

STEM²⁰²³ REPORT

This report provides an overview of understanding the current structures, needs, implementation strategies, and impact on STEM education and workforce development. With a data-driven and evidence-based approach, we are able to identify the trends of STEM job needs, compare the impact of the pandemic on STEM workforce equity, and recognize the importance of diverse pipelines to enhance engagement and enable the STEM workforce ecosystem.



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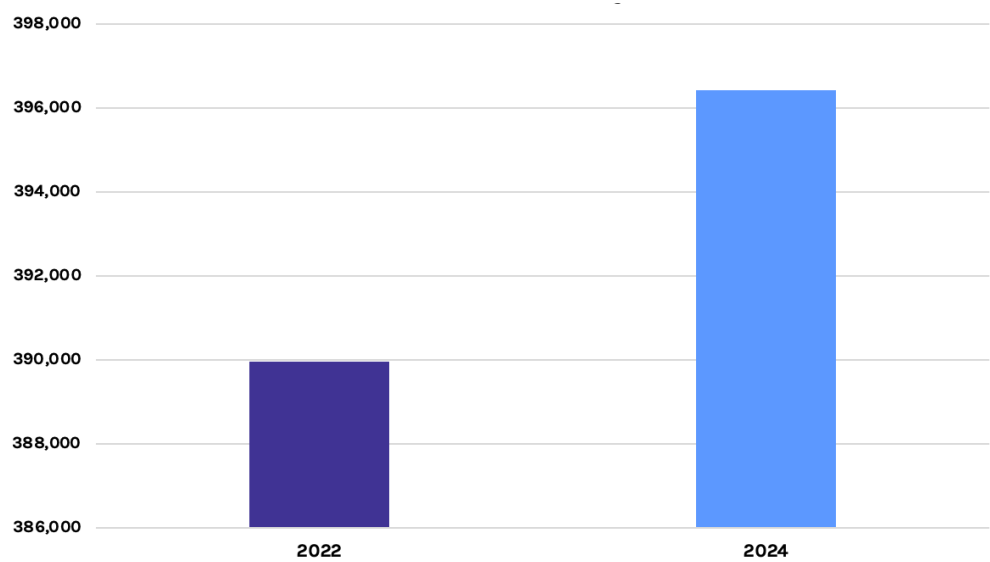


The Commonwealth of Massachusetts has long been a frontrunner in the pursuit of excellence in Science, Technology, Engineering, and Mathematics (STEM) fields. These disciplines form the backbone of innovation, technological advancement, and economic growth. In this report, we present an in-depth analysis of the current landscape of STEM education and workforce trends within the state. Building on the significance of STEM disciplines for economic growth and societal advancement, the report aims to shed light on the latest developments and challenges in this critical domain.

INTRODUCTION

Massachusetts has witnessed significant job growth in STEM-related fields over the past decade. As of the latest available data, STEM employment has outpaced many other sectors, contributing substantially to the state's overall economic health. According to the Massachusetts Department of Economic Research information from[1] Short Term Occupational Projections, STEM Openings, between Quarter Two 2022 (389,971 recorded positions) and Quarter Two 2024 (396,429 projected positions) STEM job openings are projected to grow by about 1.66%, a testament to the continued importance of these fields in our evolving economy.

MA STEM 2022 RECORDED JOBS VS PROJECTED 2024 JOBS



[1] Labor Market Information. (n.d.). Mass.gov. Retrieved September 15, 2023, from <https://lmi.dua.eol.mass.gov/LMI/STEMOccupationalProjections/STEMShortResult?A=01&GA=000025&Cmd=Go&Type=shor&Dopt=TEXT>

In addition, according to the U.S Bureau of Labor Statistics [2], it reveals a growing demand for specific STEM skills (see Table 1). Industries such as biotechnology, information technology, and engineering are experiencing particularly high demand for specialized talent. This trend underscores the need for targeted educational and training programs to equip our workforce with the skills required for these evolving roles.

EMPLOYMENT IN STEM OCCUPATIONS, 2022 AND PROJECTED 2032
NUMBERS IN THOUSANDS*

	Non-STEM Occupations	STEM Occupations	All Occupations
Employment 2022	154,118*	10,365*	164,483*
Employment 2032	157,661*	11,487*	169,148*
Employment Change2022-2032	3,543*	1,122*	4,666*
Percent Employment Change	2.3%	10.8%	2.8%
Median Wage Salary	\$44,670	\$97,980	\$46,310

* Data are from the Occupational Employment and Wage Statistics program, U.S. Bureau of Labor Statistics. Wage data cover non-farm wage and salary workers and do not cover the self-employed, owners and partners in unincorporated firms, or household workers.

While Massachusetts has made significant strides in promoting diversity and inclusion within STEM fields, challenges remain. According to the National Science Foundation 2023 - Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023 report, STEM jobs, training, and education nationally remain underrepresented by diverse populations. [3] In 2021, despite women making up about half the workforce in the United States, they only contributed to about 35% of all STEM positions. This is paralleled by further data in this NSF report, which identifies that the Hispanic population makes up 15%, the Asian American population makes up 10%, and the African American population makes up 9% of all STEM positions.[4] The data highlights that women and underrepresented minorities continue to be underrepresented in STEM jobs. In the following Themes (i.e., Theme II and III) will provide expanded State and Federal efforts to minimize the gap in underrepresented groups in STEM placement, education, and the STEM workforce.

