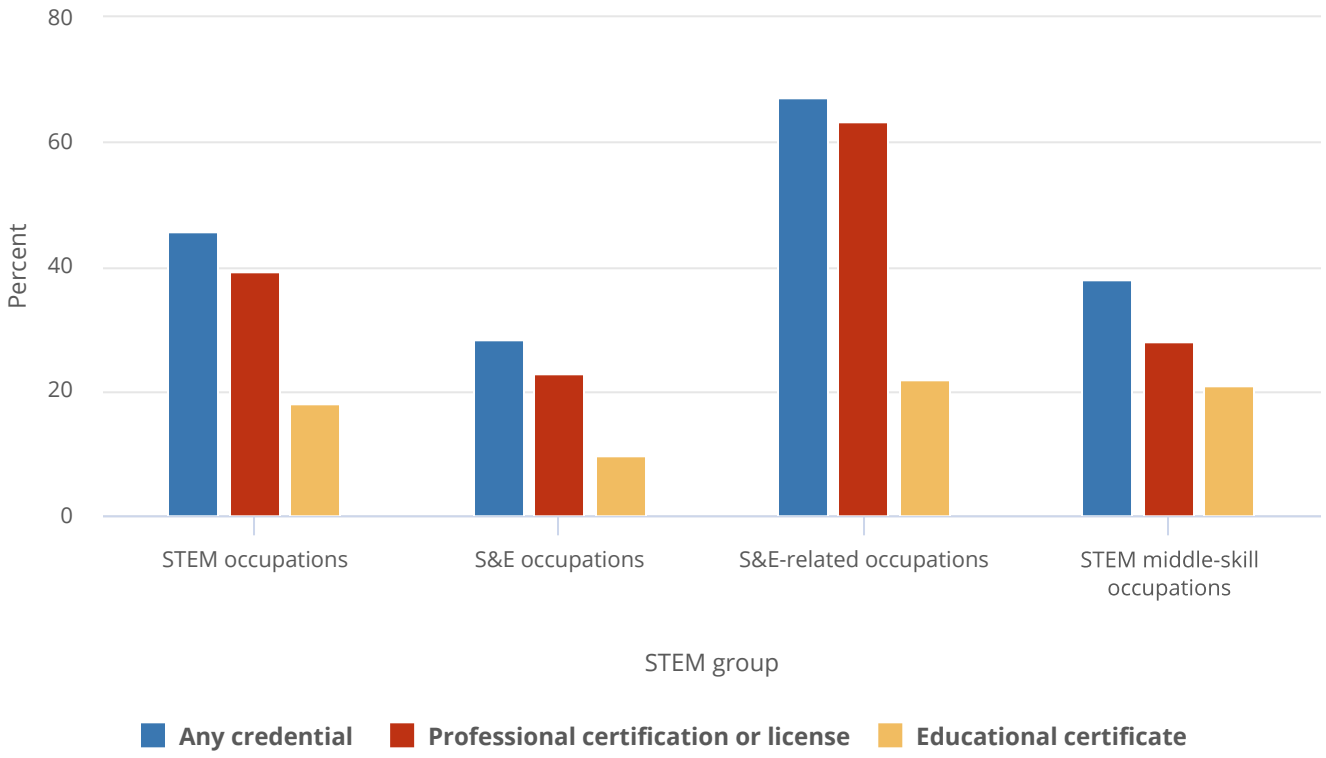
There are three main types of work credentials: educational certificates, professional certifications, and licenses. Educational certificates are typically awarded by an educational institution, such as a community college, and indicate the completion of a program of study. Professional certifications indicate that the worker possesses certain skills, abilities, or specializations and are awarded by independent organizations that are often associated with a particular industry or profession (Finamore and Foley 2017; Kominski and Ewert 2014; BLS n.d.). Licenses are issued by a government agency and convey a legal authority to perform an occupation (BLS 2019). Workers with and without a bachelor's degree can have work credentials, and some occupations require at least a bachelor's degree in addition to a credential in order to qualify for the work (BLS n.d.). For example, in 2022, 98% of nurse practitioners require at least a master's degree and 93% require a license (**BLS Occupational Requirements Survey 2022**).

Data from the 2021 Survey of Income and Program Participation (SIPP) was used to analyze the distribution of credentials among STEM workers.[17] The 2021 SIPP allows analysis of all three types of credentials available to workers in STEM occupations—licenses, educational certificates, and professional certifications. The SIPP is a retrospective survey, and the 2021 data use 2020 as the reference year for monthly data collection. Estimates below are presented from month 12 of the reference year among respondents ages 16–75 years that had at least a high school diploma or GED.

In 2020, about 46% of all STEM workers held a professional certification, license, or educational certificate (**Figure LBR-12**; Table SLBR-24). The proportion with work credentials varied by type of STEM worker, ranging from 67% among S&E-related workers to 28% among S&E workers. Work credentials were most common among S&E workers (43%) and STEM middle-skill workers (52%) with an associate's degree, whereas a high prevalence of credentials was present among S&E-related workers with both an associate's degree (81%) and an advanced degree (79%).

Figure LBR-12

STEM workers with credentials, by occupation group and type of credential: 2020



S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the civilian, non-institutionalized population ages 16–75 with at least a high school diploma or GED employed in the 12th month of 2020 and exclude those with only military occupations, those missing occupation data or who have not worked in the last 5 years, and those currently enrolled in primary or secondary school. Non-STEM occupations are not shown.

Source(s):
Census Bureau, Survey of Income and Program Participation (SIPP), Public-Use File, 2021.

Science and Engineering Indicators

In S&E occupations, workers with professional credentials outnumbered those with educational certificates. Similarly, workers in S&E-related occupations had a higher prevalence of professional credentials compared with educational certificates overall and at all levels of educational attainment. In both S&E and STEM middle-skill occupations, educational certificates were most prevalent among workers with an associate's degree, while the same was true among S&E-related workers with some college or an associate's degree.[18] Professional credentials were most common among S&E-related workers with an associate's degree (74%) or an advanced degree (78%). Neither S&E nor STEM middle-skill occupations had a high prevalence of professional credentials across the different levels of educational attainment.