[2] Employment in STEM occupations: U.S. Bureau of Labor Statistics. (n.d.). Retrieved September 15, 2023, from https://www.bls.gov/emp/tables/stem-employment.htm#ep_table_111.f1

[3] Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023 | National Center for Science and Engineering Statistics Directorate for Social, Behavioral and Economic Sciences - National Science Foundation. (n.d.). Ncses.nsf.gov. Retrieved September 21, 2023, from <https://ncses.nsf.gov/pubs/nsf23315/report>

[4] Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023 | National Center for Science and Engineering Statistics Directorate for Social, Behavioral and Economic Sciences - National Science Foundation. (n.d.). Ncses.nsf.gov. Retrieved September 21, 2023, from <https://ncses.nsf.gov/pubs/nsf23315/report/stem-median-wage-and-salary-earnings>

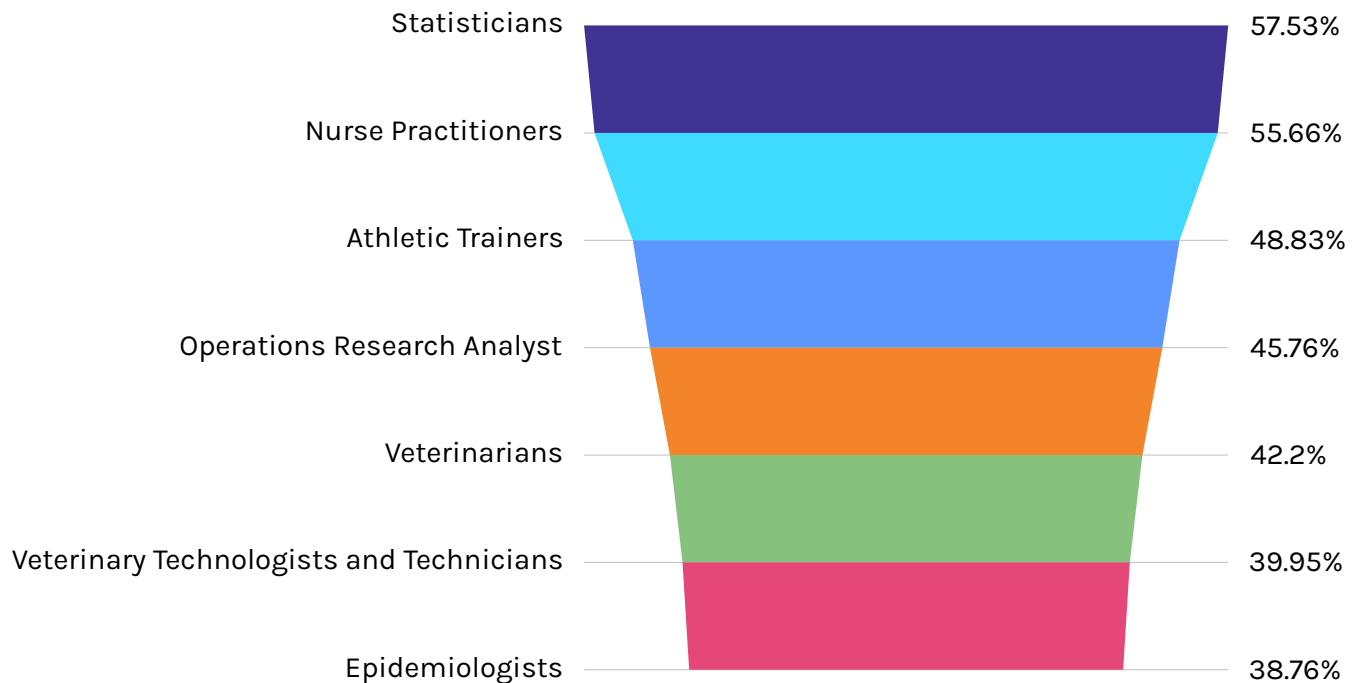
Workforce Trends in Massachusetts STEM Industries





According to the Massachusetts Department of Economic Research[5], the short-term projected gains in STEM were evidenced to increase by about 1.7%. This section expands on this number and delves into the current workforce trends across various STEM sectors, encompassing technology, biotechnology, engineering, and more. The top 3 occupations projected to grow the most in Massachusetts in the long term (from 2020 to 2030) are Statisticians (57.53%), Nurse Practitioners (55.66%), and Athletic Trainers (48.83%).

STEM OCCUPATIONS BY PERCENT CHANGE FROM 2020 TO 2030

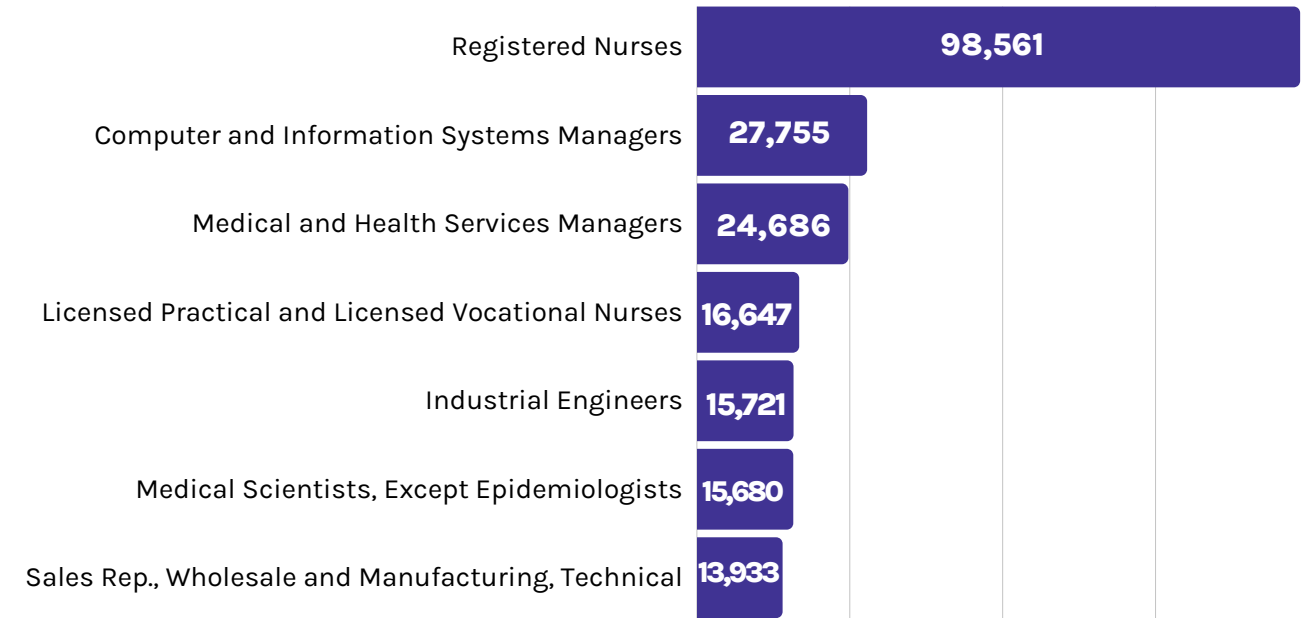


[5] Labor Market Information. (n.d.). Mass.gov. Retrieved September 15, 2023, from <https://lmi.dua.eol.mass.gov/LMI/STEMOccupationalProjections/STEMShortResult?A=01&GA=000025&Cmd=Go&Type=shor&Dopt=TEXT>



Furthermore, some careers that remain at a high demand, evidenced by projected total employment include Registered Nurses (98,561) Computer and Information Systems Managers (27,755) Medical and Health Services Managers 24,686 Licensed Practical and Licensed Vocational Nurses (16,647), Industrial Engineers (15,721) Medical Scientists, Except Epidemiologists (15,680) Sales Representatives, Wholesale and Manufacturing, Technician (13,933). [6]

MOST POPULAR STEM OCCUPATIONS BY NUMBER PROJECTED EMPLOYMENTS 2030



[6] Labor Market Information. (n.d.). Mass.gov. Retrieved September 21, 2023, from <https://lmi.dua.eol.mass.gov/LMI/STEMOccupationalProjections/STEMLongResult?A=01&GA=000025&Cmd=Go&Type=long&Dopt=TEXT>



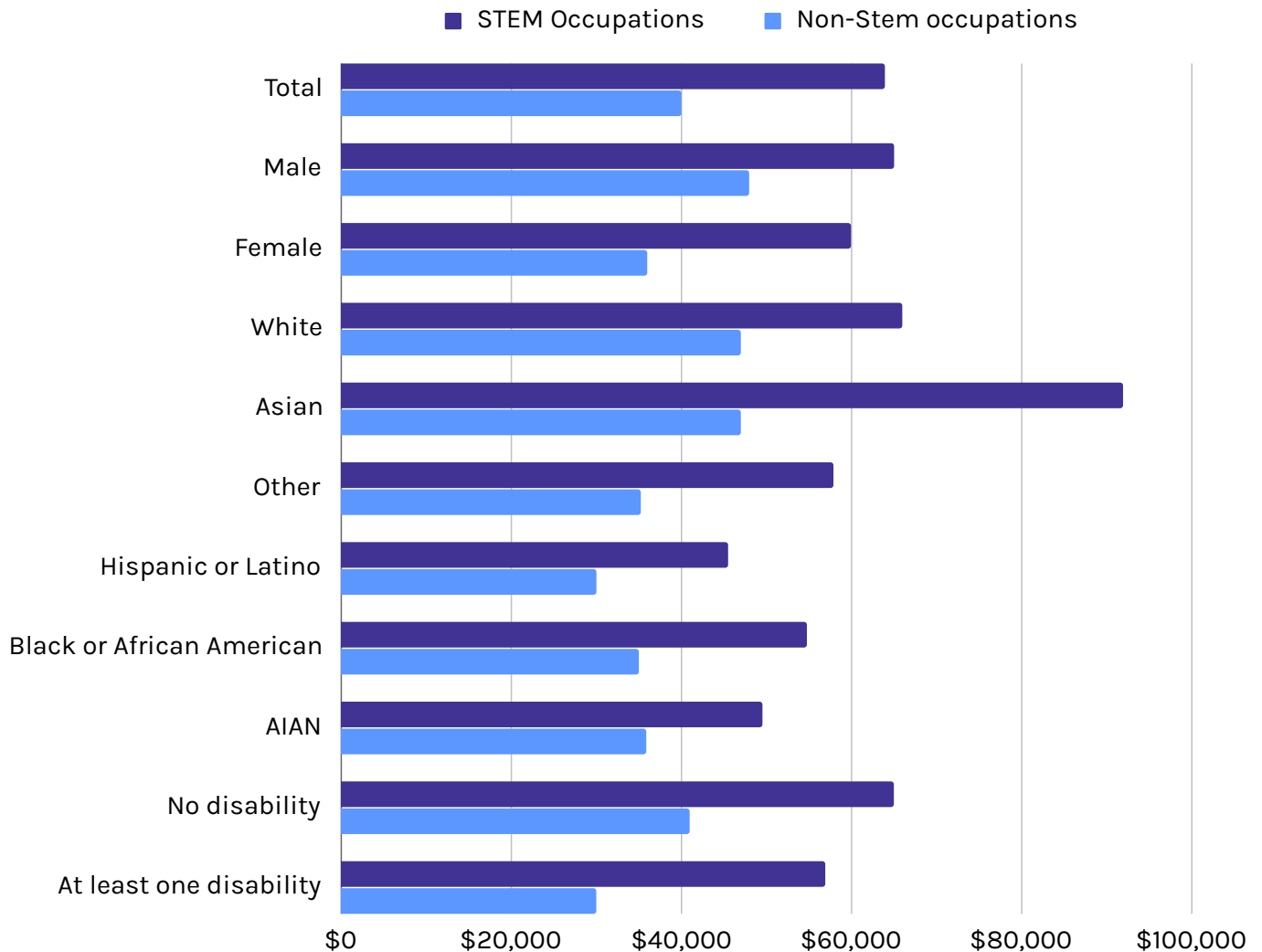
Massachusetts has responded proactively to the evolving needs of the STEM workforce. Innovative educational pathways have been established to bridge the gap between academic institutions and industry demands. These programs focus on hands-on training, experiential learning, and registered apprenticeships, providing students with real-world skills that directly translate into employment opportunities.