Employment Outcomes for Recent Graduates

Key participants of the STEM workforce pathway are individuals entering the workforce with S&E and S&E-related postsecondary degrees, particularly those with bachelor's degrees and higher. According to NSCG data, there were about 7,474,000 individuals who earned their highest degree in an S&E or S&E-related field between January 2015 and February 2021 (**Table LBR-3**).[19] The data on these recent graduates provide insights on recent S&E and S&E-related graduates in the labor market.

Table LBR-3

Labor market indicators for S&E and S&E-related degree recipients earning their highest degree between 2015 and 2021, by level and field of highest degree: 2021

(Number, percent, and 2021 dollars)

Indicator and highest degree level	All S&E and S&E-related fields	S&E fields						S&E-related fields
		All S&E fields	Biological, agricultural, and environmental life sciences	Computer and mathematical sciences	Physical sciences	Social sciences	Engineering	
Number of new graduates								
All degree levels	7,474,000	4,911,500	968,100	985,900	252,900	1,694,200	1,010,400	2,562,500
Bachelor's	4,555,700	3,307,200	722,800	628,200	151,400	1,178,300	626,500	1,248,500
Master's	2,078,200	1,248,600	146,900	319,300	52,600	423,900	305,900	829,600
Doctorate	470,600	342,800	98,400	38,400	48,900	79,100	77,900	127,800
Professional	369,400	12,900	na	na	na	12,900	na	356,600
Employment rate (%)								
All degree levels	87.0	85.9	78.5	89.1	88.5	84.4	91.8	89.2
Bachelor's	85.1	84.3	74.9	88.7	84.4	83.8	91.5	87.3
Master's	88.4	87.6	85.9	88.8	93.6	83.4	92.1	89.7
Doctorate	93.7	95.0	93.6	96.6	96.0	96.7	93.5	90.2
Professional	94.7	93.8	na	na	na	93.8	na	94.8
Out-of-field rate (%)								
All degree levels	14.4	18.6	24.5	7.1	15.0	29.7	8.4	6.6
Bachelor's	20.0	24.4	32.2	7.3	22.3	37.4	11.5	9.0
Master's	7.4	8.7	7.7	7.5	5.9	14.1	3.9	5.6
Doctorate	4.1	3.3	s	1.4	4.6	5.9	1.8	6.3
Professional	1.1	s	na	na	na	s	na	1.1

Table LBR-3

Labor market indicators for S&E and S&E-related degree recipients earning their highest degree between 2015 and 2021, by level and field of highest degree: 2021

(Number, percent, and 2021 dollars)

Indicator and highest degree level	All S&E and S&E-related fields	S&E fields						S&E-related fields
		All S&E fields	Biological, agricultural, and environmental life sciences	Computer and mathematical sciences	Physical sciences	Social sciences	Engineering	
Involuntarily out-of-field rate (%)								
All degree levels	5.8	7.7	11.7	3.7	9.2	10.5	3.6	2.3
Bachelor's	8.0	9.8	15.0	3.3	14.8	12.8	5.0	3.5
Master's	3.2	4.2	4.6	4.8	2.0	5.9	1.6	1.7
Doctorate	1.6	1.9	s	s	1.8	3.5	s	s
Professional	s	s	na	na	na	s	na	s
Median annual earnings for employed individuals ($)								
All degree levels	60,000	54,000	40,000	75,000	43,000	42,000	75,000	65,000
Bachelor's	50,000	48,000	35,000	68,000	37,000	38,000	72,000	58,000
Master's	70,000	65,000	48,000	85,000	42,000	50,000	86,000	74,000
Doctorate	78,000	77,000	61,000	110,000	72,000	75,000	101,000	80,000
Professional	70,000	s	na	na	na	s	na	70,000

na = not applicable; s = suppressed for reasons of confidentiality and/or reliability.

S&E = science and engineering.

Note(s):
Data include the civilian, non-institutionalized population ages 16–75. Data include highest degrees earned between January 2015 and February 2021. The out-of-field rate and involuntarily out-of-field rate are for employed individuals only. The involuntarily out-of-field rate is the proportion of all employed individuals who report that their job is not related to their field of highest degree because a job in their highest degree field was not available. Median annual earnings are rounded to the nearest $1,000. Numbers and percentages may not sum due to rounding.

Source(s):
National Center for Science and Engineering Statistics, National Survey of College Graduates (NSCG), Public-Use File, 2021.

Science and Engineering Indicators

In February 2021, 87% of recent S&E or S&E-related degree recipients were employed with employment rates increasing as educational attainment increased.[20] About 85% of recent S&E or S&E-related bachelor's degree recipients were employed, compared to 94% of recent doctorate recipients. Recent bachelor's degree recipients in engineering fields were the only group with an employment rate (92%) higher than the combined employment rate of recent bachelor's degree recipients across all S&E and S&E-related fields combined. Meanwhile, recent bachelor's degree recipients in biological, agricultural, and environmental life sciences fields had the lowest employment rate (75%) of recent S&E bachelor's degree recipients, although employment rates may be depressed by enrollment in graduate education (Henderson et al. 2022; BLS 2023).

When researchers discuss the STEM pipeline, attrition from STEM is one aspect, which includes the individuals who work out of their field of degree (Speer 2023). Based on self-reported data on the relationship between a respondent's job and their highest degree, 24% of recent S&E bachelor's degree recipients worked out of field.[21] Larger percentages of recent bachelor's degree graduates with majors in social sciences (37%), biological, agricultural, and environmental life sciences (32%), and physical sciences majors (22%) worked out of field than those who majored in computer and mathematical sciences (7%), S&E-related fields (9%) and engineering fields (11%) in 2021. Graduates with S&E-related degrees had lower rates of working out of field than S&E fields for all fields and degree levels combined.