In a data-driven era, workforce trend data is paramount in understanding the dynamics of STEM employment in Massachusetts. According to the Executive Office of Labor and Workforce Development, from March 2022 – March 2023, there were 169,000 unique STEM-related job postings in the Commonwealth, excluding any additional internships. [7] The top skill reported in 18% of STEM job postings overall was Computer Science, with demand for computer science experience consistently growing in the digital age. In 2020, STEM jobs overall had a median salary of about \$64,000 across the country, while non-STEM jobs had a median of \$40,000, reinforcing the skew towards higher salaries STEM positions have historically had. [8] Men who worked in STEM positions in that same year had a median of \$65,000, while women had a median of \$60,000. Additionally, Asian individuals had a median salary of \$92,000; white individuals had a median salary of \$66,000, black individuals had a median salary of \$55,000, American Indian or Alaska Native had a median salary of \$50,000, and Hispanic individuals had a median salary of \$45,000.

[7]STEM Spotlight: Manufacturing | Mass.gov. (n.d.). [www.mass.gov](https://www.mass.gov/news/stem-spotlight-manufacturing). Retrieved September 21, 2023, from <https://www.mass.gov/news/stem-spotlight-manufacturing>

[8]Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023 | National Center for Science and Engineering Statistics Directorate for Social, Behavioral and Economic Sciences - National Science Foundation. (n.d.). [Ncses.nsf.gov](https://nces.nsf.gov/pubs/nsf23315/report/stem-median-wage-and-salary-earnings). Retrieved September 21, 2023, from <https://nces.nsf.gov/pubs/nsf23315/report/stem-median-wage-and-salary-earnings>

MEDIAN WAGE AND SALARY EARNING OF THE US WORKFORCE 18 - 74 IN STEM AND NON-STEM OCCUPATIONS BY SEX, ETHNICITY, RACE AND DISABILITY STATUS: 2020



One notable trend is the growth of public-private partnerships aimed at nurturing STEM talent. Collaborations between educational institutions, government agencies, and industry leaders have resulted in initiatives that offer financial support, mentorship, and internship opportunities. These partnerships not only prepare students for the workforce but also serve as a talent pipeline for Massachusetts-based companies.

Educational Landscape and Preparation for STEM Careers





To ensure a well-prepared STEM workforce, Massachusetts has implemented strategies to bridge the skills gap. These initiatives encompass educational reforms, registered apprenticeships, and reskilling programs to equip workers with the skills demanded by the job market. Several educational programs and initiatives have been established to foster STEM education, align it with industry needs, and bridge the skills gap. These include the following.

MASSACHUSETTS STEM PIPELINE

Massachusetts has established the STEM Pipeline Fund with a dedicated \$1.5 million allocation to bolster STEM education across all educational levels during FY23. [9] This fund is designed to facilitate various initiatives, including curriculum development, the establishment of a STEM network, the implementation of effective teaching methodologies, and the provision of summer programs tailored for high school students, with a particular emphasis on fostering inclusivity for underrepresented groups.

The STEM Pipeline Fund further extends its support by allocating \$315,000 annually to bolster the STEM Regional Network. This contribution aids in organizing and promoting over 500 community and classroom events throughout the year, including those taking place during STEM week. Additionally, the fund provides essential backing for students by offering hands-on learning opportunities through the Design Challenges Grant program. Annually, a substantial sum totaling over \$250,000 is awarded to organizations, institutions, or individuals with innovative proposals aimed at addressing specific STEM challenges in impactful and creative ways.

The primary portion of the pipeline funding is directed towards curriculum grants, highlighting the Commonwealth's strong dedication to advancing innovative STEM education. During FY23, the STEM Advisory Council funded four grantees using a sum of \$1,000,463 dedicated from STEM Pipeline Funds and Federal GEER Funding. This initiative was part of a larger effort from 2015 to 2022 that has been designated for STEM curriculum programs, benefiting more than 230 schools and approximately 20,000 students each year. Importantly, this funding prioritizes equity, with a particular focus on schools serving high concentrations of low-income students and historically underrepresented student populations. [10]

[9] 15957066: STEM Pipeline Fund | Governor's FY22 Budget Recommendation. (n.d.). Budget.Mass.gov. <https://budget.digital.mass.gov/govbudget/fy22/appropriations/education/executive-office-of-education/15957066>

[10] Commonwealth of Massachusetts. (n.d.-b). STEM Dashboard. Mass.gov. <https://www.mass.gov/info-details/stem-dashboard#2022-stem-report->



The primary portion of the pipeline funding is directed toward curriculum grants, highlighting the Commonwealth's strong dedication to advancing innovative STEM education. Over the past seven years, an impressive sum of \$5.5 million has been designated for STEM curriculum programs, benefiting more than 230 schools and approximately 20,000 students each year. Importantly, this funding prioritizes equity, with a particular focus on schools serving high concentrations of low-income students and historically underrepresented student populations.[11]