Across all S&E and S&E-related degree fields combined, those who recently earned master's and doctoral degrees in STEM fields worked involuntarily out of field at lower rates than bachelor's degree holders. Over 12% of workers with bachelor's degrees in biological, agricultural, and environmental life sciences and in social sciences were involuntarily working out of field.

Foreign-Born STEM Workers

S&E fields and the general U.S. economy have long included and benefited from the contributions of foreign-born workers (Abramitzky and Boustan 2017; Kerr and Kerr 2017; Khanna and Lee 2020; Rovito, Kaushik, and Aggarwal 2021). Additionally, NSB's *Vision 2030* report recognizes the importance of the U.S. international STEM talent in maintaining its lead in research and bolstering the workforce of the future (NSB 2020). This section provides an analysis of foreign-born STEM workers, including their demographic composition. It examines the proportion of foreign-born workers in STEM occupations (by degree level) and estimates rates of intentions to stay as well as actual stay rates among U.S.-trained doctoral recipients.

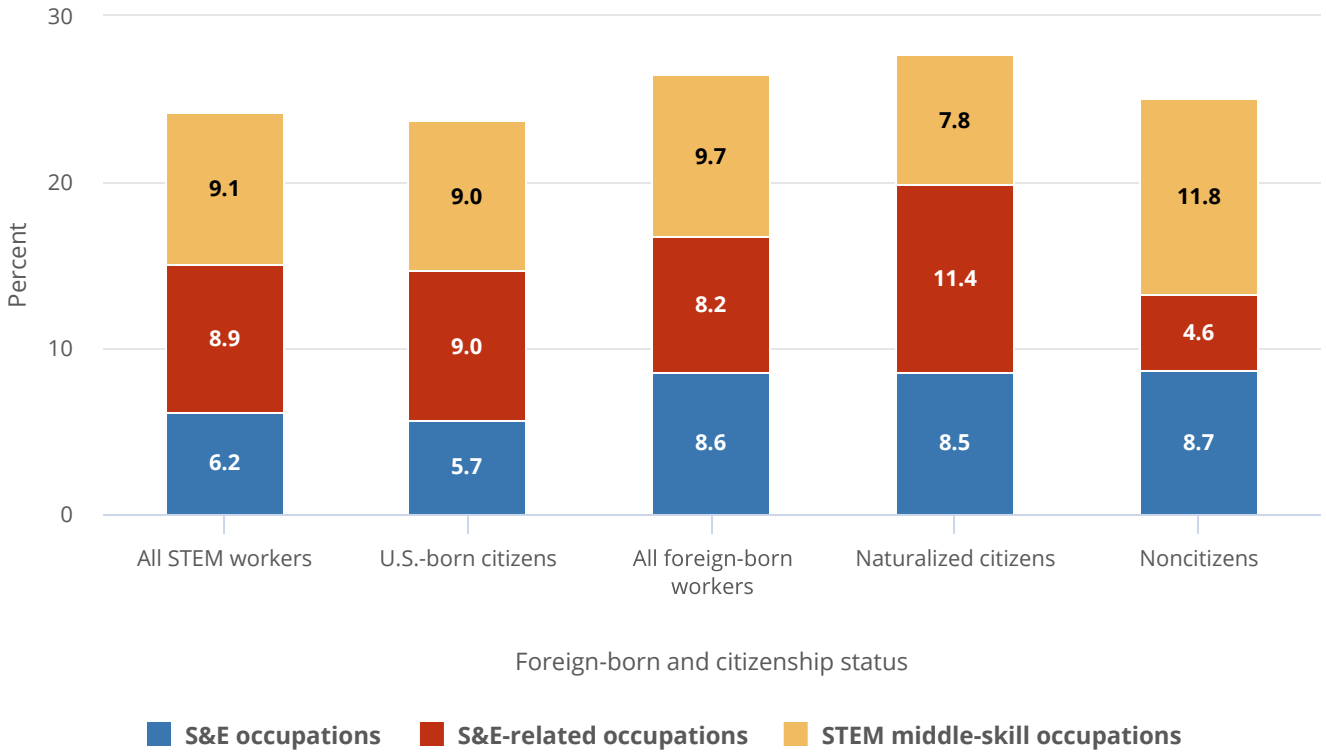
Foreign-born STEM workers are defined as those STEM workers born outside of the United States who were not citizens by birth.[22] In 2021, 17% of all civilian workers (26,546,400 people) and 19% of STEM workers were foreign born (7,023,900 people),[23] according to the ACS (Table SLBR-25).[24] Over a quarter (26%) of foreign-born workers employed in the United States worked in STEM occupations. There are three subsets for the foreign-born population: noncitizens who live in the United States on visas (*temporary visa holders*), those with *permanent resident* status (or Green Cards), and foreign-born workers who have become U.S. citizens (*naturalized citizens*).

Occupations and Geographic Characteristics of Foreign-Born STEM Workers

Foreign-born STEM workers' occupational characteristics vary by citizenship status and are distinct from U.S.-born STEM workers. Of foreign-born workers, a larger percentage were employed in STEM occupations (26%) than the percentage of U.S.-born workers (24%) (Table SLBR-25). Similarly, both naturalized and noncitizen foreign-born workers worked in STEM occupations at slightly higher rates (28% and 25%, respectively) than U.S.-born workers (24%) did. Proportionally, more naturalized citizen workers (11%) worked in S&E-related occupations than noncitizen workers (5%) or U.S.-born citizen workers (9%). Additionally, larger proportions of noncitizens worked in STEM middle-skill occupations (12%) than naturalized citizens (8%) or U.S.-born workers (9%) (**Figure LBR-13**).