ALIGNMENT BETWEEN STEM EDUCATION AND THE EVOLVING NEEDS OF STEM INDUSTRIES

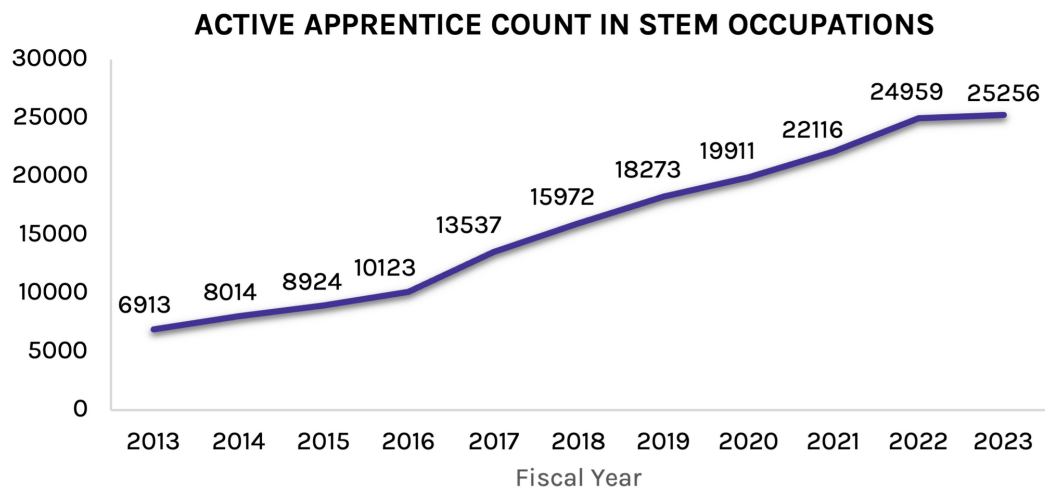
Massachusetts recognizes the importance of aligning STEM education with the evolving needs of STEM industries to ensure a skilled workforce. To achieve this alignment, the state collaborates with STEM industries through partnerships, advisory boards, and internships. These connections help educators understand industry trends and adapt their curricula accordingly. Educational institutions continually update their STEM curricula to reflect industry demands. They focus on teaching not only technical skills but also critical thinking, problem-solving, and communication skills, which are crucial in STEM professions. Each year, the STEM Week and the STEM Summit bring together educators, policymakers, industry leaders, researchers, and other stakeholders to discuss and promote STEM education and workforce development in the state.

To support various workforce development initiatives that train students and workers for STEM careers, Massachusetts develops innovative programs, including internships, Co-op Programs, apprenticeships, on-the-job training, and vocational programs. These opportunities are valuable for students looking to explore STEM careers, develop their skills, and make connections in the industry.

[11] Commonwealth of Massachusetts. (n.d.-b). STEM Dashboard. Mass.gov. <https://www.mass.gov/info-details/stem-dashboard#2022-stem-report->

APPRENTICESHIP PROGRAMS

Registered apprenticeship programs are structured training initiatives that combine on-the-job training with classroom or theoretical instruction. Massachusetts Division of Apprentices Standards oversees registered apprenticeships in the trades, other technical fields, and expanded industries. These programs are typically designed to provide individuals with hands-on experience and formal education in a specific trade or profession. Apprenticeship programs play a vital role in workforce development, offering an effective pathway for individuals to gain valuable skills and enter well-paying careers while providing industries with skilled labor. Eligible employers can apply for \$4,800 tax credits for each apprentice and up to \$100,000 each calendar year. Apprenticeships are a highly sought-after experience for both apprentices and employers. From 2013 to 2023, the active apprentices in STEM occupations across the nation increased from 6,913 to 25,256.



In Massachusetts, there also has been a noteworthy surge in student enrollment in apprenticeship programs over the past decade. Starting at 6,178 in 2013, the number has nearly doubled, reaching 11,956 in 2023. This substantial increase underscores the growing popularity and recognition of apprenticeships as a valuable pathway for skill development and career advancement within the state. Currently, Massachusetts boasts 740 apprenticeship opportunities. Of these, 447 apprenticeships are dedicated to the STEM field, spanning sectors such as construction, healthcare, technology, and more. It is important to note that these apprenticeship opportunities are distributed across the entire Commonwealth, although a significant concentration can be found on the eastern side of Massachusetts. This distribution ensures that aspiring apprentices from various regions have access to these valuable educational and career development pathways, contributing to the overall workforce readiness. [12]