Figure LBR-13

Prevalence of workers in STEM occupations, by foreign-born and citizenship status: 2021



S&E = science and engineering; STEM = science, technology, engineering, and mathematics.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75 and exclude those currently enrolled in primary or secondary school. Foreign-born individuals were born outside of the United States and were not citizens by birth. Non-STEM occupations are not shown.

Source(s):
Ruggles S, Flood S, Goeken R, Schouweiler M, Sobek M, 2022, *IPUMS USA: Version 12.0, 2021 American Community Survey (ACS)*, https://doi.org/10.18128/D010.V12.0, accessed 23 December 2022.

Science and Engineering Indicators

There are 24 countries or economies of origin that each contributed 1% or more of the foreign-born STEM workforce (Table SLBR-26).[25] Together, these 24 countries or economies accounted for about 75% of all foreign-born STEM workers. Of all foreign-born STEM workers, 18% were born in Mexico, followed by 14% born in India, 7% in China, and 6% in the Philippines. Within the different portions of the STEM occupations, country or economy of origin varies for foreign-born workers. For example, the largest proportion of foreign-born STEM middle-skill workers were born in Mexico (40%). Of foreign-born S&E workers, 29% were born in India, and 13% were born in China. Among S&E-related foreign-born workers, 13% were born in the Philippines, and another 12% were born in India.

Foreign-Born STEM Workers with Bachelor's Degrees or Higher

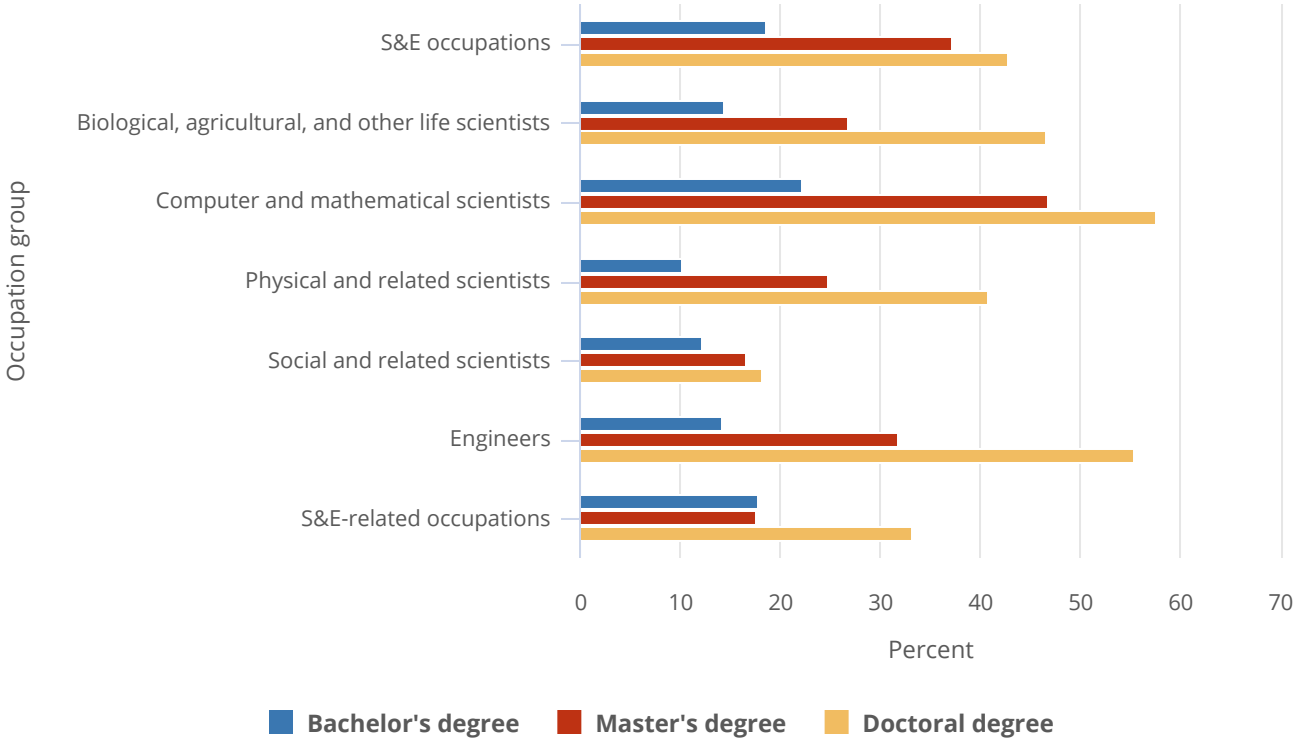
The proportion of foreign-born STEM workers overall and with a bachelor's degree or higher was similar in 2021 and 2019 (NSB ***Indicators 2022***: **Figure LBR-31**; Table SLBR-25). In 2021, there were over 7 million (7,023,900) foreign-born STEM workers (or 19% of all STEM workers); almost 4 million (3,931,400) held a bachelor's degree, of whom 3,621,200 worked in S&E or S&E-related occupations according to the ACS (Table SLBR-25). The NSCG, which applies a survey coverage and occupation classification that are different from the ACS, estimates that there are about 3,937,700 foreign-born S&E or S&E-related workers with a bachelor's degree or higher, or 23% of STEM workers (Table SLBR-27). The rest of this section is based on the NSCG estimates.

Overall, about 60% of foreign-born S&E or S&E-related workers are U.S. citizens (Table SLBR-27). Of the other 40%, some 22% were temporary visa holders, and 18% were permanent residents. Overall, for S&E and S&E-related occupation fields, more workers were foreign-born citizens than temporary visa holders, although there is variation in proportions of foreign-born workers' citizenship status across S&E fields. For example, computer and mathematical scientists was the largest S&E or S&E-related occupation field for temporary visa holders, employing 32% of workers with temporary visas. Among permanent residents, 20% worked in S&E-related occupations, although 3% of workers in S&E-related occupations were permanent residents.

The prevalence of foreign-born individuals also varied by degree level. Larger proportions of doctoral degree holders in S&E occupations were foreign born (43%) than either master's degree holders (37%) or bachelor's degree holders (19%) (**Figure LBR-14**). This was also true for all S&E occupation groups. Further, among S&E occupation groups, more than 50% of doctorate holders that worked as computer and mathematical scientists (58%) and engineers (56%) were foreign born.

Figure LBR-14

Share of workers with a bachelor's degree or higher who were foreign born, by highest degree level and occupation group: 2021



S&E = science and engineering.

Note(s):
Data include the employed, civilian, non-institutionalized population ages 16–75. STEM middle-skill occupations are not included. Non-S&E occupations are not shown.

Source(s):
National Center for Science and Engineering Statistics, National Survey of College Graduates (NSCG), Public-Use File, 2021.

Science and Engineering Indicators

Stay Rates of U.S.-Trained Scientists and Engineers

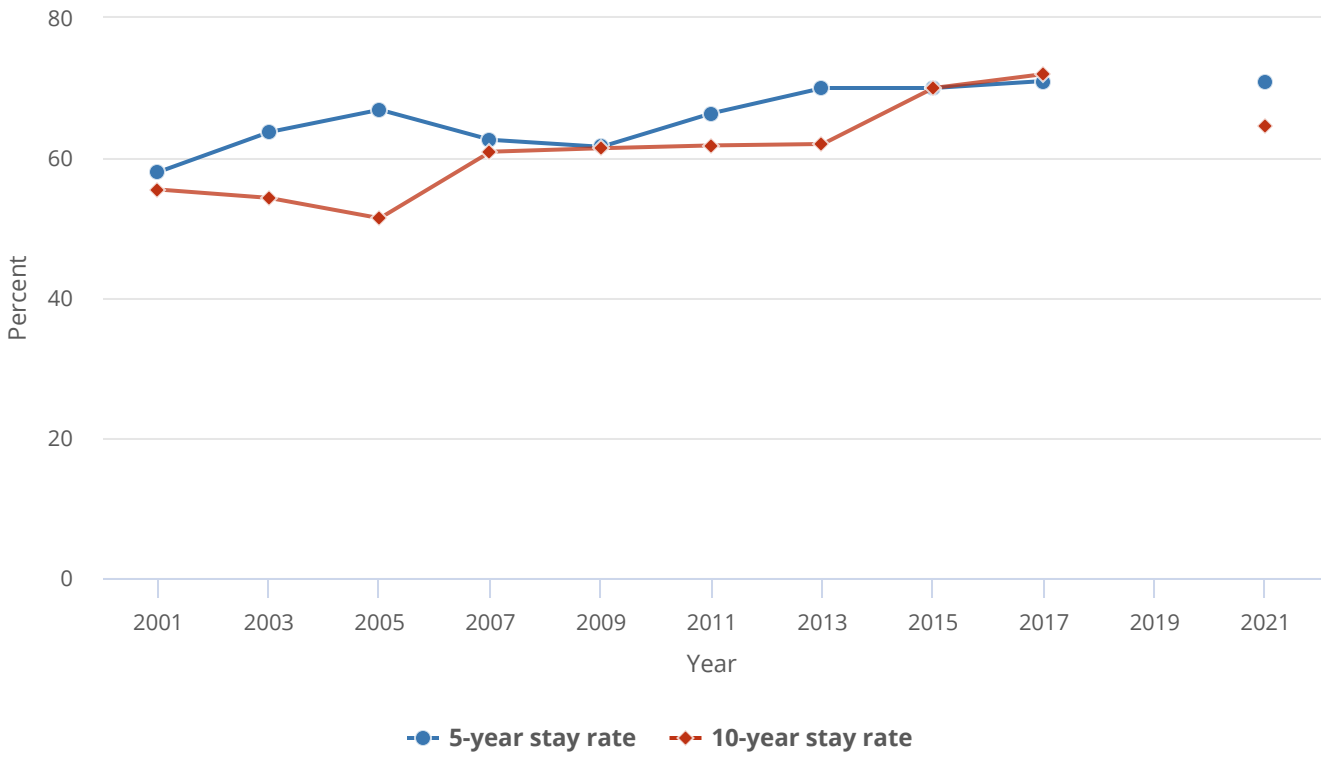
Stay rates of U.S.-trained scientists and engineers provide insights into whether foreign-born individuals remain in the United States after earning their degrees. NSB's *Vision 2030* report suggests that attracting and retaining global talent are necessary for the United States to remain competitive in S&E fields and that stay rates are critical indicators for understanding how well the United States is retaining global talent (NSB 2020). Stay rates help policymakers understand the degree to which U.S.-trained S&E doctorates contribute to the U.S. economy. Countries such as the United Kingdom, China, and Canada have implemented programs to attract international STEM talent, which could impact stay rates in the United States (Rovito, Kaushik, and Aggarwal 2021). For the remainder of this section, the focus is on individuals on temporary visas at the time they earned their research doctorates in science, engineering, and health (SEH) fields.[26]

The intent-to-stay rate among research doctorate recipients remained relatively stable over the last decade, although the number of research doctorate recipients intending to stay increased due to an increase in temporary visa-holding new doctorates (Table SLBR-28; NCSES ***SED 2021***: **Table 1-6**, **Table 1-7**, **Table 1-8**). Thus, the number of new SEH doctorates planning to stay in the United States was about 9,900 higher in the 4-year period of 2018–21 compared with 2010–13 due to the overall increase of about 12,200 temporary visa-holding doctorate recipients in SEH fields (Table SLBR-28; NCSES ***SED 2021***: **Table 1-8**, **Table 1-9**). At the same time, the proportion of temporary visa-holding SEH research doctorate recipients with definite commitments to stay increased between the 2010–13 period (47%) and the 2018–21 period (53%).[27]

While intentions to stay provide insight at the time of degree completion, the 5- and 10-year stay rates for SEH research doctorate recipients from earlier graduation cohorts show the longer-term retention of doctorate-holding scientists and engineers. Across all countries of citizenship and SEH degree fields, the 5-year stay rate was 71% in 2021, and the 10-year stay rate was 65% (**Figure LBR-15**). While the 5-year stay rate in 2021 was similar to that of 2017 (the last time stay rates could be calculated from the SDR), the 10-year stay rate declined from 72% in 2017 to 65% in 2021.