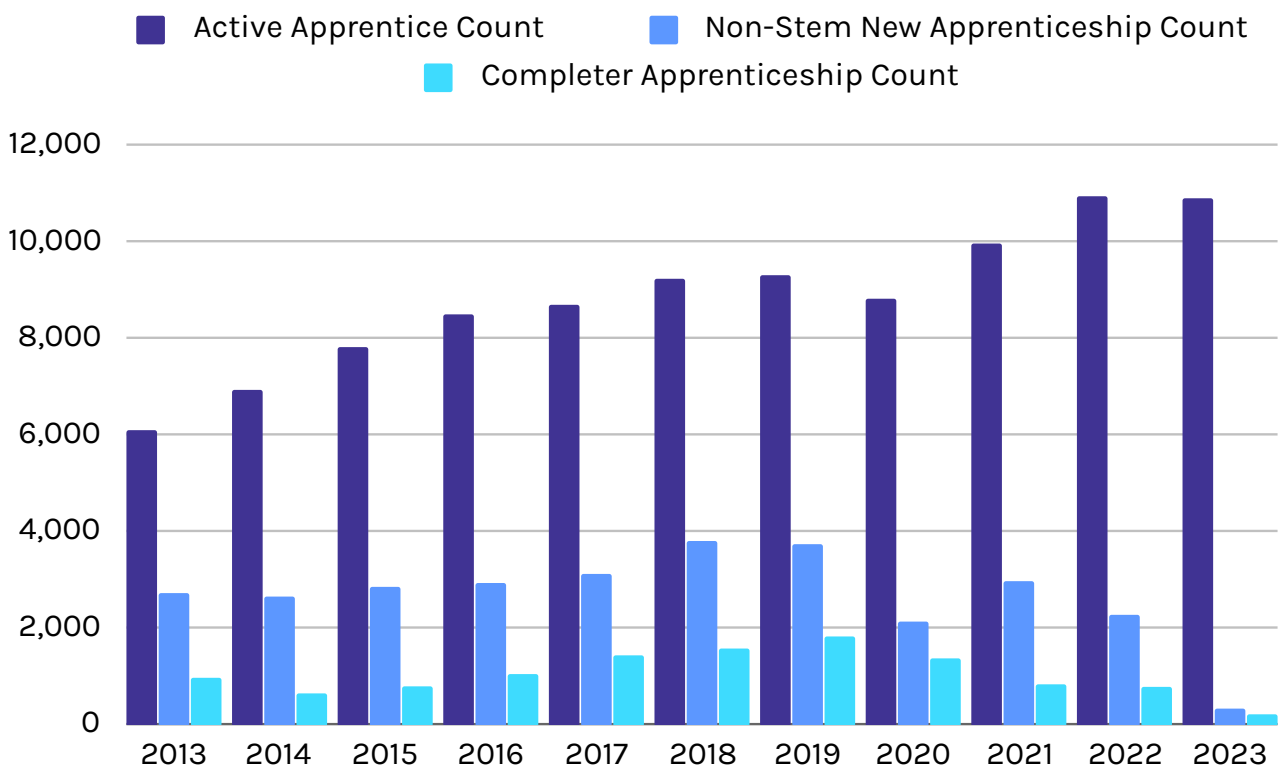
Massachusetts has a robust ecosystem for STEM education, aligning it with the needs of STEM industries through partnerships and initiatives. The state's focus on fostering STEM education from an early age, its commitment to curriculum alignment, and collaboration with industry stakeholders contribute to a well-prepared STEM workforce.

[12] Apprenticeship, O. of. (n.d.). Data and Statistics. Apprenticeship.gov. <https://www.apprenticeship.gov/data-and-statistics> Apprenticeship USA, U.S. Department of Labor, Interactive Apprenticeship Data

REGISTERED APPRENTICESHIPS IN MASSACHUSETTS

Making up total apprenticeships is the number of Registered Apprenticeships present in Massachusetts. This number is supplied by the Division of Apprenticeship Standards responsible for servicing registered apprenticeship programs in the Commonwealth of Massachusetts. Occupations recorded for Registered Apprenticeships overtime have been electricians, sheet metal worker & tinsmiths, refrigeration and air conditioning maintenance, refrigeration mechanics, plumbers, and pipe fitters. The following is a chart tracking totals in registered apprenticeships that are specifically apprentices who began in the fiscal year (New) were/are currently participating in an apprenticeship in the fiscal year (Active) and have completed their apprenticeship in the fiscal year (Completer.) [13]

ACTIVE, NEW AND COMPLETER APPRENTICESHIPS IN MA

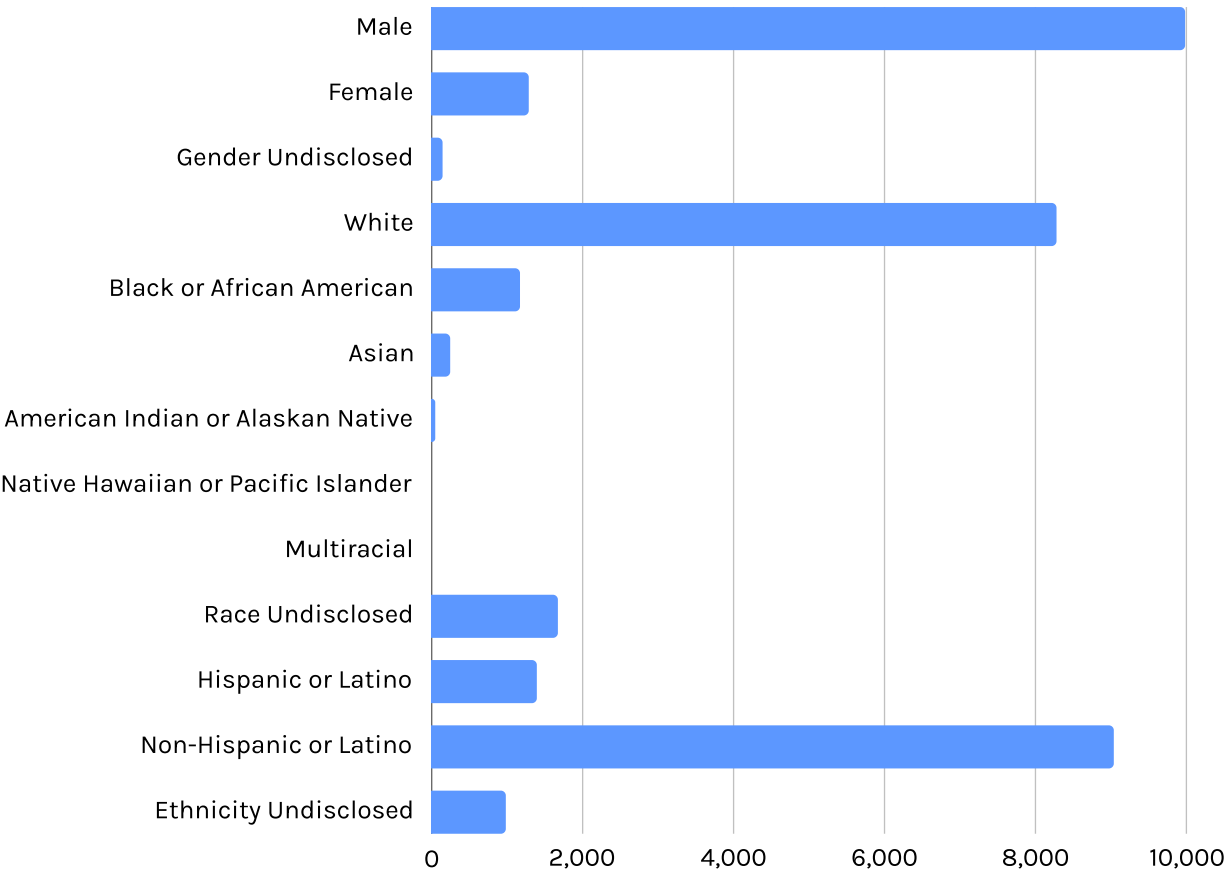


[13] Apprenticeship Data | Mass.gov. (n.d.). <https://www.mass.gov/info-details/apprenticeship-data>. Retrieved December 7, 2023.