Figure LBR-15

Stay rates for U.S. S&E doctoral degree recipients with temporary visas at graduation: 2001–21



S&E = science and engineering.

Note(s):
Data are available for odd-numbered years only. Data are not available for 2019. Stay rate estimates prior to 2011 may not be comparable to subsequent years due to differences in source data.

Source(s):
Finn M, *Stay Rates of Foreign Doctoral Recipients from U.S. Universities, 2011,* Oak Ridge Institute for Science and Education (2001–11); National Center for Science and Engineering Statistics, Survey of Doctorate Recipients (SDR), 2013–21.

Science and Engineering Indicators

Stay rates varied by both field of doctoral degree and country, economy, or region of citizenship (**Table LBR-4**). The 5- and 10-year stay rates of doctorate recipients with temporary visas were similar (just over 70%) in both the biological, agricultural, health, and environmental life sciences and in engineering. Yet for doctorates in computer and mathematical sciences, the 5- and 10-year stay rates were quite different—the 5-year stay rate was 79%, whereas the 10-year stay rate was 63%.

Table LBR-4

Temporary visa holders receiving S&E doctorates in 2015–17 and 2010–12 who were in the United States in 2021, by S&E degree field and by region, country, or economy of citizenship at time of degree

(Number and percent)

Degree field and region, country, or economy of citizenship	Foreign doctorate recipients, 2015–17 (number)	5-year stay rate (%)	Foreign doctorate recipients, 2010–12 (number)	10-year stay rate (%)
Total	42,950	71	38,650	65

Table LBR-4

Temporary visa holders receiving S&E doctorates in 2015–17 and 2010–12 who were in the United States in 2021, by S&E degree field and by region, country, or economy of citizenship at time of degree

(Number and percent)

Degree field and region, country, or economy of citizenship	Foreign doctorate recipients, 2015–17 (number)	5-year stay rate (%)	Foreign doctorate recipients, 2010–12 (number)	10-year stay rate (%)
Doctoral fields				
Biological, agricultural, health, and environmental life sciences	10,150	71	8,750	71
Computer and mathematical sciences	6,100	79	5,700	63
Physical sciences	6,450	72	5,550	60
Social sciences	5,400	53	5,300	41
Engineering	14,850	73	13,350	72
Citizenship				
China (including Hong Kong)	14,250	88	11,200	81
India	6,650	79	5,900	77
South Korea	2,750	57	4,150	43
West Asia	6,500	65	3,750	66
Europe	3,600	55	3,850	67
North and South America	3,600	56	4,100	50
All other countries	5,400	50	5,650	44

S&E = science and engineering.

Note(s):
Weighted frequencies are rounded to the nearest 50. Stay rates are rounded to the nearest integer. Due to changes in the National Center for Science and Engineering Statistics Taxonomy of Disciplines, field of degree numbers and proportions may not be comparable to prior years.

Source(s):
National Center for Science and Engineering Statistics, Survey of Doctorate Recipients (SDR), 2021.

Science and Engineering Indicators

While there were fewer temporary visa holders who received doctorates in the social sciences, these doctorate holders had the lowest 5-year (53%) and 10-year stay rates (41%), with under 50% remaining in the United States 10 years after earning a doctorate. Turning to the country, economy, or region of citizenship of doctorate recipients, those with Chinese citizenship had higher 5- and 10-year stay rates (88% and 81%, respectively) than the overall population of temporary visa-holding doctorate recipients, as did those with Indian citizenship (79% and 77%, respectively).

Conclusion

STEM workers are integral to the development and support of innovation and technological advancement. They also transform these advancements into tangible and useful goods and services through their skills and knowledge. The use of STEM skills is widespread in the United States, with STEM workers making up nearly a quarter of the total workforce and more than half holding less than a bachelor's degree. STEM workers tend to have favorable labor market outcomes relative to non-STEM workers, including higher salaries. People associated with STEM occupations also have higher employment rates.

Many suggest that a nation's workforce diversity is associated with increased innovative capacity. Women and some racial and ethnic minorities are underrepresented in STEM overall, with lower proportions of female and Black or African American workers with S&E degrees working in S&E occupations; however, representation levels vary by occupation group. Further, median earnings differences between the sexes persist in STEM occupations, with men earning more than women.

Foreign-born workers account for a considerable share of STEM workers in the United States. In addition, noncitizens comprise a large proportion of U.S.-trained STEM doctorate holders, with the majority remaining in the United States after finishing their degrees, especially those from India and China, indicating that their contributions to the U.S. economy continue well after their training in U.S. institutions ends.

The STEM labor force is comprehensive and diverse, made up of workers at all education levels in a wide variety of occupations. Many factors—global competition, demographic trends, aggregate economic activities, STEM training pathways, and developing labor demands, among others—will affect the availability of workers equipped with STEM knowledge and skills as well as the kinds of jobs that the U.S. economy generates in the future. As a result, comprehensive and timely analysis of current labor force and demographic trends will play a critical role in providing the policy-relevant information needed to understand the dynamic STEM landscape in the United States.

Glossary

Definitions

Employment rate: A measure of the extent to which people available to work are being used. It is calculated as the ratio of the employed to the population of interest. For more information, see **https://data.oecd.org/emp/employment-rate.htm**.