REGISTERED APPRENTICESHIPS IN MASSACHUSETTS

Nonetheless, a significant portion of apprentices in these programs are white males. It is imperative to prioritize the promotion of gender, racial, and ethnic equality within apprenticeship programs with a sense of urgency.

FY 23 REGISTERED APPRENTICESHIPS BY DEMOGRAPHICS



In the next section, this report will elaborate on continued efforts to innovate educational and experiential pathways in STEM education.

Innovative Pathways for STEM Education



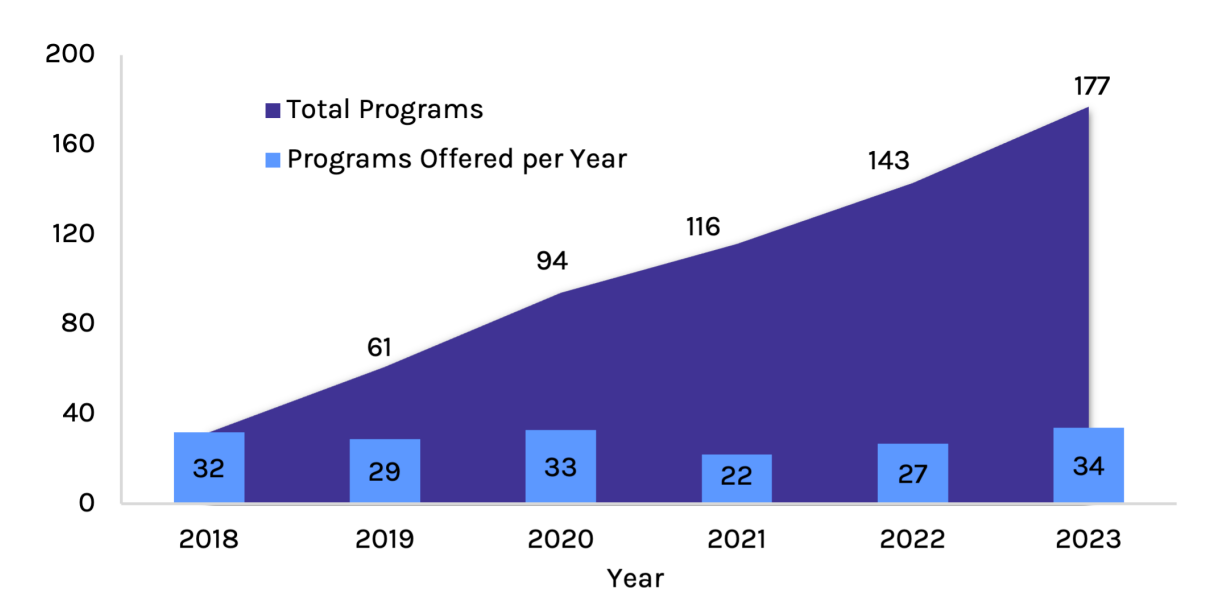
Massachusetts has a strong commitment to STEM education and preparing students for STEM careers. Several educational programs and initiatives have been established to foster STEM education, align it with industry needs, and bridge the skills gap.

In recent years, there has been a growing emphasis on creating innovative pathways for STEM education to cultivate talent and promote equity. These pathways aim to provide students with accessible and diverse routes into STEM fields while addressing issues of inclusivity and diversity.

INNOVATION CAREER PATHWAYS

Innovation Pathways aim to create partnerships with employers to provide high school learners with an opportunity to develop their knowledge and skills in specific career pathways. These pathways are aligned with industry sectors in demand within the region and state, helping students connect their high school experiences to postsecondary education and training. As of 2023, this program has 183 pathways across the Commonwealth, with over 6500 student enrollments this fall. The number of designated pathway programs increased significantly in just 5 years, from 32 to 177 in April 2023, with an annual increase of about 30 programs per year. The program covers different sectors in STEM fields: including Manufacturing, Business & Finance, Healthcare & Social Assistant, Environmental & Life Sciences, and Information. [14]

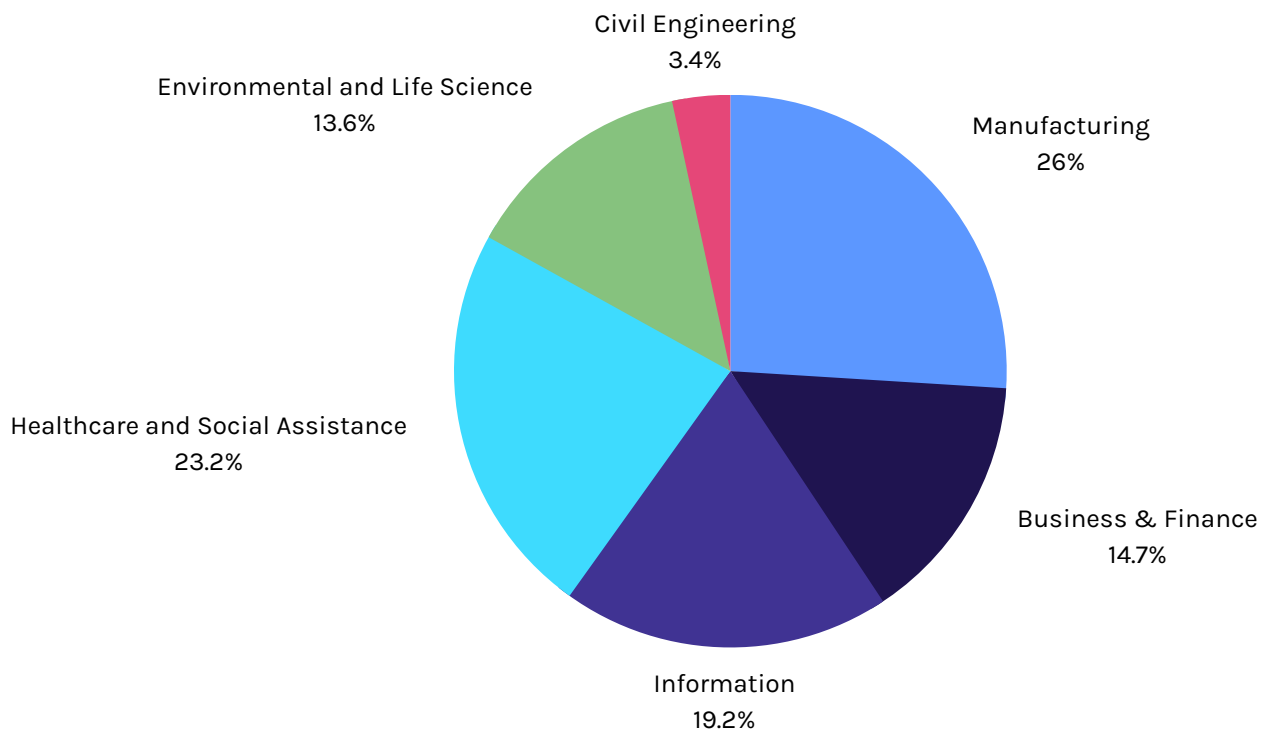
GROWTH IN PROGRAM COUNT FROM 2018 TO APRIL 2023



[14] Innovation Pathways - College, Career and Technical Education. (n.d.). <https://www.doe.mass.edu/ccte/innovation-pathways/default.html> Massachusetts Department of Elementary and Secondary Education, Office of College, Career and Technical Education, Innovation Career Pathways data



NUMBER OF INNOVATION PATHWAY PROGRAMS PER SECTOR INDUSTRY 2018 - APRIL 2023



INTO THE FUTURE: INNOVATIVE PROGRAM LAUNCH AND INITIATIVES

In addition to the existing successful programs, Massachusetts has also launched and integrated several innovative initiatives in the STEM field. The initiatives and programs represent a significant step forward in our commitment to fostering innovation, preparing the workforce for emerging industries, and promoting diversity and inclusion within STEM fields.

STRENGTHENING THE WORKFORCE PIPELINE: THE CAREER TECHNICAL INITIATIVE

The Career Technical Initiative (CTI) is an initiative of the Workforce Skills Cabinet (WSC) which aims to address the persistent demand for workers in manufacturing, construction, and trades by expanding training capacity at high schools with designated aligned Chapter 74 vocational programs. CTI forms a collaboration between vocational-technical schools, MassHire Career Centers, and Market Makers to engage employers and ensure training programs meet local workforce demand, recruit students, and place students in jobs upon graduation.

By leveraging the state's existing vocational training resources at high schools, CTI provides a growing number of Massachusetts residents with access to high-quality career technical training, creating a pipeline of skilled, credentialed workers to meet employers' hiring needs. CTI programs are offered in an "after dark" format designed to upskill adult learners during times outside the typical school day when vocational technical facilities are underutilized. This approach transforms vocational high schools across the Commonwealth into "Career Technical Institutes" that run three shifts a day for increased accessibility, including a night/weekend program for adults with integrated credentialing, wraparound support, and placement services.

CTI's target population is unemployed and underemployed Massachusetts residents who require additional skills to meet employers' hiring requirements, have been disconnected from the workforce, and need support reconnecting to job opportunities. As of June 2023, CTI serves an increasingly diverse group of adults, with the largest group being Hispanic/Latinx students (36%), followed by students identifying as "white" (decreasing from 41% in 2022 to 34% in 2023), while the percentage of Black/African-American students rose from 8% to 15%. CTI also represents an almost equal breakdown of unemployed (48%) and underemployed (52%) program participants prior to enrolling in CTI's job training. Furthermore, 73 percent of students identified as low-income. Additionally, 84 percent of enrollees did not hold an Associate's, Bachelor's, or advanced degree.

Through the end of FY23, over 1,300 unemployed and underemployed adults have enrolled in 20 career pathways programs in priority occupations and industries in manufacturing, construction, and skilled trades. Among the graduates hired upon completing training through CTI, 34 percent reported a salary range between \$20-25 per hour, and 12 percent reported earning \$25 per hour or greater.

NEXT STEP: BUILDING THE STEM-CAPABLE WORKFORCE OF THE FUTURE

This report aims to provide a comprehensive analysis of the STEM workforce trends and innovative educational pathways in Massachusetts. Through rigorous research and analysis, it will help to continue to shed light on the current state of STEM industries, the role of education in preparing students for STEM careers, and the promising pathways that are addressing workforce demands. In addition, this report identifies current barriers towards STEM employment and provides examples of the Commonwealth to bridge the gap for STEM training, education, and employment for underrepresented populations in Massachusetts. The need for STEM employment has also led to a need for increased training, and this increased demand mobilizes new generations of workers to fulfill the needs of STEM related fields in the Commonwealth.





**We thank you for your
continued support.**

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