Foreign-born workers: Those whose nativity is outside of the United States, regardless of citizenship. Foreign-born workers may be U.S. citizens or permanent residents.

Full-time, year-round workers: Workers who were employed at least 50 weeks in the preceding year (year round) and worked at least 35 hours per week during that year (full time).

Labor force: A subset of the population that includes only those who are employed and those who are not working but actively seeking work (unemployed).

Metropolitan Statistical Area (MSA): A core-based statistical area designated by the Office of Management and Budget. It represents a core area containing at least one urban area with a population of 50,000 or more, together with adjacent communities that have a high degree of economic and social integration with the core area. For more information, visit **https://www.census.gov/programs-surveys/metro-micro/about.html**.

STEM middle-skill occupations: A range of occupations that require a high level of science technology, engineering, and mathematics (STEM) expertise to perform their core duties, although these occupations do not require a bachelor's degree for entry. STEM middle-skill occupations are primarily in health care; construction; installation, maintenance, and repair; and production. See Table SLBR-1 for a full list.

Noncitizens: A subset of foreign-born workers who are temporarily in the United States on visas or are permanent residents. This includes temporary visa holders on H-1B, J-1, and L-1 visas and Green Card holders.

Non-STEM occupations: Primarily includes occupations in management (excluding science and engineering [S&E] and S&E-related managers, industrial production managers, and farmers, ranchers, and agricultural managers), sales (excluding sales engineers), transportation and material moving (excluding transportation inspectors and pumping station operators), office and administrative support, and education and training. See Table SLBR-1 for a full list of non-STEM occupations.

Non-STEM workforce or non-STEM workers: A subset of the U.S. workforce in non-STEM occupations (see *non-STEM occupations*).

Postdoctoral researcher (postdoc): A temporary position awarded in academia, industry, government, or a nonprofit organization, primarily for gaining additional education and training in research after completion of a doctorate.

Public Use Microdata Area (PUMA): The smallest level of geography available in the American Community Survey. PUMAs are geographic areas that contain at least 100,000 people and do not cross state lines.

S&E degree fields: Degree fields at the bachelor's level or higher in the following categories: (1) computer and mathematical sciences; (2) biological, agricultural, and environmental life sciences; (3) physical and related sciences; (4) social sciences; and (5) engineering. At the doctoral degree level, the medical and health sciences are included under S&E (i.e., science, engineering, and health) because these data correspond to the doctorate holder's research or scholarship degree level, which are research-focused degrees. For detailed degree fields within these major categories, see the National Center for Science and Engineering Statistics (NCSES) Taxonomy of Disciplines (NCSES *SDR 2019*: **Table A-1**).

S&E occupations: Occupations in the following five major categories: (1) computer and mathematical scientists; (2) biological, agricultural, and environmental life scientists; (3) physical scientists; (4) social scientists; and (5) engineers. For more details and examples of the minor and fine S&E occupations, see the NCSES Taxonomy of Occupations (NCSES *NSCG WMPD 2017*: **Technical Table A-1**).

S&E-related degree fields: Degree fields at the bachelor's level or higher in the following categories: (1) health, science, and mathematics teacher education; (2) technology and technical fields; and (3) other S&E-related fields. For detailed degree fields within these categories, see the NCSES Taxonomy of Disciplines (NCSES *SDR 2019*: **Table A-1**).

S&E-related occupations: These occupations require science and technology expertise but are not part of the five major categories of the S&E occupations. S&E-related occupations include these four minor occupations: (1) health, (2) S&E managers, (3) S&E precollege teachers, and (4) technologists and technicians. For more detail and examples of S&E-related occupations, see the NCSES Taxonomy of Occupations (NCSES *NSCG WMPD 2017*: **Technical Table A-1**).

Skilled technical workforce (STW): Workers in S&E (see *S&E occupations*), S&E-related (see *S&E-related occupations*), and STEM middle-skill occupations (see *STEM middle-skill occupations*) who do not have a bachelor's degree or higher.

Stay rate: The proportion of foreign recipients of U.S. S&E doctorates who expect to stay or stay in the United States after receiving their doctorate.

STEM fields or STEM degree fields: A subset of degree fields comprised of S&E (see *S&E degree fields*) and S&E-related (see *S&E-related degree fields*) degree fields.

STEM occupations or STEM groups: A subset of occupations comprised of S&E, S&E-related, and STEM middle-skill occupations. Each of these groups is a STEM group, and the occupations within them are STEM occupations.

STEM workforce or STEM workers: A subset of the U.S. workforce comprised of S&E (see *S&E occupations*), S&E-related (see *S&E-related occupations*), and STEM middle-skill occupations (see *STEM middle-skill occupations*).

Underrepresented demographic groups: Races or ethnicities whose representation in S&E education and S&E employment is smaller than their representation in the U.S. population. This includes Blacks or African Americans, Hispanics or Latinos, and American Indians or Alaska Natives.

Workforce: A subset of the labor force that includes only employed individuals.

Key to Acronyms and Abbreviations

ACS: American Community Survey

BLS: Bureau of Labor Statistics

CPS: Current Population Survey

MSA: Metropolitan Statistical Area

NCSES: National Center for Science and Engineering Statistics

NSB: National Science Board

NSCG: National Survey of College Graduates

NSF: National Science Foundation

PUMA: Public Use Microdata Area

PUMS: Public Use Microdata Sample

R&D: research and development

S&E: science and engineering

SDR: Survey of Doctorate Recipients

SED: Survey of Earned Doctorates

SEH: science, engineering, and health

SIPP: Survey of Income and Program Participation

STEM: science, technology, engineering, and mathematics

STW: skilled technical workforce

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Notes

1 See the **Technical Appendix** in *Indicators 2020* report "**Science and Engineering Labor Force**" for how these occupations were determined.

2 For the 2021 American Community Survey (ACS), the employed civilian population represents 62.3% of the non-institutionalized population ages 16–75 years, and the civilian population represents 77.1%. For the 2019 ACS, the employed civilian population represents 64.4% of the non-institutionalized population ages 16–75 years, and the civilian population represents 76.6%. For the 2021 National Survey of College Graduates (NSCG), the employed civilian population is 75.1% of the total NSCG population, and the civilian population is 98.7%.

3 Records that have occupation information in the ACS include those that are currently employed with a reported occupation or those that were employed within the past 5 years. Occupation data are not recorded for those who have never worked or who have not worked in the past 5 years.

4 Technical documentation for the ACS, including methodology, sample design, and weighting, can be found at **https://www.census.gov/programs-surveys/acs/microdata/documentation.html**.

5 Technical documentation for the NSCG, including methodology, sample design, and weighting, can be found at **https://ncses.nsf.gov/surveys/national-survey-college-graduates/2021#sd**.

6 Technical documentation for the SDR, including methodology, sample design, and weighting, can be found at **https://ncses.nsf.gov/surveys/doctorate-recipients/2021#sd**.

7 To calculate employment rates and labor force participation of STEM workers, workers are identified based on the occupation they currently hold or on the occupation they previously held if they are not currently working.

8 Employment rates are defined as a measure of the extent to which people available to work are being used. Because this thematic report is looking at occupation groups, the employment rate is for those with a current occupation or an occupation in the last 5 years. Note that the population associated with occupations is smaller than those who may be available to work, but may not have associated occupations, such as those individuals entering the labor force for the first time.

9 In this thematic report, data about race are only among workers who are not Hispanic. The grouping "Hispanic" is Hispanic workers of any race.

10 Major demographic groups are presented here. Analyses of other groups could not be presented due to small sample sizes in the categories of interest.

11 In this thematic report, data about race are only among workers who are not Hispanic. The grouping "Hispanic" is Hispanic workers of any race.

12 Among those with an S&E degree that held S&E-related occupations, Hispanic workers were significantly different from Black workers. Neither group was significantly different from Asian workers or White workers.

13 In this thematic report, data about race are only among workers who are not Hispanic. The grouping "Hispanic" is Hispanic workers of any race.

14 This methodology is based off the methodology used to identify "high-tech" industries in the BLS publication by Wolf and Terrell (2016). For this thematic report, the NCSES definitions of S&E, S&E-related, and middle-skill occupations were used to identify industries with at least 2.5 times the national concentration of each STEM group. Table SLBR-2 contains the national rates of each STEM group used to identify the industries.

15 Iowa, Indiana, Nebraska, and Alabama were not significantly different from Vermont. Nebraska was not significantly different from Louisiana or Kentucky. None of the listed states were significantly different from each other or from Arkansas, Mississippi, Wisconsin, North Dakota, or Alaska. Wyoming is the only state listed that was significantly different from Oklahoma or West Virginia.

16 The percentages provided are estimates of the percentage of workers. Thus, these are not explicit comparisons but descriptive discussions about the geographic distributions of larger and smaller populations of workers.

17 Information about the SIPP, including technical documentation, sampling, weighting, and survey nonresponse, can be found at **https://www.census.gov/programs-surveys/sipp/tech-documentation.html**. The 2021 SIPP uses 2020 as the reference year. Employment status is taken from month 12 of the reference year. Certification questions were asked of respondents who were ages 18 years or older, regardless of educational attainment, and of respondents who were ages 16 years or 17 years if they had a high school diploma or GED. For ease of analysis, these numbers only include respondents with at least a high school diploma or GED.

18 S&E-related workers with an associate's degree who have an educational certificate are not significantly different from those with some college who have an educational certificate.

19 Field of highest degree is defined by reported first or second major of the highest degree. It is in S&E if at least one major was in an S&E field. It is in S&E-related if both are not in S&E and at least one major was in a S&E-related field.

20 For this comparison, doctoral and professional degrees are both compared to master's degree recipients because both categories are mostly comprised of terminal degrees.

21 In the NSCG, respondents are asked "To what extent was your work on your principal job related to your highest degree?" (Item A21, variable name OCEDRLP). In this thematic report, respondents who selected "Not related" are referred to as working out of field.

22 Individuals who are born outside of the United States but are citizens by birth usually have at least one parent who is a U.S. citizen and include many people who are born to U.S. military or foreign service personnel stationed abroad. These individuals have no restrictions on entering the United States, and unlike those born abroad without U.S. citizenship, they do not need to get a visa for work or school.

23 Consistent with the rest of the report, foreign-born STEM workers are non-institutionalized civilians ages 16–75 years who are employed in the United States.

24 Analyses using the ACS will show this population divided by naturalized citizens (14,044,900) and noncitizens (12,501,500) and includes the STW. Analyses using the NSCG, Survey of Earned Doctorates (SED), and SDR allow for the noncitizen, foreign-born S&E or S&E-related workers to be further disaggregated by permanent resident and temporary visa holders but do not include the STW or middle-skill occupations. These data sources will be used in combination to highlight different aspects of the foreign-born STEM workforce. A very small number of individuals in the NSCG reported being born in the United States and responded that they were not U.S. citizens; because these individuals were born in the United States, they are counted with the U.S-born population.

25 For this ACS analysis, country or economy of origin is the birthplace of the individual.

26 The SED provides intentions to stay, and the SDR—a subset of former SED respondents—allows calculation of stay rates for temporary visa-holding doctorate holders; these are data that other surveys focusing on the U.S. labor market cannot estimate.

27 Students who are Saudi Arabian nationals have notably lower levels of intent to stay than other students. This could be related to programs that fund their education abroad for those with the intent to return to Saudi Arabia. See **https://educationusa.state.gov/scholarships/scholarships-available-saudi-students** and Alkubaidi and Alzhrani (2020).

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